Greetings



Mr. Gilles RATIA *President of the APIMONDIA Federation*

In the long line of Apimondia Congresses (over a century of rich exchanges), Daejeon will be remembered as a great event, the one that answered the scientific and beekeeping world's expectations of a strong International Federation.

This book brings you a rich, pertinent and politically committed scientific programme, the fruit of a heavy workload undertaken by the seven Apimondia Scientific Commissions and the team of South-Korean organizers. This year, there are over 700 lectures – plenary sessions, symposia and round tables – without forgetting an important number of posters, these will give this Congress scope and interest.

In fact, all the main beekeeping problems and solutions will be treated during the Daejeon Congress. The material presented in this book reflects the scientific and technical groundwork of the beekeeping world, as well as pointing to the main directions that we need to take to ensure the survival of bees and the excellence of hive products.

Take your time to read it carefully in order to choose your own scientific and technical program for the Congress and please don't forget that the full papers will be downloadable, by the end of this year, through the official website www.apimondia.org

Enjoy your visit in Daejeon and thank you for your participation.

Gilles RATIA President of Apimondia and International Beekeeping Consultant

Greetings



Mr. Kyoonhwan CHO *President of the Local Organizing Committee*

Honorable delegates of APIMONDIA member countries,

It is a great pleasure to welcome you all to the 2015 APIMONDIA International Apicultural Congress in Daejeon. Beekeeping has continued to evolve and mature together with human history.

In particular, honeybees not only play a critical role as an important pollinator for the circulation of the global eco-system, but also are increasingly utilized in diverse industries worldwide. Eventually, honeybees are becoming increasingly significant these days.

Being the ones who make this possible as beekeepers or professionals in apiculture-related fields worldwide, we have gathered here in Daejeon to communicate and exchange valuable information with one another. And it is my great pleasure and privilege to see you here as delegates of APIMONDIA member countries.

Held under the theme "Bees Connecting the World", the APIMONDIA 2015 will serve as a venue for diverse events including exhibition for apiculture products and equipment, academic symposiums, and the World Beekeeping Awards 2015. I am sure that you will find these events exciting and fun.

Living up to Korea's reputation as a tech-power combining the apiculture industries and modern science, the APIMONDIA 2015 in Daejeon will provide cutting edge facilities and hands-on experience opportunities related to apiculture. The event will be a festival for all of us to witness the perfect harmony of apiculture and the beautiful natural sceneries in Korea together in one place.

Again, I extend the warmest welcome to you all who came to Daejeon to attend this event as delegates of APIMONDIA member countries. It is my sincere hope that the APIMONDIA 2015 serves as a golden opportunity for all apiculture people worldwide to feel even stronger sense of unity.

Thank you.

Kyoonhwan CHO The President of Organizing Committee for the APIMONDIA 2015

Greetings



Prof. Dr. Byoung-Su YOON

President of the Local Scientific Commission

Dear colleagues, scientists and beekeepers,

On behalf of the local scientific committee, it is a great honor for me to introduce Scientific Programs of the 44th APIMONDIA International Apicultural Congress.

The leading specialists, beekeepers, and scientists of the bee, beekeeping and bee-products of the world gathered in Korea this September to present their latest findings and discuss the top issues of the whole bee-world.

I would like to personally welcome each of you to Scientific Program in APIMONDIA. I would like to give you an idea of what you can expect and what we hope to achieve over the next few days.

First, lots of information will be given to you in seven scientific areas, including Beekeeping Economy, Bee Biology, Bee Health, Pollination and Bee Flora, Beekeeping Technology and Quality, Apitherapy, and Beekeeping for Rural Development, secondly, through 3 plenary lectures, 8 plenary sessions, 67 symposia, 7 poster sessions, 9 round tables and 2 workshops by over thousand presenters. I would like to request you to participate actively in your related areas.

The world of Apicultural research is an exciting area. We are transforming the way we operate to continuously improve our ability to be science and bee-related technology. We have continued to meet the challenges of our field and to excel despite setbacks. We should all be very proud of where we are today and excite about where we are headed.

Before I close, I'd like to thank each of your for attending our conference and bringing your expertise to our gathering. You, as special researchers, have the vision, the knowledge, and the experience to help us pave our way into the future. You are truly our greatest asset today and tomorrow, and we could not accomplish what we do without your support and leadership. Throughout this conference, I ask you to stay engaged, keep us proactive and help us shape the future of Apicultural research. My personal respect and thanks goes out to all of you.

Byoung-Su YOON President of the Local Scientific Commission, 44th APIMONDIA International Apicultural Congress 2015

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Prof. Dr. Yong-Ho CHA	Chief of Workshop Committee
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Dr. Seung Won KANG	Chief of Special Affairs
Ms. Ji Hye LEE	Secretary-General



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Venue



PCO사무국 및 물자보관실 Secreatariat Office (LOC) 205

	Staff Room
207	의무실 First Aid Room
208	기도실 Prayer Room

210 연맹사무국

Secretariat Office (Federation) 211 연맹사무국

Secretariat Office (Federation)

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101~102	중회의장	108	연사라운지	
	Medium-size Meeting Room		Preview Room	
103~106	55mposid 人히이자	$109 \sim 112$	개ㆍ폐막식, 전체회의장	
103~106	조외의경 Small size Meeting Beem		Ceremonial Hall	
	Siman-size meeting Room		Plenary Lecture	
	Symposia		Plenary Sesson	
107	라운드테이블			
	Roundtable / Workshop			

Program at a Glance

	14 MON	15 TUE		16 WED	17 THU	18 FRI	19 SAT	20 SUN			
08:00-09:00			Registration (08:00-18: Ani Expo (09:00-18:0				•••••••••••••••••••••••••••••••••••••••				
					Plenary Lecture						
09:00-09:50			Jeff Pettis		Lucas Garibaldi	Dowon Lee	AT Plenary Session				
09:50-10:10	4				Break		I				
10:10-10:20					BE Plenary	BH Plenary	Symposia				
10:20-10:40			Sy	mposia	Session	Session	DII, I D, DK				
10:40-11:00	•] BH	I, BB, BE, BR, AT	Symposia BH_BB_TO	Symposia BB, PB, TO,	Break				
11:00-11:20			Rou	ind Table	BR, PB	BE, AT	G				
11:20-11:40				TQ	Round Table	Round Table	Symposia BH, BR, AT				
11:40-12:00					AI	BK					
12:00-13:00					Lunch / Post	er Presentation	1				
13:00-13:20				Symposia BH BB	AT Plenary Session I	BB Plenary Session		ц			
13:20-13:40	Regi		BE, BR, AT Round Table BH	Round Table BH	BE, BR, ATSymposia BH, BB, TQ, BR, PBSymposia BH, PB, TQ BE, ATRoundBR, PBBE, ATTable BHBLWorkshop BHBHBEBH		BE, BR,	Symposia	Symposia		echn
13:40-14:00	stration	-					Round	BH, BB, TQ, BR, PB	BH, PB, TQ, BE, AT		ical
14:00-14:20							Table	Round Table	Workshop		Four
14:20-14:40						BH					
14:40-15:00	•				Break	BR Plenary					
15:00-15:20				Symposia BH, PB,		Session					
15:20-15:40			Gen	TQ. BR, AT	Symposia	Symposia					
15:40-10:00			eral /	Round	BH, BB, BE, BR, AT	AT					
16:20-16:20			Assen	Table BB		Workshop	Closing				
16:40-17:00	•		ably		Break	BH	Ceremony (Gereral				
17:00-17:20		Opening		Symposia			Assembly II)				
17:20-17:40	4	Ceremony		BH, PB, TQ, BR,	Symposia BH, TQ, BE,	TQ Plenary Session					
				AT	BR, AT	Symposia					
17:40-18:00				Round Table BH	Round Table BH	BH, BB, PB, BR, AT					
18:30~					Korean Night (Invited Only)						

% BE: Beekeeping Economy / BB: Bee Biology / BH: Bee Health / PB: Pollination and Bee Flora

TQ: Beekeeping Technology and Quality / AT: Apitherapy /BR: Beekeeping for Rural Development





- BE: Beekeeping Economy
- BB: Bee Biology
- BH: Bee Health
- PB: Pollination and Bee Flora
- TQ: Beekeeping Technology and Quality
- AT: Apitherapy
- BR: Beekeeping for Rural Development

※ Program

- PS: Plenary Session
- S: Symposium
- RT: Round Table
- WS: Work-Shop

2015, 44th APIMONDIA International Apicultural Congress Scientific Program



Wednessday, 16 September

08:00 - 18:00.	Lobby				
Registration	, and the second s				
09:00 - 09:50,	Exhibition Ha	all			
Plenary Lectur	e I: Dr. Jeff PE	ETTIS,			
2	Bees and Be	e Problems: Are	We Our Own We	orst Enemy?	
09:50 - 10:10,	Break				
10:10 - 12:00,	Symposia Ro	om: 101-106 /	Round Table	Room: 107	
101-102	103	104	105	106	107
BH	BB	BE	BR	AT	TQ-RT
Parasitic	Nutrition &	Societal	Beekeeping	A Potential	Adulteration of
Disease I	Physiology 1	Beekeeping	Development I	Agents, Honey	Impact on
		Economy I	I	<u>e</u>	Markets
12:00 - 13:00,	Lunch & Post	ter Session (D	aejeon Trade I	Exhibition Cen	ter)
13:00 - 14:40.	Symposia Ro	om: 101-106 /	Round Table	Room: 107	
101-102	103	104	105	106	107
BH	BB	BE	BR	AT	BH-RT
Parasitic Disease	Nutrition &	Societal	Beekeeping for	Pharmacological	Vespid biology,
11	Physiology II	Beekeeping	Development II	Honey	Management of
		Economy II	I	5	Beekeeping
14:40 - 15:00,	Break				
15.00 16.40	Sumposia Do	om. 101 106 /	Dound Table	Doom. 107	
101 102		104		106	107
BH	PB	TO	BR	AT	BB-RT
Viral Disease	Pollination I	Beekeeping	Beekeeping for	Identification for	Artificial Food
		Techniques	Rural	the Use of	for Bees
			Development III	Apitherapic Propolis	
16.40 17.00	Dreak			Topons	
10:40 - 17:00,	Бгеак				
17:00 - 18:40,	Symposia Roo	om: 101-106 /	Round Table	Room: 107	
101-102	103	104	105	106	107
BH	PB Dollingtion II	TQ Desidues and	BR Deckeoping for	AT	BH-RT
Management I	Pollination II	Adulteration	Rural	Studies of	Prevent Global
			Development IV	Propolis	Losses of Honey
					Bee?

Thursday, 17 September

08:00 - 18:00, Lobby

Registration

09:00 - 09:50, Exhibition Hall

Plenary Lecture II: Dr. Lucas GARIBALDI,

Pollination and Food Security: Win-Win Scenarios between Pollinator Diversity and Crop Yield for Smallholdings Worldwide

09:50 - 10:10, Break

10:10 - 12:0	0, Exhibition	Hall / Sympos	ia Room: 1	101-106 / Roun	d Table Roo	m: 107
E.H.	101-102	103	104	105	106	107
BE	BH	BB	TQ	BR	PB	AT-RT
Plenary	Bacterial	Genetics &	Analytical	Indigenous	Pollination III	Workshop on
Session	Disease	Breeding	Techniques	Bees and		Standardization
				Conservation I		of Propolis

12:00 - 13:00, Lunch & Poster Session (Daejeon Trade Exhibition Center)

13:00 - 14:4	0, Exhibition	Hall / Sympo	sia Room: 10)1-106 / Rour	nd Table Roo	m: 107
E.H.	101-102	103	104	105	106	107
AT	BH	BB	TQ	BR	PB	BE-RT
Plenary	Fungal	Behavior &	Breeding and	Indigenous	Pollination IV	Current Issues
Session I	Disease	Neurology	Selection	Bees and		on Asian
				Conservation		Beekeeping
				II		

14:40 - 15:00, Break

15:00 - 16:40	, Exhibition	Hall / Sympos	sia Room: 1	101-106 / Rour	nd Table Roon	n: 107
E.H.	101-102	103	104	105	106	107
TBA	BH Hygienic Management II	BB Genomics & Molecular Marker	BE Current Situation of Beekeeping Economy	BR Apiculture with Indigenous Bees	AT Use of Propolis as a Natural Antibiotics	TBA

16:40 - 17:00, Break

17:00 - 18:40,	Exhibition	Hall / Sympos	sia Room: 1	01-106 / Roun	d Table Roo	m: 107
E.H.	101-102	103	104	105	106	107
	BH	TQ	BE	BR	AT	BH-RT
TBA	Pest	Characterizati on of Honey and Bee Products I	Political Aspects for Boosting Beekeeping Economy	Apiecotourism and Urban Beekeeping	A Variety of Application Studies of Propolis	Agrochemicals and Intensive Agriculture. Impacts on Bees and Other Pollinators

X TBA: To Be Announced

Friday, 18 September

08:00 - 18:00, Lobby

Registration

09:00 - 09:50, Exhibition Hall

Plenary Lecture III: Prof. Dr. Dowon LEE

Perspectives in Traditional Ecology and Landscapes of Korea

09:50 - 10:10, Break

10:10 - 12:0	0, Exhibition	Hall / Sympo	o <mark>sia Room:</mark> 1	101-106 / Rou	nd Table Ro	om: 107
E.H.	101-102	103	104	105	106	107
BH	BB	PB	TQ	BE	AT	BR-RT
Plenary Session	Environment & Population	Bee Flora I	Characterization of Honey and Bee Products II	Market Innovation for Beekeeping Economy I	Clinical Studies of Bee Venom	Indigenous Bees / Exotic Bees (Conservation & Management)

12:00 - 13:00, Lunch & Poster Session (Daejeon Trade Exhibition Center)

13:00 - 14:	40, Exhibition	Hall / Sympo	osia Room:	101-106 / Rou	nd Table Ro	om: 107
E.H.	101-102	103	104	105	106	107
BB	BH	PB	TQ	BE	AT	WORKSHOP
Plenary	Hygienic	Bee Flora II	New	Market	Pharmacological	HoneyBee
Session	Management		Technology	Innovation for	Effects of Bee	Diagnostics
	III		and Good	Beekeeping	Venom	PCR Kit by
			Beekeeping I	Economy II		iNtRON
						Maxim
						Technology

14:40 - 15:00, Break

15:00 - 16:4	40, Exhibition	Hall / Sympo	osia Room: 1	101-106 / Ro	und Table Ro	om: 107
E.H.	101-102	103	104	105	106	107
BR Plenary Session	BH Pesticides I	BB Diversity & Ecology I	TQ New Technology and Good Beekeeping II	TBA	AT Pharmacological Effects of Royal Jelly, Bee Pollen	WORKSHOP Immuno- chromatographic Detection Technology Against Pathogens of Honeybee

16:40 - 17:00, Break

17:00 - 18:40	, Exhibition	Hall / Sympo	osia Room:	101-106 / Rot	ind Table Roo	m: 107
E.H.	101-102	103	104	105	106	107
TQ Plenary Session	BH Pesticides II	BB Diversity & Ecology II	PB Pollination V	BR Beekeeping Sector Reviews	AT Specification Studies of Royal Jelly, Bee Pollen	ТВА

X TBA: To Be Announced

Saturday, 19 September

08:00 - 18:0)0, Lobby					
Registration	1					
09:00 - 10:4	40, Symposia	Room: 10	1-106 / Rou	and Table Ro	om: 107	
E.H.	101-102	103	104	105	106	107
AT Plenary Session II	BH Surveillance & Epidemiology I	TBA	PB Pollination VI	BR Regional Beekeeping I	TBA	TBA
10:40 - 10:5	50, Break					
10:50 - 12:4	40, Symposia	Room: 10	1-106 / Rou	ind Table Roo	om: 107	
101-102	2 10)3	104	105	106	107
BH Surveillanc Epidemiolog	e & gy II T I	3A	TBA	BR Regional Beekeeping II	AT Present Situation and Perspectives of Apitherapy	TBA

**** TBA: To Be Announced**

※ BE: Beekeeping Economy / BB: Bee Biology / BH: Bee Health / PB: Pollination and Bee Flora
TQ: Beekeeping Technology and Quality / AT: Apitherapy /BR: Beekeeping for Rural Development



Plenary Lecture

Phone Phone

09:00-09:50, (Wed) 16 - (Fri) 18 September

Exhibition Hall, 1st Floor

[Plenary Lecturer]

- · 16 Sep: Dr. Jeff PETTIS
- · 17 Sep: Dr. Lucas GARBALDI
- · 18 Sep: Prof. Dowon LEE

2015, 44th APIMONDIA International Apicultural Congress Scientific Program



Plenary Lecturer



Dr. Jeff PETTIS

Dr. Jeff Pettis is a Research Entomologist at the United States Department of Agriculture, Agriculture Research Service (USDA-ARS) located in Beltsville, Maryland. Dr. Pettis is conducting extensive research on honey bee health and the management of honey bee pests and diseases. Dr. Pettis' experience and position place him coordinating the research on Colony Collapse Disorder (CCD) with other researchers, to reveal the causes of North American bee population decline. He and his colleagues had found that pesticides including imidacloprid could cause synergistic effect on honeybee health decline.

Dr Pettis is serving as a vice president of Bee health commission in Apimondia, and also working as CLA on the global assessment of pollinator and pollination service for food production in IPBES.



Dr. Lucas Alejandro GARIBALDI

Dr. Lucas Alejandro Garibaldi is a Professor at the Univ. of Río Negro (UNRN) and Researcher of the National Scientific Research Council of Argentina (CONICET). Both positions at San Carlos de Bariloche in Argentina. As you know I am CLA at IPBES and Consultant for the Food and Agriculture Organization of the United Nations (FAO) on pollinator initiative. I am also part of the Editorial board of "Basic and Applied Ecology" and "Ecología Austral"

Education: Engineer Agronomist, College of Agronomy, Univ. of Buenos Aires (FAUBA).

PhD on Agronomic Science, Graduate School, FAUBA, Argentina.



Prof.Dowon LEE

LEE Dowon is a professor of ecology in Graduate School of Environmental Studies, Seoul National University, Korea. He has studied and taught ecology-and biogeochemistry-related subjects at the scales of ecosystem and landscape. For the past decade, in particular, he has worked on traditional ecology of Korea, seeking for ecological knowledge and practices embedded in remaining traditional landscapes, old maps, paints, written documents, oral stories, and other forms of relics. He led an editorial board to publish an English-written book, entitled "Ecology of Korea (2002)", and edited two Korean-written books, entitled "Traditional Ecology of Korea I & II (2004 & 2008)." He authored many books in Korean, for example, entitled "Landscape Ecology (2001)," "Ecological Knowledge and Practices Embedded in Traditional Korean Landscapes (2003)," and "Ecological Implications of Landscape Elements in Traditional Korea Villages (2004)," and coauthored a book in Korean with English abstract, entitled "Ecosystem Services of Traditional Village Groves in Korea (2007)." He published many English-written scientific papers and book

chapters related to ecosystems, landscapes, and ecological concepts. He was honored with the 1990 Wesley W. Honor Award from American Society of Civil Engineering for a research paper of hydrology, published in Journal of Environmental Engineering in 1989, and with the 45th Korean Paeksang Book Culture Award from Hankook Ilbo in 2005 for a book, entitled "Traditional Ecology and Pungsujiri," was designated one of 2013 excellent academic books by Korean Ministry of Culture, Sports and Tourisms. The book was compiled, based on a seminar which he organized.

Bees and Bee Problems: Are we our own worst enemy?

Jeff Pettis

USDA-ARS Bee Research Lab. Beltsville, MD USA

Honey bees have had a long association with human management and are moved around the globe for honey, wax and pollination. As with any animal, the attempt to domesticate the honey bee has lead to an increase in pests and diseases as we crowd bee colonies together in apiaries. Further, we move species to new areas and cause host shifts such as Varroa mite to occur that bring more problems for all beekeepers. We have disrupted the natural balance between pests, diseases and the natural defense mechanisms of bees. In nature, the average distance between hives is often great and the chances of disease or pest spread is thus reduced. Additionally, secondary pests like wax moth can eliminate abandoned hives and further reduce the spread of some diseases, such as American foulbrood. Two case studies will be discussed to illustrate how we as beekeepers have made our problems more severe: the first case will be that of the interaction between wax moths, American foulbrood scales in old comb and the spread of AFB; the second case will be to examine the current and future spread of small hive beetle around the globe in honey bees but also the threat that SHB poses to other species like stingless bees and bumblebees. Lessons can be learned by comparing and contrasting these two examples to illustrate things we may be able to change in beekeeping to reduce the impact or pests and diseases. It is especially important that we learn from mistakes of the past and find better ways to manage all species of honey bees around the globe.

Pollination and food security: win-win scenarios between pollinator diversity and crop yield for smallholdings worldwide

Lucas Alejandro Garibaldi

Sede Andina, Universidad Nacional de Río Negro, Argentina

A spouse indicated the marriage partner, he or she called "our wife or our husband", not "my wife or my husband." Closing gaps in crop yield while enhancing sustainability is among the greatest challenges for achieving food security. Ecological intensification, the improvement of crop yield through ecosystem services provided by biodiversity, may be a sustainable pathway. However, data supporting such an approach are missing, especially for two billion smallholders, many of which are undernourished. Despite fruit or seed set of many crops relies on pollinators, management for improved pollination services is uncommon, likely contributing to yield gaps globally. Indeed, pollination has been neglected even in the studies analyzing the continental or global drivers of yield gaps. Pollinator deficits may be more significant than before, as (i) other resources (e.g. nutrients) are increasingly provided (e.g. fertilizers) to crops, (ii) cultivated area of pollinator-dependent crops is expanding more rapidly than the area of pollinator-independent crops, (iii) cultivated area of pollinator-dependent crops is also expanding more rapidly than the stock of managed honey bee colonies, and (iv) wild populations of pollinators are increasingly threatened. Furthermore, pollinator-dependent crops provide essential micronutrients to humans in those regions of the world where micronutrient deficiencies are common. To date, it is uncertain to what degree local populations of pollinators need to be enhanced ("flower-visitor gap"), and how much of the yield gaps (kg ha-1) can be closed by such management. Using the same coordinated protocol, we quantified to what degree enhancing flower-visitor density can close yield gaps on 344 fields from 33 pollinator-dependent crop systems in small- and large-holdings from Africa, Asia, and Latin America. For <2ha holdings, we found that yield gaps could be closed by a median of 24% through higher flower-visitor density. For larger holdings, such level of yield benefits only occurred if they sustained high flower-visitor richness. Therefore, biodiversity can compensate the negative effects of field size. Worldwide, our study demonstrates that ecological intensification can create winwin scenarios between biodiversity and crop yield.

Perspectives in traditional ecology and landscapes of Korea

Dowon Lee, Yoori Cho

Department of Environmental Planning, Graduate School of Environmental Studies Seoul National University, Republic of Korea

A spouse indicated the marriage partner, he or she called "our wife or our husband", not "my wife or my husband," in the traditional societies of Korea. The nomen keeps even in contemporary Korean societies, although it sounds strange. The unique nomen may be associated with Korean peoples' perspectives, which were derived from experiences undergone with nature and culture in the long history. In this lecture, the perspective is called "weperspective" and related to concepts of watershed and hierarchy embedded in Korean traditional knowledge and managed landscapes. Divides of watersheds are identified in many relevant maps and historical documents, including an old map which was drawn in 1402 and is currently kept in a library of Ryukoku University, Japan. Furthermore, old documents and remaining traditional villages show that in the past, Koreans preferred to locate a village nested within a watershed, enclosed by mountain ranges. In particular, they sought for a watershed, the mouth of which is well closed or narrow. They used to cover the mouth of village watershed by nurturing a grove when it was open. The preference might be related to life and culture, which relied on rice paddies that require a lot of water supply. We will discuss how well water was conserved in cropland adjacent to the village. Frequently, the enclosure of watershed was called wul, which means "fence". It seems that the group of people who lived inside wul was called wuri, which means 'we' in English. Hierarchy concept seems to be intimately related to human genealogy. It is unknown when Koreans began writing family trees, but a comprehensive genealogy of mountains was compiled in the 18th century. In the genealogy of mountains, high peaks and major mountain ranges of Korea were arranged in the way as they recorded family trees of humans. Interestingly, combining ideas of watershed and hierarchy is exemplified in a map, Daedongyeojido which was carved by Jungho Kim in 1861, referring to the genealogy of mountains. We-perspective may be good and bad from time to time. New perspective seems to be complemented by experiences of bee-farming, which will be proposed in our presentation.





X Scientific Commissions:

- BE: Beekeeping Economy
- BB: Bee Biology
- BH: Bee Health
- PB: Pollination and Bee Flora
- TQ: Beekeeping Technology and Quality
- AT: Apitherapy
- BR: Beekeeping for Rural Development

※ Program

- PS: Plenary Session
- S: Symposium
- RT: Round Table
- WS: Work-Shop

2015, 44th APIMONDIA International Apicultural Congress Scientific Program



Plenary Session: Beekeeping Economy and Innovation

Chair-Person: Prof. Dr. Kunsuk WOO and Prof. Dr. Chuleui JUNG

10:10-10:35	Korea	Beekeeping Economy in Korea: From income generation to ecosystem service Chuleui Jung, Sungmin Jeong, Changreol Lee
10:35-11:00	India	Role of beekeeping in the economic development of India: Challenges and opportunities Dharam Pal Abrol, Uma Shankar
11:00-11:30	Greece	International and national legislation causing inconsistency to honey trading Andreas Thrasyvoulouu, Chrysoula Tananaki , Georgios Goras
11:30-12:00	United Kingdom	COLOSS B-RAP: Bridging bee research and beekeeping practice Norman Carreck, Sven Branner, Ralph Büchler, Bjørn Dahle, Johann Fisher, Asger Søgaard Jørgensen, Ole Kilpinen, Lotta Fabricius Kristiansen, Preben Kristiansen, Per Kryger, Magnus Ljung, Patricia Aldea Sánchez, Josef van der Steen, Flemming Vejsnæs, Geoffrey Williams

Symposium: Societal Innovation for Beekeeping Economy I

Chair-Person: Prof. Dr. Kunsuk WOO and Prof. Dr. Chuleui JUNG

10:10-10:20 Introduction

10:20-10:35	France	The campaign 'The Bee, sentinel of the environment': how communities and business stakeholders can help beekeeping Henri Clement
10:35-10:50	Taiwan	Urban Beekeeping in Taiwan Yue Wen Chen
10:50-11:05	United States	Does proximity and size of blue orchard bee nests predict almond nut yield? Insu Koh, Eric Lonsdorf, Derek Artz, Theresa Pitts-Singer, Taylor Ricketts
11:05-11:20	Uganda	Beekeeping Practices and Bee Pollination Jude Ssettaba
11:20-11:35	Ghana	The Economic Benefits of Integrating Beekeeping into Cashew Farms in Ghana and Benin Kwame Aidoo, Mary Adzanyo, Rita Weidinger, Andre Tandjiekpon
11:35-11:50	Turkey	Determining of Consumer Preferences and Consumer Profile Oriented to Honey: A Case of Izmir-Turkey FATIH Baki, GAMZE SANER, Hakan Adanacioglu, Düran Güler
11:50-12:00	Discussion led	by chair persons

Symposium: Societal Innovation for Beekeeping Economy II

Chair-Person: Prof. Dr. Kilwon KIM and Prof. Dr Andreas THRASYVOULOUU

13:00-13:15	New Zealand	Manuka: The Biography of an Extraordinary Honey Cliff Van Eaton
13:15-13:30	India	Beekeeping Technology and Quality issues in India: Contribution of VSBT, Baramati Dhananjay Wakhle, Vivek Khalokar, Sushama Chaphalkar
13:30-13:45	Thailand	The Meliponiculture for Honey Production in Thailand Duangphakdee O., Rod-im P.
13:45-14:00	Indonesia	Indonesian beekeeping in maximizing its development and honey bee products Musthoha Iskandar, Mohammad Candra, James Hutagalung, Budi Santosa
14:00-14:15	Mongolia	Beekeeping in Mongolia Khaliunaa Tsevegmid
14:15-14:30	Turkey	Beekeepers' perceptions of agricultural cooperatives: Case study of Milas district Tayfun Cukur
14:30-14:40	Discussion led	by chair persons

 $\ensuremath{\mathbb{X}}$ Guide time: it could be often changed by chairman under condition of symposium

Symposium: Current Situation of Beekeeping Economy

Chair-Person: Prof. Dr. DB ABROL and Prof. Dr. K. TSEVEGMID

15:00-15:15	China	21 Century: The status and trend of beekeeping development in China Lihong Chen, Ming Xu, Jie Wu, Pinpin Hu, Jianmei Wang
15:15-15:30	Slovakia	Improving beekeeping economy by moving bee colonies Tibor Vargapál
15:30-15:45	Nepal	An overview of apiculture and its constraints in Nepal Sunil Aryal, Chuleui JUNG
15:45-16:00	Turkey	Pine honeydew honey; importance, conditions of production and economy Muhsin Dogaroglu, Banu Yucel, Gamze Saner
16:00-16:15	Japan	The Beekeeping economy in Japan John Hamilton
16:15-16:30	Bangladesh	Impact of honey bee on the economy of Bangladesh and chemical characters of Bangladesh honey Hasan Fuad El Taj, Chuleui Jung, Andreas Thrasyvoulou
16:30-16:40	Discussion led	by chair persons

 $\ensuremath{\mathbb{X}}$ Guide time: it could be often changed by chairman under condition of symposium

Sumposium: Political Aspects for Boosting Beekeeping Economy

Chair-Person: Prof. Dr. Kunsuk WOO and Prof. Dr. Norman CARRECK

17:00-17:15	Korea	An overview for the implications of natural bee keeping management that to boost beekeepers profits. Kunsuk Woo
17:15-17:30	Ukraine	Mainstreaming conservation and sustainable use of biodiversity pollinators into ukrainian production landscapes. an attempt to spread the successful experience and new knowledge from small local project to the national level Viacheslav Tsuprykov, Ruslan Nesterenko
17:30-17:45	Tanzania	Impact of projects and financial support on the growth of beekeeping sector and beekeepers: A case of Tanzania in east Africa Stephen Msemo
17:45-18:00	China	The design and effect prediction of subsidy policy on positive- externality industry-take subsidies for mobile bee-keeper purchase for example Yun Gao, Zhijun Zhao
18:00-18:15	Denmark	Exploring opportunities and constraints for payments for pollination services in Africa Aske Skovmand Bosselmann, Lise Hansted
18:15-18:30	China	Government attach more importance to apiculture and promote beekeeping development in China Ming Xu, Lihong Chen, Jie Wu, Pingping Hu, Jiangmei Wang
18:30-18:40	Discussion le	d by chair persons

Symposium: Market Innovation for Beekeeping Economy I

Chair-Person: Prof. Dr. Kunsuk WOO and Dr. Lihong CHEN

10:10-10:20 Introduction

10:20-10:33	China	Honeybee products market of China - performance in 2014 and prediction for 2015 Ming Xu, Lihong Chen
10:35-10:50	Turkey	The social laboratory analysis of solution for beekeepers' marketing problems (a case study of Turkey) Murat Emir
10:50-11:05	Korea	Honey bee as source of nutritional product: scientific insight Sampat Ghosh, Chuleui Jung
11:0511:20	Korea	Global and Korea propolis industry trends Seunghwan Lee
11:20-11:35	France	Using geographic information system to evaluate honey and pollen potential on a territory Michel Bocquet
11:35-11:50	Korea	Market survey and quality assessment of locally distributed honey: Case study in Gyoungbuk province Chuleui Jung, EunRan Cho, Seunghee Lee
11:50-12:00	Discussion 1	led by chair persons

Symposium: Market Innovation for Beekeeping Economy II

Chair-Person: Prof. Dr. Kilwon KIM and Prof. Dr. Hasan L. TAJ

United States	Mead production, the perfect beverage Brian Schlueter, Celina Pennisi
Malaysia	Enhancing sustainability and competitive bee industry for economic growth in Malaysia Mohd Mansor Ismail
Russia	Beekeeping in Russia Larisa Prokofyeva
Turkey	Bee products marketing and its marketing strategies for the future: Case of Turkey Figen Cukur, Tayfun Cukur
Iran	Introduction to beekeeping industry in Iran Sayed Mazaher Sayedi, Alireza Abbasian, Mahmood Salesi, Mansour Kimiaei, Shahabodin Mosharaf
Kenya	Protect African bees, in order to preserve our future and global food security Norber MBAHIN, Simplice Nouala
Ethiopia	Inclusive business in competing market chains: the case of Ethiopian honey Paulos Desalegn Woldesellassie
Algeria	Effect of harvesting method and hives model on the amount of honey produced by the bee colonies in Algeria. Zohra Ghalem Berkani
	United States Malaysia Russia Turkey Iran Kenya Ethiopia Algeria

Plenary Session

Chair-Person: Prof. Dr. Karl CRAILSHEIM and Dr. Myeong-lyeol LEE

13:00-13:20	Austria	What's new in honey bee science? Karl Crailsheim
13:20-14:00	Switzerland	A global view of small hive beetles and the COLOSS network Peter Neumann
14:00-14:20	Germany	A new approach for honeybee breeding - genomic selection Kaspar Bienefeld, Andreas Spötter, Norbert Reinsch, Manfred Mayer, Pooja Gupta

Bee Biology

Symposium: Nutrition & Physiology I

Chair-Person: Dr. Daniel STABLER and Prof. Dr. Hyung Wook KWON

10:10-10:40	United Kingdom	Regulation of macronutrient intake by adult worker honeybees and bumblebees Daniel Stabler, Geraldine Wright
10:40-10:55	Austria	Food consumption and food exchange of caged honey bees using radioactive labelled sugar solution Robert Brodschneider, Vera Kupelwieser, Anika Libor, Karl Crailsheim
10:55-11:10	United States	Larval metophrene application affects the live weights of the queen bees and ovariole numbers of the worker bees (Apis mellifera L.) Osman Kaftanoglu, Cahit Ozturk
11:10-11:25	Korea	Brood rearing status of the honey bee is associated with acetylcholinesterase 1 expression Young Ho Kim, Ju Hyeon Kim, Kyungmun Kim, Si Hyeock Lee
11:25-11:40	China	Juvenile hormone regulates the production of 10-hydroxy decenoic acid in mandibular gland of honeybee workers (Apis mellifera) Bihua Ying, Xin Su, Lihua Ling, Wenbing Chen, Shaokang Huang
11:40-11:55	Turkey	Effects of feeding honey bees (<i>Apis mellifera</i> , Hymenoptera: Apidae) with industrial sugars on foraging behaviour and colony development Ahmet GULER, Deniz Ekinci, Selim Biyik, Ali V. Garipoglu, Hasan Onder, Hasan Kocaokutgen
11:55-12:10	Russia	Peculiarities of honey flow by bee families of different origins have genetic base Nicolaj Kharitonov

Bee Biology

Symposium: Nutrition & Physiology II

Chair-Person: Dr. Daniel STABLER and Prof. Dr. Hyung Wook KWON

13:00-13:15	Switzerland	Identifying nectar storage patterns and honey ripening processes with non-invasive diagnostic radioentomology Michael Eyer, Peter Neumann, Vincent Dietemann
13:15-13:30	China	Longevity extension of worker honey bees (<i>Apis mellifera</i>) by royal jelly: optimal dose and active ingredient Yang Wenchao, Tian Yuanyuan, Miao Jing, Wu Zhenhong, Miao Xiaoqing
13:30-13:45	Korea	Analysis of bacterial communities in the guts of Asian honey bee Apis cerana and Eurpean honey bee Apis mellifera Jae- Hyung Ahn, In-Pyo Hong, Sang-Hoon Han, Jaekyeong Song, Hang-Yeon Weon
13:45-14:00	Russia	Proxy indicators of queen bees and drones quality Lubov Savushkina, Anatolii Borodachev
14:00-14:15	China	Biological Analysis of Iron-metabolism Protein Genes in <i>Apis</i> <i>cerana cerana</i> Feng Liu, Zhaohua Liu, Wenfang Qi, Fanggui Xi, Baohua Xu
14:15-14:30	Russia	Correlation of biological and farm useful characteristics of honey bees (<i>Apis mellifera</i> L.) Vyacheslav Lebedev
14:30-14:45	China	Transcriptome comparison among mandibular glands of the honeybee (<i>Apis mellifera</i> L.) queen and workers Yu-Qi Wu, Huo-Qing Zheng, Christian Pirk, Fei Meng, Fu-Liang Hu

Symposium: Genetics & Breeding

Chair-Person: Prof. Dr. Walter SHEPPARD and Dr. Myeong-lyeol LEE

10:10-10:40	USA	The role of germplasm cryopreservation in honey bee breeding and conservation Walter Sheppard
10:40-10:55	China	Chalkbrood resistance associated SNP markers in honey bees, Anis mellifera, by whole-genome resequencing
		Yuanzhen Liu, Limin Yan, Zhiguo Li, Wei-Fong Huang,
		Subas Pokhrel, Xiaoyan Liu, Songkun Su
10:55-11:10	Slovenia	Breeding and selection activities for carniolan honeybee (<i>Apis mellifera carnica</i>) in Slovenia Peter Kozmus
11:10-11:25	Turkey	Breeding and Selection of Yığılca honeybee (<i>Apis mellifera</i> L.) ecotype in respect to hygienic behavior Meral Kekecoglu, p Goç Rasgele, A Burgut, M Kambur
11:25-11:40	Turkey	Selecting Muğla honey bee (<i>A.m. anatoliaca</i>) for hygienic behavior Devrim Oskay, Rahşan İvgin Tunca, Meral Kence, Aykut Kence
11:40-11:55	Russia	The directions of bee selection in Russia Anatolii Borodachev, Lubov Savushkina, Vladimir Borodachev
11:55-12:10	Korea	Microsatellite markers through next-generation sequencing for bee breeding in <i>Apis mellifera</i> in Korea Hye-kyung Kim, Iksoo Kim, Myeong-Lyeol Lee, Yong-Soo Choi, Byung Rae Jin

 $\ensuremath{\mathbb{X}}$ Guide time: it could be often changed by chairman under condition of symposium

Bee Biology

Symposium: Behavior & Neurology

Chair-Person: Prof. Paul SZYSZKA and Prof. Dr. Kil Won KIM

13:00-13:30	Germany	Odor representations in the honey bee brain Paul Szyszka
13:30-13:45	Korea	Functional characterization of an amino acid-sensing gustatory receptor in honeybee and its application to bioelectronic tongue Je Won Jung, Hyung Wook Kwon
13:45-14:00	Thailand	Foraging dance of dwarf honey bee , <i>Apis florea</i> Siriwat Wongsiri, Sitthipong Wongvilas, Natapot Warrit, Sureerat Deowanish, Orawan Duangphakdee, Lihong Chen
14:00-14:15	Nepal	Egg-laying behavior of reproductive worker honeybees in queenless colonies of <i>Apis cerana</i> Ratna Thapa, Siriwat Wongsiri, Myeong Lyeol Lee, Yong Soo Choi, Hyung Wook Kwon
14:15-14:30	China	Honey bee <i>Apis cerana</i> eavesdrop on other bee species' alarm pheromone to avoid predator risky Ken Tan
14:30-14:45	Tanzania	Abundance and architecture of natural nests of colonies of honey bee (<i>A. mellifera</i>) in selected plant communities along the coast in Rufiji district Karengi Slaa
14:45-15:00	Sudan	Evolutionary advantage of honey bees dying after they sting Mogbel El-Niweiri

Symposium: Genomics & Molecular Marker

Chair-Person: Prof. Dr. Songkun SU and Prof. Dr. Hyung Wook KWON

15:00-15:30	China	Molecular markers were screened to be related to high royal jelly yield trait Songkun Su, Xiaoyan Liu, Zhiguo Li, Shupeng Xu, Weihong Meng, Wenfeng Li, Shaowu Zhang
15:30-15:45	China	Cytochrome C oxidase subunit I (COI)-COII intergenic sequence noncoding AT-rich region haplotype groups of <i>Apis</i> <i>mellifera</i> species Xing-an Li, Yunbo Xue
15:45-16:00	Canada	Expression biomarkers can be used to select for complex traits in honey bee breeding: results of three generations of selection for hygienic behavior Shelley Hoover, M. Marta Guarna, Robert Currie, Stephen Pernal, Leonard Foster
16:00-16:15	Thailand	Conservation of Aculeate silk gene copy number for 155 million years: the riddle of 'why four proteins?' partially solved. Jakkrawut Maitip, Holly Trueman, Benjamin Kaehler, Gavin Huttley, Panuwan Chantawannakul, Tara Sutherland
16:15-16:30	Korea	Genome information on Asian honey bees and its perspectives Hyung Wook Kwon, Doori Park, Murukarthick Jayakodi, Je-won Jung, Tae-Jin Yang
16:30-16:45	China	Real-time polymerase chain reaction method to determine mRNA levels of heat shock protein genes in diapause honeybee (<i>Apis mellifera carnica</i>) during overwintering period Xing-an Li, Yunbo Xue
16:45-17:00	Jordan	Evaluation of Apis mellifera syriaca bee conservation using comparative genome hybridization. Nizar Hadddad, Ahmed Batainh, Deepti Saini, Osama Migdadi, Mohamed Aiyaz, Rushiraj Manchiganti, Venkatesh Krishnamurthy, Banan Al-Shagour, Mohammad Brake, Lelania Bourgeois, Lilia De Guzman, Thomas Rinderer, Zaid Alhamuri

Bee Biology

Symposium: Environment & Population

Chair-Person: Prof. Dr. Peter NEUMANN and Dr. Yong Soo CHOI

10:10-10:25	United States	Prevalence of <i>Nosema</i> species in a feral honey bee population: A 20-year survey Juliana Rangel, Kristen Baum, Robert Coulson, Spencer Johnston, Brenna Traver
10:25-10:40	Sweden	Rescue project for the native bee in Sweden Per Thunman
10:40-10:55	Korea	Apis cerana collapse in Korea by sacbrood virus Yong Soo Choi, Myeong Lyeol Lee, Man Young Lee, Hye Kyung Kim, Kyu ho Byeon
10:55-11:10	Brazil	Diploid males in a managed stingless bee species population is responsible for ca. of 8% of new colony losses Ayrton Vollet Neto, Vera Lucia Imperatriz-Fonseca
11:10-11:25	Russia	Comparing three bee breeds in their natural damage by four diseases Andrei Berezin, Nicolai Kharitonov
11:25-11:40	Taiwan	Effects of sublethal dosage of fungicides (propiconale, tebuconazole and triadimefon) on honey bee growth Wan Yi Chen, Yu Wen Chen, Yu Shin Nai
11:40-11:55	Saudi Arabia	Seasonal population dynamics and performance evaluation of the <i>Apis mellifera jemenitica</i> and imported hybrid honeybee colonies in Southwestern Saudi Arabia Ahmad Al-Ghamdi, Nuru Adgaba, Yilma Tadesse, Awraris Getachew, Anwer Al-Maktary

Symposium: Diversity & Ecology I

Chair-Person: Prof. Dr. Sushama CHAPHALKAR and Dr. Hye-kyung KIM

15:00-15:15	India	Genetic variations among <i>Apis florea</i> Sushama Chaphalkar
15:15-15:30	Indonesia	New haplotypes variations of <i>Apis koschevnikovi</i> and <i>Apis cerana</i> in Indonesia based on Cytochrome oxidase 1 (CO1) of mitochondrial DNA Rika Raffiudin, Dzulfaqor, Tri Atmowidi
15:30-15:45	India	Biology of red dwarf honeybee , <i>Apis florea</i> Fabricius in plains of Karnataka, India Narayanappa Nagaraja
15:45-16:00	China	Extreme food-plant specialisation in Megabombus bumblebees as a product of long tongues combined with short nesting seasons Jiaxing Huang, Jiandong An, Jie Wu, Paul Williams
16:00-16:15	Benin	Variability of the morphometric characteristic of the bees Apis mellifera adansonii in relation with the climatic zones in Benin Waliou Abiola, Valère Salako, Franck Akogbeto, Romain Glele Kakaï, Armand Paraiso, Ambaliou Sanni
16:15-16:30	Korea	Temporal and spatial variations of sex ratio of Osmia cornifrons and O. pedicornis (Hymenoptera: Megachilidae) in Korea Youngmi Kim, Chuleui Jung
16:30-16:45	Philippines	Arthropods associated with stingless, <i>Tetragonula</i> spp., bee nests Kietyl Gerd Balais, Franz Kevin Manalo, Alejandro Fajardo Jr.

Bee Biology

Symposium: Diversity & Ecology II

Chair-Person: Prof. Dr. Sushama CHAPHALKAR and Dr. Hye-kyung KIM

17:00-17:15	Ukraine	How to reveal the enigma of structure of natural honeybee nest and apply the solution to create effective beehive for the modern apiary? Vasyl Priyatelenko, Victor Fursov, Elena Ilienko
17:15-17:30	Korea	Population structure of the Korean Bombus ignitus (Hymenoptera: Apidae)as revealed by microsatellite markers Taeman Han, In Gyun Park, Hyung Joo Yoon, Haechul Park
17:30-17:45	India	Study of genetic diversity and relationship some honey bee species using RAPD molecular markers Budiguppe Kapanigowda Chikkaswamy
17:45-8:00	Korea	Correlation between ovarian development and vitellogenin secretion in Mason bee, <i>Osmia cornifrons</i> Kyeong Yong Lee, Kwang Sik Lee, Hyung Joo Yoon, Byung Rae Jin
18:00-18:15	Pakistan	Morphometric diversity of indigenous honeybee , <i>Apis florea</i> in district faisalabad and chakwal of Punjab, Pakistan Samina Qamer
18:15-18:30	Philippines	A protocol for mitochondrial DNA analysis and assessment of genetic variation in natural populations of stingless bees (<i>Tetragonula</i> spp.) Bernabeth Jo Tendero, Rita Laude, Ma. Carmina Manuel, Rosalina Tandang, Celia dela Viña, Neilyn Villa
18:30-18:45	Egypt	Egyptian honeybee race <i>Apis mellifera lamarckii</i> cockerell.1- morphometric study, 2- Biological study Mahmoud EL-Feel, Mohamed Abd Al-Fattah, Sayed Haggag, Ahmed Hegazi
Plenary Session

Chair-Person: Dr. Jeff PETTIS and Dr. Yun Sang CHO

10:10-10:40	France	Activities of the World Organisation for Animal Health (OIE) in support of bee health François Diaz
10:40-11:10	France	Overview of the knowledge gained in France on the Asian yellow-legged hornet, Vespa velutina (Hym.: Vespidae), and its invasion in Europe Claire Villemant, Quentin Rome
11:10-11:40	Hungary	Epidemiology of honeybee pathogens in Europe, recent studies and findings in Hungary Petra Forgách , Petra Deákné Paulus, István Görgics, Gero Behl, Tamás Bakonyi, Miklós Rusvai

Symposium: Parasitic Disease I

Chair-Person: Prof. Joachim MIRANDA and Prof. Sung-Shik SHIN

10:10-10:25	Switzerland	Host-parasite specificity in the <i>Apis – Varroa</i> complex in Asia Paul Page, Ninat Buawangpong, Panuwan Chantawannakul, Peter Neumann, Vincent Dietemann
10:25-10:40	Sweden	Resistance to Varroa: What have viruses got to do with it? Joachim Rodrigues de Miranda, Peter Neumann, Orlando Yanez
10:40-10:55	India	Breeding Apis mellifera L. resistant to Varroa and PMS with superior production traits in India G Narendra Kumar, O P Chaudhary, H D Kaushik
10:55-11:10	Korea	Competitive effect of <i>Varroa destructor</i> and <i>Tropilaelaps</i> <i>mercedesae</i> in <i>Apis mellifera</i> brood cells Dongwon Kim, Chuleui Jung
11:10-11:25	Belgium	Impact of honey bee hygienic behavior on Varroa destructor infestation and reproduction in unselected stocks Gil Leclercq, Nicolas Gengler, Eric Haubruge, Bach Kim Nguyen, Frédéric Francis
11:25-11:40	Egypt	Antibacterial activity of different types of honey produced by many methods Abdelhaliem Meshref , Yasser Abdelaliem

Symposium: Parasitic Disease II

Chair-Person: Prof. Joachim MIRANDA and Prof. Hee Jeong YOUN

13:00-13:15	Turkey	Coumaphos and clove oil rotation can reduce residues in bee products and Varroa mite resistance risk Ahmet Onur Girisgin, Levent Aydin, Shimon Barel
13:15-13:30	Iran	The occurrence of <i>Acarapis externus</i> in honey bee colonies in an apiary in Iran Mohammad Forsi, Rahim Ghogooghi
13:30-13:45	Portugal	Chemosensing and behaviour response of <i>Varroa destructor</i> to some essential oils of Portuguese aromatic plants A. Sofia Lima, Nurit Eliash, Nitin Singh, Victoria Soroker, Miguel Vilas-Boas, A. Cristina Figueiredo
13:45-14:00	Slovakia	Royal jelly apalbumin isoforms as novel antibiotics against <i>P.larvae</i> and multiresistant bacterial strains Katarina Bilikova, Karl Skriner, Kikuji Yamaguchi, Hans Lehrach, Jozef Simuth
14:00-14:15	Korea	Development of new antibiotics from actinomycetes to control bee and human pathogens Jaisoo Kim, Tuan Manh Nguyen

Symposium: Viral Disease

Chair-Person: Prof. Dirk De GRAAF and Dr. Chang Hee KWEON

15:00-15:15	Belgium	Understanding the intimate relationship of the honeybee and its viral pathogens in order to tackle bee mortality from a different angle Dirk De Graaf, Lina De Smet, Jorgen Ravoet, Tom Wenseleers
15:15-15:30	Korea	Derivation of cell-adapted Sacbrood virus (SBV) from Korean honeybee (<i>Apis mellifera</i>) Chang-Hee Kweon, Mi-Sun Yoo, Hyun-Ji Seo, Ha-Na Jung, Woo Ram Bae, Hee-Soo Lee, Seung-Won Kang, Yun Sang Cho
15:30-15:45	Korea	Artificial infection of Korean Sacbrood virus to Apis mellifera: analysis on its capability of viral replication. Joo Seong Lee, So Jung Yong, Giang Thi huong Luong, Ji Hee Wang, Sang Hyoun Min, Byoung Su Yoon
15:45-16:00	Korea	Development of Ultra-Rapid Real-Time PCR for detection against Korean Sacbrood Virus Sang-Hyoun Min, Chil-Woo Lee, Sun-Bok Lee, Byoung-Su Yoon
16:00-16:15	Korea	Development of Ultra-Rapid Real-Time PCR for detection against Black Queen Cell Virus Giang Thi Huong Luong, Joo-Seong Lee, So-Jung Yong, Sang-Hyoun Min, Ji-Hee Wang, Byoung-Su Yoon
16:15-16:30	China	Infection of Apis cerana sacbrood virus in Apis mellifera Hong-Ri Gong, Xiu-Xian Chen, Zhe-Guang Lin, Fu-Liang Hu, Huo-Qing Zheng
16:30-16:45	Switzerland	The more the merrier: deformed wing virus loads, clinical symptoms and longevity of honeybee workers Benjamin Dainat, Marion Mehmann, Peter Neumann

Bee Health

Symposium: Hygienic Management I

Chair-Person: Dr. Francois DIAZ and Dr. Myoung-lyeol LEE

17:00-17:15	Korea	Foundation of natural bee comb Youngseog Lee, Seungtae Kim
17:15-17:30	Canada	Mineral deficiencies in bees
		Hossein Yeganehrad, Hamzeh Ramezani Karim
17:30-17:45	Canada	Occurance of Eurpean foulbrood disease (EFB) during
		Hamzeh Ramezani Karim, Hossein Yeganehrad, Maryam Moarefi
17:45-18:00	United States	Master beekeeper education programs: Tool to support small scale beekeeper education Mark Dykes
18:00-18:15	Canada	Investigating the effect of high relative humidity and high
		carbon dioxide concentration in beehives on honeybees death rate in winter
		Hamzeh Ramezani Karim, Hossein Yeganehrad, Sajad Jazani
18:15-18:30	Nepal	Pest surveillance in indigenous bee hives in subtropical hilly
		region of Nepal Min Raj Pokhrel

Bee Health

Symposium: Bacterial Disease

Chair-Person: Dr. Violeta SANTRAC and Dr. Yun Sang CHO

10:10-10:15	Bosnia and Herzegovina	Clinical veterinary bacteriology as reference for finding Paenibacillus larvae in apiaries Violeta Santrac
10:15-10:30	Turkey	In vitro evaluation of antimicrobial effect of propolis against Paenibacillus larvae genotypes in Turkey Aygün Schiesser, Ömür Gençay Çelemli, Aslı Özkırım, Nevin Keskin
10:30-10:45	Turkey	In Vitro Assessment of the Antibacterial Potential of <i>Rhododendron</i> sp. Extracts as an Alternative Remedy for American Foulbrood Disease Aygun Schiesser, Sedat Sevin, Emine Baydan, Aslı Özkırım
10:45-11:00	Canada	Investigating the genetic and environmental factors on the chalkbrood disease Hamzeh Ramezani Karim, Hossein Yeganehrad, Sajad Jazani
11:00-11:15	Sweden	Fighting AFB; Sampling, sanitation and management strategies Eva Forsgren

Symposium: Fungal Disease

Chair-Person: Dr. Asli OZKIRIM and Dr. Mi-Sun YOO

13:00-13:15	Turkey	Transmission of Nosema spores examined by using Cages Asli Ozkirim, Aygun Schiesser
13:15-13:30	Iran	Molecular Identification of <i>Nosema ceranae</i> in East-Azerbaijan province, Iran Nasser Razmaraii, S. Sadegh-Eteghad, H. Babaei, H. Paykari, K. Esmaeilnia, L. Froghy
13:30-13:45	Taiwan	Screening and identification of microsporidia specific gene from <i>Nosema ceranae</i> infected honeybee and its application of microsporidium detection Yu-Shin Nai, Ming-Ren Yen, Yue-Wen Chen, Chung-Hsiung Wang
13:45-14:00	Turkey	Dynamic of Honey Bee Mid-gut During <i>Nosema</i> spp. Infections and After Treatment Asli Ozkirim, Aygun Schiesser
14:00-14:15	Korea	Development of molecular diagnostics of honeybee fungal diseases in field So Jung Yong, Joo Seong Lee, Giang Luong Thi Huong, Sang Hyoun Min, Ji Hee Wang, Byoung Su Yoon
14:15-14:30	Korea	Development of ultra-fast detection method for honeybee fungal pathogens in field Ji-Hee Wang, Sang-Hyoun Min, So-Jung Yong, Joo-Seong Lee, Giang Thi Huong Luong, Byoung-Su Yoon

Symposium: Hygienic Management II

Chair-Person: Dr. Jeff PETTIS and Prof. Yoon-Kyu LIM

15:00-15:15	Korea	Remote monitoring system of the honeybee-controlled microenvironment in the hive for the precise apiculture Yoonkyu Lim, Suyeon Kim, JongMoon Cho
15:15-15:30	Ethiopia	Circumstances, Constraints and Prospects of Honey-bee (<i>Apis mellifera</i>) Conservation: The Case of Dale District, Sidama Zone, Southern Ethiopia Tariku Olana Jawo, habil Mechthild Roth
15:30-15:45	India	Comparative hygienic behaviour of <i>Apis mellifera</i> L. and <i>Apis cerana</i> F. Division of Entomology, 6th Block, Sher-e-Kashmir University of Agricultural Sciences & Technology, Faculty of Agriculture chatha - 180 009. Devinder Sharma, Dharam Pal Abrol, Diyva Chaand
15:45-16:00	United States	Colony failure linked to low sperm viability in honey bee (<i>Apis mellifera</i>) queens and potential factors affecting viability. Jeff Pettis, Nathan Rice, Dennis vanEngelsdorp, Katie Joselow, Veeranan Chaimanee
16:00-16:15	Germany	Genetically modified bees Walter Haefeker
16:15-16:30	Greece	Efficacy of HiveAlive [™] in increasing colony population during field trials Fani Hatjina
16:30-16:45	Indonesia	Collagen type I density on dental pulp inflammation of Sprague-Dawley rats following the application of Trigona sp propolis from South Sulawesi province, Indonesia ARDO Ardo Sabir, Latief Mooduto, Cahyono Kaelan, Sherly Horax

Symposium: Pest

Chair-Person: Dr. Franco MUTINELLI and Mr. Martine BERNIER

17:00-17:15	Canada	Pupal Development of <i>Aethina tumida</i> (Coleoptera: Nitidulidae) in Thermo-Hygrometric Soil Conditions Encountered in Temperate Climates Martine Bernier, Valérie Fournier, Pierre Giovenazzo
17:15-17:30	Libya	Study by scanning electron microscopy of the antenna of the female Bee louse fly <i>Braula coeca</i> Nitzsch (Diptera: braulidae) Alhashmi Agleyo
17:30-17:45	Nigeria	Co-existence and interactions of pests with bee-wax baited <i>Gmelina arborea</i> (Roxb.) woodhives in Abeokuta, Nigeria Gabriel Adedeji, Adedapo Aiyeloja, Emuobonuvie Emerhi
17:45-18:00	Italy	Early reaction measures, management and surveillance of small hive beetle in Italy Franco Mutinelli, Giovanni Federico, Antonino Ammendola, Gianluca Grandinetti, Andrea Maroni Ponti
18:00-18:15	Nepal	Pests and predators of honey bee species of Nepal Khem Raj Neupane
18:15-18:30	Canada	Control of Aethina tumida (Coleoptera: Nitidulidae) using in- hive traps Martine Bernier, Valérie Fournier, Les Eccles, Pierre Giovenazzo

Bee Health

Symposium: Hygienic Management III

Chair-Person: Dr. Stephen PERNAL and Dr. Sang Mi HAN

13:00-13:15	Canada	Assessing Risk Factors Associated with Honey Bee Colony Survival in Canada Stephen Pernal, Marta Guarna, Shelley Hoover
13:15-13:30	United States	Do Nanotechnology Based Formulations Increase Pesticide Exposure to Honey Boos?
		Louisa Hooven, Jino Son, Ramesh Sagili, Stacey Harper
13:30-13:45	Ukraine	Unsustainable beekeepings is main cause for the decline of populations of honey bees in Orzhytsky district, Poltava region, Ukraine : Results of epidemiological analysis Viacheslav Tsuprykov
13:45-14:00	China	Different hygienic performance of European honeybee (<i>Apis</i> <i>mellifera L.</i>) and Asian honeybee (<i>Apis cerana</i> Fabr.) Zhe-Guang Lin, Paul Page, Peter Neumann, Vincent Dietemann, Huo-Qing Zheng
14:00-14:15	United States	Super DFM - Honey Bee Increases Winter Hive Survival and Reduces Disease. Vyacheslav Strogolov, Earl Hoffman, Carol Hoffman
14:15-14:30	Taiwan	Application of new type bee counter for monitoring the homing rate of microsporidian, <i>Nosema ceranae</i> , infected honeybee colonies Chung Yu Ko, Yu Shin Nai, Joe Air Jiang, Yu Wen Chen

Symposium: Pesticides I

Chair-Person: Dr. Fani HATJINA and Prof. Dr. Chuleui JUNG

15:00-15:15	United Kingdom	Neonicotinoids & Bees: A review of recent regulatory decisions & published literature Peter Campbell
15:15-15:30	Greece	Field assessment of impacts of different neonicotinoids on
		honey bee queens and drones
		Fani Hatjina, B. Bak, M. Bienkowska, C. Costa, R. Dall'Olio, M.
		Drazic, C. Garcia, D. Gerula, A. Grey, D. Kezic, N. Kezic, P.
		Medrzycki, M. Mladenovic, B. Panasiuk, M. Peterson, S. Rasic,
		M. Siuda, L. Stanisavljevic, S. Tosi, J. Wilde
15:30-15:45	Russia	Background concentrations of imidacloprid cause degradation
		of drone sperm in field studies
		Alexey Nikolenko, Luiza Gayfillina, Iskander Gilyazitdinov,
		Vladimir Kugeyko, Kirill Kugeyko, Elena Saltykova
15:45-16:00	Korea	Acute oral toxicity of neonicotinoid insecticides on honey bees
		with different body sizes from different geographic
		distribution
		Changyeol Lee, Sungmin Jeong, Chuleui Jung
16:00-16:15	Belgium	Risk assessment of pesticides on bees – state of the art
		Noa Simon-Delso, Janine Kievits, Etienne Bruneau,
		Job van Praagh
16:15-16:30	China	Screening of natural herbs against Nosema ceranae in
		honeybees (Apis mellifera L.)
		Xiu-Xian Chen, Shuai Wang, Hong-Ri Gong, Fu-Liang Hu,
		Huo-Qing Zheng
16:30-16:45	India	Are Varroa destructor mites resistant to acaricides in India?
		G Narendra Kumar, O P Chaudhary, H D Kaushik

Symposium: Pesticides II

Chair-Person: Dr. Geoffrey WILLIAMS and Dr. Yong Soo CHOI

17:00-17:15	France	Neonicotinoids and bees: The worldwide integrated assessment of these insecticides reveals major impacts on pollinators and also on biodiversity Jean Marc Bonmatin
17:15-17:30	Switzerland	Neonicotinoid pesticides severely affect honey bee (<i>Apis</i> <i>mellifera</i>) queens Geoffrey Williams, Aline Troxler, Nadège Forfert, Gina Retschnig, Kaspar Roth, Orlando Yañez, Dave Shutler, Robin Moritz, Peter Neumann, Laurent Gauthier
17:30-17:45	Benin	Toxicity to honey bees <i>Apis mellifera adansonii</i> of some insecticides used in cotton production in Benin Armand Paraiso, Adrien Zocanclounon, Henry Tchibozo, Franck Sokenou, Constantin Yeyi
17:45-18:00	France	French Beekeepers against systemic insecticides: a 20-years fight Henri Clement
18:00-18:15	Switzerland	Lethal and sub-lethal time-lag effects of neonicotinoids and Varroa destructor on western honey bees Apis mellifera Lars Straub, Geoffrey Williams, Kitiphong Khongphinitbunjong, Annette Schneeberger, Gina Retschnig, Panuwan Chantawannaku, Vincent Dietemann, Peter Neumann
18:15-18:30	Singapore	A Risk Assessment Scheme to Assess Potential Side Effect of Pesticide to Honeybees Christian Maus

Symposium: Surveillance & Epidemiology I

Chair-Person: Prof. Dirk De GRAAF and Dr. Mi-Sun YOO

09:00-09:15	Korea	Molecular Detection of Honeybee Disease in <i>Apis mellifera</i> and <i>Apis cerana</i> in Korean Apiaries, the first half 2015 Woo Ram Bae, Mi-Sun Yoo, Hyun-Ji Seo, Ha-Na Jung, Hee-Soo Lee, Seung-Won Kang, Yun Sang Cho
09:15-09:30	China	Prevalence and incidence of viruses in honey bee (<i>Apis cerana cerana</i>) in China Chunsheng Hou, Qingyun Diao, Beibei Li, Yanna Chu
09:30-09:45	China	Current Situation and Development Trends of Risk Assessment for Bee Pests and Disease Linsheng Yu, Yun Li, Youhua Zhang, Fangdong Li
09:45-10:00	Belgium	New biological threats to Uganda's beekeeping sector Moses Chemurot, Lina de Smet, Anne Akol, Dirk de Graaf
10:00-10:15	Brazil	Colony collapse incidents in Africanized honey bees in Brazil Dejair Message, Izabel Christina Silva, David De Jong, Naiara H.A. Freitas, Erica Weinstein Teixeira
10:15-10:30	United Kingdom	Build the Buzz (the value of "big data") Sandra Kordic , Huw Evans
10:30-10:40	Thailand	Evaluation of stingless bee propolis for the control of Nosemosis in dwarf honeybee, Apis florea Guntima Suwannapong, Samrit Maksong, Mananya Phiancharoen, Eric Benbow
10:40-10:50	Russia	The role of vitellogenin gene expression level in <i>Apis mellifera</i> <i>mellifera</i> L. longevity Elena Saltykova, Lusa Gaifullina, Aliya Karimova, Almaz Gataullin, Alexey Nikolenko

Bee Health

Symposium: Surveillance & Epidemiology II

Chair-Person: Dr. Fani HATJINA and Dr. Lionel Segui GONCLAVES

10:50-11:05	Belgium	Unexplained honeybee colony disorders: new research questions coming from field experience Noa Simon-Delso, Gilles San Martin, Etienne Bruneau, Louis Hautier
11:05-11:20	France	Bees and climate change Henri Clement
11:20-11:35	Brazil	Application of the electronic device "BEE ALERT" for registering death of Honey Bees, Stingless Bees in general and Disappearance of Honey Bees (CCD) in Brazil. Lionel Segui Goncalves, Dayson Castilhos
11:35-11:50	Turkey	Current status of honeybee diseases in Turkey Ahmet Onur Girisgin
11:50-12:05	Philippines	Physico-chemical Characteristics of Honey from Indigenous Honey Bee Species from the Island of Palawan, Southern Philippines Elmer A. Polintan, Cleofas R. Cervancia
12:05-12:20	France	Identifying effectors of the honeybee immune response, through mass spectrometry, may represent a promising solution for bee health monitoring Michel Bocquet, Philippe Bulet, Yves le Conte, Laurent Gauthier, Katarina Bilikova
12:20-12:35	China	Appropriate Linoleic Acid Supplemental Level in Larvae Diet of Apis mellifera lingustica Zhen-guo Liu, Sheng-wei Wang, Bao-hua Xu

Symposium: Pollination I

Chair-Person: Dr. U. Lee and Dr. SG Lee

15:00-15:15	United States	Drivers of pollinator health in the United States Dennis Van Engelsdorp
15:15-15:30	Japan	Flower resource utilization and seasonal growth of Japanese honeybee colonies in a Satoyama landscape in northern Japan. Ayumi Fujiwara, Takehito Yoshida, Izumi Washitani
15:30-15:45	Nigeria	Assessment of the floristic, nutritional and anti-nutritional composition of west-African honeybee "stored" pollen Caroline Akachuku
15:45-16:00	Togo	Pollination and bee flora Kodjo Logou Agossou
16:00-16:15	Russia	The melliferous resourses of the Russia and a new criterion of the regions' melliferous value Vladimir Kulakov
16:15-16:30	Bangladesh	Role of honeybee (<i>Apis mellifera</i>) on the yield and yield contributing characteristics of rapeseed (mustard) variety BARI Sarisha-14 Rabiul Islam
16:30-16:40	Discussion led	by chair persons

Symposium: Pollination II

Chair-Person: Prof. Dennis VANENGELSDORP and Dr. SG LEE

17:00-17:15	India	Pollination of tomatoes by the stingless bee , <i>Tetragonula irridipenis</i> , Chikmagalore , India M.S. Reddy, Nethra S.
17:15-17:30	India	Diversity and abundance of pollinating insects on cucumber and bittergourd flowers and their impact on quality and quantity of crop production Dharam Pal Abrol, Ngawang Dorjay
17:30-17:45	Brazil	Colony multiplication and management of stingless bees to provide crop pollination services Cristiano Menezes, Kátia Braga, Marcelo Poletti, Ayrton Vollet-Neto, Kátia Aleixo, Ariany Rossi, Maurício Castro, Fernando Quenzer
17:45-18:00	Oman	Differentiation of Omani Acacia (Acacia tortilis) and white Acacia (Robinia pseudoacacia) honeys using botanical and physicochemical analysis Aliya Sajwani, Sardar Farooq, Elsadig Eltayeb
18:00-18:15	China	The status of bee pollination on oilseed rape in China Pinpin Hu, Lihong Chen, Jie Wu, Jianmei Wang
18:15-18:30	Malaysia	Melissopalynology of stingless bees (Hymenoptera: Apidae: Hetrotrigona itama) at Taman Tropika Kenyir (TTK), Terengganu Roziah Ghazi, wahizatul afzan azmi, mohd Fahimee jaapar, Norul Badriah Hassan
18:30-18:45	Turkey	Researching pollination effect of honeybees (<i>Apis mellifera</i> L.) on Almond Gökhan Akdeniz, Ajlan Yılmaz, Ahmet Güler, Yeşim Okay, Ahmet Kuvancı, Şeref Cınbırtoğlu, Cem Bilim, İzzet Açar

Symposium: Pollination III

Chair-Person: Prof. Nazim SEKEROGLU and Dr. YK PARK

10:10-10:25	Malaysia	Effects of stingless bees, <i>Heterotrigiona itama</i> (Apidae: Meliponinae) pollination on greenhouse rock melon (<i>Cucumis melo</i> var. Glamour) Wahizatul Afzan Azmi
10:25-10:40	Korea	A pollination method for using Bumblebees in onion (Allium
		<i>cepa</i> L.) seed production
		Kyeong Yong Lee, In Sik Hwangbo, Young Bo Lee, Hyung Joo Yoon
10:40-10:55	India	Bombiculture in India: Present status and future prospects
		RajKumar Thakur, Lokender Kashyap, Avinash Chauhan
10:55-11:10	Indonesia	Can differences in pollinator communities and consequent
		crop pollination deficits be detected?
		Damayanti Buchori, Akhmad Rizali, Anik Larasati,
		Purnama Hidayat, Hien Ngo, Barbara Herren
11:10-11:25	Turkey	Morphological, organoleptical and starch analysis of the pollen
		grains collected in ardahan region by honey bees
		Deniz Canli, Kadriye Sorkun
11:25-11:40	Philippines	Native bees of Mt. Banahaw-San Cristobal protected
		landscape, Philippines
		Cecilia Gascon, Amalia Almazol, Ronald Garcia,
		Maynard Vitoriano, Elloida Esclanda
11:40-12:00	Discussion lec	l by chair persons

Symposium: Pollination IV

Chair-Person: Dr. EU NOH and Dr. YK PARK

13:00-13:15	Russia	Comparative productivity of common evening primrose (<i>Oenothera biennis</i>) from different ecologic-geographical zones Anatolii Savin
13:15-13:30	Korea	The effect of climate change on the predicted spring emergence of Osmia cornifrons Radoszkowski in Korea, China and Japan Shubao Geng, Chuleui Jung
13:30-13:45	Russia	Thuringer mallow as a perspective honey plant of Russia Yurii Dokukin
13:45-14:00	Malaysia	Pollen distribution of <i>Apis mellifera</i> in the East coast of Peninsular Malaysia. Shamsul Bahri Abd Razak, Muhammad Firdaus Sulaiman
14:00-14:15	United States	National assessment of native pollinator abundance: status, trends, and impact in the United States. Insu Koh, Eric Lonsdorf, Neal Williams, Claire Brittain, Rufus Isaacs, Jasson Gibbs, Taylor Ricketts
14:15-14:30	Turkey	The importance of pollination on pomiculture and its effects on yield and quality Turan Karadeniz
14:30-14:40	Discussion led	by chair persons

Symposium: Bee Flora I

Chair-Person: Dr. YK PARK and Ms. HS KIM

10:10-10:25	Turkey	The favorite plants of honey bees in Turkey Mine Kocyigit, Bahar Gürdal
10:25-10:40	Korea	Traditional and ethnobotanical honey plants list in South
		Korea Sugwang Laa Dahuun Kim, Jaangha Laa, Yaungki Dark
		Sugwang Lee, Donyun Kim, Jeongho Lee, Youngki Park, Seahyun Kim
10:40-10:55	Canada	Impact of different feeding strategies on honey bees during cranberry pollination
		Georges Martin, Pierre Giovenazzo
10:55-11:10	Turkey	Protein and mineral contents of pollen that is important for honey bees Seref Cinbirtoglu, Metin Deveci, Fazil Guney
11:10-11:25	Turkey	The characterization of <i>Petroselinum crispum</i> L. honey from Hatay-Turkey Kadriye Sorkun, Ö mür Gençay Ç elemli, Deniz Canli, Duygu Nur Ç obanoğlu, Fatma Güzel
11:25-11:40	Turkey	The characterization of Anzer pollen collected by honey bees Kadriye Sorkun, Ö mür Gençay Çelemli, Duygu Nur Çobanoğlu, Deniz Canli, Fatma Güzel
11:40-12:00	Discussion le	ed by chair persons

Symposium: Bee Flora II

Chair-Person: Prof. YG PARK and Dr. SG LEE

13:00-13:15	Korea	The flowering pattern of Korean <i>Robinia pseudoacacia</i> L. during recent 10 years
		Dong Jin Seo, Hyeon Cheol Kim, Wi Yeong Lee, Jae Cheon Lee
13:15-13:30	Korea	The value of honey plants of Styrax japonicus Sieb. & Zucc.
		based on honeybee visit and nectar secretion characteristics
		Hyeusoo Kim, Moon Sup Kim, Jeong Ho Song, Sea Hyun Kim
13:30-13:45	Korea	Analysis of secreted nectar characteristics, sugar and amino
		acid content in floral nectar of Korean and Chinese hawthorn,
		Crataegus pinnatifida Bunge
		Moon-Sup Kim, Hyeusoo Kim, Jeong-Ho Song, Sea-Hyun Kim
13:45-14:00	Korea	The value of honey plants of <i>Tilia amurensis</i> Rupr. and <i>T</i> .
		mandshurica Rupr. & Maxim based on nectar secretion
		characteristics
		Jeong Ho Song , Hyeusoo Kim , Moon Sup Kim , Sea Hyun Kim,
		Uk Lee
14:00-14:15	Turkey	Honey and nectar plants of Turkey
		Nazim Sekeroglu
14:15-14:30	Korea	Classification according to flower morphological
		characteristics of genus Actinidia selected from Korea
		Youngki Park, Chul-Woo Kim, Sea Hyun Kim, Mahn-Jo Kim
14:30-14:45	Korea	Honeybee visiting and secreted nectar characteristics of Tilia
		insularis Nakai and relation with meteorologic traits
		Sea Hyun Kim, Moon Sup Kim, Hyeusoo Kim, Jeong Ho Song,
		Su Gwang Lee

Symposium: Pollination V

Chair-Person: Dr. John PREECE and Dr. YK PARK

17:00-17:15	Kenya	Enhancing strawberry productivity through bee pollination Grace Asiko, Jane Oketch, Jared Mochorwa, Patricia Nzano, Dinah Momanyi, Teresa Okecha, Blaise Okinyi, Christine Koech, Ruth Yego, David Palla
17:15-17:30	Benin	Beekeeping and bee pollination services in pesticide application context: case study in Benin, West Africa Bruno Agossou Djossa, Désiré Madohonan, Hermann Cyr Toni, Cyriaque Tokouè, Brice Augustin Sinsin
17:30-17:45	Libya	Arbutus pavarii Shrub a nectar and pollen source for <i>Apis</i> <i>mellifera</i> in EL-Jabal EL-Akhdar region in Libya Alhashmi Agleyo
17:45-18:00	Jordan	Influence of elevation on honeybees <i>Apis mellifera syriaca</i> (Hymenoptera: Apidae) flight activities and its impact on fruit set and quality of watermelon (<i>Citrullus lanatus</i> , Cucurbitaceae Shahera Zaitoun, Abd Al-Majeed Al-Ghzawi
18:00-18:15	Kenya	Important bee forage plants of African honey bee Apis mellifera Sculleta. (Hymenoptera: Apidae) in Southern Rangelands of Kenya Richard Kimitei, Bernard Korir, Peter Kaguthi, Paul Katiku
18:15-18:30	Grenada	Literature review for complied list of nectar, pollen and propolis sources for honey bees (<i>Apis mellifera</i>) throughout the world Megan Wannarka
18:30-18:40	Discussion le	d by chair persons

Symposium: Pollination VI

Chair-Person: Prof. Dennis VanEngelsdorp and Mr. MS Kim

09:00-09:15	Zimbabwe	The Pollination industry in Africa, challenges and options for enhancement Jacqueline Gowe
09:15-09:30	India	Assessing pollination efficiency of European honey bee (<i>Apis mellifera</i> L.), fruit yield and mono-floral honey production of litchi (<i>Litchi chinensis</i> Sonn.) in Indian Subtropics. Rajesh Kumar
09:30-09:45	Philippines	Mapping and distribution of native bees in Mt. Banahaw-San Cristobal protected landscape, Philippines Cecilia Gascon, Amalia Almazol, Ronald Garcia, Maynard Vitoriano
09:45-10:00	India	Mellissopalynological analysis of <i>Apis dorsata</i> honey from Coonoor and Kotagiri regions in the Nilgiris, India. Shiny Rehel
10:00-10:15	Philippines	Salicin is not detected in propolis from stingless bee, <i>Tetragonula biroi</i> , from the Bicol Region, Luzon Island, Philippines Elmer A. Polintan, Cleofas R. Cervancia
10:15-10:30	Brazil	Trophic niche of <i>Melipona (Melikerria) interrupta</i> (Apidae: Meliponini) bred in Central Amazon, Brazil. Maria Lúcia Absy, Marcos Gonçalves Ferreira
10:30-10:45	Jordan	Bee diversity, bee pollination and seed set of <i>Trigonella</i> <i>moabitica</i> Zoh. (Leguminosae) as a native range plant grown under semiarid Mediterranean conditions Abd Al-Majeed Al-Ghzawi, Shahera Zaitoun

Plenary Session

Chair-Person: Mr. Etienne BRUNEAU and Dr. Hyun-Woo OH

17:00-17:25	Belgium	Single-flower honeys as aromatic references for honey wheel Etienne Bruneau, Marie Warnier, Carine Massaux
17:25-17:50	Germany	Fast Authenticity and Quality Profiling of Honey by NMR Spectroscopy Stephan Schwarzinger, Felix Brauer, Bernd Kaempf, Lucas Koeberle, Benjamin Duddenhoefer, Christopher Igel, Wolfrat Bachert, Markus Hessefort, Paul Roesch
17:50-18:15	Korea	Immunological discrimination of honey by honey major protein Hee-Woong Kim, Deug-Chan Lee, Hae-Ik Rhee
18:15-18:40	Turkey	Production of propolis in accordence with food safety and security with contracted beekeping model Taylan Samancı, Aslı Elif Sunay, Mustafa Bayraktar

Beekeeping Technology and Quality Room 104, 15:00 – 16:40, Wednesday, 16 September

Symposium: Beekeeping Techniques

Chair-Person: Dr. Ming XU and Prof. Dr. HyungWook KWON

15:00-15:15	Turkey	Effects of bee feed patties with different protein ratios on overwintering abilities of honey bee colonies Devrim Oskay, Onur Görkem Akyol, Gizem Sönmez Oskay
15:15-1530	Egypt	All the colonies of any apiary in one compact hive. Abdelhaleem Esmail
15:30-15:45	Jordan	Honeybee managment in a climatologically variable environment in Jordan Mohamamd Alrababah, Mohamamd Alhamad, Ahmad Bdour
15:55-16:10	Ukraine	Effective Vasyl Priyatelenko's three-strorey beehive with unique frames Vasyl Priyatelenko, Elena Ilienko, Victor Fursov
16:10-16:25	Ukraine	The biological potential of bee colonies is the base of the intensive beekeeping Valerii Semeniuk, Nadiia Semeniuk
16:25-16:40	Egypt	Potential impacts of climate change on managed honey bee colonies in Egypt Hossam Abou Shaara

Beekeeping Technology and Quality Room 104, 17:00 – 18:25, Wednesday, 16 September

Symposium: Residues and Adulteration

Chair-Person: Dr. Lutz EIFLEIN and Dr. Jeong-Woo CHON

17:00-17:15	Slovenia	Coumaphos in wax and honey Andreja Kandolf Borovšak, Nataša Lilek
17:15-17:30	Poland	Comparison of transfer of different sulfonamides from contaminated beeswax to honey Kamila Mitrowska, Maja Antczak
17:30-17:45	New Zealand	The use of chemical profiling and contemporary data interpretation methods to quantify Manuka honey John Rawcliffe, Terry Braggins, Tony Wright, Ralf Schlothauer, Jonathan Stephens
17:55-18:10	Germany	Sources of contamination of honey with genetically modified material. Walter Haefeker
18:10-18:25	Croatia	Effect of honeybee wax processing on toxic metal content Ivana Tlak Gajger, Nina Bilandžić, Marina Kosanović, Marija Sedak

Beekeeping Technology and Quality Room 104, 10:10–11:55, Thursday, 17 September

Symposium: Analytical Techniques

Chair-Person: Prof. Dr. Ivana Tlak GAJGER and Dr. Hyun-Woo OH

10:10-10:25	France	Nuclear Magnetic Resonance (NMR) applied to honey testing: new analytical perspectives. Eric Jamin
10:25-10:40	Australia	Identification of Subtypes and Plant Sources of Kangaroo Island Propolis through Statistical and Similarity Scoring Methods Douglas Iain King, Colin Charles Duke, Noushin Aminimoghadamfarouj
10:40-10:55	Argentina	 Monofloral citrus honeys: the use of near infrared spectroscopy (nir) and volatile composition to use as markers of botanical origin Gabriela Tamaño, Ana Bonini, Eduardo Dellacassa, Eduardo Boido, Gloria Daners, Laura Fariña, Vanesa Giudici, Natalia Muchiutti, Valeria Leffler, Ivan Robson, Guillermina Fagundez
10:55-11:10	Romania	Issues about the informational quality of bee products, as evidenced by sensitive crystallization Claudia Torok, Cristina Daniela Cimpean, Cornel Hotiu, Cristina Pavel
11:10-11:25	China	HPLC method for determination of melittin in individual honeybee (<i>Apis mellifera</i>) venom sac Chen Wenbin, Dong Jiangtao, Huang Shaokang, Wu Zhenhong, Miao Xiaoqing
11:25-11:40	China	Analysis of phenolic compounds and abscisic acid of acacia honey by solid-phase extraction coupled with HPLC Hongcheng Zhang, Chunli Sun
11:40-11:55	Japan	Methodological Study on Quantitative Analysis of the Royal Jelly Protein Apisin. Takako Furusawa, Yasuko Arai, Kenji Kato, Kenji Ichihara

Symposium: Breeding and Selection

Chair-Person: Dr. Miguel Vilas-BOAS and Prof. Dr. Young-Ho KOH

13:00-13:15	Argentina	Hive double queen as a tool to increase the honey production and requeening in <i>Apis melifera</i> in subtroplical climate Gladys Schaab, Anibal Gomez, Pablo Chipulina, Alfonso Lorenzo, Edgardo Rodriguez, Emilio Figini
13:15-13:30	Canada	The roles of pollen consumption on queen introduction Hamzeh Ramezani Karim, Hossein Yeganehrad, Sajad Jazani
13:30-13:45	Argentina	New strategies of beekeeping production – genetic variability evaluation of hygienic behavior and its relationship to varroosis Osvaldo Atela, Susana Bruno, Pilar de La Rua, Rodrigo Altamirano
13:45-14:00	Ukraine	Effective technology of Mother of God's Bee-direction, with high productivity of honeybee rearing Vyacheslav Gluschenko Nikodim, Victor Fursov
14:00-14:10	Saudi Arabia	Natural nest characteristics of <i>Apis mellifera jemenitica</i> (Hymenoptera; Apidae) and its implications in frame hive adoption Nuru Adgaba, Ahmed Al-Ghamdi, Awraris Getachew, Yilma Tadesse , Jved Ansari
14:10-14:25	Egypt	A GIS approach for determination of the optimum beekeeping density and productivity during Talh (<i>Acacia gerrardii</i> Benth.) flow Abdulaziz Alqarni, Awad Hassan, Hael Raweh, Ayman Owayss
14:25-14:40	China	Effects of Division Management of Colony Linyu TANG

Symposium: Characterization of Honey and Bee Products I

Chair-Person: Dr. Miguel VILAS-BOAS and Prof. Dr. Young-Ho KOH

17:00-17:15	Colombia	Phenolic compounds identified as markers of origin in honey from colombian coffee crops Edith Castro Cruz, Martha Quicazán Sierra, Juan Marin Loaiza
17:15-17:30	Russia	Flavonoid compounds propolis
		Elena Vakhonina, Nataliya Budnikova, Dmiyrii Mitrofanov,
		Galina Stepantseva
17:30-17:45	Serbia	Polyphenolic and sugar profiles of nectars of some melliferous plants
		Živoslav Tešić, Uroš Gašić, Tomislav Tosti,
		Dušanka Milojković-Opsenica
17:45-18:00	Kenya	"An analysis of the challenges faced by SMES in marketing
		honey in the third world countries'', a case study of Nairobi,
		Kenya.
		Benson Wainaina

Beekeeping Technology and Quality Room 104, 10:10 – 11:40, Friday, 18 September

Symposium: Characterization of Honey and Bee Products II

Chair-Person: Ms. Gudrun BECKH and Dr. Hyun-Woo OH

10:10-10:25	Portugal	Chemical properties of Portuguese lavender honey Andreia Tomás, Paulo Russo-Almeida, Miguel Vilas-Boas
10:25-10:40	Romania	New approach on sensory analysis of honey, according to ayurvedic knowledge Cristina Pavel, Cristina-Daniela Cimpean, Laura Stan
10:40-10:55	Turkey	Functional and physicochemical properties of pine honeys collected between 2010 and 2014 from Turkey Ufuk Alpat, Emel Damarlı, Tuğçe Daştan, Ö zge Erdem Sönmezer, Elif Yorulmaz Ö nder
10:55-11:10	Slovenia	Chemical analyses of bee collected pollen from Slovenia (Sustainable project Honey future) Natasa Lilek
11:10-11:25	Ethiopia	Physical properties, hydroxymethylfurfural and sugars profile of ethiopian honey Abera Belay
11:25-11:40	China	China's royal jelly export in 2014 Ming Xu, Lihong Chen, Siriwat Wongsiri

Beekeeping Technology and Quality Room 104, 13:00 – 14:40, Friday, 18 September

Symposium: New Technology and Good Beekeeping I

Chair-Person: Dr. Abera BELAY and Prof. Dr. Deug-Chan LEE

13:00-13:15	United Kingdom	Electronic bee hive monitoring for scientists Sandra Kordic , Huw Evans
13:15-13:30	Canada	Method of operating commercial venom collection Hamzeh Ramezani Karim, Hossein Yeganehrad, Sajad Jazani-Dorche
13:30-13:45	United Kingdom	Electronic bee hive monitoring for beekeepers Sandra Kordic , Huw Antony Evans
13:55-14:10	United States	Record Keeping is for Everyone! James Wilkes
14:10-14:25	Australia	The development of a beekeeping innovation, "Flow" Stuart Anderson, Cedar Anderson
14:25-14:40	Belgium	First steps for good beekeeping practices guide for apitherapy products Etienne Bruneau

Beekeeping Technology and Quality Room 104, 15:00 – 16:15, Friday, 18 September

Symposium: New Technology and Good Beekeeping II

Chair-Person: Dr. Ming XU and Dr. Jeong-Woo CHON

15:00-15:15	Colombia	Structural disruption and bioactive effect on bee-pollen treated by proteolytic enzymes Carlos Zuluaga, Marta Quicazán
15:15-15:30	Brazil	Some challenges and achievements in the development of Brazilian green propolis Jairo Bastos
15:30-15:45	Greece	Different types of traps collecting propolis by honey bees: Do they affect quantity and quality of propolis? Antonios Tsagkarakis, Konstantinos Gardikis, Ioannis Katsenios, Sotirios Strigkos, Maria-Ioanna Stavropoulou, Konstantina Stathopoulou, Nektarios Aligiannis, Georgios Balotis
15:45-16:00	Russia	Stability of hormone components in products based on drone brood Dmitrii Mitrofanov, Nataliya Budnikova, Liliya Burmistrova
16:00-16:15	France	Gentle Beekeeping® : a brand-new certification scheme for happy bees and happy beekeepers Catherine Flurin

Plenary Session I

Chair-Person: Dr. Cristina MATEESCU and Dr. Sang Mi HAN

13:00-13:30	Australia	Honey – a sweet solution for problem pathogens and promoting digestive health Shona Blair
13:30-14:00	Bulgaria	Proposal for standardization of propolis: international
		standards - how is it possible
		Vassya Bankova, Milena Popova, Boryana Trusheva
14:00-14:30	Korea	The therapeutic effects of bee venom on liver fibrosis
		Kwan kyu Park
14:30-14:40	Discussion	
	* (Guide time: it could be often changed by chairman under condition of symposium

Plenary Session II

Chair-Person: Dr. Cristina MATEESCU and Dr. Sang Mi HAN

15:00-15:40	Romania	Apitherapy in the world. present situation and perspectives Stefan Stangaciu, Cristina Mateescu
15:40-16:20	Morocco	Therapeutic properties of moroccan bee products
		Badiaa Lyoussi
16:20-16:40	Discussion	
	× G	uide time: it could be often changed by chairman under condition of symposium

Symposium: A Potential Therapeutic Agents, Honey

Chair-Person: Dr. Cristina MATEESCU and Dr. Sang Mi HAN

10:10-10:15	Iran	Honey and runner Saleh Saleh Nezhad, Abdolkarim Salehnezhad, Majid Akef, Mashallah Jamshidi
10:15-10:30	Sudan	Honey: A complementary therapy in managing acute infant diarrhea Seif Eldin Mohammed, Kareemeldeen Nureldeen, M. Swar
10:30-10:45	Turkey	An evaluation of sperm morphology assay in mice exposed to Rhododendron honey Pınar Goç Rasgele, M. Kekeçoğlu, S., T. Kaya, F., D. Gökalp, M. Kambur
10:45-11:00	Ukraine	Honey from Uncaria tomentosa (willd.) DC: a new organic functional product that protects natural immunity and prevents premature radiation aging. Background and problem formulation Viacheslav Tsuprykov
11:00-11:15	Turkey	Microscopic and microbiological analysis of thyme honey in Turkey Ozgur Koru, Aslı Ozkok, Kadriye Sorkun
11:15-11:30	Turkey	Development of natural honey containing powder products as a sweetener Dilek Boyacıoğlu, Aslı Elif Sunay, Burcu Sezen
11:30-12:00	Discussion	

Symposium: Pharmacological Studies of Honey

Chair-Person: Prof. Dr. Shona BLAIR and Dr. In Phyo HONG

13:00-13:15	Egypt	Evaluation of honey as antibacterial agent Ahmed Hegazi, Eman Abdel- Rahman , Fayrouz Abd Allah
13:15-13:30	Pakistan	Evaluation of antibacterial activity of honey samples collected
		Naheed Rajper, Shakeel Farooqi
13:30-13:45	Turkey	Effects of honey addition on antioxidative properties of different herbal teas Asli Elif Sunay, Gamze Toydemir, Esra Capanoglu, Senem Kamiloglu, Ebru Durmus
13:45-14:00	Mexico	Antifungal activity of Melipona honey and its morphological effect Elizabeth Ortiz-Vazquez, Nidia Hau-Yama, Rubiel Dzib-Leon, Denis Magaña-Ortiz, Jesus Ramon-Sierra
14:00-14:15	Iran	Evaluation of the phenolic contents and antioxidant capacities of honey Saleh Saleh Nezhad, Kamaruddin Mohd Yusoff
14:15-14:30	Malaysia	Antioxidant activities and chromatographic phytochemical analysis of propolis derived from Malaysian Trigona apicalis Nor Hussaini Abd Hapit, Nornaimah Asem, Nur Adilah Abdul Gapar, Ahmad Firdaus Abd Hadi, Eshaifol Azam Omar
14:30-14:40	Discussion	

Symposium: Identification for the Use of Apitherapic Propolis

Chair-Person: Dr. Vassya BANKOVA and Dr. Soon Ok WOO

15:00-15:15	Turkey	Total Polyphenols and Chemical Properties of Turkish Propolis Fazil Guney, Omer Erturk, Nurten Yassihuyuk, Neslihan Cakici, Omer Yilmaz
15:15-15:30	Korea	Identification of the Active Compounds and their Anti- Alzheimer's Disease(AD) Activities of Propolis Ka Young Shin, Byoung Wook Choi, Bong Ho Lee
15:30-15:45	Korea	Geographical variation of antiviral activity of propolis against herpes simplex virus type 1 & 2. Kwon Dur Han, Gansukh Enkhtaivan, Song Jae Hyeung, Kim Narae, Lee Seung Wan
15:45-16:00	Indonesia	Transparent soap containing indonesian propolis wax againts <i>Candida albicans</i> in leukorrhea patients Muhamad Sahlan, Etin Rohmatin
16:00-16:15	China	Polyphenol-rich propolis extracts from China and Brazil exert anti-inflammatory effects by modulating ubiquitination of TRAF6 during the activation of NF-кВ Kai Wang, Lin Hu, Xiao-Lu Jin, Quan-Xin Ma, Fu-Liang Hu
16:15-16:30	Brazil	Preliminary safety data with a standard propolis extract (EPP-AF®). A phase I clinical trial in healthily volunteers Eduardo Coelho, Andresa Berreta, Erica Lia, Jairo Bastos
16:30-16:45	China	Evaluation of antioxidant polyphenols in Brazilian green propolis through spectrum-effect relationships and off-line HPLC-DPPH Xiao-Ge Shen, Cui-Ping Zhang, Xiao-Yu Cheng, Yan-Zheng Zhang, Fu-Liang Hu
Apitherapy

Symposium: Pharmacological Studies of Propolis

Chair-Person: Dr. Vassya BANKOVA and Prof. Dr. Myung-sang KWON

17:00-17:15	Brazil	"Innovative release carriers for the oral administration of Propolis: a promising medicine to Diabettes treatment" Franciane Marquele-Oliveira, Nathaly Amorim, Thalita da Silva, Daniel Carrão, Andresa Berretta
17:15-17:30	Indonesia	Analysis the expression of transforming growth factor-beta (TGF-β) in inflamed rat dental pulp tissue following application of <i>Trigona</i> sp propolis from South Sulawesi province, Indonesia (an immunohistochemistry study) Ardo Sabir
17:30-17:45	Korea	Effects of propolis on the streptozotocin-induced diabetic rats and insulin-independent diabetes mellitus mice Chung Nyun ki
17:45-18:00	Indonesia	Role of propolis as anti apoptotic agent in cisplatin-induced nephrotoxicity in mice. Joni Susanto, Imam Susilo, James Hutagalung, Heru Prasetyo, Gunawan Widodo
18:00-18:15	Indonesia	The potency of Trigona's propolis extract as reactive oxygen species inhibitor in diabetic mice Ahmad Ridwan, Ayu Nirmala Sari, Ramadhani Eka Putra, James Hutagalung
18:15-18:30	Indonesia	East Java propolis extract as potential intracanal medicament in chronic apical periodontitis caused by <i>Enterococcus faecalis</i> infections Tamara Yuanita, James Hutagalung, Ira Widjiastuti, Sri Kunarti
18:30-18:40	Discussion	

Symposium: Use of Propolis as a Natural Antibiotics

Chair-Person: Prof. Dr. Shona BLAIR and Dr. Soon Ok WOO

15:00-15:15	Hungary	Bee Hive Air Therapy in Europe János Körmendy-Rácz Dr. CSc, Attila Márkus Md
15:15-15:30	Korea	Anti-Helicobacter pylori activities of a new non-alcoholic water- soluble propolis (WEEP-30) Myung-sang Kwon, Seung-wan Lee, Narae Kim, Sunjoo Park, Uhee Jung, Hae-Ran Park, Sung-Kee Jo
15:30-15:45	Korea	Anti-inflammatory activities of a new non-alcoholic water- soluble propolis (WEEP-3®) Sung-Kee Jo, Uhee Jung, Hae-Ran Park, Seung-Wan Lee, Narae Kim, Sunjoo Park, Hyo-Jung Kwon, Myung-Sang Kwon
15:45-16:00	Brazil	The inhibition of inflammasome by Brazilian propolis (EPP-AF) Juliana Hori, Dario Zamboni, Daniel Carrão, Gustavo Goldman, Andresa Berreta
16:00-16:15	Philippines	Antimicrobial properties of propolis soaps against selected microorganisms Nicole Angelique Sanchez, Renard Jamora, Noel Sabino, Alejandro Fajardo, Cleofas Cervancia
16:15-16:30	Turkey	The effect of propolis on oral pathogens and human gingival fibroblasts Sule Sonmez, Levent Kırılmaz, Mine Yucesoy, Banu Yucel, Berna Yılmaz
16:30-16:40	Discussion	

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Apitherapy

Symposium: A Variety of Applications Studies of Propolis

Chair-Person: Prof. Dr. Badiaa LYOUSSI and Dr. Sung-Kee JO

17:00-17:15	Korea	Effects of dietary propolis supplementation on non-specific immune response and disease resistance of olive flounder (<i>Paralichthys olivaceus</i>) G.L.B.E. Gunathilaka, Dae-Han Oh, Yong-Kap Hur, Soon-Seon Kwon, Kyeong-Jun Lee
17:15-17:30	Korea	Propolis inhibits the adipogenesis of 3T3-L1 cells through down-regulation of PPARγ Byung Sun Yoo, Do Eun Kim, Han Bip Kim
17:30-17:45	Korea	Effects of propolis on skin cells: the promising material for cosmeceuticals Jung-Min Shin, Young Lee, Mi Yeung Kim, Na Rae Kim, Jeung-Hoon Lee
17:45-18:00	Japan	Brazilian propolis induces arginine-dependent insulin secretion. Takeshi Imai
18:00-18:15	Egypt	Anti-parasitic activity of propolis Eman Abdel- Rahman, Ahmed Hegazi
18:15-18:30	Japan	Biological activity of artepillin C obtained from Brazilian green propolis Byungyoon Cha
18:30-18:40	Discussion	

Symposium: Clinical Studies of Bee Venom

Chair-Person: Dr. Siu Wan IP and Dr. In Phyo HONG

10:10-10:25	Romania	Treatment of neuralgia with microdoses of bee venom Cristina Pavel
10:25-10:40	Egypt	Effect of bee venom acupuncture as a complementary modality for treatment of chronic low back pain Maha Saber, Eitedal Daoud, Aliaa al Gendy1, Khaled Abdel-Wahhab, Ahmed Hegazi
10:40-10:55	Russia	Apitherapy in diabetes Vasily Krylov, Anna Deriugina, Olga Barinova
10:55-11:10	Korea	Anti-wrinkle effects of honeybee venom serum on facial wrinkles Sangmi Han, Sungnam Chun, Kwankyu Park, Young mee Nichollos, Sokcheon Pak
11:10-11:25	Korea	Comprehensive and functional venomics of social wasps Vespa crabro flavofasciate Cameron and Vespa analis parallela Andre Kyungjae Yoon, Kyungmun Kim, Phuong Nguyen, Jong Bok Seo, Young Han Park, Ki-Gyoung Kim, Hong-Yul Seo, Young Ho Koh, Si Hyeock Lee
11:25-11:40	India	Bee bread–Various usage of bee bread and clinical experiences Pushpendra Singh Bhandari, Mirela Strant
11:40-12:00	Discussion	

Symposium: Pharmacological Effects of Bee Venom

Chair-Person: Prof. Dr. Kwan kyu PARK and Dr. Soon Ok WOO

13:00-13:15	Taiwan	Integrated apitherapy treatment of chronic osteomyelitis. Siu Wan Ip
13:15-13:30	Mongolia	Hypolipidemic and blood glucose lowering activity of honey bee venom (<i>Apis mellifera</i>) in alloxan induced diabetic rabbits Khulan Tserennadmid, Uuganbayar Baatartsogt, Solongo Ganbold
13:30-13:45	India	Effect of Indian honey bee venom (<i>Apis cerana</i>) on wound healing efficacy, anti-bacterial activity and purification of peptide components Bhargava Hunkunda Radhakrishna
13:45-14:00	Korea	The regulatory effects of purified bee venom on Propionibacterium acnes-induced inflammatory responses <i>in</i> <i>vitro</i> and <i>in vivo</i> Woo Ram Lee, Hyun Jin An, Jung yeon Kim, Hyun Chung, Kwan kyu Park
14:00-14:15	Turkey	Bioactive properties of honey bee products and their mixtures Sibel Silici
14:15-14:40	Discussion	

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Symposium: Pharmacological Effects of Royal Jelly, Bee Pollen

Chair-Person: Dr. Stefan STANGACIU and Prof. Dr. Mi Kyeong LEE

15:00-15:15	Canada	The effects of N-chromosome royal jelly & bee products on diabetes type 2
		Sajad Jazani-Dorche, Hossein Yeganehrad, Maryam Moarefi
15:15-15:30	Japan	MRJP-1 multimer activates cell proliferation of fibroblasts
		originated from gingiva and periodontal ligament
		Kikuji Yamaguchi, Toru Suzuki, Kiyoshi Murata, Akira Fujii,
		Yoshihisa Yamaguchi
15:30-15:45	China	Royal Jelly inhibits the growth of breast cancer in mice
		Zhang Shuang, Su Songkun
15:45-16:00	Romania	Transylvanian raw pollen – inhibiting effect on murine colon
		carcinoma culture cells; clinical case
		Alina Varadi, Rodica Margaoan, Ramona Grosu, Mirela Strant,
		Ioan Cozma
16:00-16:15	China	Proteomic research on the effect of royal jelly on carbon
		tetrachloride-induced liver injury in rats
		Miao Jing, Luo Yajuan, Shi Peiying, Wu Zhenhong,
		Miao Xiaoqing
16:15-16:30	Japan	Studies on estrogenic activities of royal jelly and its fatty acids
		in vitro and in vivo
		Kenji Ichihara, Satoshi Uchiyama, Shou Hotta,
		Tsuyoshi Nakanishi
16:30-16:40	Discussion	

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Symposium: Specification Studies of Royal Jelly, Bee Pollen

Chair-Person: Prof. Dr. Badiaa LYOUSSI and Dr. In Phyo HONG

17:00-17:15	Greece	A suggestion for royal jelly specifications Andreas Thrasyvoulou, Chrysoula Tananaki, Dimitrios Kanelis, Vasilis Liolios, Maria Dimou
17:15-17:30	Russia	Royal jelly normalizes microcirculation in the treatment of
		thermal injury in rats
		Alina Kovetzkaya
17:30-17:45	Japan	10-Hydroxy-2-decenoic acid, a unique fatty acid in royal jelly,
		extends lifespan in nematode Caenorhabditis elegans.
		Taketoshi Hata, Yoko Araki, Kenji Ichihara, Yoko Honda,
		Snuji Honda
17:45-18:00	China	Activity-guided isolation and identification of hepatoprotective
		components in rape bee pollen
		Liping Sun, Limiao Gao, Pengbo Gao, Alang Xu
18:00-18:15	Romania	Apilarnil (triturated drone larvae) – practical experience
		treating patients
		Cristina Aosan
18:15-18:30	China	Comparative lipidomics analysis of queen larvae and royal
		jelly from honeybee (Apis mellifera)
		Xiang XU, Limiao GAO, Pengbo GAO, Liping SUN
18:30-18:40	Discussion	

 $\$ Guide time: it could be often changed by chairman under condition of symposium

Symposium: Present Situation and Perspectives of Apitherapy

Chair-Person: Dr. Stefan STANGACIU and Dr. Sang Mi HAN

10:50-11:05	United Kingdom	The Apiceuticals : Geographic Medicine James Fearnley
11:05-11:20	China	21Century: Apitherapy Development in China Ming Xu, Lihong Chen, Jie Wu, Jiangmei Wang, Pingping Hu
11:20-11:35	Turkey	Development and recent legislative process on apitherapy in Turkey Mehmet Tanyuksel
11:35-11:50	Nigeria	Public knowledge, attitude, practice and constraints of apitherapy: A complementary remedy in health care delivery in Nigeria Adeyemi Mufutau Ajao
11:50-12:05	Russia	Possible use of apitoxins in normalization of alcohol drinking Igor Krivopalov Moskvin, Julia Korol, Alexei Krivopalov, Denis Krivopalov, Elena Fateeva
12:05-12:20	India	Clinical efficacy of an ayurvedic bee product Siktha taila & bee stings in allergic contact eczema (dermatitis) Sanjeev Sood
12:20-12:40	Discussion	

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Plenary Session

Chair-Person: Prof. Dr. Seunghwan LEE and Dr. Nicola BRADBEAR

15:00-15:30	Trinidad and Tobago	Api-tourism: an innovative beekeeping offering for visitors to Trinidad and Tobago Gradstone Solomon
15:30-15:50	Slovenia	Apitourism & apiwellness, a promising beekeeping economy on a rise Tanja Arih Korosec
15:50-16:10	United Kingdom	Urban beekeeping in London Nicholas Bishop
16:10-16:25	Czech Republic	The international meeting of young beekeepers (IMYB) Jiri Piza
16:25-16:40	Korea	Introduction and development of western honeybee (<i>Apis</i> <i>mellifera</i>) Industry in Korea Sanggyeun Cho, Seunghwan Lee

 \times Guide time: it could be often changed by chairman under condition of symposium

Symposium: Beekeeping for Rural Development I (Europe and Asia)

Chair-Person: Dr. Gladstone SOLOMON and Dr. Nicola BRADBEAR

Turkey	Queen bee science spurs entrepreneurship Meral Kekeçoğlu, P Goç Rasgele
Romania	Apitherapy for rural development Cristina Pavel, Stefan Stangaciu
Japan	Beekeeping, a part of improvements of livelihoods in rural areas of Nepal Ram Keshari Duwal, Seunghwan Lee
India	Meliponiculture for Sustainable Rural Development of North- eastern India RajKumar Thakur, Akhilesh Singh
India	Apiculture for sustainable rural development and increased crop productivity in India Raj Kumar Thakur, PK Chakrabarty, Surbhi Gupta, Neha Palliwal
	Turkey Romania Japan India India

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Symposium: Beekeeping for Rural Development II (Africa)

Chair-Person: Ms. Tanja Arih KOROSEC and Dr. Nicola BRADBEAR

13:00-13:15	Mauritius	Hives for the handicapped: Beekeeping on the island of Rodrigues Paul Draper
13:15-13:30	Comoros	Keeping quality in Comoros: using bees to create livelihoods and change destructive practices Ellen Geisler
13:30-13:45	Togo	Beekeeping for rural development Kodjo Logou Agossou
13:45-14:00	Croatia	Beekeeping schools – a great chance for rural and sustainable development Zlatko Tomljanovic, Ivana Tlak-Gajger, Itana Bukovac, Suncica Stanic-Gluhinic, Dario Frangen
14:00-14:15	Zambia	Beekeeping as a Livelihood Strategy for Women in Rural Zambia Muule Moonga
14:15-14:30	Nigeria	Beekeeping for rural development in Nigeria: A case study of my involvment in training five hundred farmers. Oluwaseun Johnson
14:30-14:45	Tanzania	Queen bee rearing in africa:Its impacts in bee population,pollination and increase of bee products Philemon Kiemi, Bernad Chove, Shimon Barrel

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Symposium: Beekeeping for Rural Development III

Chair-Person: Dr. Ram Keshari DUWAL and Dr. Nicola BRADBEAR

15:00-15:15	Uganda	Socio economic barriers to increased honey production among rural households: Case of Northern Uganda Deborah Ruth Amulen, Guy Smagghe, Paul Cross
15:15-15:30	Tanzania	Beekeeping for rural development Venance Ntahondi
15:30-15:45	Cameroon	Socio-economic and technical characteristics of beekeeping in the departments of Bamboutos, MiFi and Menoua in Western Cameroon
		Romuald Patrick Kenmogne Fotso, Meutchieye Félix, Youbissi Annie, Tchoumboué Joseph
15:45-16:00	India	Agriculture, socio-economic development through beekeeping of rural indian women. Sarika Saswade
16:00-16:15	Uganda	Beekeeping for rural development in Uganda Sarah Ankunda

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Symposium: Beekeeping for Rural Development IV

Chair-Person: Prof. Dr. Jong Kyun PARK and Dr. Gladstone SOLOMON

17:00-17:15	Tanzania	Accessibility to livelihood amenities among women and youth in western tanzania: The case of beekeeping activities Angela Mwakatobe, Janemary Ntalwila, Mwanahamisi Mapolu, Edward Kohi, Steven Nindi
17:15-17:30	Nigeria	Assessment of the utilisation of beekeeping technologies in Ekiti state, Nigeria: Implications for enhancing rural women livelihoods Bamigboye Emmanuel, Yusuf Olayinka
17:30-17:45	India	Bee keeping empowerment in India Satyen Yaadav
17:45-18:00	Nepal	Bee keeping source of income in Ilam Municipality, Nepal Nrishima Khatri
18:00-18:15	Iran	Good news about beekeeping in Afghanistan Reza Shahrouzi
18:15-18:30	Colombia	Beekeeping organizations in Colombia and the application level of quality managment systems for rural development. Lopez Carmenza

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Symposium: Indigenous Bees and Conservation I

Chair-Person: Prof. Dr. Seunghwan LEE and Dr. Nicola BRADBEAR

10:10-10:25	Germany	The status and prospects of <i>Apis cerana</i> Kaspar Bienefeld, Holly Jones
10:25-10:40	Ukraine	Quality of honey as an indicator of the health of bee colonies and sustainable production approaches and biodiversity conservation in beekeeping. International pilot project "more than honey" Viacheslav Tsuprykov, Carlos Desmaison Elespuru, Ruslan Nesterenko
10:40-10:55	Ukraine	Mainstreaming conservation and sustainable use of biodiversity pollinators into Ukrainian production landscapes. An attempt to spread the successful experience and new knowledge from small local project to national level Viacheslav Tsuprykov, Ruslan Nesterenko
10:55-11:10	Nepal	Scenario of indigenous honeybee species of Nepal Khem Raj Neupane
11:10-11:25	India	Differential nest site preference of giant honey bee , <i>Apis dorsata</i> in Bengaluru, India M.S. Reddy, G.N. Jayaram
11:25-11:40	Uganda	Treasuring beekeeping for livelihood transformation and park conservation: A case study of communities around Bwindi National Park, southwest Uganda Robert Ndyabarema, Brian Mugisha

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Symposium: Indigenous Bees and Conservation II

Chair-Person: Dr. Nicola BRADBEAR and Prof. Dr. Seunghwan LEE

	Linner Chail Complement
	Jinyeong Choi, Seunghwan Lee
India	Forest beekeeping system of Apis cerana colonies by Todas: A
	community based conservation approach.
	Robert Leo
Mexico	Community organizing strategies for the conservation of
	Scaptotrigona mexicana: a perspective from the Totonac
	culture for the appropriation of nature
	Atzin Garcia Flores, Maria Reyna Hernández Colorado,
	Crescencio García Ramos
Uganda	Evaluation of performance of different beehives types used in
	Uganda
	Robert Kajobe
Uganda	Honeybee forage plants, bee visitation counts and properties of
-	honey from different agro-ecological zones of Uganda
	Alice Kangave
-	India Mexico Uganda Uganda

% Guide time: it could be often changed by chairman under condition of symposium

Symposium: Apiculture with Indigenous Bees

Chair-Person: Prof. Dr. Ki-jeong HONG and Prof. Dr. Seunghwan LEE

15:00-15:15	India	An Integrated technique of sustainable honey harvesting from the nests of <i>Apis dorsata</i> in plains of Karnataka, India Narayanappa Nagaraja
15:15-15:30	Cameroon	Oku white honey production from Kilum-Ijim Forest- Cameroon Wirsiy Emmanuel Binyuy
15:30-15:45	Czech Republic	Beekeeping in the Czech Republic and Czech association of beekeepers Jaroslav Hrabak
15:45-16:00	Indonesia	The potential for wild bee honey production Mochammad Junus
16:00-16:15	Malaysia	Sizes of artificial hive and the performance of the stingless bee <i>Heterotrigona itama</i> in <i>Agropolis unisza</i> apiary. Abd Jamil Zakaria, Muhammad Muslim Mohd Rodi
16:15-16:30	Benin	Perceptions and adaptations of beekeepers and honey hunters to climate change in the Communes Djidja, Dassa and Tchaourou located South, center and Northern part of Benin Gregoire Paraiso, Roméo Ayeleroun, Franck Akogbeto, Bienvenu Adjoha, Armand Paraiso

 $\$ Guide time: it could be often changed by chairman under condition of symposium

Symposium: Apiecotourism and Urban Beekeeping

Chair-Person: Dr Nicola BRADBEAR and Prof. Dr. Seunghwan LEE

17:00-17:15	Korea	Ecological Alternative: Effects of Rooftop Garden on Foraging of Honey Bee in Urban Landscape Yoori Cho, Minjoo Lee, Jongho Kim, Sungsoo Yoon, Dowon Lee
17:15-17:30	Australia	The Canberra urban honey project: Lessons for the role of apiculture in sustainable urban food systems. Mitchell Pearce, Carmen Pearce-Brown
17:30-17:45	Korea	A Study on developing a non-nomadic bee-keeping model forest to promote apiculture, agroforestry and api-ecotourism in Korea Ara Seol, Joosang Chung, Shinyoung Park, Wookju Jeong, Youngji Kim
17:45-18:00	Brazil	Entrepreneurial development in Brazil by beekeeping Demian Condé
18:00-18:15	France	Crowdsourcing for starting beekeeping businesses Milan Wiercx van Rhijn
18:15-18:30	Turkey	Creation awareness in students of primary schools about importance of honey bee for society and environment Meral Kekeçoğlu, P Goç Rasgele, F Şahin, M Kambur

 \times Guide time: it could be often changed by chairman under condition of symposium

Symposium: Beekeeping Sector Reviews

Chair-Person: Prof. Dr. Khem Raj NEUPANE and Prof. Dr. Jong Kyun PARK

17:00-17:15	Saudi Arabia	Beekeeping in Saudi Arabia : past, present, opportunities and challenges Ahmad Alkhazim Alghamdi
17:15-17:30	Myanmar	The Beekeeping in the Republic of the Union of Myanmar Hlaing Minoo, Siriwat Wongsiri
17:30-17:45	Thailand	Apiculture and Pollinator Industry Survey in Thailand Chama Phankaew
17:45-18:00	Japan	Reconstruction of the farmland suffered by Tsunami damage struk by the Great East Japan Earthquake and revitalization of apicultural industry Kikuji Yamaguchi, Makoto Watanabe, Yoshihisa Yamaguchi
18:00-18:15	Korea	Beekeeping of <i>Apis cerana</i> in Korean peninsula: history, present, and future Seunghwan Lee, Minsuk Oh
18:15-18:30	Nigeria	Can beekeeping be sustained in Nigeria? Oluwasanjo Okunlola, Yusuf Adeyemo

% Guide time: it could be often changed by chairman under condition of symposium

Symposium: Regional Beekeeping I

Chair-Person: Mr. Nicholas BISHOP and Prof. Dr. Seunghwan LEE

09:00-09:15	Nigeria	Factors influencing subsistent farmers' decision to practice beekeeping in two ogbomoso local government areas, south
		western Nigeria
		Samuel Adelani Babarinde, Timothy A. Adebayo,
		Adebusola A Adepoju, Adetayo D. Adeleye, Odunyemi Ayobami,
		Ibukun B. Babatunde, Solomon Yisa
09:15-09:30	Turkey	Occupational health and safety in beekeeping – steps in risk
		assessment
		Cengiz Erkan, Ayhan Gosterit
09:30-09:45	Ghana	Top bar honey comb hangers (HCH) for fixing and
		transporting honey combs on top bars
		Abraham addo, Ansah Allotey
09:45-10:00	Nigeria	Management practices to avoid stings of honeybees during
		field work
		Akpoke Chiegele Christian, Akunne Chidiebere Emmanuel
10:00-10:15	Indonesia	Potential of sunflower and mustard greens brassica juncea l
		for bees food related to the development of bee tourism in the
		village Watu Agung Pasuruan, Indonesia
		James Hutagalung, Suhartatik, Wiwin Retnowati, Hardiyanto,
		Ahmad Radjaram
10:15-10:30	Tunisia	The tunisian experience in organic beekeeping
		Abbes Saidi

X Guide time: it could be often changed by chairman under condition of symposium

Symposium: Regional Beekeeping II

Chair-Person: Dr. Ram Keshari DUWAL and Prof. Dr. Seunghwan LEE

10:50-11:05	Ethiopia	Constraints and opportunities of beekeeping in Werieleke District of Tigray region, Ethiopia Teweldemedhn Gebretinsae Hailu
11:05-11:20	United Arab	The path to sustainable beekeeping in the United Arab
	Emtrates	Denis Anderson, Ihsan Joma, Mohammed Hammadi
11:20-11:35	Malaysia	The potential of high income beekeeping projects in acacia
		Zakbah Mian
11:35-11:50	Tanzania	Challenges and opportunities for sustainable beekeeping in miombo woodlands of mlele district western Tanzania Janemary Ntalwila
11:50-12:05	Ethiopia	Honeybee colony marketing and its implications for queen rearing and beekeeping development in Werieleke district, Northern Ethiopia Teweldemedhn Gebretinsae Hailu
12:05-12:20	Nigeria	Assessment of the knowledge level on "Apiforestry" among beekeepers in Oyo State, southwestern Nigeria Yusuf Adeyemo, Saka Jimoh, A Alarape, Samuel Babarinde
12:20-12:35	Czech	Bee the source
	Republic	Sona Dubna

X Guide time: it could be often changed by chairman under condition of symposium



Round Table

10:00-18:00, (Wed) 16 - (Fri) 18 September

Room 107, 1st Floor



2015, 44th APIMONDIA International Apicultural Congress Scientific Program

Adulteration of bee products. Impact on markets.

Consumption of honey and honey products has grown considerably during the last few decades. With the internationalization of markets, the adulteration of bee products is a major beekeeping problems. Fraud are many and are at all levels. The lack of official definitions and efficient official control technologies are elements that promote these illegal practices. Incomplete traceability makes the situation more difficult. All these elements deconstruct the market and push down prices. Recently, some countries have strengthened their controls.

- Overview of the actual situation on international market.

- International standard of identity for bee products, the detection of analytical methods, and trade policies and testing for adulterated products.
- The development of market-reliable indicators derived from modern analysis methods to protect against adulteration.
- Testing program: implementation difficulties and market impact

Moderator:

Mr. Etienne Bruneau, President of TQ Commission, CARI, Belgium

Dr. Hyun-Woo Oh, LOC President of TQ session, KRIBB, Republic of Korea

Speakers:

Dr. Norberto Garcia, NEXCO S.A. IHEO President, Argentina Mr. Eric Wenger, Chairman of True Source Honey, USA Dr. John Rawcliffe, Administrator UMF Honey Association, Australia Dr. Jonathan Stephens, Comvita Innovation, New Zealand Dr. Olivier Prunaux, The DG Santé, EU Ms. Long Xue Jung, The secretary of the China Chamber of Bee Products, China Dr. Terry Braggins, (terry.braggins@analytica.co.nz), New Zealand, Using LC-HRMS to determine the authenticity of Manuka Honey in New Zealand **Dr. Lutz Elflein** (*Germany*, *lutz.elflein@intertek.com*) Honey adulteration testing at the Intertek Food Servies Lab in Bremen, Germany Dr. Emel Danarli (Emel.Damarli@altiparmak.com.tr), Turkey Dr. Dilek Boyacıoğlu (dilek.boyacioglu@sbs-turkey.com), Turkey Dr. Cristina Pavel (crispavel@yahoo.com), Romania Dr. Ivana Tlak Gajger (itlak@vef.hr), Croatia Dr. Abera Belay (ab.berabelay@gmail.com), Ethiopia Dr. Ming XU (clhb@hotmail.com), China

Vespid Biology, Ecology and Management of Beekeeping

Recent invasion of Vespa velutina into France and Korea provoked diverse questions on their invasion ecology as well as its impact to honeybee industry. From this Round Table, we discuss various aspects of Vespid hornets and options for risk mitigation into honeybee.

- First recognition of Vespa velutina in Port City of Busan and its spread
- Compositional change of Vespa species assembly before and after the invasion and its impact on honeybee in Korea
- Behavioral response of honeybee from Vespa attack
- Behavioral aspects of Vespidae hornets
- Socio-economic impact of invasion of Vespa velutina in France
- Impact of Vespa invasion into France on honeybee health and management
- Beekeepers response of Vespa attack to honeybee colonies
- Trap design for Vespid hornets for catching flying hornet

Moderator:

Dr. Claire Villemente, NHM, France

Prof. Kilwon Kim, Incheon National University, Republic of Korea

Speakers:

Prof. Moon Bo Choi, Kyoungbuk National University, Republic of Korea

Prof. Chuleui Jung, Andong National University, Republic of Korea

Dr. Tan Jiangli, China

Mr. Henry Clement and Mr. Gilles Lanio, Beekeeper, France

Mr. Sangkyun Cho, Beekeeper, Republic of Korea

Mr. JoonGi Lee, Damok, Republic of Korea

Artificial Bee Food, Risks for Bees and Bee Products Quality

Since humans are keeping bees and are gaining honey from them, and since sugar is available at low prices, bees are fed nutrients that are not collected by them in the environment. Initially, carbohydrates were primarily used, but later proteinaceous components were also implemented. Dependent on the management regime, availability of natural food throughout the year, and climate, different traditions can be observed. These range from feeding no protein to regularly feeding protein (as pollen or protein from various mostly plant sources mainly mixed with sugars). The motivation behind these efforts ranges from simply doing something good for the bees, to increasing brood production or to the absolute necessity of supplying amino acids that are not sufficiently available. Within a colony, bees have a system of division of labor. In a colony provided with natural pollen, it is mainly the nurse bees that consume the pollen and thus are supported in their care for the nutrition of the brood and queen, but also in providing other members of the colony with proteinaceous jelly. If a colony is fed proteinaceous artificial food, a variety of other members consume this food directly and the distribution of these nutrients is altered. Via the mouth to mouth feeding between the bees (trophallaxis), the provision of the larvae and the deposition of food in the pollen or the honey stores, portions of the offered artificial food can be found in various locations. This creates a nutritional distribution that differs from the distribution of proteins coming from natural sources. This feeding of artificial food will be discussed in the light of biology and commerce.

Moderator:

Prof. Karl Crailsheim, President of Scientific Commission "Bee Biology" in Apimondia, University of Graz, Austria (karl.crailsheim@uni-graz.at)

Speakers:

Ken Tan, Chinese Academy of Science, China Myeong-lyeol LEE, National Academy of Agricultural Science, Republic of Korea Robert Brodschneider, University of Graz, Austria Daniel Stabler, Newcastle University, UK Maureen Conquer, Wild Forage Ltd., New Zealand Bosco Okello, ApiTrade Africa, Uganda Jeff Pettis, ARS USDA, USA Etienne Brueneau, CARI, Belgium Seungjae Oh, Yasaeng Honey Co., Republic of Korea

Strategies to Prevent Global Losses of Honey Bees?

Monitoring and Prevention of the spread of new pests to new areas Effective management of known pests and diseases Improving nutrition and forage availability for bees Limiting pesticide exposure both from miticides and the agricultural environment Working together to improve overall bee health

Moderator:

Dr. Jeff Pettis, USDA-ARS, United States Dr. Francois Diaz, World Organisation for Animal Health, France

Speakers:

Dr. Franco Mutinelli, Istituto Zooprofilattico Sperimentale delle Venezie, Italy Prof. Asli Ozkirim, Hacettepe University, Turkey Dr. Fani Hatjina, Hell. Agricultural Org. DEMETER, Greece Mr. Henri Clement, National Union of French Beekeeping, France Mr. Walter Haefeker, EPBA, Germany

Workshop on Standardization of Propolis

Although propolis, so called 'natural antibiotics', has various biological activities, international standardization has not yet been realized. It is due to characteristics of natural products that their chemical compositions are different between various production areas, depending on kinds of plants according to climate. Even though it is necessary to standardize propolis internationally for the wide usage of good products. Hence, the issues to be researched and overcome will be proposed and discussed in this workshop. Furthermore, the way for the standardization could be suggested through many discussions.

The discussion is open for any issues concerning.

- Global and Korea Propolis Industry Trends
- Proposal for standardization of propolis international standards.
- How can we draw marker compounds for the standardization of the geographically collected propolis?
- Why is it necessary to standardize propolis?
- How are the chemical components of propolis different depending on the region and plants?
- What is reasonable index for the standardization of propolis?

Moderator:

MD. Young-Soo Jin, Vice Presidentof WPSF, Seoul Asan Medical Center

Speakers:

Seung-Wan Lee, President of WPSF, Republic of Korea

Ph.D Vassya Bankova, Bulgaria Academy of Science

Ph.D. Hyun-Sik Kim, Korea Basic Science Institute, Republic of Korea

Nivia Alcici, Brazil Essenciale Itda

Prof. Myung-Sang Kwon, Kangwon National University, Republic of Korea

Ph.D. Sung-Kee Jo, Korea Atomic Energy Research Institute, Republic of Korea

AAA and Asian Beekeeping

From this round table, we discuss various topics on Asian beekeeping development including country report of recent achievement in beekeeping sciences and industry. Further formal issues on AAA (Asian Apicultural Association) are discussed. Delegate of every member country of AAA is invited.

Moderator:

Siriwat Wongsiri, *Thailand* Kunsuk Woo, *Republic of Korea* Cleofas R. Cervancia, *Philippine* Lihong Chen, *Chiana*

Speakers:

Siriwat Wongsiri (Siriwat.W@chula.ac.th), Thailand

Recent development of AAA: issues from regional to industry

Lihong Chen (clhb@hotmail.com), China

Formatting for publication of Economic aspects of Asian Beekeeping industry

Chuleui Jung (cjung@andong.ac.kr), Andong National University, Republic of Korea

Scientific publication of Asian Apicultural Association, the journal of Apiculture: Current and Future

Charn Chooprasit: Thailand beekeeping economy, (charn.cps@gmail.com), Thailand

Ratna Thapa: Current beekeeping economy in Nepal, Nepal

Hlaing Min Oo: Beekeeping status in Myanmar, (drhminoo@gmail.com), Myanmar

Preecha Rod-im and O Duangphakdee: Beekeeping in Thailand: current status and future perspective, (preecha.rod@hotmail.com), Thailand

Young Rae Kim, Korea Apicultural Agriculture Cooperative, (jiayousong@nonghyup.com), Republic of Korea

Agrochemicals and Intensive Agriculture. Impacts on Bees and Other Pollinators

Intensive agriculture is modifying and deteriorating pollinators' habitats for nesting and foraging including honey bee.

Increased exposure of honey bee to diverse agrochemicals including insecticide is considered as one of the most important drivers of honeybee health decline. Two years ago, EU temporarily banned 3 pesticides belonging to neonicotinoids family.

From this round table, we discuss followings;

- Beekeepers response from the EU countries: After ban
- Actions from scientific sectors for reducing the exposure to pesticides
- Safety guidelines and researches from industry sectors
- Impact of intensive agriculture on the habitat suitability of wild pollinators
- Honeybee toxicity to diverse pesticides including neonicotinoids

Moderator:

Dr. Fani Hatjina, Institute of Animal Science, Greece

Dr. Geoffrey Williams, University of Bern, Wsitzerland

Speakers:

- Dr. Peter Campbell, Syngenta, United Kingdom
- Dr. Christian Maus, Bayer, Singapore
- Prof. Chuleui Jung, Andong National University, Republic of Korea
- Dr. Henri Clement, UNAF, France
- Dr. Noa Simon Delso, CARI, Belgium
- Dr. Anne Furet, UNAF, France
- Dr. Jean Marc Bonmatin, CNRS, France
- Dr. Insu Koh, Purdue University, USA

Indigenous and Exotic Bees: Possibilities for Their Conservation, Management, Co-existence and Markets for Their Produce

As European Apis mellifera honey bees have been moved throughout the world, we are inevitably experiencing their competition with other bee species that are naturally present. In addition, due to farmland expansion by human activity and global warming, the habitat of indigenous honey bees is being destroyed. Indigenous honey bee species may be decreasing in numbers of colonies, and facing extinction in their original regions. This is why we should consider the status of indigenous bee diversity and think about ways of conserving habitat for wild bees.

The discussion is open for issues concerning:

- Indigenous bee diversity including honey bees, stingless bees, and other pollinating bees.
- Co-existence and competition of exotic (Apis mellifera) and indigenous bees (Apis cerana).
- Conservation of regional indigenous bees
- International efforts for the protection of Asian honey bees
- Markets for honey from indigenous honey bees
- Extensive beekeeping and honey hunting practices, and issues of sustainability
- Sustainable utilisation and conservation of honey and stingless bee populations
- The need for an additional Apimondia Scientific Commission: Bee Diversity and Conservation

Moderator:

Dr. Nicola J. Bradbear, President of Scientific Commission, Beekeeping for Rural Development

Prof. Seunghwan Lee, LOC President of Scientific Commission, Beekeeping for Rural Development, Seoul National University

Speakers:

Prof. Seunghwan Lee: habitat loss of indigenous honeybee in Laos, Seoul National University, Korea

Khem Raj Neupane: Indigenous honey bee species and honey hunting in Nepal, (krneupane@hotmail.com), Nepal

M.S. Reddy, G. N. Jayaram: Beekeeping industry and conservation of Apis dorsata in India, (jenureddy@gmail.com), India

Viacheslav Tsuprykov: Conservation of wild bees for pollination, (gogolmed@gmail.com), Ukraine

Chama Phankaew, Co-existence and competition of Apis mellifera and Apis cerana in Thailand, Thailand

Kaspar Bienefeld: prospects for Apis cerana, (Kaspar.Bienefeld@hu-berlin.de), Germany



Workshop

13:00-16:40, (Fri) 18 September

107, 1st Floor



2015, 44th APIMONDIA International Apicultural Congress Scientific Program

Title: Honeybee Diagnostics PCR Kit by the iNtRON Maxim Technology

Content:

Rapid and accurate diagnostic methods are generally required for the detection of honeybee pests, diseases, and parasites. iNtRON Biotechnology has developed several diagnostic kits that apply the latest techniques to identify bacteria, fungi, mites and viruses that affect honey bees.

The diagnostic PCR detection Kit aims to specifically detect SBV, EFB, AFB and Stonebrood & Chalkbrood in honeybee with high sensitivity and accuracy. Each product type is made for ready to use. Everything needed for PCR is included in one tube, which requires minimum handling for the reaction to set up. All PCR components are premixed and aliquoted in each tube preventing them from cross-contamination. Therefore, the diagnostic PCR detection Kit will guarantee to deliver results in an accurate, reliable and timely manner.

Time schedule:

1-5 minutes: Greeting and introduction of iNtRON PCR kits5-30 minutes: Presentation for Honeybee diagnostics PCR kit30-65 minutes: Performance and evaluation of results65-80 minutes: Q&A time

Coordinator:

Dr. Seol Jae Goo, iNtRON Biotechnology, Inc., www.intronbio.com, Republic of Korea

Experimentor:

Mrs. Kim Bo Min, *iNtRON Biotechnology, Inc., www.intronbio.com, Republic of Korea* Mrs. Park Ji Sung, *iNtRON Biotechnology, Inc., www.intronbio.com, Republic of Korea* Mr. Park Man Soon, *iNtRON Biotechnology, Inc., www.intronbio.com, Republic of Korea* Mr. Choi Yoon Hyuk, *iNtRON Biotechnology, Inc., www.intronbio.com, Republic of Korea* Mr. Jang Tea Young, *iNtRON Biotechnology, Inc., www.intronbio.com, Republic of Korea*

Title: Immunochromatographic Detection Technology against Pathogens of Honeybee and the *in Vitro* Diagnostic kit Development

Content:

Introduction about the technology, personnel, major products of BIONOTE, INC and introduces the immunochromatographic assay as a key technology. After introduction about the honey bee pathogens and how detecting the pathogens using immunochromatographic assay. Introduction about the design, current progress, release date of the final product. The current prototype will show and be performed. Finally, some prototype will be provided to the participants as a sample.

Time schedule:

1-5 minutes: Greetings and introduction of Bionote.

5-25 minutes: Oral Presentation

- Introduction of immunochromatographic assay

- Presentation of honey bee pathogens and Application to the

immunochromatographic technology.

25-80 minutes: Practice Time: Performance of the prototype and providing

Coordinator: DVM Ms. Kang Bo-Hye

Experimentor: DVM Mr. Yeh Sang-Woo



Abstracts of Oral Presentations





2015, 44th APIMONDIA International Apicultural Congress Scientific Program



Prof. Dr. Kunsuk WOO, President of BE Commission

College of Agriculture & Life Sciences, Seoul National University, Republic of Korea wooks@snu.ac.kr

Prof. Dr. Chuleui JUNG, President of Local BE Commission

Department of Plant Medical, Andong National University, Republic of Korea cjung@andong.ac.kr

Mission

Promote the development of bee products, commercial activities, improve the alimentary resources, and welfare of mankind





BEO-023

Beekeeping Economy in Korea: From income generation to ecosystem service

Chuleui Jung, Sungmin Jeong, Changreol Lee

Department of Bioresource sciences, Graduate school, Andong National University, Andong. GB 760-749, South Korea

Beekeeping in Korea dates back to AD 5 in history book Sagi. Native bee is *Apis cerana*. European honeybee, A. mellifera was introduced in early 1900s. Currently ap. 2 million hives are kept, but most of them A. mellifera. A. cerana population crashed down to 10% due to recent sacbrood epidemics. Honeybee had been provided a source of incomes ap. 400 million USD for more than 20 thousand beekeepers annually as well as diverse ecosystem services including pollination. In 2009, Jung estimated the pollination value of fruit and vegetable production provided by honeybee as 5.8 billion USD. Approximately 50% of the annual production was turned out as the honeybee pollination service. Incorporating the recent research findings and the circumstantial changes on pollinating service providers as well as the consumers, further analysis of the pollination service markets and future research efforts to sustain the service was presented; regional distribution of the market demands and supply, new policy changes on the bee pollination sectors are proposed.

BEO-008 Role of Beekeeping in the economic development of India: Challenges and opportunities

Dharam Pal Abrol, Uma Shankar

Division of Entomology, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology Chatha , Jammu 180 009, Jammu & Kashmir, India

India, one of the largest honey producer and exporter in the world, plays an important role in world honey production and trade. It is a vast country with diversity of climates. Such diversity of geographical features plays a dominant role in determining the topography, climate and plant species present in the region. It offers great potential for both migratory and non-migratory beekeeping. The current agricultural transformation, once linked to apicultural operations, offers much scope for income generation through beekeeping. Only 10 percent of the existing potential has been utilized so far. India has a potential to keep about 120 million bee colonies that can provide self-employment to over 6 million rural and tribal families. In terms of production, these bee colonies can produce over 1.2 million tons of honey and about 15,000 tons of beeswax. Organized collection of forest honey and beeswax using improved methods can result in an additional production of at least 120,000 tons of honey and 10,000 tons of beeswax. This can generate income to about 5 million tribal families. The study analyses the future prospects of the beekeeping industry and the policy changes that are required for the same.

International and national legislation causing inconsistency to honey trading

Andreas Thrasyvoulouu, Chrysoula Tananaki, Georgios Goras

Aristotle Univesity, Greece

In addition to the European standards of honey and the revised Codex Alimentarius, there are national provisions, decisions, guidelines, even set of rules for the domestic trading of the product established by local beekeeping Associations. When we studied all these regulations, we traced differences in the definition of honey, the claim of the country of origin, the characteristics of monofloral honey types, the control parameters, the establishing of quality grades and others issues that could result in conditions of unfair competition, which are likely to mislead consumers, and thereby have a direct effect on the establishment and operation of the common market. In order to cope with the inconsistency that exists in international legislation regarding honey and to ensure the free movement of bee products between countries, we propose minimum requirements for all countries that produce, import or export honey.

BEO-019

COLOSS B-RAP: Bridging bee research and beekeeping practice.

Norman Carreck¹, Sven Branner², Ralph Büchler³, Bjørn Dahle⁴, Johann Fisher⁵, Asger Søgaard Jørgensen², Ole Kilpinen², Lotta Fabricius Kristiansen⁶, Preben Kristiansen⁷, Per Kryger⁸, Magnus Ljung⁹, Patricia Aldea Sánchez¹⁰, Josef van der Steen¹, Flemming Vejsnæ s², Geoffrey Williams¹²

¹ International Bee Research Association, United Kingdom

² Danish Beekeepers Association, Fulbyvej 15, 4180 Sorø, Denmark

³ LLH Bieneninstitut Kirchhain, Erlenstrasse 9, 35274 Kirchhain, Germany

⁴ Norwegian Beekeepers Association, Dyrskuev. 20, NO-2040 Kløfta, Norway

⁵ Staatliche Fachberatung für Bienenzucht am Amt für Ernährung, Landwirtschaft und Forsten Kaufbeuren, Höfatsstr. 23-25 87600, Kaufbeuren, Germany

⁶ Apinordica, Haagra 21, 590 34 Tjaellmo, Sweden

⁷ Swedish Beekeepers Association, Borgmaestaregatan 26, SE-596 34 Skaenninge, Sweden.

⁸Agroecology, University of rhus, Forøgsvej 1, 4200 Slagelse, Denmark

⁹ Competence Centre for Advisory Services, SLU, Box 234, Skara, Sweden

¹⁰ Centro de Emprendimiento Apícola de la Universidad Mayor, South Amerigo Vespucci 357, Las Condes, Santiago, Chile

¹¹ Plant Research International, Wageningen University and Research Centre, Business Unit Plant Research International, Wageningen, Netherlands

¹² Institute of Bee Health, Vetsuisse Faculty, University of Bern, Bern, Switzerland
Since its establishment in 2008, the COLOSS (Prevention of honey bee COlony LOSSes) association has been successful in bringing together bee research scientists, bee health specialists and extension advisors to study the causes of global honey bee losses, and now has a substantial output of papers published in refereed scientific journals. The newly established COLOSS B- RAP Core Project has the mission to bring the results of this new research to the beekeeping target audience. Analysis of the causes of colony losses suggest that in many cases, these, such as starvation, queen failure or failure to effectively control pests and disease, should be preventable by timely actions by the beekeeper. Through study of existing extension and training practices, which vary widely from country to country, B-RAP aims to understand the reasons why beekeepers may be slow to adopt innovative management methods. Improved extension and information dissemination can thus motivate beekeepers to change their management practices to reduce future honey bee colony losses.

Symposium: Societal Innovation for Beekeeping Economy I

BEO-012

The campaign 'The Bee, sentinel of the environment': how communities and business stakeholders can help beekeeping

Henri Clement

National Union of French Beekeeping (UNAF), France

As French beekeepers have faced for several years a serious increase of death rate among the colonies, the National Union of French Beekeeping (UNAF) has promoted for the last 10 years an environmental awareness campaign "Abeille, sentinelle de l'environnement" (1). This program encourages communities or business called stakeholders to protect the bees' environment. Partners sign an environmental charter with several commitments as "Not using pesticide", "Planting melliferous flowers", etc. This operation turned out to be very successful since more than 50 partners have joined the project: regions, counties, cities or prestigious locations such as le Château de Versailles. An important number of hives has been set up on buildings or green areas with the support of local beekeepers. The hives establishment and honey harvesting are real opportunities to show people and politicians how important bees and pollinators are. Every year, UNAF and its partners organize a national event named "APIdays" in more than 70 places in the same time. Open to a large public, this free event helps to present the honeybees' products and to better understand bees' mortalities. In 2014, there were more than 200 press releases on national and international radio, TV, or newspapers. Beehives in our cities highlighted the beekeeping situation in our countryside and particularly in the area of field crops. With its 10 years of experience, UNAF will be able to provide the beekeepers information and tools to develop such a program in their own countries. (1)The Bee, sentinel of the environment

BEO-013

Urban beekeeping in Taiwan

Yue Wen Chen

National I-Lan University, Taiwan

Colony collapse disorder (CCD) is a phenomenon in which honey bees abruptly disappear. Many researches had showed the pesticide pollution in beekeeping environment is one of the main caused factors. In order to save bee population from the dramatically loss, we encouraged Taiwanese people to keep honey bee colonies at the city area of the North Taiwan. The urban beekeeping program had been conducted by Taiwan Apicultural Society and Syin-Lu Social Welfare Foundation since 2014. We collaborated with some companies and constructed 6 apiaries which were more than 100 bee colonies totally at their private area, especially at the rooftop of city buildings. Honey bees seem to live successfully at this urban area. The virgin queen can mate and lay fertilized eggs even though their hive located at the rooftop of a 100 m building. The benefits and challenges will discuss in this presentation.

BEO-035

Does proximity and size of blue orchard bee nests predict almond nut yield?

Insu Koh¹, Eric Lonsdorf², Derek Artz³, Theresa Pitts-Singer³, Taylor Ricketts¹

¹ University of Vermont, USA ² Frank & Marshall College, USA ³ USDA-ARS, Pollinating Insects Research Unit, USA

The use of managed honey bees to enhance crop pollination has become increasingly uncertain due growing losses of managed hives. In response to these losses, growers of almonds, apples, and other orchard crops have begun to explore alternatives to honey bees by enhancing nesting habitats for native bees by placing nest boxes within the orchards. The spatial influence of these nest enhancements on crop yields has been poorly studied. Here, we analyzed yield data from almond orchards in California. We predicted that almond yields increase with decreasing distance of nests and increasing size of nests. We located different size of nest boxes of native blue orchard bees in 16 plots (3.8 ha per plot) across the 61 ha orchard area and released 4000 female and associated male O. lignaria bees from the center of each plot. We measured nut weight of a total of 216 almond trees in 2011. Then we developed a spatially-explicit model to predict the density of bees foraging from the nests to each almond trees, using a range of distance decay parameters (i.e., average foraging distances for bees). We compared the relationship between the predicted bee densities with measures of nut yields for individual almond trees. We found that nut yields significantly increased with our measure of bee density and that the best estimate of foraging distance was roughly 60 m. This result and approach can be applied to find optimal solution of the spatial allocation of insect pollinator nest habitats in orchards.

BEO-030

Beekeeping practices and bee pollination

Jude Ssettaba

Native Products ltd, Uganda

Beekeeping is emerging as Avery successful agricultural practice for local people in rural areas of less developed countries. Not only does the practice of beekeeping have intrinsic health benefits through providing food source of great nutritional value which is lacking in rural areas, but beekeeping requires few inputs and capitalizes on a ready supply of pollen. Beekeeping as a Commercial Enterprise may not be easily done by an individual but can easily be achieved by a couple of individuals who can produce collectively for the market which currently outstrips supply locally. Beekeeping practice in developing countries is majorly done in local hives using traditional methods which comprises approximately 85% and the other 15% use top bar & frame hives. Despite the types of technologies, majority of the beekeepers still use old beekeeping practices based on their forefather's know how techniques and this could also explain why the yields are low coupled with poor quality of the honey. Bees are the most effective pollination agents second to none. Bees pollinate about 80% of the various plants (more than half of food crops) & vegetation to yield fruit. Pollination is the biggest benefit mankind gets from bees like Dr. Albert Einstein was quoted "if bees disappeared from the surface of the earth, man would have no more than 4 years to live. No more bees, no more pollination, no more food…no more man." This is how important bees can be as regards pollination. Bee pollination can increa se yields by 45% and above.

BEO-011

The Economic Benefits of Integrating Beekeeping into Cashew Farms in Ghana and Benin

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The study investigated the income benefits of integrating beekeeping into cashew orchards in Ghana and Benin. A possible integration of crops and animals into cashew farms was also studied. Two cashew farms with similar growth characteristics were selected from different communities in Ghana and Benin. A 1 ha plot of 70 cashew trees were marked and 2 strong *Apis mellifera adansonii* colonies placed by it. A second plot in a different community was also selected and 70 trees marked but without honeybees. Treatments were replicated 4 times at different locations in both countries. Colony weights, total nut yields per plot were recorded weekly. Two hundred nuts were sampled from each plot and weighed. Honey, beeswax and propolis harvested were weighed and recorded. Eighty (80) farmers in Ghana and 40 in Benin were interviewed on cashew farm integration. Honeybees on farms increased nut yields by 116.7 % in Ghana and 212.5 % in Benin. Nut yield/tree increased from 4.2-9.1 kg in Ghana and 2.16-6.75 kg in Benin. Two honeybee colonies produced 41.4 kg honey, 2.8 kg beeswax and 0.74 kg propolis in Ghana; in Benin 27.48 kg honey, 1.84 kg beeswax and 0.5 kg propolis. Total annual income of farm with honeybee was US\$ 591.74/ha/yr in Ghana and in Benin US\$ 575.96. Cashew farmers could keep poultry birds, sheep, goats, snails and grow ginger, cocoyam, and black pepper under cashew trees.

Determining of consumer preferences and consumer profile oriented to honey: A case of Izmir-Turkey

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Ege University, Turkey

Bee products (primarily honey) have important effects on human health and nutrition. The honey consumption per capita (app.1 kg) is not enough, although Turkey's honey production is the second in the world honey production. In this study, the consumption of honey and consumer preferences are investigated in the province of Izmir of Turkey. The research data was collected from selected 118 consumers in 11 central districts of Izmir province using face- to- face survey method in the production year of 2013. The socio-economic characteristics of consumers, consumption of bee products, consumption per capita is found as 1.55 kg. in research area. It is determined that men consume more honey than women and 82% of consumers is consumed packaged honey. It is determined that consumers notice product's reliability (4.92), flavor (4.78), expiration date (4.69), origin (4.69), variety (4.44) precisely and food safety is very important for consumers. Conjoint Analysis (CA) was used to estimate consumer preferences for comb honey in this research. The place where consumers prefer to purchase honey (38.48%) was identified as the most important factor, followed by origin of honey (30.65%), brand (11.60%), honey price (10.88%) and color of honey (8.39%).

Symposium: Societal Innovation for Beekeeping Economy II

BEO-010

Manuka: The Biography of an Extraordinary Honey

Cliff Van Eaton

Not so long ago, in a small island nation in the South Pacific, beekeepers produced a most peculiar honey. It was much darker than the clover honey everyone put on their toast in the morning, and it tasted very different. In fact, the honey was a problem: it was hard to get out of the combs, and even harder for beekeepers to sell. Today that honey, manuka from New Zealand, is known around the world. It fetches high prices, and beekeepers do everything in their power to produce as much of it as possible. Wound dressings containing manuka honey are used in leading hospitals, and it has saved the lives of patients infected with disease-causing bacteria that are resistant to standard antibiotic drugs. The book entitled Manuka - The Biography of an Extraordinary Honey chronicles the remarkable 'rags-to-riches' story of manuka honey. It's a great tale of science, in which an inquisitive university lecturer found something totally unexpected in a product everyone had written off. It's also an entertaining account of the way that a seemingly simple discovery caught the international media's attention, helping enterprising New Zealanders to develop manuka honey-based products and take them all around the globe. But above all else it's a story of hope for the future, sounding a note of optimism in a world that for good reason feels saddened and sometimes even afraid about the future of the special relationship we humans have always had with those marvellous creatures, the honey bees.

Beekeeping technology and quality issues in India: Contribution of VSBT, Baramati

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Honey collection (hunting), as depicted on rock paintings found in Central India and use of honey is known as per Ayurvedic systems for medicine and health in India since ancient times. However, beekeeping as an industry to some extent has been a recent development since last 50 – 60 years only. Beekeeping activities are restricted to some pockets. Moreover, perhaps India is the only country blessed with 4-5 species of natural honeybee colonies. Diversity of honey bees ecotypes, biology and behavior demands specific technologies for respective targeted activities. At present, the main focus of beekeeping in India is for production of honey to meet demand in local market and for export. Estimated total of about 70,000 tonnes of honey, including honey from giant rock bees *Apis dorsata* in forests and mountains, *Apis mellifera* and *Apis cerana* from apiaries and even from *Apis florea* and to some extent produced from stingless bees *Trigona irridipennis*. The demand of beekeeping for honey and other valuable bee products besides for pollination of crops by honey bee colonies to increase yields, have been increasing very rapidly due to awareness and publicity. The most potential areas in different states in India in general and especially Baramati and other areas in Maharashtra state, the beekeeping may boost by systematic planning and application of modern technologies. In view of this the VSBT, Baramati, has been undertaking various training programmes and need based research projects to promote beekeeping among farmers. The data and results are presented in this paper.

BEO-042

The meliponiculture for honey production in Thailand

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Honey from stingless bees has recently become of interest because of its medicinal properties. Comparisons of honey and propolis yields from four common species of stingless bee of Thailand (Trigona pagdeni, Trigona laeviceps, Trigona terminata, Trigona fuscobalteata) kept in the wooden boxes showed that the total yields from best to worst for honey production was T. pagdeni, T. laeviceps, T. terminata and then T. fuscobalteata; and for propolis T. terminata, T. pagdeni, T. laeviceps and T. fuscobalteata respectively. The compositions of honey from three stingless bee species, *T. pegdeni*, *T.laeviceps* and *T. terminata*, collected from experimental areas in Ratchaburi province, Thailand were analyzed for apparent reducing sugar, calculated as invert sugar, moisture content, apparent sucrose, water insoluble solids, mineral (ash), acidity, diastase activity, hydroxymethylfurfural and food additives contents. The results revealed that stingless bee honey has free acidity and moisture content higher than maximum established for A. mellifera honey while total reducing sugars content were lower than a minimum established for A. mellifera honey.

BEO-022 Indonesian beekeeping in maximizing its development and honey bee products

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Background: Beekeeping is an environmentally friendly agribusiness and useful in improving the community welfare, especially for people around the forest. It increases income and nutritional quality by providing bee products such as honey, pollen, royal jelly, propolis etc. Additionally, bees are very potentia pollinators in agriculture. Three main beekeeping activities in Indonesia are: collecting honey of forest bees (*Apis dorsata*), cultivating local honey bee *Apis cerana & Trigona* as well *Apis mellifera*. Method: One of State-Forest Owned Enterprises, (*Perum perhutani*), initiated to focus the development in three areas, West Java for *Apis cerana*, Central Java for *Apis mellifera* and in East Java *A. cerana* and *Trigona*. The methods applied: 1. Business Evaluation, 2. Participatory approach, 3. Policy Maker approach, 4. Technology Guidance and Training, 5. Demonstration Plot. The results are improvement of A mellifera beekeeping in Central Java and East Java new product development of ready to drink honey water and also in West Java for *Apis cerana*. Conclusion: some improvements, high participation of beekeeping stakes holders are urgently needed. Current policy of forestry development switching from forest maximizing to sustainable forest. The new paradigm of forest resource management in the future is not solely the production approach, but should include natural resource management (Resource Based Management), cooporating the synergy of ecological, economic and social community through pro-community development approach (Community Based Development).

BEO-037

Beekeeping in Mongolia

Khaliunaa Tsevegmid

HB GROUP NGO, Mongolia

In Mongolia first introduction of honeybee *Apis mellifera* was in 1959 and it has been scientifically developing since mid of the 70s. Ten years later the number of bee colonies was reached to nearly 4000 only in the forest steppe zone. Economy transition period–since 1990 two decades in Mongolia the number of bee colonies and beekeepers was dropped-off. However, it is now increasing and attracts interests of many people, thanks to few specialists who saved the root of the beekeeping in Mongolia during the crisis period. Raising interest to have and keep bee colonies influences very positively to livelihood of families in countryside of the country and good as well as to the natural vegetation cover. Nowadays Mongolia has around 500 beekeepers, of them 96% are beginners or hobby beekeepers and only 4% is more professional people who have at least 50 and more bee colonies and 20 years work experiences. We will present and discuss in detail the beekeeping status of Mongolia.

BEO-001 Beekeepers' perceptions of agricultural cooperatives: Case study of milas district

Tayfun Cukur

Mugla Sitki Kocman University, Turkey

Agricultural cooperatives are very important organizations for farmers in rural areas. Farmers could buy cheaper agricultural inputs through cooperatives, sell their agricultural products more expensive thanks to the cooperative. Also agricultural cooperatives could contribute to agricultural production increases.

Agricultural ccoperatives can be classified as follows agricultural services and procurement (purchasing) cooperatives, agricultural processing and marketing cooperatives, agricultural production cooperatives, and agricultural credit cooperatives. Agricultural cooperatives are established to protect the economic rights of farmers and to gain more profits. Milas district has a significant potential for beekeeping. As of 2013, beekeeping activities carried out 67 neighborhoods (village) in Milas district. There are 726 beekeepers in Milas district. Milas district has a 133 955 hives. Total honey production is 3348 tonnes and wax production is 2248 kg in the district. The research depends on survey data will be collected from beekeepers in Milas district. There are three objectives of this research. The first aim of the research is to determine the socio-economic status of the beekeepers. The second aim of the research is to determine the perspectives of beekeepers. The third aim of the research is to identify factors that impact on the cooperative membership of beekeepers.

Symposium: Current Situation of Beekeeping Economy

BEO-038

21 Century: The status and trend of beekeeping development in China

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China is an ancient country, a big agricultural country and also a large apicultural country in the world. China beekeeping has a long and rich history. The Chinese government has attaches importance to the protection of beekeeping. Since the national strategy of The 12th Five-year-plan of National Beekeeping and the National Beekeeping Regulation issued, China apiculture has made enormous strides and well developed. In 2014, Apicultural Science Association of China (ASAC) statistics show that China possesses approximately 9,200,000 honeybee hives, 300,000 beekeepers, over one thousand bee products enterprises and academic institutions on apiculture in the whole country. The output of honey is averagely 400, 000 tons, royal jelly 4,000 tons, bee pollen 4000 tons, beeswax 6000tons, propolis 400 tons and some drone pupae and larvae per year in China. 50% of the all bee products are exported to EU, Oceania, American, African and Asian countries. More importantly, ASAC

has set up more and more Bases of Bee Products Safety and Standardization in main beekeeping provinces and has made a great improvement on bee products quality.

Improving beekeeping economy by moving bee colonies

Tibor Vargapál

PROMED - velie produkty, s.r.o., Slovakia

Climate changes and intensification of economy in recent years led to a reduction in the number of regular honey harvests from 3 or 4 harvests per year to 1 or 2, what is not sufficient for beekeeping economy. We solved this situation by moving bee colonies to have 3 or 4 honey harvests per year. We move bee colonies after rapeseed honey harvest to acacia forests and then is one part of bee colonies moved to linden forests and another part to raspberry fields. After that we move bee colonies to conifer forests for honeydew. After above mentioned main honey harvests we move bee colonies to Solidago canadensis fields, so bees can collect enough pollen for winter generation and honey for winter, so we can reduce costs for feeding for winter. This is how we are trying to ensure good economy of beekeeping.

BEO-033

An overview of apiculture and its constraints in Nepal

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Beekeeping has been in practice since ancient time in Nepal. It is one of the high value and income-generating activities for majority of people in Nepal. Diverse climatic conditions of Nepal inhabit five species of honeybee out of which *Apis laboriosa*, *A. dorsata*, *A. cerena*, *A. florea* are native whereas *Apis mellifera* was introduced and is being reared commercially. Three sub-species of *A. cerana*, viz. *A. cerana indica*, *A. cerana himalaya* and *A. cerana cerana* are colonized in different regions of Nepal. *A. cerena* is cultivated on local as well as in modern bee hive. However, most of the annual honey production comes from wild honeybee. Number of hives recorded during 2012/13 was 169,000 with 1625 MT of honey production. Hive productivity is very low due to problems associated with apiculture. Inadequate knowledge on benefit of pollination, low quality of *A. cerena*, inadequate bee research program, colony migration and absconding, pesticide application, inadequate data on bee floral identification and carrying capacity, quality control, and poor hive management are the major concerns for beekeeping in Nepal. Though attempts have been made to address a few issues such as pest and disease management, behavioral study of wild honey bees, pollination and floral diversity, but most of the problems are unattended because researches on beekeeping is very scattered and not well organized. Ample opportunities are available to promote apiculture for pollination and hive product. This paper reviews on honeybee diversity, honey production, problems in apiculture, and areas for future study in Nepal.

Pine honeydew honey; importance, conditions of production and economy

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Pine honeydew honey is produced by honeybees from secretions of endemic insect (Marchalin a hellenica Genn.) that of indigenous from the coast of Aegean Sea with part of West Coast Meditearraen and they make it into richly flavoured reminisce nt of sweet molasses. The pine honeydew honey offers such a unique physicochemical parameters that it is not similar to any other honey. In general, sucrose level of pine honeydew honey determines below the CODEX and EU standards whereas reducing sugar, mineral contents and pH levels could be found higher so, special properties of pine honeydew honey necessitate a specific consideration of CODEX different from floral honey. Otherwise, most pine honeydew honey might be considered out of standart and tricky. Turkey ranks the 2nd place for number of bee hives and 4th place for honey producing in the World beside of the the biggest honeydew honey producer and exporter in it. While the production amount could be change by years, 92-95% (app.25.000 tonnes) of the pine honey in the world is produced in the Aegean region of Turkey. Mugla Province obtains only app.80% of the Turkish pine honeydew honey production. Turkey exports 95% of the annual production of pine honey. There is a great demand for Turkish Pine Honey from abroad with its quality and aroma. Provided that some measures are taken, Turkey is surely ready to share with whole world "sweet blessing" god gifted to this unique geography.

BEO-005

The Beekeeping Economy in Japan

John Hamilton

Aichi University, Japan

This presentation will begin with an analysis of a strawberry house pollination contract in Japan. The speaker has lived in Japan for more than 30 years with long 'holidays' in England, and contrived to keep bees in both countries for most of that time. At present his bees in Japan are in a bamboo thicket in Seto Akazu near to Nagoya. It is April and shade and ventilation are about right, but there is a danger that bamboo shoots will come up under the hives and tip them over. So they have to be watched carefully. Japanese beekeepers migrate. The Aichi beekeepers from around here start the year pollinating strawberries in greenhouses. Honey starts coming in about now from clover, vetch and then Acacia and Citrus. Next the pollination of pears (Nashi) in Anjo and Sanage is important. At the end of May beekeepers truck their bees north to Iwate and Akita for the horse chestnut and acacia again, and some go on to Hokkaido. A friend who lives in Gifu used to take his bees to Otoinep in the north of Hokkaido for the thistle and lime honey. There is a problem with bears up there.

In this presentation there will also be information about Cerana beekeeping in the mountains, comparing it with Cerana beekeeping in Korea and China, and comments on migratory beekeeping in Western China and the pollination of Japanese Fuji apples in Xinjiang, west of the Taklimakan desert.

Impact of honey bee on the economy of Bangladesh and chemical characters of Bangladesh honey

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The history of beekeeping in Bangladesh is not very old and started successfully from 1977 with *Apis cerana indica*. Bangladesh has a great potentiality of beekeeping due to its favourable weather condition prevailing round the year and plenty of multi- seasonal plants or crops nectar and pollen producing plants throughout the country. About 200 species of plants are identified as the hosts of bee in Bangladesh. At present around 25,000 skilled and unskilled beekeepers and 2,000 bee-farms are involved in Bangladesh. The forest, Sundarbans is the largest mangrove forest in the world where about 75% natural honey is produced by giant bees, *Apis dorsata*. The amount of honey produced through beehives and derived naturally from the Sundarbans is estimated about 6,000 tons per year. Beekeeping also enhances the yield (more than 30%) of important agronomical and horticultural crops due to bee pollination. About 200 species of plants are identified as the hosts of bee in Bangladesh. Bangladesh has immense potential to export honey and the earning from honey export during February-June period in 2013-14 was \$23125. In 2013, the honey from different origin of Bangladesh included *Apis mellifera* and *Apis dorsata* was analysed. Twelve samples were tested and found moisture % ranged from 17.7-23.1, electrical conductivity 0.17 – 0.55 mS/cm, HMF value N.D-370 mg/kg, pH 3.26 – 4.25, Acidity 15-30 meq/kg, Fructose 29.04-44.90 and Glucose 35.57- 43.63. Sucrose % detected from two and trehalose from single samples; however melezitose and melibioze were not detected from any samples.

Symposium: Political Aspects for Boosting Beekeeping Economy

BEO-036

An overview for the implications of natural bee keeping management that to boost beekeepers profits.

Kunsuk Woo

Seoul National University, Republic of Korea

Since 2009, in order to find out international bee products market environment at some countries; USA, Italy, Japan, Thailand, and South Korea were working surveyed. Among the bee products, focused on retail market prices of 21 kinds of honey. There are some remarkable cases of some kinds of bee products appear different prices at different region or countries. In the niche market, we know that many of these interactions beekeeping industry are not simple stories of intimate relationships between one-on-one. Recently, domestic prices are increased than of the international market. Current environment of the beekeeping industry certainly points to the need for new approaches and ways of thinking. Natural beekeeping management is right way at the consumers

demand. In the future to provide for our long-term bee products quality, maintain a sound sustainable basic for economic activity. This also one of the reasons why the consumer is willing to pay a premium for organically certified bee products. Promote and explore the value and bee products diversification based on domestic market studies. Key words: bee products, natural beekeeping, market environment, organic.

BEO-040

Mainstreaming conservation and sustainable use of biodiversity pollinators into Ukrainian production landscapes. An attempt to spread the successful experience and new knowledge from small local project to the national level

Viacheslav Tsuprykov, Ruslan Nesterenko

Environmental NGO

The long-term challenge for Environmental NGO "Gogolmed" is to ensure that Biodiversity of pollinators conservation is mainstreamed into production and marketing of agricultural business, in order to create community incentives to conserve and enhance biodiversity of pollinators including honey bees in Ukrainian land while maintaining appropriate incomes to satisfy beekeepers family needs for livelihood and wellbeing. There are three main barriers to achieve this: -the institutional framework is not sufficiently capacitated to address the needs of an emerging biodiversity-based beekeeping business sector, based on sustainable harvesting and production principles; -at the community-level, sustainable beekeeping production approaches and biodiversity conservation efforts are inadequate due to low incomes from present product categories; -community revenues are limited due to low prices in honey market, due to the fact that high-quality honey, produced using sustainable methods of beekeeping in the natural area, beekeepers are forced to sell as a regular honey. The project will directly address these barriers through the three major components of the project: 1. Building national capacity for support of Biodiversity Beekeeping Business. 2. Piloting Community-based Social Enterprises in valuable Ecoregions. 3. Mainstreaming Biodiversity Business into the supply chains of high-value consumer markets. Our strategy addresses the most critical underlying driver of biodiversity pollinators loss; the failure to account for and price the full economic and human health value of ecosystem pollination service and goods. Especially, it concerns of high-quality honey, an essential functional product in the diet of every modern person, one of the last surviving natural products.

BEO-015

Impact of projects and financial support on the growth of beekeeping sector and beekeepers: A case of Tanzania in East Africa

Stephen Msemo

Tanzania Forest Services (TFS) Agency, Tanzania

Most of beekeepers in Africa are doing substantial beekeeping to meet family necessities and only few are practicing commercial beekeeping. The Government in most countries have restrictions and standards that regulate importation of honey. Consumers of honey are very keen to quality, safety and authentic the situation which few actors (beekeepers in developing) are able to meet these requirements. The Governments are putting effort to maximize production by supporting beekeepers with bee equipment; extension services and facilitates market access including provision of credits. A number of projects are being implemented to support communities to undertake beekeeping as an income generating activity. Desk review method used to collect information on projects and financial supports in Africa, whether it helps beekeepers to grow. Interview approach also applied to beekeepers and other actors based on the Research Question (RQ). Data analysis was due to Qualitative method using grounded theory, coding quotations (statements) from interviewees and from the literature review. Findings were presented through table and discussion based on coded statements. Results revealed numbers of beekeeping interventions happening were focused to improve beekeeping sector and concentrated on the provision of beehives, storage and packaging facilities and trainings. It also proved failure on the aspect of sustainability to beekeepers at the end and what beekeepers and beekeeping entrepreneur's wants and needs were not within the scope of the project objectives. It is recommended interventions to focus factors that address low production, quality of the products and entrepreneurial process to individual beekeepers in a corporate.

BEO-006

The design and effect prediction of subsidy policy on positive- externality industry-take subsidies for mobile bee-keeper purchase for example

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An identification and evaluation on agriculture externality is an essential precondition to subsidize agriculture. In China, the annul value of honeybee pollination reached 242.9 billion RMB (about 40.5 billion US dollar), while it was 14.6 billion US dollar in the 90's of last century in United States, which is 143 times of that of honeybee products. As Chinese agricultural is becoming more specialization, increasing in scale, productivity and utilizing of herbicides and pesticides, it confronted serious pollinator decline. The main obstacle to the establishment and growth of pollination services is the problem of "hitchhiker". This paper attempts to identify policy problems in the commodity program which efforts to promote pollination services issued by the Federal government of U.S., to help Chinese government avoid these mistakes in each effort to establish pollination service, does subsidy for promote pollination services, what is the focus of subsidy should be, and how the subsidy affect. The paper took subsidies for bee industry for example to analyze breakthrough and policy framework of subsidy policy and carried out an evaluation of subsidies adopted data of fixed observation point of national bee industry program. It showed that to implement subsidies for mobile bee- keeper purchase is the most feasible, appropriate and economic intervene measurement to internalize the externality of bee industry based on current situation of China.

Exploring opportunities and constraints for payments for pollination services in Africa

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Payments for pollination services (PPS) can play an important role in securing an adequate crop yield for farmers while generating a new source of income to beekeepers, also in Africa, where small-scale bee keeping is widespread. Combining a global pilot survey of PPS-schemes among beekeepers associations with a review of the sparse PPS literature, this study identifies and discusses the opportunities and challenges for PPS to work in agricultural regions of Africa. Worldwide, PPS-schemes exist in many countries, but besides South Africa, PPSschemes are mainly unknown on the African continent. Willingness of farmers to pay for pollination have been shown in specific locations, but willingness depends on awareness which is often low; a widespread perception exists among farmers of pollination being freely and adequately provided by nature thus a low demand for pollination services. Other constraints include widespread traditional beekeeping and limited number of largescale beekeepers or beekeepers associations with sufficient number of beehives; poor rural infrastructure and low transport capacity among beekeepers limiting mobility for timely provision of pollinators; and limited institutional capacity and political prioritization for pollination markets, which hinders national strategies for PPS. Furthermore, international pollination projects often do not include research on economic incentives for pollination services. Other research needs include institutional mechanisms and economic trade-offs between service delivery and honey production, a disincentive for beekeepers to engage in pollination services. With an institutional framework to support the development of pollination services market, pollination services could be an important add- on to national and local beekeeping economy.

BEO-032

Government attach more importance to apiculture and promote beekeeping development in China

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As is known to all, China is the biggest beekeeping country in the world. Since new century, government has attached more importance to beekeeping and promulgated a series policy such as Beekeeping Regulation of China, The Twelfth Five-Year-Plan of National Beekeeping Development, Green Channel, Beekeeping License, Bee pollination Technology, Bee Quarantine Practice and so on. The government also issues a series standards, for example, Regulation of Beekeeping Technique, Protocol of Diagnosis for Foulbrood Disease, Bee Products Production Management Regulation, Green Food-Bee Product etc.and provided massive financial supports for bee research. All of these make great promotion for Chinese beekeeping rapid and standardize development. Nowadays, China has abundant nectar resources in correspondence to its vast land territory to feed the largest honeybee population in the world. Around 8.9mln honeybee hives, including *Apis mellifera and Apis cerana*, are

under the care of beekeepers in the whole country. Most beekeepers have to practice migratory beekeeping in pursuance of the nectar blooming season from south to north of China in order to harvest as much as possible honey and produce more royal jelly, propolis, pollen and drone pupa. At present, the average annual yield of honey is about 400,000tons, royal jell 4000 tons, propolis 500 tons and bee pollen 6000 tons, which position China to the top producer of honeybee products in the world. Bee products procedures are also growing gradually with standardization and specialization and get higher quality of product promotion.

Symposium: Market Innovation for Beekeeping Economy I

BEO-025

Honeybee Products Market of China -Performance in 2014 and Prediction for 2015

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China is a major beekeeping country in the world. It ranks the first in the world in terms of production of honey, royal jelly, pollen, propolis. Its annual honey production varied from 400 to 450 thousand tons. Its capability for fresh royal jelly production can be fetched to more than 4,000 tons annually accounting for 90% of the world total production of royal jelly, with over 10,000 tons potential for annual pollen production. The honeybee products are not only for export in exchange for foreign currency, but also are consumed in the domestic market. The performance and market information of honeybee products for 2014 are elaborated and the predictions are made for 2015.

BEO-004

The social laboratory analysis of solution for beekeepers' marketing problems (a case study of Turkey)

Murat Emir

Ondokuz Mays University, Turkey

Turkey comes 2nd after China in terms of its presence of 6 million bee colonies, and its annual production of about 100.000 tons of honey. The biggest problem facing beekeepers in Turkey is their lack of sufficient marketing methods and capacity. The aim of this study is to present solutions to the marketing problem of beekeepers in Turkey. In the study observations and applications (also called a 'social laboratory') were utilised. Social laboratory (SL) means that the theoretical information of social sc iences are tested against the conditions on the field. Initially the concepts of marketing and selling are compared. Afterwards, suggestions for solutions of the

SL created for the marketing of bee products are presented. Some marketing methods for a variety of bee products are applied and observations pre- and post-marketing are analysed. As per the results of the SL, it has been identified that honey marketing depends on mutual trust, consumers prefer to buy the honey they find to their taste from persons or companies that they feel as trustworthy, beekeepers who cannot sell their products for the prices they wish to sell can minimise their marketing problems by basing the main elements of marketing on trustworthiness and work ethics. Apart from these, preparing a customer database, making note of the transactions, taking good care of the product packaging, informing the consumers through product advertisement, identifying customers' wants before selling products and after sales of the product getting customer feedback are some methods that can solve marketing problems.

BEO-031

Honey bee as source of nutritional product: Scientific insight

Sampat Ghosh, Chuleui Jung

Andong National University, Republic of Korea

We studied the possibility of incorporating the honeybee (*Apis mellifera*, Apidae) as a marketable product as human food and animal feed. Honeybee is among few insects domesticated with large population in small space. Nutritional analysis showed high potential, i.e. higher protein and ash and less fat content. Adult honeybee contained higher amount of protein (52%) than that of brood (36 to 46% in larval and pupal stage). Almost all essential amino acids were found. Adult honeybee contained less amount of fat (7%) than brood one. Unsaturated fatty acid (66.8%) was higher than the saturated. The higher value of PUFA: SFA (0.5) indicated higher nutritional quality of the oil. The higher ash content indicated better source of minerals. The use of honeybee as a source of nutrition advocates health benefits and possibly additional source of income for beekeepers, given some obstacles resolved.

BEO-041

Global and Korea propolis industry trends

Lee Seungwan

Seoul propolis co., lt. Republic of Korea

Propolis is a natural antibiotic made by honeybees and commonly used in nutraceuticals in health care, drugs, cosmetic and medicinal preparations because of its antiseptic, antiinflammatory, and anesthetic properties. The developments in propolis research and technology using propolis extracts in nutraceuticals, cosmetics and drugs have been applied internationally for a patent since 1970s. Looking at trends in international patent applications for the last 20 years, the use of propolis has been more dedicated to the development of products rather than method for extracting propolis. The patents after the mid-2000s show that method for improving the water-solubility of propolis extracts has been extensively studied in order to be substituted for ethanol extract of propolis. Thus, demand propolis is expected to continue growing in the markets and it will be being used in many areas

with increasing success. Increasing healthcare cost, rising aging population and the growth of emerging middle class in China and developing countries in Asia are one of the key factors driving the growth of the global nutraceuticals market. The global nutraceuticals market are expected to reach \$120 billion (USD) in 2016. Additionally, as a natural supplement, propolis market is expected to increase significantly in the future.

BEO-021

Using geographic information system to evaluate honey and pollen potential on a territory

Michel Bocquet

Apimedia, France

Territorial collectivities are willing to develop policies to help the beekeeping sector, in order to increase honey production, pollination services and biodiversity in land management. For this purpose, they need a precise geographical approach, and a good evaluation of the honey potential. A method to evaluate nectar and pollen potential at territory scale on a weekly base using GIS (Geographic Information System) has been developed. Using a phytosociological approach, the vegetation of homogenous zones on the territory is quantified. A foraging area, for instance, is usually divided in more than one thousand polygons and more than 30 homogeneous zones, on which the botanical survey is done. The collected data are linked to a phenologic and a nectar/pollen database to calculate the production. This method has been used to evaluate the impact of pesticide practices on bees. This tool is a support to better understand the use of the landscape by honeybees in order to discuss the origin of pollutants or pollen incomes in the colony. For beekeepers, we can plan the organization of the season, and improve the colony renewing without reducing the honey production. The next step is developing a better integration of climatic data to improve the precision of the evaluations, and applying the method for a better use of bees on the monitoring of the environmental quality.

BEO-024

Market survery and quality assessement of locally distributed honey: Case study in Gyoungbuk province

Chuleui Jung¹, EunRan Cho², Seunghee Lee²

¹Andong National University, Republic of Korea ² Dept Plant Medicine, Andong National University, Republic of Korea

Honey has a long history of human consumption, and is mostly consumed in its unprocessed state (i.e. liquid) after extraction. It is taken as medicine, eaten as food, or incorporated as an additive in a variety of food and beverages. Global production is 1.5 million MTs in 2010. The major supplier countries are China followed by Mexio, Argentine and Turkey. Global imports of honey is increasing. Biggest buyer is EU followed by US and Japan. In Korea, honey production has been dramatically increased now upto 25-30 thousand MTs but most of them are in

domestic consumption. For the sustainable beekeeping development, honey production and marketing would follow the international standard called Codex. As a basement information, we did a market survey of honey displayed in the local markets and those quality were analyzed based on the international quality assessment standards. In the most categories, bottled honey satisfied the standards but some are questionable for the adulteration based on the pollen contents or stable radioisotope analysis. Further consideration and research area are discussed

Symposium: Market Innovation for Beekeeping Economy II

BEO-014

Mead production, the perfect beverage

Brian Schlueter, Celina Pennisi

Moonstruck Meadery, USA

In our discussion we will explore what mead is, its history, and components of mead. A short introduction of how mead in produced and the many varietals of mead. Processing methods including fermentation of honey, clarifying by filtration, and still and carbonation bottling or kegging. Required equipment to start up in mead production. We will share a look at the some trending information from the United States and the opportunities of growing this market and utilizing its existing abundant resources to the world.

BEO-002

Enhancing sustainability and competitive bee industry for economic growth in Malaysia

Mohd Mansor Ismai

Universiti putra malaysia, Malaysia

Sustainable beekeeping industry generates profit to agro entrepreneurs, firms and industries in the supply chain. Through pollination services, the industry directly and indirectly producing food, and conserve forest and biodiversity in Malaysia. The contribution of beekeeping industry to economic growth and food security in Malaysia depends on sustainable production of bee products and by-products through augmenting bee population, food standard, safety and quality, and efficient marketing and trade strategies. Beekeeping also plays a major role in wealth creations, socio-economic development and environmental conservation. It is a source of health food and wound healing. The bee products can also be used as raw materials for various industries. But the most important of all is its usage as potential preventive measures and treatment of Non Communicable Diseases (NCD) such as cancer, diabetes, respiratory and liver diseases. Thus, the research program attempts to increase bee populations, and hence, bee products that meet the Malaysian Standard, safety and quality for new formulation of commercial health supplements and NCD treatments. By doing so, the beekeeping industry is expected to create

new source of wealth along the supply chain from upstream to downstream activities in line with the Malaysian government aspiration of diversifying high income projects.

BEO-020

Beekeeping in Russia

Larisa Prokofyeva

FSBSI "RI of Beekeeping"

According to the last data the number of bee families in the Russian Federation is 3.3 mln at that 92 % at private farms. It is necessary to point out that private beekeeping during the years of economic reforms has turned to be more stable not only in preserving the number but in increasing bee families' productivity as compared with the social sector. It has provided the dynamic growth of cash honey production in the country during last years. At the expense of small beekeepers in a case of total families' number decrease by 1.5 mln. during last 20 years the production of cash honey has increased from 48-50 to 65-68 thousand tons. Taking into account that the forage resources state of beekeeping has not improved during last decades at the expense of cutting the areas with honey plants one can consider the increase of honey production per one bee family as a result of bee families quality improvement and the use of progressive technologies. In a case of state support there exists a real possibility for the dynamic development of beekeeping in our country. Based on some honey gathering and social-economic parameters one can forecast the increase of number and cash honey production in Russia by 2-2.5 times.

BEO-003

Bee products marketing and its marketing strategies for the future: Case of Turkey

Fgen Cukur, Tayfun Cukur

¹Mugla Sitki Kocman University, Milas Vocational School, Department of Management and Organization, Turkey ²Mugla Sitki Kocman University, Milas Vocational School, Department of Marketing and Advertising, Turkey

Beekeeping has been played a critical role in rural development and increasing in importance day by day. Beekeeping has a significant additional value in both macro economy and micro-economy. On the other hand, sometimes marketing problems are negatively affect to the beekeeping industry. Therefore, determining the marketing strategy for bee products must be detected. Sustainability of Turkey in the world honey sector will be solve current marketing problems strategies and determine marketing strategies for the future. From past to present Mugla province has been produced the majority of Turkey pine honey production. Mugla province continues to take place in a important position in the world and Turkey honey industry. Also, Milas district is first place in beekeeping industry of Mugla province. In this study, survey will be face to face with beekeeping producer in Milas District. First, current marketing structure of the products obtained from beekeeping activities in beekeeping farms (marketing channels, market price and so on.) will be revealed. Then, problems of beekeeping farms in the marketing phase of bee products and solutions will be investigated. Also, in this research, different marketing strategies for ensuring the sustainability of the added value in terms of creating the marketing of bee products in the rural development of the region will be determined.

BEO-028

Introduction to beekeeping industry in Iran

Sayed Mazaher Sayedi¹, Alireza Abbasian¹, Mahmood Salesi¹, Mansour Kimiaei², Shahabodin Mosharaf¹

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Iran, having over six and a half million honey bee colonies ranks second following China as a huge apiculture industry worldwide. The growth of apiculture industry in Iran has been very high such that the statistics of colonies during the last 20 years indicates a growth of over %100. Along with increase of the colonies, axillary industries such as honey packaging factories and workshops, manufacturing apiculture tools, wax sheeting, hive making, apiculture clothes, manufacturing drugs and food supplements from apiary products, and specialty laboratories for honey bee products have experienced a significant growth. About a hundred Iranian are directly involved in this industry. Several higher education centers in the academic study of honey bee have been established such that numerous educated people are serving in this industry. In the past most attention was paid to honey production however, nowadays production, processing and sale of other honey bee products such as pollen, propolis, and royal jelly is prosperous in such a way that traders sell their products not only in Iran but also in the neighboring countries along the coasts of the Persian Gulf. We dare say that beekeepers in the Middle East and newly independent countries of the former Soviet Union provide all beekeeping industry needs from our country.

BEO-007

Protect African bees, in order to preserve our future and global food security

Norber Mbahin, Simplice Nouala

African Union – Inter African Bureau for Animal Resources

Today, a major decline in honey bee (bee apocalypse) has put agriculture, healthy lifestyles, and worldwide food security at risk. This decline in bee health has been linked to a variety of factors, including those influenced by the activities associated with both beekeeping and crop production such as online trading of various bee breeding packages, eggs and other is a powerful factor of globalization of bee diseases; intensification of commercial beekeeping and miticide resistance who has increased bee susceptibility to Varroa mites (pest s and disease); the lack of a varied diet due to declining wild spaces and increased monocultures – have led to malnutrition (lack of Forage & nutrition); the use of pesticide and other crop protection products can incidentally expose bees (Incidental Pesticide Exposure), and lastly management and selective breeding practices may reduce genetic diversity (Hive Management).

What could be the mains apiculture policies to be adopted by African Union member States to avoid the bee apocalypse? Also sharing some data on honey production in Africa will be discussed in this presentation.

BEO-029 Inclusive business in competing market chains: The case of Ethiopian honey

Paulos Desalegn Woldesellassie

SNV - Netherlands Development Organization, Netherlands

Ethiopia is among the top ten producers of honey in the globe with more than 1.4 million beekeepers. The honey sector is one of the few sectors that had the most inclusive ability to achieve transformation and growth across all categories of rural households in Ethiopia. Ethiopia's total honey production reached more than 48,711 ton in 2014. The potential production is more than 10 times the current levels. This is because of its large resource base and low barriers to entry. The demand increased from domestic and export markets. The significant volume of honey goes to a local drink called 'Tej' making. Some proportion goes to table honey consumption in the big cities with a growing trend in the local consumption. At the same time Ethiopian honey export showed significant growth starting from 2005. The main destination are Europe, Sudan from Africa and Middle East countries (Saud Arabia, UAE, Oman, Yemen) in total to more than 18 countires. In general Ethiopia honey is fetching more than the average price for the conventional honey export price. Efforts were made by government and nongovermental organizations to encourage more inclusivness business and export growth. The incentives from the two competing market chains (domestic that is dominated by the local drink Teje and the export market) creates dynamics in the growth of sustinable inclusinvess business. Lessons and trends in the country reviewed and the paper summarizes the main findings.

BEO-039

Effect of harvesting method and hives model on the amount of honey produced by the bee colonies in Algeria.

Zohra Ghalem Berkani

Higher Normal School Kouba

The effect of the method of harvesting the honey yield and that of the hive model on the evolution of brood and honey production. The comparative study was conducted on bee *Apis mellifera intermissa* breed reared in two models hives (Langstroth and Dadant) in northern Algeria. Two harvesting methods were tested. The single harvest and partial harvests. The results show the interest of the method of partial harvests that produces far more honey than the single harvest; the effect is significant. This finding was verified in two hives models. This advantage seems to be attributable to the release of the space inside the pipes hives to harvest partielles.Ce factor seems to stimulate the queen to intensify its spawning activity and the workers to reap more nectar.

As for the hive model, the results are for the Langstroth hive. This by its undoubted benefits allows a better evolution brood over the Dadant; the differences are quite significant. For its part, the Langstroth hive helps

provide greater honey production as Dadant. In the latter, more voluminous, settlements are increasingly confronted to climatic hazards and develop late compared to those housed in Langstroth and are less active during the honey.



Bee Biology



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Mission

The mission of the Standing Commission on Bee Biology is to give attention to the current state of research on bee biology





Plenary Session

BBO-061

What's new in honey bee science?

Karl Crailsheim

University of Graz

Scientists and members of the public are being attracted more and more by honey bees. From early 2013 until mid-2015, thousands of articles were published in reviewed scientific journals; in the 2 most important ones (Science and Nature) alone, 59 contributions dealt with bees! During recent decades, the number of honeybee publications has steadily increased. Multiple stress factors have been suggested as reasons for honeybee losses in the northern hemisphere, and the mite Varroa destructor is still one of the most important ones. The ongoing discussion about the impact and role of agrochemicals used in agriculture is one of the most exciting themes. This contribution presents a short review of these major topics, and emphasizes the increasing importance of their influence also on the fate of non-honey bee pollinators.

BBO-049

A global view of small hive beetles and the COLOSS network

Peter Neumann

Vetsuisse Faculty, University of Bern

An undesired effect of globalisation is the widespread occurrence of pests and pathogens. This often results in multiple infections / infestations of bee colonies and an almost indefinite number of possible interactions with other factors compromising bee health, e.g. pesticides and nutrition. To promote bee health and mitigate losses of colonies, an international approach seems to be required to avoid redundancies and instead foster mutual enrichment.

Here, I will give an overview of the current global small hive beetle situation as an example of an emerging bee health factor. Small hive beetles are generalists native to sub-Saharan Africa and reproduce in association with honeybees, bumblebees, stingless bees, fruits and meat. They have become an invasive species and introductions have been recorded from America, Australia, Europe and Asia since 1996. While SHB are usually considered a minor pest in Africa, they can cause significant damage to social bee colonies in their new ranges, thereby calling for adequate mitigation. I will also provide a short update of the COLOSS network (prevention of honeybee Colony LOSSes), which has been initiated to promote bee health at a global scale.

BBO-017

A new approach for honeybee breeding - Genomic selection

Kaspar Bienefeld¹, Andreas Spötter¹, Norbert Reinsch², Manfred Mayer², Pooja Gupta¹

¹ Institute for Bee Research Hohen Neuendorf, Germany ² Leibniz Institute for Farm Animal Biology Dummerstorf, Germany

In order to identify the genes involved in honey bees' Varroa tolerance, a honey bee SNP (single nucleotide polymorphism) chip with 44,000 genetic markers was developed at the Institute for Bee Research Hohen Neuendorf (Mol. Gen. Resources: 12:323-332). Altogether, 22,000 individually labeled workers were monitored by infrared video technique to observe their response to Varroa-infested brood cells. 122 highly hygienic worker bees and 122 non-hygienic sisters were genetically analyzed with the help of the SNP chip. Four genetic markers showed a highly significant genome-wide association with uncapping behavior towards Varroa-infested cells. Inspection of the genomic region around these markers led to the discovery of putative candidate genes. In addition to detecting genetic markers for traits of interest, high density SNP chips can also be used for genetic evaluation. Traditional breeding programs rely mainly on phenotypes, plus pedigree information. Genomic selection is a new approach for improving quantitative traits that use whole-genome molecular markers. Genomic prediction combines marker data with phenotypic and pedigree data in an attempt to increase the accuracy ofbreeding and genotypic value prediction. Using next generation sequencing of drones from different A.m. carnica populations, a new 100,000 SNP chip is in development, aiming to initiate genomic selection for traits of Varroa resistance, productivity, and gentleness in honey bees.

Symposium: Nurtriton & Phsiology I

BBO-039

Regulation of macronutrient intake by adult worker honeybees and bumblebees

Daniel Stabler, Geraldine Wright

Newcastle University, United Kingdom

Bees eat an unusual diet. Specialization on nectar and pollen provides bees the possibility of regulating their intake of carbohydrates and proteins independently, as nectar is mainly carbohydrates whereas pollen is mostly proteins and fats. In this talk, I will describe experiments designed to test how honeybees and bumblebees regulate their intake of carbohydrates, proteins, and fats. We have found that carbohydrate regulation is mainly independent of protein intake. Bees prioritize their intake of carbohydrates above protein and will over-eat protein to gain carbohydrates if necessary. Nurse honeybees tolerate diets high in protein or free amino acids and will self-select diets higher in protein/amino acids. In contrast, foragers have more difficulty regulating the amount of protein they eat and function best over a narrow range of protein in diet. Foraging age worker honeybees and bumblebees require relatively little protein - as little as 0.1% of their diet – and die rapidly when fed diets high in protein or

free amino acids. We have also found that bees feeding on a protein such as casein consume 3x as much to gain amino acids as bees fed with diets composed of free amino acids. Workers regulate their intake of fat around an optimum level, and prioritize fat below protein. The implications of our work for bee husbandry and land management to optimize bee nutrition will be discussed.

BBO-029

Food consumption and food exchange of caged honey bees using radioactive labelled sugar solution.

Robert Brodschneider, Vera Kupelwieser, Anika Libor, Karl Crailsheim

University of Graz, Austria

We estimated the distribution of sugar solution within groups of caged honey bees under standard in vitro laboratory conditions as used for toxicity tests. ¹C polyethylene glycol was used as marker to analyze consumption of each bee after group feeding. Labelled sugar solution was unequally distributed in bees in 36 of 135 investigated cages compared to a theoretical equal distribution (Kolmogorov-Smirnov, p0.05). As equality parameter, we calculated an intake ratio by dividing the intake of the 90th percentile bee by the intake of the 10th percentile bee (trimming the distribution to the inner 80 to eliminate outliers). These intake ratios ranged from 1.3 to 94.8 in 133 cages, 8.8 on average, further supporting an unequal distribution of food among caged bees. In another experiment, starved and marked bees were added to the cages in a ratio of 10:5 or 20:20 after the initial set of bees consumed all the labelled sugar solution. The transmission of this labelled initial sugar solution by trophallaxis within 48 hours to added bees was 26.3 (10:5) or 45.1 (20:20). Our results demonstrate that differences in food intake may exist within caged bees although a substantial amount of food is also shared among bees after feeding. However, group feeding may not provide all bees in a cage with the same amount of testing compound.

BBO-020

Larval metophrene application affects the live weights of the queen bees and ovariole numbers of the worker bees (Apis mellifera L.)

Osman Kaftanoglu, Cahit Ozturk

Arizona State University, USA

Juvenile hormone analog metophrene has been used extensively in sericulture to increase the cocoon yield and silk productions. It also affects the queenliness of bumblebees and ants. We have tested the sub lethal doses of metophrene on the development of honey bee queens and workers. Fourth instar worker larvae were treated with 12.5 μ g metophrene in 2 μ l acetone. Fourth instar queen larvae were treated with 12.5 μ g and 25 μ g metophrene, one day before the cells are sealed. No lethal effects were observed on the queen and worker larvae at given doses. Live weights of the control queens, 12.5 μ g and 25 μ g metophrene treated queens were 207.2±19.82 mg; 225.52±21.13 mg and 232.22±18.69 mg respectively. Sub lethal dose of metophrene prolongs the larval period

and the queen larvae consumes more food and grow bigger. Therefore, metophrene treated queens were significantly heavier than the control groups (P<0.01). The average live weights of the control and metophrene treated worker bees were 101.57 ± 6.99 mg and 103.81 ± 10.25 mg respectively. The average ovariole numbers of the control and metophrene treated worker bees were 8.76 ± 5.44 and 28.16 ± 20.60 respectively. Application of metophrene did not affect the live weights of the worker bees since the worker cells were sealed and there was no more food in the cells to grow further. However, it increased the ovariole numbers significantly (P<0.0001). The effects of metophrene application on queen rearing and the lifespan of the worker bees are discussed.

BBO-041

Brood rearing status of the honey bee is associated with acetylcholinesterase 1 expression

Kyungmun Kim, Young Ho Kim, Ju Hyeon Kim, Si Hyeock Lee

Seoul national university, Republic of Korea

The acetylcholinesterase 1 (AmAChE1) of the honey bee is known to be abundantly expressed both in the central and peripheral nervous systems. AmAChE1 exists mostly in the soluble form with little catalytic activity and has non-neuronal functions. Our preliminary observation showed that AmAChE1 expression fluctuated between the forages and nurses. A more systematic expression profiling of AmAChE1 over a year cycle on a monthly basis revealed that AmAChE1 was predominantly expressed during the winter. However, no significant difference in AmAChE1 expression was noticed between the nurse and forager workers. Interestingly, AmAChE1 expression was inhibited when bees were allowed for brooding by placing overwintering bee hives in green houses with the supplement of pollen diets whereas it was resumed when the bee hives were removed from the green houses, thereby suppressed brooding. To confirm whether brooding status is a main determining factor for the suppression of AmAChE1 expression, active bee hives were placed in a screen tent, thereby hindering foraging, until brooding was completely suppressed, and then allowed to restore brooding by removing the tent. The AmAChE1 expression in the head was up-regulated when brooding was suppressed whereas its expression was down-regulated when brooding was resumed. These findings demonstrate that AmAChE1 expression in the central nervous system (i.e., head) is related with brooding status of honey bee. To understand the connection between the AmAChE1 expression and other pathways related with brood rearing, currently in progress are the analyses of head transcriptomes of honey bee workers with or without their brooding suppressed.

BBO-023

Juvenile hormone regulates the production of 10-hydroxy decenoic acid in mandibular gland of honeybee workers (Apis mellifera)

Shaokang Huang, Bihua Ying, Xin Su, Lihua Ling, Wenbing Chen

College of Bee Science, Fujian Agriculture and Forestry University, China

10-hydroxy decenoic acid (10-HDA), the main unsaturated fatty acid secreted by mandibular glands of honeybee worker (Apis mellifera), plays an important role in honeybee development and caste differentiation. In order to elucidate the relationship between juvenile hormone and 10-HDA in workers, we analyzed the 10-HDA in the head and juvenile hormone titre in the rest parts of 0-, 5-, 10-, 15, 20-, 25-day old workers kept in cages. the results showed that they were high positively correlated (y=3.401x-40.593, y:10-HDA, x:JH, r=0.999). After 25ug, 50ug, 200ug of juvenile hormone analogue(JHA) applied to the dorsal thorax of 0-day old worker (<24h) individually, 10-HDA contents significantly increased three days later comparing with those of solvent control (isopropanol) and blank groups. Furthermore, the ultrastructure revealed that the secretion structures, like collection canals and microvilli in gland cells of treated bees, were thicker and more abundant respectively. It suggested that juvenile hormone probably regulated the 10-HDA synthesis in mandibular gland of worker bees.

BBO-018

Effects of feeding honey bees (*Apis mellifera*, Hymenoptera: Apidae) with industrial sugars on foraging behaviour and colony development

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In the present study, 130 honey bee colonies fed with different levels (5, 20 and 100 L/colony) of various commercial sugars, including High-Fructose Corn Syrup 85 (HFCS-85), High-Fructose Corn Syrup 55 (HFCS-55), Glucose Monohydrate Syrup (GMS), Bee Feeding Syrup (BFS) and Sucrose Syrup (SS), for 2 months were compared with colonies fed with no sugar (control) in terms of their colony loss, worker bee population, brood rearing, hive weight, wax production and foraging behavior. Utilization of industrial sugars by honey bee colonies showed differences in terms of colony performance parameters. Honey bees did not use GMS eagerly, resulting in increased worker bee loss (50%) in winter and decreased worker bee numbers over time. SS and BFS had a positive effect on wintering ability, wax production and hive weight. The highest foraging was observed with BFS. Sugars containing high levels of monosaccharide (such as GMS) and fructose (such as HFCS-85) were not used efficiently or adequately by honey bee colonies, whereas the sugars containing fructose and glucose at rates of 40% and 30% (BFS and HFCS-55), were utilized efficiently.

BBO-045

Peculiarities of honey flow by bee families of different origins have genetic base

Nicolaj Kharitonov

FSBSI "RI of Beekeeping", Russia

Our comparative tests of bee families of the interbreed type of middle Russian breed "Prioksky" got by crossing middle Russian and gray mountain Caucasian bees as well as Carpathian, gray mountain Caucasian and middle Russian taking into account 5-7 times during the season the honey stock and the sealed brood in brood nests of experiment bee families. During three years of tests we have got similar results and discovered that differences in honey flow remain.

Different breeds bee families' adaptation to honey stock accumulation at definite type of honey flow has an exact genetic basis and must be one of the most important characteristics of any bee breed both natural and artificial. This feature manifestation lies in the fact that during the evolution of any race (breed) of bees in definite honey flow and climatic conditions (these two factors are inseparably connected with each other). It provides some biological strategy of the maximum honey stock accumulation to survive unfavorable conditions in a definite period of the honey flow season and from definite plants. By the time of using this honey flow the bee family gets the maximum number of bees. This strategy is rigidly fixed by natural selection. One should consider this feature on all the stages of the selection process. It is closely connected with other features of the geographical race differing one race from another: exterior, physiological, biochemical, behavioral ones. Its difference from other features is that it appears on the level of the bee family all-in-all.

Symposium: Nurtriton & Physiology II

BBO-016

Identifying nectar storage patterns and honey ripening processes with non-invasive diagnostic radioentomology

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Honey bee workers collect sugar solutions in their environment as fuel for their metabolic processes. Once brought into the hive by foragers, the secretions are transferred to receiver bees that distribute them to hungry nest mates. After metabolic needs have been covered, the surplus of collected carbohydrates is stored in wax-cells and ripened to produce honey. Honey stores enable colonies constant carbohydrate supply when foraging is not possible. The processes involved in carbohydrate storage and ripening are not well understood, which is surprising given the econo mic and nutritional value of honey. We used Diagnostic Radioentomology, to monitor descriptively the cell filling and honey ripening processes, over time. Measuring density of storage cell content as a token of sugar concentration, we were able to indirectly describe the behaviour of workers, which stored and ripened nectar. Over 12 days, more than 1,000 cells were measured in three colonies. Visual inspection of density-patterns within individual cells revealed non-homogeneous content, suggesting that workers do not thoroughly mix nectar during ripening. In most cases, sugar concentration of cell content increased steadily over time, but fluctuated in some cells, decreased or remained stable in others. Relocation of cell content was frequently observed, confirming its importance in the ripening process. The sugar concentration in capped-storage cells was significantly higher than in partly-capped cells, suggesting that final cell content ripening occurs when capping has already started. A better

knowledge of these mechanisms might help beekeepers improve their colony management in order to promote honey ripening and harvest quality.

BBO-021

Longevity extension of worker honey bees (*Apis mellifera*) by royal jelly: optimal dose and active ingredient

Yang Wenchao, Tian Yuanyuan, Miao Jing, Wu Zhenhong, Miao Xiaoqing

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In the Western honey bee, *Apis mellifera*, queens and workers have different longevity although they are derived from the same genome. Queens consume royal jelly (RJ) as the main nutrition source throughout their life, including adult stage, but workers only have chance to do that when they are less than 3 days old in larva stage. In order to explore the effect of royal jelly and its components on longevity of worker honey bees, we first determined the optimal dose of RJ for prolonging longevity of workers. A method of obtaining relatively long lived workers was developed. We then compared bee collected pollen from different plants to the optimal dose of RJ. Lastly, we tried to determine which factor(s) is responsible for this effect by comparing longevity of workers fed with RJ crude protein extract (RJCP), RJP30 and RJP60 obtained by precipitation with ammonium sulfate and ethanol extraction of RJ (EERJ). We found 4% RJ was the optimal dose for longevity extension and the main factor in inducing this effect may be RJP60, which protein or other factor(s) in RJP60 is responsible for this effect needs further study.

BBO-042

Analysis of bacterial communities in the guts of Asian honey bee *Apis cerana* and Eurpean honey bee *Apis mellifera*

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In this study, we surveyed the bacterial community structure in the guts of Asian honey bee *Apis cerana* and European honey bee *Apis mellifera* using both culture-independent and culture-dependent methods. Pyrosequencing analysis of the 16S rRNA genes showed that both honey bee species harbored 18~22 bacterial species (analyzed at a 97% similarity cut-off) in their guts and most of them are highly similar to the known honey bee gut-specific ones, with Lactobacillus and Gilliamella as the predominant bacterial gener a. In the other hand, the bacteria affiliated with Lactococcus, Spiroplasma, Flavobacter iaceae, and Enterobacteriaceae were much more abundant or exclusive in the guts of *A. cerana* while so were those affiliated with Bifidobacterium,

Snodgrassella, and Frischella in the guts of A. mellifera. Although the two honey bee species harbored the same putative bacterial species (at 97% similarity cut-off) of Lactobacillus and Gilliamella, these bacterial groups were clearly different at the strain level (at a 100% similarity cut-off) between the two honey bee species. The above results substantiated the previous observations that honey bee guts are dominated by several specific bacterial groups but also showed that their abundances can be variable among honey bee species. This study also suggested that the gut bacteria might establish a specific relationship with a honey bee species. We isolated more than 100 bacterial strains from the guts of two honey bee species using various culture conditions, among which two lactic acid bacteria showed an inhibitory effect against Paenibacillus larvae subsp. larvae, the causal agent of American foulbrood.

BBO-032 Proxy indicators of queen bees amd drones quality

Lubov Savushkina, Anatolii Borodachev

Grading of queen bee quality requires at least two years so the need for early selection of high-quality queen bees according to different characteristics arises during their breeding. Studies have shown that the proxy indicators of the quality of future queen bees may be mass selected eggs for their breeding and the volume rebuilt queen cells, as there is a positive average correlation between them (r=0,57; 0,48). When analyzing of correlations between exterior characteristics and mass of unmated queens the highest positive correlation is identified with the length and width of the third sternite (r=0,77; 0,56) and negative between the width of the front wing and the weight of queen bees (r= -0,30). A close correlation of the mass of unmated queens with the number of egg tubes is defined as 0,72, and the mass of laying and unmated queens is 0,51. A positive correlation between these features allows realizing an objective and early selection of high-quality queen bees. Although the direct influence of the mass of the queen bees on their egg production is caused by many factors, determining by the external and internal conditions of bee-family life these symptoms are positively correlated (r=0,31). Studies have shown that the mass of drones closely correlates with mass of their seed-breeding plots (r=0,74), under the average correlation with number of sperm (r=0,44) and exterior characteristics: the length and width of the front wing (r= -0,58; -0,51) and tarsal index (r=0,60).

BBO-015

Biological analysis of iron-metabolism protein genes in Apis cerana cerana

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Transferrins (Tfs) and ferritins (Fers) play important roles in maintaining intracellular homeostasis by scavenging reactive oxygen species. However, few Tfs and Fers have been functionally characterized in *Apis cerana cerana*. In this study, we identified three genes, AccTf, AccFTH and AccFTL, and investigated their connection to antioxidant defense. The gene structures, including complete ORF were verified that coding peptides with 712 (78.6 kDa), 219 (25.5 kDa) and 218 (25.2 kDa) amino acids, respectively. Multiple sequence alignments revealed higher sequence identity of AccTf, AccFTH, AccFTL with other insects (*Apis florea, Apis mellifera, Apis dorsata*)

and *Bombus terrestris*). AccTf was mainly detected in fourth instar larvae, whereas AccFTH were highly concentrated in pink-eyed pupa. The expression level of AccTf was the highest in fat body. However, the expression levels of AccFTH and AccFTL were the highest in middle gut. AccTf was induced by temperature (4, 16, 25 and 42 oC), H2O2, UV, heavy metal (FeCl3 and HgCl2) and pesticide (paraquat, imidacloprid, decamethrin and cyhalothrin). AccFTH was up-regulated by H2O2, UV, thiamethoxam, phoxim and down-regulated by 4 and 42 oC, deltamethrin and cyhalothrin. After treated with FeCl3, the iron concentration in hemolymph increased and the transcript levels of AccTf and AccFTH were markedly up-regulated. These results indicate that AccTf and AccFTH might respond to various environmental stresses, protect against reactive oxygen species and induced by free iron ions and functioned in iron storage and transportation

BBO-033

Correlation of biological and farm useful characteristics of honey bees (*Apis mellifera* L.)

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We have studied correlation links between the level of the family provision with the fodder, the brood growth, the bees' physiological state and their winter resistance. The research took place in 1974-2004. We have discovered keen positive correlation between the pollen mass in the beehive and the brood number (r = +0.818+0.136), as the same link between bee-bread in the beehive and the brood number till August (the period of brood growing before and during the honey flow) is weaker (r = +0.425+0.297). The number of the brood being grown in August is strongly connected with the amount of protein fodder kept in the beehive (r = 0.731+0.122) as at that time there are not many blooming polliniferous plants and bees largely depend on the amount of bee-bread kept in the beehive. The bee-bread in the beehive weakly influences the protein in the organism of bees (r = 0.014+0.002) as while growing the brood bees use the reserve fat and nitrogen compounds of their organism thereby compensating protein deficit preventing imperfect individuals. High productivity of bees closely correlates the bee-bread amount in the beehive during the whole season (r = 0.617+0.043). Besides high productivity of bees closely correlates pollen gathering (r = 0.582+0.14), nectar bringing (r = 0.697+0.054) and brood growing (r = 0.737+0.124).

BBO-019

Transcriptome comparison among mandibular glands of the honeybee (*Apis mellifera* L.) queen and workers

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Secretions of mandibular glands (MG) have important caste-specific functions associated with the social evolution of honeybees. In queens the MG produce pheromones involved in regulating the behavior and reproduction of other members of the colony, in workers secretions of these glands include fatty acid components of the royal jelly. The complex regulation of MG function is further influenced by social and environmental signals associated

with reproduction. In order to identify candidate genes associated with caste and reproductive state, we compared the gene expression patterns of MG between queens, queenright workers and queenless workers with activated ovaries by means of high-throughput RNA-sequencing technology. In total 5457 genes were differentially expressed among these samples. Of these, 2629 were differentially expressed when comparing queens and queenright workers, 2761 in case of the queenright and queenless comparison and the highest one, 4662 genes showed expression differences when laying workers and queens are compared. Multi genes associated with the caste specific mandibular gland secretion biosynthesis were identified, including several genes related to the hydroxylation and oxidation of fatty acid, providing an important clue for clarifying the mechanisms underlying the MD production of mandibular fatty acids. Our results unravel the molecular basis of mandibular gland functions.

Symposium: Genetics & Breeding

BBO-064

The role of germplasm cryopreservation in honey bee breeding and conservation

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Historically, the geographic distribution of *Apis mellifera* was greatly expanded by human-assisted transportand the species can now be found on continents and in regions of Asia previously free of *Apis mellifera*. This range expansion was accompanied by bottleneck events that, together with colony losses due to Varroa mites, reduced genetic diversity in many populations. Fundamental to selective breeding programs is a genetically diverse starting population, a requirement that can be a challenge to attain in areas where honey bees are derived from introduced populations. Recent advances in germplasm cryopreservation methods now make it possible to preserveviable honey bee semenfor extended periods of time and use such semen in breeding and conservation programs. In addition to adding genetic diversity into current breeding stocks viainstrumental insemination, cryopreserved imported semen of desired subspecies or strains could be used to produce new populations of the imported stock via insemination and repeated backcrossing. We report here our use of cryopreserved semen from A. m. caucasica and A. m. ligustica to supplement current US breeding stocks and semen from A. m. caucasica and A. m. pomonella to introduce new subspecies diversity to managed honey bee populations.

BBO-060

Chalkbrood resistance associated SNP markers in honey bees, Aips mellifera, by whole-genome resequencing

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Chalkbrood disease seriously impairs brood growth and productivity of colonies. Honey bees can develop chalkbrood resistance naturally, and studies demonstrated that the regions on chromosomes 2 and 11 were associated with chalkbrood resistance. The detail mechanisms were not fully understood, and no easy method is available for selecting and breeding resistant bees. SNPs that can be applied as genetic markers and even to find the genes involving in the resistance development are needed. We conducted whole-genome resequencing (5-25× coverage) to compare chalkbrood resistant and susceptible larvae selected by chalkbrood inoculation in vitro. 12 genomic libraries, 14.4 Gb sequence data, were analyzed using SNP finding algorithms. Specific SNPs existed in resistant individuals were selected and confirmed by PCR and Sanger sequencing. The SNP, C2587245T, located in the second intron of Mrjp5, was statistically supported to correlate with the chalkbrood resistance though all trials. We also noted the risk of developing chalkbrood was much less in larvae of C/C genotype on C2587245T than the T/T genotype, and the frequency of C allele in larvae from CR colonies was significantly higher than that from CS colonies (P < 0.05). C2587245T was statistically supported to serve as a molecular marker in larvae or queen for the chalkbrood resistance breeding programs.

BBO-037

Breeding and selction activities for Carniolan honeybee (*Apis mellifera carnica*) in Slovenia

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Today, *Apis mellifera carnica* is the only subspecies reared in Slovenia and supposed to be the second most spread honeybee subspecies in the world. The Service for Carniolan Bee Selection Program was established at the Agricultural Institute of Slo venia in 1984. The Beekeeping Association of Slovenia is now registered as the Breeding Organization for Carniolan Bee and the "Authentic Carniolan" is a trade mark for indigenous Carniolan breeding material. The two levels of breeding activities include: a) the basic examination of honeybee colonies carryied out in all apiaries; b) the second level is carried out in queen rearing apiaries under the supervision of Beekeeping Association of Slovenia and Agricultural Institute. The field production test of queens is organised and the breeding values of queen mothers are evaluated. The colony performance test is conducted in the progeny of each of the breeding colonies. Racial characteristics, honey production, swarming tendency, gentleness and tendency to remain calm on the comb, varroa tolerance of breeder colonies are tested. The performance test of honeybee queens is conducted on approximately 700 queens yearly. Queens are delivered to approximately 40 queen testing apiaries and after the evaluation the breeding values for main characters are estimated. Bee breeders with the support of professional service rank the potential breeder colonies and suggest them as breeding colonies in the next generation. The service ensures to perform effective selection and queen rearing program with approximately 30,000 queens recorded in the Herd Book.

BBO-013 Breeding and selection of ylca honeybee (*Apis mellifera* L.) ecotype in respect to hygienic behavior

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Honeybee diseases are particularly important problem for beekeeping. Hygienic behavior (HB) of the honey bees is considered to be a potential characteristic associated with resistance to bee disease and many pathogens. With the present study, artificial selection for HB of honeybees of Ylca district in Duzce province of Black Sea Region of Turkey was carried out. To determine the performance of HB of the bees in Ylca district, pin-killing method was applied to 250 colonies. Observation were made of each of the following characters: number of capped cells, empty cell, punctured cells, uncapped cells, cells with pollen and honey, cells with brood partially removed. The frequencies of the various sequences of the characters were calculated for the hygienic colonies and non-hygienic colonies. According to the results, HB of these colonies was detected in 24 and 48 hours. Among of these colonies performing HB over 95% were selected at second step. We compared the stages of uncapping and removal of hygienic (H) and non-hygienic (NH) honeybee colonies. The Hygienic bees were significantly faster at detecting dead brood in the cells than the NH bees. The best performance in the HB of five colonies was observed and they were selected breeder queen for artificial insemination. In conclusion the hygienic colonies were derived from Ylca honeybees. The results of this study demonstrate that HB is a highly desirable trait. The amount of Varroa destructor in colonies can be reduced by requeening colonies with instrumentally inseminated queens from a hygienic line of bees.

BBO-052

Selecting Muğla honey bee (A.m. anatoliaca) for hygienic behavior

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Honeybee diseases and pests have become resistant to the commonly used and previously effective treatment chemicals. Different studies have shown that honeybees have genetically determined mechanisms for disease resistance such as hygienic behavior. In this study we aim for genetic improvement in Mula Honeybee (A. m. anatoliaca) resistance to American foulbrood diseases. In our project 200 Mugla bee (A. m. anatoliaca) colonies collected from Mugla province. Colonies were identified with genetic methods. The colonies were kept in standard Langstroth hives. The experimental colonies were evaluated for their hygienic behavior using the pin-killed test for 24 hours. Colonies evaluated 2 times for hygienic behavior on April each year. The colonies showing hygienic behavior over %95 in at least two measurements were selected and used as breeder colonies for queen production.

Daughter queens instrumentally inseminated with 10 l of semen from randomly collected drones from the whole population. All inseminated queens were marked and introduced 3 Langstroth frames nuc boxes with pushing cages. We used "Closed Population" breeding program. Hygienic behavior increased in the population after 3 year of selection on queens with mating control (instrumental insemination) from 43% in 2012 to 63% in 2013 to %91,7 in 2014 in 2015 to %96,86. Hygienic behavior ratio was significantly different among 2012, 2013, 2014 and 2015 (P < 0.001). Heritability was 0,35 for 1.year between 2. year, 0,77 for 2.year between 3. year, 0,61 for 3. year between 4 year.

BBO-044

The directions of bee selection in Russia

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In recent years studies on bee breeding were focused on development of new preservation genofond methods, selective improvements of lines, sorts, improvement of reproduction techniques of queens. Federal State Budgetary Research Institution «State Research Institute of beekeeping», the information center of selection, provides research and methodological instructions and coordination of bee breeding, improvement of selection programs, development selective techniques, preparing the stock breeding scientific and technical documentation. Throughout the Russian Federation due to difference of climatic conditions Apis mellifera mellifera L., Apis mellifera caucasica Gorb., Apis mellifera carpathica are recommended to breeding. In recent years resulting in purposeful breeding work Bashkir breed and other improved breed types, such as «Prioksky», «Orlovsky», «Tatarsky», «Burzyanskaya bortevaya», «Maykopsky», «Krasnopolyansky» were selected. In the state register of the Russian Federation for cultivation in Russia are enrolled on 10 breeds and breed types. Conducted research and given the molecular genetic characterization of the allele Fund of Apis mellifera mellifera L., Apis mellifera caucasica Gorb Apis mellifera carpathica with using mitochondrial DNA and nuclear DNA microsatellites. The given data about genetic markers of investigated species of bees will be applied for development genetic control methods of origin and passportization. For bee breeding the regulatory document such as the regulation on state nature reserve for the conservation of the gene pool of indigenous breeds (population) honeybees, rules for classification of tribal farms engaged in bee breeding, national standard for Queen bee, interstate standard on the bee colony.

BBO-050

Microsatellite markers through next-generation sequencing for bee breeding in *Apis mellifera* in Korea

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Microsatellites, a special class of repetitive DNA sequence, have become one of the most popular genetic markers for population/conservation genetic studies. However, its application has been impeded by high development costs, a lack of available sequences, and technical difficulties. We adopted next-generation sequencing (NGS) to elucidate the microsatellite markers of Apis mellifera. In this study, a total of 51 individual, 6 Apis mellifera strains preserved in our research center was typed for 9 polymorphic microsatellite loci. We performed genotype analysis to determine the efficiency of this method as applied to population genetics. We obtained 205 Mbp of nucleotide information from 45,476 Contigs reads. A total of 20,580 repeat motifs was identified; di-repeats were 2-fold more common than tri-repeats. [GT]n repeats were the most frequent di-repeats, respectively. Of the 20,580 repeat motifs, 42,469 microsatellite primer pairs were derived and we selected 50 microsatellite primer pairs. PCR amplification of 50 primer pairs yielded 26 amplicons and we selected 9 polymorphic markers for 6 population, 51 individual Korean Apis mellifera. The PIC values of the 9 new microsatellites varied from 0.5432 to 0.8945 per locus. The result of phylogenetic analyses revealed that that 51 individual bees clustering 6 groups based on maintaining the population. In this study, we successfully selected Apis mellifera microsatellites primer pairs that shows appropriate polymorphisms. These data suggest that these markers are very useful and effective for evaluating genetic diversity and it could be used as the potential of the markers for genetic analysis of honey bee.

Symposium: Behavior & Neurology

BBO-058

Odor representations in the honey bee brain

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Honey bees primarily rely on olfaction to locate flowers. Tracking down a flower by its odor poses a particular challenge: small scale air dynamics cause floral odors to occur in turbulent plumes in which they intermingle among themselves and with background odors, creating temporally complex patterns of different concentrations and odor mixtures. Additionally, odors from different flower species can be very similar. How do honey bees detect, recognize and find the right flower in such a complicated odor environment? We now know that bees can identify the molecular composition of flower scents, and that they use temporal stimulus cues to separate odors coming from different flowers. I will show the current knowledge about the olfactory capabilities of honey bees and how we explore the neural correlates of odors in the laboratory. I will present data from brain imaging to show how the chemical identity of an odor identity is transformed such that it supports odor discrimination and odor learning in a higher brain area, the mushroom body. Finally, I will present data from behavioral, electrophysiological and functional imaging approaches to shed light on neural mechanisms of odor-background segregation that enable honey bees to find the right flower in its complicated olfactory environment.
Functional characterization of an amino acid-sensing gustatory receptor in honeybee and its application to bioelectronic tongue

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Insect taste system is responsible for choosing profitable food sources and for nest mate recognition. Taste substances are recognized by gustatory sensory neurons that express putative seven- transmembrane proteins in the gustatory receptor (Gr) family. The Gr family is encoded by many related but diverse genes, and genome projects have revealed 13 Gr genes in the honeybee. Yet, the gustatory tuning of the molecular receptors encoded by these gustatory receptor genes remains unknown. Here we first functionally characterize a gustatory receptor responding to umami taste L-amino acids in the western honey bee, Apis mellifera. Using Ca2+ imaging assay and two-voltage clamp recording, we first report that one of the gustatory receptors of honeybee, AmGr10, functions as a selectively tuned amino acid receptor in taste neurons. We also demonstrate that sensitivity of AmGr10 to these L-amino acids were dramatically enhanced by 5'-ribonucleotide (IMP). In addition, we report a floating electrode-based bioelectronic tongue mimicking honeybee taste systems for the detection and discrimination of umami substances. This strategy enables us to discriminate between L-monosodium glutamate (MSG), best-known umami tastant, and non-umami substances with a high sensitivity and selectivity. By combining electrophysiological and molecular approaches, AmGr10 is a unique umami taste receptor responding these results provide basic knowledge for further research on the gustatory coding in insect species. In addition, this floating electrode-based bioelectronic tongue mimicking insect taste systems can be a powerful platform for various applications such as food screening, and it also can provide valuable insights on insect taste systems.

BBO-057

Foraging dance of dwarf honey bee, Apis florea

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Foraging dance of Dwarf honey bee, *Apis florea* is one of honey bee's communication systems. This newly discovered behavior system contrasts with Karl Von Frisch's two theories of *Apis mellifera*'s forging dances; (1) the round dance which does not specify its flower location (2) the waggle dance, which identifies the flower location over 100 m. away. This study investigates colonies of A. florea dance orientation in the forest at Saiyok District in Kanjanaburi Province, Thailand. For the study convenience, these bee colonies were moved to the research station near the original area. These workers were trained to fly from their nest to the flower source at the distance of 30, 50, 100, and 200 m. Foragers were marked with water color. Foraging dance was recorded and

analyzed. It could be concluded that either closer or further than 100m, the Dwarf honey bee could perform waggle dance only. In other words, they do not perform the round dance in any circumstances.

BBO-024

Egg-laying behavior of reproductive worker honeybees in queenless colonies of *Apis cerana*

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The eastern multi-comb honeybees, *Apis cerana*, play a crucial role in pollination, and poverty alleviation in developing countries. The colony frequently loose their queen during absconding and honey harvesting times; workers start to lay eggs. We investigated the egg-laying behavior of workers in three queenless colonies of *A. cerana*. We found that the laying-workers retained 1 to 4 mature eggs in their ovaries, and on an average laid 4.0 ± 5.1 of eggs per cell per week. Additionally, on an average, the laying- workers spent 109.2 ± 67.5 seconds per cell to lay eggs. In this study, we showed for the first time that a single worker cell of *A. cerana* retained up to 33 eggs in queenless colonies. We did not observe false-queen in A. cerana queenless colonies. The workers of queenless colonies built new comb and reared the new queen without successful development of the queen from laying-worker eggs. The colony activities such as participation of food collection, and nest defense are normal as in queenright colonies.

BBO-008

Honey bee *Apis cerana* eavesdrop on other bee species' alarm pheromone to avoid predator risky

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Abstract: Pollinators face considerable predation risk when foraging, while the pollinators developed sophisticated skills to anti- predator, honeybee release alarm pheromone to inform its conspecific mates if they were attacked by predator during their foraging, however, if this alarm pheromone can detect by heterospecific bees is still unknown. In the present study, eastern bees (*Apis cerana*) were trained to a foraging site, then tested them via two choice assay, which one feeder with conspecific (*Apis cerana*) and heterospecific (*Apis dorsata* and *Apis mellifera*) alarm pheromones paired with a control feeder respectively. Which were main components of alarm cues of the *Apis dorsata* alarm pheromone can be detected by *Apis cerana* were

determined as well. The results showed that eastern bees response to both conspecific and heterospecific bee venom extracts, and also avoid to the main components of heterospecific alarm (Isopentyl acetate, gamma-octanoic lactone). Foragers changed their foraging strategy to avoid feeders contain risky cue indicated that similarity of the alarm components of *Apis* can eavesdrop by the other species may raise the fitness of eastern bees and other species as well.

BBO-005

Abundance and Architecture of Natural nests of colonies of honey bee (A. *mellifera*) in selected plant communities along the coast in Rufiji District Tanzania.

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A study was carried out in three plant communities in Rufiji District Tanzania to examine and assess Abundance and architecture of the natural nests of honey bee colonies. The three plant communities were: riverine, mangrove and coastal hill forests. We used quadrants of the size 20x50m to survey the natural nests of honey bee in both in holes in the ground and on trees. A total of 80 natural nests and 255 trees with potential nests were observed. Among of the 80 natural nests 95.2% were from tree cavities and rest were from termite mounds. The natural nests of A.mellifera colonies were significantly related to plant community type, species richness and trees with potential cavities. Furthermore abundance of natural nests of A.mellifera colonies were significantly predicted by percentage of diameter size-class distribution of bigger trees in community forest structure of the three vegetation types. The density of natural nests of A.mellifera colonies was higher in coastal hill forest, followed by riverine forest and lastly mangrove forest, that is 36,24 and 20 respectively.

For trees preference by honey bees for setting natural nests fall in to three categories, namely tree base, stem and branches. The volume of the natural nests in cavities of trees were significantly correlated with the diameter at breast height (dbh), number of combs and total comb area. The information on abundance and architecture of natural nests of colonies of honey bee (A.mellifera) generated during this study add knowledge that can provide insights into conservation and survival strategies.

BBO-034

Evolutionary advantage of honey bees dying after they sting

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It is quite well known that honeybee die after sting because, it can't pull the stinger back out. It leaves behind not only the stinger but also part of its digestive tract, plus muscles and nerves. This massive abdominal rupture is what kills the bee. However, the evolutionary advantage of this feature is still controversial and has never been well explained. In this paper two reasons were suggested to demonstrate the evolutionary benefits that can be gained from dying after stinging in honey bee species: 1/ Die after sting attack because the bee after stinging became fatigue, lazy and very easy to be track while flying back to her colony. In this case predators and enemies will be able to locate and destroy the honey bee colony.2/ Die after sting attack because if not die the bee might be contaminated with her victim pathogenic load which induce transmission of parasites and diseases to her healthy colony and consequently colony collapse. Preliminary evidences support these suggestions from the literature were discussed, this finding would have great role in understanding not only the evolutionary advantage of honey bees dying after they sting but the evolution of the defensive behavior in the entire social insect. Experimental tests were suggested for further confirmation of these hypotheses

Symposium: Genomics & Molecular Marker

BBO-056

Molecular markers were screened to be related to high royal jelly yield trait

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Royal jelly is the principle food of queen and young larvae, which contains abundant bioactive substances and is well known as one of the natural healthy foods for human being. Genetic markers related to high royal jelly yield were summarized in this study. Zhenongda No. 1 Italian bees (ZND-No. 1), a strain with high royal jelly yield, and low royal jelly yield Italian honeybee (American Italian bee) were re-sequenced to exploit SNP markers using SLAF-seq technology. The Genome Wide Association Study (GWAS) was used to seek key genes related to high royal jelly yield. As a result, twenty-one SNPs were screened, and 83 genes were annotated near them. In order to reveal the underlying mechanism, we carried out biological analysis on these potential genes. GO analysis indicated that they participated 3 processes, including biological process, cellular component and molecular function. KEGG analysis showed that they were involved in 24 pathways, and the main pathways were related to nutritious material synthesis and metabolism, the formation of nerve receptors and ligands, and three singling pathways. Furthermore, we collected 50 honeybees from each strain to verify the 21 SNPs. Primers were designed from DNA sequences involved the novel loci, and then verified by PCR amplification and DNA sequencing. Finally, four SNP loci showed significant difference in allele frequency between ZND No.1 and American Italian bee groups (P<0.05). This study provides molecular genetic markers to identify high royal jelly yield trait of honeybees.

Cytochrome C oxidase subunit I (COI)-COII ingtergenic sequence noncoding AT-rich region haplotype groups of *Apis mellifera* species

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Apis mellifera (*A. m.*) is with mtDNA specific for cytochrome C oxidase subunit I (COI)-COII ingtergenic sequence noncoding AT-rich region (COI-COII NC or COI-NC-COII). This region has considerable DNA variability in both length and sequence, for which it has been used extensively as a polymorphic marker of mtDNA for analyzing DraI RFLP and SNP among A. m. geographic subspecies. Here, mtDNA of A. m. lineage in Africa, which are characterized by 28 DraI RFLP patterns, is composed of 3 COI-COII NC haplotype groups of A. m., i.e. the groups with both P and Q elements where P can also appear in two types of variations (P0 and P1); mtDNA of A. m. lineage in western Europe, which are characterized by 90 DraI RFLP patterns, is composed of 1 COI-COII NC haplotype group of A. m., i.e. the group with both P and Q element; mtDNA of A. m. lineage in eastern Europe, which are characterized by 25 SNP patterns, is composed of 1 COI-COII NC haplotype group of A. m., i.e. the group only with Q element; mtDNA of A. m. lineage in western Asia, which are characterized by 29 DraI RFLP patterns, is composed of 3 COI-COII NC haplotype group of A. m., i.e. the group only with Q element; mtDNA of A. m. lineage in western Asia, which are characterized by 29 DraI RFLP patterns, is composed of 3 COI-COII NC haplotype groups of A. m., i.e. the group only with Q element; mtDNA of A. m. lineage in western Asia, which are characterized by 29 DraI RFLP patterns, is composed of 3 COI-COII NC haplotype groups of A. m., i.e. the group only with Q element; mtDNA of A. m. lineage in western Asia, which are characterized by 29 DraI RFLP patterns, is composed of 3 COI-COII NC haplotype groups of A. m., i.e. the groups with both P and Q elements where P can also appear in two types of variations (P0and P1). COI-COII NC polymorphic analysis of A. m. can add new knowledge on insect taxonomy for A. m, i.e. COI-COII NC haplotype groups of A. m.

BBO-025

Expression biomarkers can be used to select for complex traits in honey bee breeding: results of three generations of selection for hygienic behaviour

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We demonstrate that protein markers can be successfully used to breed livestock, using the honey bee as a model system. Selecting traits when breeding honey bees is very time-consuming, and it can be difficult to measure large numbers of traits on broad populations, thus limiting the scope of breeding programs. We used a panel of protein markers to guide selective breeding for hygienic behaviour in honey bees through three generations.

To establish our initial breeding population, we surveyed the hygienic behaviour of 635 colonies from 38 commercial beekeeping operations across western Canada in 2011. From the 635 colonies surveyed, 100 colonies were randomly selected from across the region to serve as benchmark unselected stock. In addition, we selected 100 queens from colonies with the highest hygienic behaviour scores in their apiaries. Over the next two years we reared three successive generations from this initial population in one of two ways: 1) using the response of parental colonies in the classic freeze-killed brood assay for hygienic behaviour as a positive control, or 2) using the levels of the previously identified expression markers. In addition to these selected lines, the benchmark stock was maintained through open mating, as a negative control.

By the third generation, bees raised through marker-assisted selection had increased levels of hygienic behaviour, and were able to resist disease as effectively as bees raised through conventional selective breeding for hygienic behaviour, with no detectab le loss of other desirable traits such as honey production.

BBO-062

Conservation of Aculeate silk gene copy number for 155 million years: the riddle of 'why four proteins?' partially solved.

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Around 150 million years ago multiple gene duplication events in the precursor of the aculeate Hymenoptera (bees, ants, hornets) gave rise to four silk genes that have been conserved in all species investigated to date. The retention of a copy of each homolog in all species implies a critical role for the proteins in silk formation or function. Yet the proteins have similar amino acid composition and coiled coil molecular architecture and, individually, self assemble into the native coiled coil structure with material properties equivalent to material generated from all four silk proteins. In this study we identified, produced and characterized the four silk proteins from *Apis dorsata*, the giant Asian honeybee. The proteins were readily purified, allowing us to investigate the folding behavior of solutions of individual protein in comparison to mixtures of all four proteins. In contrast to individual proteins, a mixture of the four proteins formed coiled coils that were stable against dilution and detergent denaturation. The results are consistent with the formation of a heterotetrameric coiled coil protein complex where each protein contributes to one strand of the molecule. The mechanism of silk protein coiled coil formation and evolution is discussed in light of these results.

BBO-053

Genome information on Asian honey bees and its perspectives

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The honey bee is a social insects and provide better understanding of molecular and neural mechanisms underlying many aspects of social behaviors relevant to the agricultural industry as well as basic science. In contrast to the western honey bee, *Apis mellifera*, which served as a model species and its genome sequence has been revealed in 2006, the genome of the Asian honey bee, *Apis cerana*, has not yet been sequenced. Here, we report that using de novo assembly methods, we produced a 238 Mbp draft of the *A. cerana* genome with new annotation of 10,651 genes. Seventy-two percent of the *A. cerana*-specific genes had more than one GO term, and 1,696 enzymes were categorized into 125 pathways. Genes involved in chemoreception and immunity were carefully identified and compared to those from other sequenced insect models. These included 10 gustatory receptors, 119 odorant receptors, 10 ionotropic receptors, and 160 immune -related genes. Further, In an attempt to identify long intergenic non- coding RNAs (lincRNAs) and their possible involvement in honey bee development and diseases in *Apis cerana* and *Apis mellifera*. We identified 2,470 lincRNAs with an average length of 1,011 bp from *A. cerana* and 1,514 lincRNAs with an average length of 1011 bp from *A. cerana* and 1,514 lincRNAs with an average length of a better understanding of the complex behaviors and biological and hormone signaling pathways as well as various diseases of the Asian honey bee and to anticipate its future evolutionary trajectory.

BBO-047

Real-time polymerase chain reaction method to determine mRNA levels of heat shock protein genes in diapause honeybee (*Apis mellifera carnica*) during overwintering period

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One of the many challenges beekeepers face is minimizing honeybee colony losses during winter period. Diapause honeybees during overwintering period are physiologically different from honeybees in the spring and summer periods, as appear to be focused on their unique tolerance to withstand the winter. Relatively high levels of mRNA transcripts for heat shock proteins (Hsps) are shown in diapause insects during overwintering. Quantitative real-time PCR is one of the most accurate methods to measure small change in mRNA levels for individual genes. Objective of the present study was to utilize real-time polymerase chain reaction method to determine mRNA levels of Hsps genes that are abundantly expressed in diapause honeybee workers during overwintering period. Co-up-regulation of four Hsps genes was observed, including Hsp-60, Hsp-70, Hsc-70 and Hsp-90. Our findings indicate that expression pattern of Hsps genes in diapause honeybee during overwintering period is highlighted as a potentially physiological index to understand honeybee colony with cold resistance.

BBO-038 Evaluation of *Apis mellifera syriaca* bee conservation using comparative genome hybridization.

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Apis mellifera syriaca is the native honeybee subspecies of Jordan and much of the Middle East. It expresses behavioral adaptations to a regional climate with very high temperatures, nectar dearth in summer, attacks of the Oriental wasp and is resistant to Varroa mites. The *A. m. syriaca* control reference sample (CRS) in this study was originally collected and stored since 2001 from "Wadi Ben Hammad", a remote valley in the southern region of Jordan. Morphometric and mitochondrial DNA markers of these honeybees had shown highest similarity to reference *A. m. syriaca* samples collected in 1952 by Brother Adam of samples collected from the Middle East. Samples 1-5 were collected from the National Center for Agricultural Research and Extension breeding apiary which was established for the conservation of *A. m. syriaca*. Our objective was to determine the success of an *A. m. syriaca* honey bee conservation program using genomic information from an Array-based Comparative Genomic Hybridization (aCGH) platform to evaluate genetic similarities to a historic reference collection (CRS). Our results had show insignificant genomic differences between the current population in the conservation program and the CRS indicated that program is successfully conserving *A. m. syriaca*. Functional genomic variations were identified which are useful for conservation monitoring and molecular markers were identified which may be useful for breeding programs designed o improve locally adapted strains of *A. m. syriaca*.

Symposium: Environment & Population

BBO-055

Prevalence of *Nosema* species in a feral honey bee population: A 20-year survey

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Nosema spp. are microsporidian pathogens of honey bees that cause nosemosis, a disease implicated in colony losses worldwide. Few studies have measured Nosema spp. levels in feral honey bees. We evaluated the presence and infection intensity of *Nosema apis* and *N. ceranae* in a feral Africanized honey bee population in south Texas from 1991-2001 and in 2013. Overall, less than 6% of samples had Nosema spp. spores. *Nosema apis* was only found in samples from 1991 to 1995. Conversely, *N. ceranae* was found every year examined, ranging from 16.7% infection in 1991 to 85.7% in 2013. There were no effects of temperature or rainfall on either infection over time. This suggests that feral honey bees are relatively free of Nosema spp. compared to managed colonies. More studies on the incidence of Nosema spp. in feral honey bee populations are needed.

BBO-012

Rescue project for the native bee in Sweden

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Until mid 1800 *Apis mellifera mellifera*, the black bee, was the absolutely dominant bee in Sweden. It is well adopted for the climate with long winters. It can fly at somewhat lower temperature and uses less food during the winter than other races. Unfortunately, a massive import of ligustica and carnica led to hybridisation of the black bee. The hybrid between mellifera and carnica does not differ much in colour from a pure mellifera but has a temperament that is bad. It was therefore said that the mellifera was an aggressive bee and it lost its popularity. In 1990 a project started for saving the mellifera bee. A message was sent to the bee-keepers asking them if they believed they had pure mellifera in their hives. Around 150 persons gave a positive answer and were asked to send samples of their bees. By using morphological values 10 colonies were considered pure. Over the years some more colonies were found that seem to be pure. By using mtDNA we can see 30 different lines. The main characteristics used in the selection are colour and wing pattern where we look mostly at cubital index and the discoidal angle. To secure pure mating we have some islands and remote areas where only mellifera exists but apart from that artificial insemination is also used. The Swedish government and WWF supported the project at the start but without the efforts from enthusiastic bee-keepers it would have failed.

BBO-051

Apis cerana collapse in Korea by sacbrood virus

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South Korea has over 38 million of managed honey bee (*Apis cerana*) colonies before 2009 years ago, which produce the highest quantity of honey in the Korea; however, almost colony (99%) were collapsed by Korean Sacbrood Virus (KSBV) in South Korea. Korean Sacbrood Virus (KSBV) is the pathogen of *A. cerana* Sacbrood disease, which poses a serious threat to honeybee *A. cerana*, and tends to cause bee colony and even the whole apiary collapse. Colony collapse of *A. cerana* was first reported on the Pyeong-Chang of the South Korea in 2009.

Symptoms of KSBV include the rapid transmission of larval stage honeybees (*A. cerana*), many dead larvae found in the bottom of hive and comb. Honeybees (*A. cerana*) are a very important species because they provide a number of pollination services for various ecosystems in some provinces (ex. jeon-nam, jeon-buk province). They are also extremely important organisms within human society, both agriculturally and economically. The fact that a direct cause has been determined suggests that colony collapse is a complex problem with a combination of natural and anthropogenic factors. Possible instigators of colony collapse include: wax moth, viral and fungal diseases, increased population, decreased genetic diversity, climate changing and a variety of other factors. The interaction among these potential causes may be resulting in immunity loss for honeybees and the increased likelihood of collapse.

BBO-035

Diploid males in a managed stingless bee species population is responsible for ca. of 8% of new colony losses

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Sex determination system in the eusocial stingless bees (Apidae, Meliponini) is based on the combination of alleles at the complementary sex determination (CSD) locus. In this system, males are haploid and females are diploid. However, diploid males can develop from fertilized eggs when they are homozygous at a single sex locus (when a queen performs a matched mating). Since the queen is mated with only one male in stingless bees, ca. of 50% of the diploid brood that was supposed to be females (workers) develop into males. In that case, the queen is executed and there is low success rate of colony establishment. We forced queen replacement in 83 colonies of a managed population of Scaptotrigona depilis, an important species in stingless bees' beekeeping (meliponiculture). We analysed the brood produced by the new queens and identified diploid males at first by the proportion of males in the brood combs, and later we genotyped in four microssatelites loci to confirm ploidy. Seven queens out of the 83 (~8%) produced diploid males. Using the formula PMM=2/n, where PMM is the proportion of matched mating, and n is the number of sex alleles, we estimated the number of sex alleles in 23,7 with a 95% confidence interval of 15 to 350 alleles. Our results indicates that diploid male production can be an issue that significantly affect the production of new colonies in managed populations of stingless bees. We suggest to increase males' genetic diversity in the breeding area to attenuate this effect.

BBO-030

Comparing Three Bee Breeds in Their Natural Damage by Four Diseases

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Selection of lines resistant to diseases is one of the most important tasks of beekeeping nowadays. The first approach to solve it is studying the natural resistance to different bee breeds diseases. The aim of our work has been to study the natural damage by ascospherosis, varroosis, nozematosis and European foul brood of middle Russian, Caucasian and interbreed type of middle Russian breed "Prioksky" in the same conditions so that to get some definite information about differences of their resistance to diseases. During the test of damages by diseases we have also taken into account farm useful features of bees families according to standard methodologies (G.D. Bilash, N.I. Krivczov, 1991; Ya.L. Shagun, 2000). Comparing three bee breeds: gray mountain Caucasian, middle Russian and interbreed type of middle Russian breed "Prioksky" in their farm useful features has mainly proved the results of the previously conducted experiments in Ryazan oblast. The analysis of data concerning the natural damage of the breeds being tested by nozematosis, ascopherosis, European foul bro od and varroosis lets make a conclusion about larger resistance of interbreed type of middle Russian breed "Prioksky" and middle Russian breed bee families to nozematosis than the bee families of gray mountain Caucasian breed. We have not noticed any differences in resistance of the tested breeds to three other diseases.

BBO-027

Effects of sublethal dosage of fungicides (propiconale, tebuconazole and triadimefon) on honey bee growth

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Honey bee (*Apis mellifera* L.) plays a vital import role for the pollination in agricultural ecosystem as well as generates products of high economic value. However, the pesticide pollution in beekeeping environment is threatening honeybee population and consequently, affects agricultural yields. Effects of three widely used fungicides (propiconale, tebuconazole and triadimefon) on honeybee growth were studied herein. Our preliminarily results showed that the toxicity of fungicides studied to bees is low; the LD50 of propiconale at 96 h was 77.5 g/per bee and tebuconazole and triadimefon were higher at 100 g/per bee. Furthermore, the cappedbrood, pupation and eclosion rates were also recorded after treating with different dosages of three fungicides. The result revealed that the sublethal dosage of fungicides although affected little on honeybee larvae growth, but once they developed into adult bees, the olfactory associative behavior was impaired if they had been previously exposed to propiconale during larval stage. These fungicides, if combine with acaricide pesticide of fluvalinate, commonly used for Varroa mite control; will become a potent toxin to the honeybees. These results revealed the potential negative effects of multiple pesticides usage on honeybee growth.

BBO-014

Seasonal population dynamics and performance evaluation of the *Apis mellifera jemenitica* and imported hybrid honeybee colonies in Southwestern Saudi Arabia

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The aims of this study were to assess the seasonal population dynamics and evaluate the performance of *Apis mellifera jemenitica* (Amj) and imported hybrid honeybee colonies (ihhc) and to identify possible reasons for the deterioration of the honeybee populations in the lowlands and highlands of southwestern Saudi Arabia. Data regarding the performance and population dynamics parameters were gathered from the two types of honeybee colonies (25 colonies of each) for one year (April 2013 through March 2014), and tested statistically. The results indicated that at low altitude, Amj colonies maintained higher populations (P < 0.05) than ihhc and produced more (P < 0.05) honey. They were able to hoard three times more (P < 0.05) pollen and produce more (P < 0.05) queen cells than ihhc colonies in both the low and highland areas. Amj colonies had almost double (P < 0.05) the annual survival rate of ihhc colonies and had greater (P < 0.05) adult bee and brood populations throughout the year. Failures to cope with dynamic, unpredictable, and resource-limited environmental conditions were the most challenges for the populations of the ihhc colonies. Generally, Amj was observed to perform better in both beekeeping production landscapes and had higher survivorship and productivity than ihhc in the unpredictable and erratic beekeeping areas of Saudi Arabia.

Symposium: Diversity & Ecology I

BBO-006

Genetic variations among Apis florea

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Nine agro-climatic zones within Maharashtra were screened for genetic diversity of Indian honey bee *Apis florea*. The objective of the study was to understand the gene flow across the country. The other collaborators were studies on *Apis florea* within different regions of India. The two species of dwarf honey bees include *Apis andreniformis* Sm. and *Apis florea* F. In this study the genetic diversity was done by using Mt DNA amplification analysis within *Apis* spp. are being ecomapd both via geo climatic as well as genetic variability in this research. Nine agro climatic zones within Maharashtra (across 330 miles) were chosen for this National Collaborative survey by VSBT. Studies related to polymorphism and allelic frequency Micro Satellite marker studies have related Polymorphism and allelic frequency. To study the polymorphism and allelic frequency the microsatellite markers were used for the finding out the heterozygosity and homozygosity within population. The Analysis of molecular variance (AMOVA) was done for the population of *Apis florea* across the region by microsatellite markers and the percentage of variation within population was 80-82%. Different software's were used for this study like PHYLIP for the determination of maximum likelihood tree construction, MEGA.

New haplotypes variations of *Apis koschevnikovi* and *Apis cerana* in Indonesia based on cytochrome oxidase 1 (CO1) of mitochondrial DNA

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Indonesia, the homes for the highest number of honey bee species, two of them are Apis koschevnikovi and A. cerana. A. koschevnikovi in Kalimantan shows declining population due to the transformation land use. Whereas Apis cerana is Asian honey bee with native distribution from China to the Philippines archipelago. Nine haplotypes of Cytochrome Oxidase Subunit I (COI) of mitochondrial DNA of this bee from Malaysia, Brunei, Thailand, Taiwan, Korea, Japan, and Russia were recorded in GenBank. However, there is no A. cerana COI haplotype data from Indonesia. Currently, there are 15 haplotypes of COI gene of A. koschevnikovi has published in GenBank database, but none resulted from Indonesia as well. We used Cytochrome oxidase subunit I (COI) in mitochondrial DNA (mtDNA) as suitable molecular marker with DNA barcode-based technology. A. koschevnikovi were explored in South Kalimantan Hulu Sungai Selatan (HSS), Hulu Sungai Tengah (HST), Kotabaru (KB), Tanah Bumbu (TB), and Balangan (BL). A. cerana was explored from Java, Lombok, and Sumbawa and Flores islands. Here we report the four new haplotypes of Apis koschevnikovi, two of the haplotypes are the common haplotype, two haplotypes of A. cerana from Java and Flores Island and one haplotype from Lombok and Sumbawa. This variations might be due to the isolation of islands by the sea. Phylogenetics study showed A. cerana from Lombok, Sumbawa, and Flores were also clustered in one group separated from the mainland samples. This explained the arising of those four islands from the land at shallow sea level during Pleistocene.

BBO-004

Biology of red dwarf honeybee, *Apis florea* Fabricius in plains of Karnataka, India

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The biology of dwarf honeybee, *Apis florea* in respect of vertical nest distribution, brood rearing activity, seasons of swarming and absconding was recorded. The results showed that, the colonies of A.florea were well distributed on different arboreal nesting structures vertically between 4 to 6 m above ground level in greater numbers (35%). Despite the nests were found up to 12 m above ground level, only a few nests were recorded at lower heights. Furthermore, the brood rearing activity of the colonies was continuous throughout the year and showed fluctuations seasonally. The greater brood rearing activity was recorded during summer (March and April) followed by winter seasons (October and November). However, low brood rearing activity was recorded during June and July. The bee colonies showed seasonal production of drones and queen bees and greater numbers of drone and queen cells were found during summer season (March and April). There was no drone and queen production during rainy season (June to September). The colonies of A. florea produced a maximum of 5 swarms/colony but most of the colonies produced only 1 to 3 swarms/colony in a year. Similarly, the absconding tendency of A. florea colonies was recorded high during dearth season for bees (March to May.

It is concluded that, A. florea is well adapted to plains of Karnataka through active brood rearing, swarming and absconding behaviours.

BBO-010

Extreme food-plant specialisation in Megabombus bumblebees as a product of long tongues combined with short nesting seasons

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Megabombus bumblebees have unusually long tongues and are generally more specialised than other bumblebees in their choice of food plants. The phylogeny of Megabombus bumblebees shows that speciation was concentrated in two periods. Speciation in the first period (ca 4.25-1.5 Ma) is associated with the late rise of the Hengduan Mountains at the eastern end of the Qinghai- Tibetan plateau. Speciation in the second period (1.2-0.3 Ma) is associated with climatic cooling in the northern forests. The most extreme food-specialist species belong to the second group, which may point to climate as a factor in specialisation. These extreme specialist species occur either in the far north (Bombus consobrinus), or at high elevations (Bombus gerstaeckeri), in situations where long tongues coincide with the shortest nesting seasons. Species with the longest tongues but occurring further south (even at high elevations) use a broader range of food plants

BBO-028

Variability of the morphometric characteristic of the bees Apis mellifera adansonii in relation with the climatic zones in Benin

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Honeybees, *Apis mellifera* L. (Hymenoptera: Apidae) ensure nearly 80% of the pollination carried out by insects. In agriculture, they are responsible for pollination of more than 20.000 plant species, and can increase crop yield by 15 to 50%. Studies on bee' morphometric characteristic variability in relation with the ecological zones are seldom in Benin and African countries, south of Sahara. The objective of this work is to study the relation between the morphomoetric characteristics of the bees in Benin and the ecological zones. To this end, 100 to 300 bees were collected from thirty (30) localities) belonging to eight phytodistricts and the three climatic zones of Benin. From each study site, two to three hives were examined and 100 to 300 bees were collected. In the laboratory, 70 to 100 bees were chosen and fourteen (14) morphometric characters were measured on each bee using a microscope provided with graduated eyepieces. Variance analysis, principal component analysis and

discriminant analysis were performed using SAS.9.2. The results of the study showed that, the Sudano-Guinean zone and the Sudanian zone were the most morphological distant (D=47.55) while, the Guineo-Congolean zone and the Soudano-Guinean zones were the closest (D=16.34) zones. This suggested that there are two great zones of morphometric variability of bees in Benin. The first is constituted of Guineo-Congolean and the Sudano-Guinean zones, and, the second is the Sudanian zone. This diversity of bees' population in Benin is an asset for selection programs and bees species preservation in Africa.

BBO-063

Temporal and Spatial Variations of sex ratio of Osmia cornifrons and O. pedicornis (Hymenoptera: Megachilidae) in Korea

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Mason bees in Megachilidae are important pollinators especially in early blooming fruit trees. Among 9 species of mason bees, Osmia cornifrons is the most dominant followed by O. pedicornis. Since asymmetric distribution of male and female adults and resulting competence on pollination activity as well as future generation production, study on sex determinants has important implementation. Here we provides the results of a decade study of wild population sex ratio variation among regions and years. Female ratio of O. cornifrons ranged between 0.25 and 0.46 with average of 0.37 while that of O. pedicornis varied between 0.04 and 0.24 with average of 0.13. Female ratio was in increasing pattern on O. pedicornis for the last decade while stable in O. cornifrons. Significant variation existed among different regions. Climate factors seemed influence the sex ratio through differential provision of food resources of flower pollens. Further implementations of the finding were discussed.

BBO-059

Arthropods associated with stingless, *Tetragonula* spp., bee nests

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Meliponiculture is gaining popularity in the country as a means of producing honey and for pollinating select high value crops. As a result, colonies of stingless bees were removed from trees and relocated to beekeeping yards. However, reports of increasing mortalities, absconding and outbreaks of pests among domesticated stingless bee colonies is cause for concern. It is hypothesized that this is a result of the process of relocating wild colonies. The relocation process disturbed the ecological balance around the nest and paving way for the emergence of a pest species. To better manage colonies, a survey of arthropods found on wild stingless bee nests and hive

colonies was conducted. Three hived and 3 wild colonies were used in the study. The overall appearance of the nests were described. Samples were taken from the surface of the nests and hive. Seventeen genera from 9 orders were identified. Most dominant in wild nests were Myrmecine ants, a predator of insects and other arthropods. In hived colonies, scavenger ants belonging to the genus Tapinoma abound.

Symposium: Diversity & Ecology II

BBO-036

How to reveal the enigma of structure of natural honeybee nest and apply the solution to create effective beehive for the modern apiary?

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TASKS OF STUDY: 1) To reveal reasons of high efficiency and disease's resistance of honeybee colonies in natural nests; 2) to apply it in modern beehives. MATERIAL. Five natural honeybee nests were studied in hollow trees. Revealed principles were applied on 50 honeybee colonies in V.Priyatelenko's beehives in private apiary. RESULTS. It was found that number of honeybee combs in natural honeybee nest is only 7–8, and their length is initially 40–50 cm. Then honeybees build nest vertically down. Usually expansion of combs is not more than 26 cm in length. It was found that in natural nest honeybees can build a long comb, up to length of 40–50 cm. Then honeybees are building further small wax connections and burr combs to walls of dwelling that provides strength of whole structure of nest. The building of honeybee nest starts from formation of parallel honeycombs. Place of attachment of combs is crucial for structure of whole nest. In natural conditions, like in hollow tree, honeybees use wooden ceiling of bees' dwelling to attach its honeycombs. It was found that surface of ceiling is covered with thick layer of wax and propolis (at least, 3–5 mm). This special coating takes minimum three functions: 1) protection of wood from decay; 2) it seals space between combs; 3) it provides healthy, propolized water for honeybee colony. This propolized part can be considered as basement of honeybee nest which provides integrity and holistic structure of honeybee nest. These peculiarities were applied in V. Priyatelenko's beehives.

BBO-040

Population structure of the Korean Bombus ignitus (Hymenoptera: Apidae) as revealed by microsatellite markers

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Bumblebee, Bombus ignitus, which is indigenous to Korea, Japan, and China, has been recognized as a valuable pollinator for both crops and wild plants. This species has now become commercially important as a pollinator because of its use in the agricultural industry, particularly for greenhouse pollination. For long-term management and effective conservation of B. ignitus, an understanding of the genetic structure of its naturally occurring populations is practically important. In this study, the genetic structure among the five populations of B. ignitus in South Korea was assessed using nine microsatellite loci. These markers showed high levels of genetic variablility, with the number of alleles ranging from 6 to 22 and the frequency of the most common allele ranging from 0.11 to 0.66. Only the Sabuk (SB) population showed a genetic significant among all pairs of populations (P<0.001) across the nine microsatellite markers, suggesting a lack of gene flow among those population. The phylogenetic analysis showed evidence supporting our hypothesis that the Taebaek population is genetically more divergent than the other populations. Overall, our result suggest that the Korean populations of B. ignitus ight have undergone geographic isolation and have become highly separated spatially from one another, thereby having a limited range of migration among their local habitats.

BBO-043

Study 0f genetic diversity and relationship some Honey bee species using RAPD molecular markers

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Genetic relationships between 10 were assayed with Random Amplified Polymorphic DNA (RAPD) markers, which distinguish individuals, as well as reflecting the inherent variation and interrelationships among the Honey bee species. 5 decamer RAPD primers were used in the present study. Over 105 reproducible bands were generated by RAPD primers, out of which, 92.2 polymorphic bands were identified, conferring 97.6% polymorphism. All the primers produced typical banding in each of the Honey bee species, suggesting the applicability of this test in Honey bee species identification. Most of the individuals of the test exhibited to have unique molecular genotype. Population genetics structure analysis of these species further revealed high genetic differentiation coefficients (Gst), the heterozygosity among populations (Ht) showed with the low gene flow (Nm) when the 1st cluster was paired with other Honey bee species can be considered as a separate group of Honey bee species, whereas the others may be grouped as separate clusters. A dendrogram was constructed using Wards Euclidean distance methods. Based on the number of bands the Honey bee species were grouped to form1-2 clusters. The data provided genetic variability of Honey bee species from Karnataka, India and also provided information for future management and conservation of Honey bee species

BBO-022

Correlation between ovarian development and vitellogenin secretion in Mason bee, *Osmia cornifrons*

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¹ National Academy of Agricultyral Science, Republic of Korea ² Dong-A University, Republic of Korea The Osmia cornifrons bee plays an important role in pollinating fruit trees, such as apple trees. To better understand diapause and oviposition in O. cornifrons, we investigated the correlation between the ovarian development and secretion level of OcVg protein in hemolymph. During ovarian development in wintering the number of oocytes progressively increased in comparison with the length of the ovaries and the oocytes. After emergence, the oocyte and ovary sizes developed until 6 days after emergence and declined after 6 days, but the number of oocytes decreased gradually. The secretion level of OcVg protein in hemolymph revealed that during wintering, the secretion level increased from 1 month to 2 months and then stagnated after 2 months. After diapause, the secretion level increased gradually until day 6 of the newly emerged adult from cocoon stage, and thereafter gradually declined, remaining detectable until day 30 of the adult stage. The correction analysis between ovarian development and OcVg secretion level in hemolymph found that in wintering, the number of oocytes showed significant changes in OcVg secretion level and positively correlated with OcVg secretion level, respectively. These results suggest that there is a significant interaction between ovarian development and the secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian development and secretion level of OcVg protein and the pattern of ovarian deve

BBO-046

Morphometric diversity of indigenous honeybee, *Apis florea* in district Faisalabad and Chakwal of Punjab, Pakistan

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The selected bee species *Apis florea* is native honeybee species of Pakistan and called "chotii makhi". Thirty to sixty samples of worker honey bees from each hives were collected from Marzipura, Chak 279 Rb, Chak 29 Jb, Shakot, Bhawana, G M Abad, Chak 30 Jb Pansara, Chak 32Jb and Chak 33 Jb areas of district Faisalabad and Kallar Kahar, Dhok Talian, Chak Bakar Shah and Ratta Shrif from district chakwal, Pakistan. These bees were preserved in 70% alcohol before analysis. Thirty morph-metric characters which includes the body weight, body length and body width, number of strips on thorax, number of segments of abdomen, sub segments of antennae, length and width of fore and hind wing and leg, cubital index (a ratio of lengths of two wing vein) of forewing and the number of humuli present on anterior margins of hind wing, basistarsus length and width were measured. Number of humuli were found 11 and 12 and cubital index in the range of 2.88-3.08 and 2.75-3.1 in A. florea species from Faisalabad and Chakwal districts, respectively. Number of humuli and Cubital indexes appeared most important characteristics in discrimination of worker bees from ecologically different niches. Length of hind leg (5.92-5.54mm and 5.6-5.81mm), width of basitarsus (0.58-0.62mm and 0.59-0.64mm), width of 2nd (1.64-1.78mm and 1.71-1.74mm) and 4th (1.45-1.47 and 1.44mm-1.51mm) tergite showed variation in A.florea collected from Faisalabad and Chakwal districts.

A protocol for mitochondrial DNA analysis and assessment of genetic variation in natural populations of stingless bees (*Tetragonula* spp.)

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To assess the genetic diversity of the stingless bee, Tetragonula populations, modification of a Waldschimdt, et al. (1997) protocol for DNA Isolation and testing of the cross amplification of primers designed for mitochondrial genes in Melipona were done. The modifications includes absence of liquid nitrogen during maceration, amout of extraction buffer used, deproteinization using 24:1 chloroform: isoamyl instead of just chloroform. The modified procedure resulted in DNA samples with an average concentration of at 100ng/ul and purity of 1.8-2.0. Three out of the seven primer pairs tested were consistent with the PCR products previously reported. These three primer pairs were able to amplify two regions of the mitochondrial genome, namely COI/COII and 16S/20S, of forty-one (41) Tetragonula spp., collected from selected apiaries in the provinces of Laguna, Quezon, Batangas, Cavite, Albay and Sorsogon. Genetic diversity was assessed using Polymerase Chain Reaction -Restriction Fragment Length Polymorphism (PCR-RFLP). The resulting PCR products were digested using 5 restriction enzymes namely, Cla I, Dra I, Hae III, Hinf I and Nde I, to generate restriction patterns that were used to assign the population into haplotype groups. The bands were scored and 47 loci were detected. Using the software GenAlEx, pairwise genetic identities and genetic distances were computed. A dendrogam was constructed and bootstrapped using PowerMarker, analyzed in the Consense package of Phylip3.96 and viewed using MEGA 6. The developed PCR-RFLP protocol was discriminating enough to provide preliminary genetic diversity assessment even with a small sample size.

BBO-002/003

Egyptian honeybee race *Apis mellifera lamarckii* cockerell.1-Morphometric study and 2-Bological study

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Egyptian honeybee, *A. m. lamarckii*, is likely one of the oldest subspecies (race) of honeybee cultivated by mankind and is likely the oldest race of honey bee cultivated by human in Egypt for a long time. Twenty five queen right observation hives, in fact with open mated pure queens, were established and transported to the Siwa station of Apiculture Research Department, Samples of 20 young workers from each colony were taken from the middle of brood nest, then the bees were killed by ethyl acetate to insure the fully extension of the proboscis, All

numbers of the bees was mounted for studying morphological characters, The following parts of the Egyptian honeybee workers (*Apis mellifera lamarckii*) were dissected from each individual bee which taken from 25 colonies in two successive years. The flagellum, the left hind leg: femur, tibia, basitarsus: length and width, wax mirror: length and width, the proboscis: submentum, mentum and alaglossa, the left forewing: length and width, cubital index, tomentum index, the number of hooks on left hind wing. From six honey bee colonies chosen of Apis mellifera lamarckii, It was very important to begin with eggs newly laid in an empty comb using a marked frame inserted in the middle of the experimental hive where it daily examined for eggs, the cells of this comb were of the worker size, once the eggs were found to be laid in the cells, then Examination at 2 hours intervals (six examination sessions were conducted per day for each colony) the area full of eggs was bounded by pieces of wood and the data of egg lying wrote on a prepared map having hexagonal drawing of the same area of cells used (100 cells: 10 columns and 10 rows). Six honeybee colonies of the Egyptian race in spring season were used in this experiment. To find out the purity of the transported bees to Siwa Oasis after many generations determined, the duration of egg, larva and pupa (sealed brood) developmental stages, in hours and days of the Egyptian honeybee workers cells were evaluated. Individuals (egg: n = 235 cell, larva: n = 252 cell, pupa: n = 229 cell, life cycle: n = 163 cell) were calculated of all workers.



Bee Health

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Mission

The major missions of the Standing Commission on Bee Health are to focus on the current state of research on bee pathology and bee health, and pay attentions on the way to solve bee health problem for improvement bee health, including practical and scientific aspects. **Plenary Session**

BHO-064

Activities of the world organization for animal health (OIE) in support of bee health

François Diaz

World Organisation for Animal Health (OIE), France

The World Organisation for Animal Health (OIE) is an intergovernmental organisation established in 1924 with 180 Member Countries (as of September 2015). Its mandate is to improve animal health, veterinary public health and animal welfare world- wide; the health of bees is included in the OIE remit. Under this general mandate, the OIE is dedicated to: - ensuring transparency of the animal disease situation world-wide, including diseases transmissible to humans (see paper on the World Animal Health Information System), - collecting, analysing and disseminating veterinary scientific information, - providing expertise and promoting international solidarity for the control of animal diseases, - guaranteeing the sanitary safety of world trade in animals and animal products, - improving food safety from the farm to the abattoir, - promoting animal welfare through a science-based approach, - improving the legal framework and resources of national Veterinary Services. In application of its mandate, the OIE has published different Standards related to bee diseases. They are mainly laid down in two publications: the Terrestrial Animal Health Code and the Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. For bee diseases, the OIE and its Member Countries can benefit from the support and expertise of several OIE Reference Laboratories. The OIE also published recently a publication titled bee health and veterinarians (2014) providing useful information to all the actors involved in the management of the health of bees.

BHO-035

Overview of the knowledge gained in France on the Asian yellow- legged hornet, *Vespa velutina* (Hym: Vespidae), and its invasion in Europe

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The abundance and impact on honeybees of the Asian hornet Vespa velutina caused great concern among French public authorities and beekeepers. Since 2004, the hornet spread throughout most of France and, from 2010 to 2014, successively arrived in Spain, Portugal, Belgium, Italy and Germany. We present here the knowledge gained by French scientists on this species and its expansion in Europe. 1.The invasion is monitored by the MNHN, mainly by nest recording through public warning (http://inpn.mnhn.fr): after ten years, the hornet already spread out 360 000 km² (more than 2/3 of France). 2.The invasion risk was assessed using modeling tools of climatic suitability: V. velutina is expected to spread throughout Europe and recent climate change scenarios showed that future range expansion may be even larger. 3.A genetic study of V. velutina populations from France and Asia enabled to describe the history of the invasion: the hornet originates from Chinese provinces adjacent to Shanghai and the strong consanguinity in French population indicates that a unique but multi-mated queen was probably introduced in France. 4.Dissection of 77 nests from France showed that mature

colonies can produce up to 13,000 individuals and several hundreds of founder queens.5.Contrary to Asian honey bees, *Apis mellifera* in France is unable to defend against *V. velutina* attack while the hornet mainly impacts colonies by disturbing foraging. 6.Two native parasitoids (a conopid fly and a nematode) now attack *V. velutina* in France but they seem unable to slow down the invasion

BHO-068

Epidemiology of honeybee pathogens in Europe, recent studies and findings in Hungary

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Between 2012 and 2014 a harmonised, pan-European epidemiological surveillance programme was set up in 17 European Member States to study honeybee colony losses and the main honeybee diseases. By the results, in Hungary the overwintering mortality decreased from 8.3% (2012-2013) to 4.8% (2013-2014), the seasonal mortality were 2% and 1.6%, while the yearly mortality was measured 9.9% and 6.3% in the study years, respectively. American foulbrood was demonstrated in a maximum of 1.5% (2012-2013) and 0.5% (2013-2014), Varroa mite infestation in 1% and 1.1%, respectively, while nosemosis in 9.9% and 6.3%. Within the official diagnostic investigation on the occurrence of European foulbrood, American foulbrood, varroosis and nosemosis done by the National Reference Laboratory for Bee Health in the recent years, the overall presence of these four agents are detected in a higher rate than in the surveillance study, not only in samples of clinically ill but also in samples of apparently healthy colonies. In our study on the natural spread of bee pathogens, 34 samples of six different wasp species (Vespidae) collected in Hungary and 15 samples of three different wasp species collected in Germany were investigated by polymerase chain reaction in order to detect five honeybee viruses, Nosema spp. and Paenibacillus larvae. In the samples, the presence of all five bee viruses, Nosema spp. and Paenibacillus larvae was detected in different distribution. By phylogenetic analysis genetic similarity of wasp-origin and bee- origin pathogens were found. By our results the spread of bee pathogens to be likely.

Symposium: Parasitic Disease I

BHO-030

Host-parasite specificity in the *Apis – Varroa* complex in Asia

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The ectoparasitic mite Varroa destructor shifted from its original host, the Eastern honey bee (*Apis cerana* Fabr.), to the Western honey bee (A. mellifera L.) and is now one of the major biotic threats to beekeeping globally. Previous studies suggest that host specificity may exist between *A. cerana* host populations and their Varroa haplogroups, which is relevant for our understanding of host-parasite adaptations. However, strong behavioral (reproductive) and genetic data are often lacking to ascertain the basis of this specificity. Moreover, the biogeography of these host-parasite associations has been elucidated based on mites of unidentified reproductive status. We readdressed host specificity in this *Apis-Varroa* complex at a higher resolution by genetically identifying Varroa mites that are able to effectively reproduce on local *A. cerana* lineages and on the long-time introduced A. mellifera, in three distant locations in Thailand. We also investigated the potential of multiple colony infestations, i.e. with more than one mite haplogroup, relying on a large sample size within colony and within location. This approach will allow us to define local adaptation and host specificity at a finer scale, providing us with a solid basis to unravel the biological mechanisms underlying the apparent capacity of some *V. destructor* haplotypes to successfully infest *A. mellifera* colonies worldwide.

BHO-046

Resistance to Varroa: What have viruses got to do with it?

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Varroa destructor is currently the most devastating pest of honeybee colonies in large part because of its role as a highly efficient vector of several honeybee viruses, initiating and accelerating within-colony virus epidemics that kill the colony within a few years, unless the Varroa population is kept under control. Despite this lethal outlook, there are a few well-documented honeybee populations that have adapted to survive untreated Varroa infestations. One such population was established 15 years ago as a natural selection experiment on Gotland, an island in the Baltic Sea. Current research is focused on the different traits that this population has developed that permit it to survive long-term with untreated Varroa infestation. Here we will address the role that virus infections have played in the adaptation process and in the continuing survival of this population in the absence of Varroa control

BHO-050

Breeding *Apis mellifera* L. resistant to Varroa and PMS with superior production traits in India

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India is a classical example of Varroa catastrophe manifesting in mass colony destruction, low production/productivity and extreme honey contamination, ultimately leading to hugely escalated management costs. Available control methods have many limitations and spill-over deleterious effects. An effort to breed Apis mellifera L., resistant to Varroa and parasitic mite syndrome (PMS) with higher production potential was thus, initiated at Hisar (Haryana), India. Starting April 2013, Varroa sensitive hygienic (VSH) behavior was studied by pin-pricking pupae cells on a compact brood frame. Time taken by worker bees to completely remove dead brood was recorded at 2 hour intervals. Colonies were classified into four groups viz. highly sensitive (HS, upto 4 hours), moderately sensitive (MS, up to 8 h), sensitive (S, upto 24 h) and least sensitive (LS, >24 h). Of 41 colonies, 3 (7.3 %) were HS, 7 (17.1 %) MS, 14 (34.2 %) S and 17 (41.5 %) were LS. Hygienicity was found to be uniform across observation period (months) and independent of colony strength (bee frames/colony). Significantly lower numbers of Varroa mites were recorded in HS (3.5/colony) group, followed by MS (7.9) and S (11.4). Mites were maximum in LS (16.7) group, signifying importance of behavior in resistant breeding. Colonies when further subjected to colony growth parameters (CGPs) though exhibited significant variations among different hygienic groups, but clearly lacked any definite trend. Based on CGPs, 12 colonies among four groups were finally selected, considering hygienic behavior and production traits, for further screening and breeding program.

BHO-058

Competitive effect of Varroa destructor and Tropilaelaps mercedesae in Apis mellifera brood cells

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Varroa destructor and *Tropilaelaps mercedesae* mites are ectoparasitic to honey bee having similar life cycle and damage symptoms. Both invade into the last instar larval cell and reproduce during capped brood period of honey bee development. We studied possible competitive interaction of invading frequencies and consequent population effects of two species. One hundred cells of newly sealed prepupal stage of honey bee were opened and counted founding females of each species from 10 hives of *A. mellifera*. This monitoring continued at weekly interval from July to October 2014. Both mite population increased and decreased after the peak densities of 39 and 42 mites/cell for *V. destructor* and *T. mercedesae* respectively. Coincidence rate of the cell was very low, but high only when potential cells to invade were extremely limited. Population growth rate of each mite species was lower in the hives where infestation rates of both mites are similarly high than in the hives with asymmetric infestation rate. Our results showed the possibility of discrimination of each invading species, and negative competitive effect on each population level.

BHO-005

Impact of honey bee hygienic behavior on *Varroa destructor* infestation and reproduction in unselected stocks

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In honey bee breeding programs the hygienic behavior is a character widely (if not exclusively) used to quantify the tolerance of a colony to Varroa-mites. This behavior was reported to limit partially the growth of the parasite population by removing the infested brood. However in several publications the benefits of the hygienic behavior were evaluated using comparisons between hygienic and non-hygienic stocks (i.e. whether or not it was selected for this character). In this way, they assumed implicitly that there is no difference between these stocks for other characters, which are potentially involved in the mite population growth. In multiple cases this assumption was found very uncertain. For this reason, we re-evaluated the possible benefits of that behavior regarding the tolerance to mites in an unselected stock. In our experiment, data were obtained from colonies which never experienced any hygienic test. These colonies were equally distributed in 3 apiaries in Belgium. The hygienic behavior was evaluated twice in each colony using freeze-killed brood tests. We also measured the mite reproductive success, as well as the infestation rate for the phoretic and reproductive phases of the parasite. The results of this study provided new insights on the impact of the hygienic behavior on mite infestation and reproduction in unselected stocks.

Antibacterial activity of different types of honey produced by many methods

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Ten types of citrus honey were used, ripe and unripe honey from the frame directly. Fresh honey and after one and 2 years ago. Many types of onion honeys was also tested, fresh and after one and 2 years. Lyophilized onion and citrus honey were tested. Nine pathogenic bacteria were tested: E.coli, S.enteretidis, L.monocytogenes, *B.cereus, B. subtilis, St. aureus, St. mrsa, P.aerogenosa* and *C. albicans*. The well diffusion assay revered that development of inhibition zone of growth depended on the type and concentration of honey, as well as the test pathogen. The potency of honey sample were arranged desceldingly as follow citrus ripe, citrus 2 years, citrus lyophilized, onion lyophilized and onion 1 year. The MIC test was adapted from Patton et al (2006) with slight modification. By visual inspection the MICs of citrus honey was 3 mg/ml for E. coli to 7 mg/ml for B.cereus for onion honey MIC ranged from 4 mg/ml of honey was 3 mg/ml for E.coli and s. enteritides while the highest concentration was 8 mg/ml for B.cereus, the lowest MBC of onion honey was 5mg/ml for *E.coli*, *S.enteriteids* and *S. aureus*. An antibiotic sensitivity test was cared out to help shoes the most effective antibiotic (16 types of antibiotic were tested) against nine types of bacteria to compare with honey samples

BHO-045

Efficacy evaluation of organic treatments against Varroa mite in different climatic zones during the whole year

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The test item is a ready-to-use Suspension, a fixed combination product consisting of oxalic acid and formic acid. It is indicated and may be utilized against varroa mites in bees during the whole year, applicable in autumn, winter and spring. The main constituents oxalic acid and formic acid have been already used for Varroa destructor fighting, but in mono products, partially via other administration pathways and/or in other concentrations. So both its complex composition and its special administration make the product unique. Doses of 15 to 45 ml, depending on colony size, given by trickling up to 5 times, depending on mite infestation level have been tested in different European climate regions (continental, maritime and mediterranean climate). The overall average efficacy of the test item at all locations and time of treatment (autumn, winter and spring) was $84.5\pm9.2\%$. In all autumn treatments the efficacy averaged $85.0\pm7.8\%$, in winter treatments $96.8\pm7.1\%$ and $84.5\pm9.2\%$ in spring treatments. The tolerability of the combination product was better than after application of the single drug. Based on the findings and data in the preclinical and clinical studies, the multiple treatments with the test item during autumn, winter and spring time is an effective concept to control Varroa destructor in honey bee colonies which could be included in the regular control intervals of the colonies.

BHO-033

Coumaphos and clove oil rotation can reduce residues in bee products and Varroa mite resistance risk

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We conducted two studies with the aim of reducing the risk of chemical residues in bee products. In one study, coumaphos, a synthetic acaricide and clove oil, an effective essential oil against Varroosis, were selected as representative acaricides to test and measure their residue levels in honey and beeswax after exposure of hive to applicable treatment and dose. The residue trials with coumaphos and clove oil were conducted in Turkey and Israel according to the label instructions for Varroa control. The second study was conducted to determine the stability and sustainability of clove oil components in beeswax samples from hive. A treatment of 50 ml of 1% clove oil was applied in combination with emulsifiers and modes of introduction. The distribution of coumaphos and clove oil within the hive, and contamination of honey or beeswax were examined and measured. All samples were analyzed by Gas Chromatography/Flame Photometric Detector/Mass Spectrometry (GC/FPD/MS) at the Israeli Veterinary Institute. The concentrations of coumaphos in wax samples were in the range of 1 - 50 ppm. The honey samples taken from the hive were below the MRL (0.1 ppm) but there was significant effect on brood development. Eugenol, the major component in clove oil, is sustainable for a minimum of two weeks, and there are no residues in beeswax after three weeks. Eventually, effective essential

oils, such as clove oil, can be used in apiaries by turn with synthetic chemicals, such as coumaphos, in order to avoid residue problem and emergence of resistant Varroa mites.

BHO-078 The occurrence of Acarapis externus in honey bee colonies in an apiary in Iran

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In April 2013, in Gorgan region at the North of Iran near the Caspian Sea a beekeeper reported the losses of more than 30 percent of the colonies in his apiary. The samples were observed by stereo microscope. High level of external Acarapis infestation on the body of adult bees was detected. To determine the species the samples were sent to veterinary faculty of Tehran University and the A. externus was detected.

Acarapis externus Morgenthaler is found on the cervix (the neck region) and A.dorsalis Morgenthaler is found on the dorsal groove of the thorax (Ibay and Burgett, 1989). Morphologically they are difficult to differentiate from one another and from A. woodi, even at high magnification. The parasites were seen at different stages of eggs, larvae and adult. The adult acarapis were moving about on the body of dead bees. The videos are available.

BHO-044

Chemosensing and behaviour response of Varroa destructor to some essential oils of Portuguese aromatic plants

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Besides olfactory cues being essential for social harmony of a honeybee colony, they play also an important role in host parasite interactions. Varroa destructor is a parasitic mite that represents nowadays the biggest threat for beekeeping. Due to preference behaviour of female mites to some host stages, chemical orientation and host finding play an important role on Varroa life cycle. Electrotarsegraphy (EAG) is a quite new screening procedure for detecting behaviour modifying compounds in Varroa. It allows examining the response of the sensory organs of Varroa located on the tarsi of the foreleg.

Dose response EAG tests were conducted to explore the potential chemosensory effect of nine essential oils (EOs) isolated from Portuguese flora. The EOs were isolated by hydrodistillation and analysed by GC and GC MS. Four of the EOs activated the mite chemosensory sensilla eliciting a positive-dose dependent effect in Varroa chemoreceptors. Interestingly two other Eos elicited negative dose dependent response. To test the effect of the EAG active compounds, two-choice behaviour bioassays were done to examine their effect on the preference of Varroa to a nurse bee (*Apis mellifera iberiensis*) in presence or without (control) EOs. The recognition of active compounds using EAG studies may be used not only to understand the unknown mechanism of Varroa host finding but mainly to find a new, sustainable and effective way of mite control. A.S. Lima is grateful to FCT for PhD grant SFRH/BD/76091/2011. This study was partially funded by FCT, under PTDC/CVT- EPI/2473/2012, Pest-OE/AGR/UI0690/2011 and UID/AMB/50017/2013.

BHO-026

Royal jelly apalbumin isoforms as novel antibiotics against P. larvae and multiresistant bacterial strains

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Pathogenic bacteria, not susceptible to the most conventional antibiotics, are growing problem in human and veterinary medicine worldwide. Some of honeybee products are often used in traditional medicine - propolis as a source of antibiotic compounds mainly of floral origin; honey is known to be effectively used in healing of burn wounds susceptible to the infection with various multirezistant human microbial pathogens. Honeybee is armed against pathogens with very effective exogenous defensive system based on proteins and peptides of larval nutrition, the royal jelly. We have found that major royal jelly proteins, the apalbumins, and antimicrobial peptides are regular components of honey. While in honeybee genom there was found just nine genes for coding of the major royal jelly proteins, there are broad number of minority homologues of apalbumis detected by 2D SDS-PAGE in royal jelly and in honey and followed characterisation by MALDI-MS analysis. These various posttranslational modifications of maternal apalbumins leads to different physiological activity including antibotic. In presented work we show the antibiotic effect of some minority homologues of apalbumin2, purified form royal jelly, and found of antimicrobial effect against P. larvae, the primary honeybee bacterial pathogen of American Foulbrood Disease. Moreover we show the high atibiotic capacity of these honeybee proteins to the multiresistant pathogenic bacterial strains isolated from wild caiman Caiman de la Costa. The minority homologues of apalbumin2 represent a novel and promising class of antibiotics usefull in beekeeping, as well as in human medicine, for potential elimination of multidrug-resistant infectious diseases

BHO-070

Development of new antibiotics from actinomycetes to control bee and human pathogens

Jaisoo Kim, Tuan Manh Nguyen

Kyunggi University, Republic of Korea

Up to now, a variety of antibiotics have been used in the life since penicillin was discovered in 1928. Actinomycetes are Gram- positive and have widely found in soil, water, air, colonizing plants and deep sea. They have remarkable diversity in chemicals and morphology, and construct a distinct evolutionary line of organisms, producing many bioactive compounds as a potential source. Around 50% among soil actinobacterial species belongs to the genus Streptomyces, especially producing more than 80% of the commercially and medicinally useful antibiotics. For isolating diverse actinomycetes, we used various kinds of soil samples with three different culture methods including a new method using transwell plates. As a result, we found 92 strains against Paenibacillus larvae (a n agent of American foulbrood honeybee disease); 5 strains against *Aspergillus flavus* (a n agent of chalkbrood honeybee disease); 7 strains against *Ascophaera apis* (an agent of stonebrood honeybee disease); 57 strains against *Bacillus subtilis*; 41 strains against Staphylococcus aureus; 17 strains against *Escherichia coli*; 13 strains against Candida albicans and 35 strains against *Aspergillus niger*. Based on the 16S rRNA gene sequence analysis, the genus *Streptomyces* spp. were dominant. Among them, nine strains were possible new species. Therefore, they may produce new antibacterial compounds and be developed as treatment drugs against diverse microbial pathogens in the near future

Symposium: Viral Disease

BHO-077

Understanding the intimate relationship of the honeybee and its viral pathogens in order to tackle bee mortality from a different angle

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¹Ghent University, Belgium ²KU Leuven, Belgium

The Varroa-mite represents the most important driver of mortality of honeybee colonies, mainly because it acts as vector for rapid and easy transmission of viruses. Like other insects, bees are able to develop an anti-viral immune response based on the RNA interfering (RNAi) pathway. Key components in the RNAi machinery are Dicer and Argonaut: two proteins involved in the biogenesis and function of small non-coding RNAs that lead to the degradation of the viral genome. We have evidences that honeybee viruses have the potential to suppress the host RNAi machinery enabling them to infect and replicate. The recent discovery that bee viruses of the ABPV complex encode viral suppressors of RNAi upstream of DvExNPGP motif located in the N-terminal region of ORF-1 (Chen et al., 2014) strongly supports this hypothesis. It is unclear why some bee colonies remain free of viral infections. Do they have the potential to circumvent these viral suppressors of RNAi? We do not know yet. However, in another study we could demonstrate that approximately one quarter of the Belgian breeder queens are free of virus infections as determined in a screen of their eggs. We are now testing whether there is a heritable component in this virus free status or with other words: does something like virus-resistance

exists in honeybees? If so, it would enable us to tackle bee mortality from a completely different angle and to focus more on virus-resistance in our breeding programs.

BHO-082

Derivation of cell-adapted Sacbrood virus (SBV) from Korean honeybee (*Apis mellifera*)

Chang-Hee Kweon, Mi-Sun Yoo, Hyun-Ji Seo, Ha-Na Jung, Woo Ram Bae, Hee-Soo Lee, Seung- Won Kang, Yun Sang Cho

Animal and Plant Quarantine Agency, Republic of Korea

Sacbrood virus (SBV), a causative agent of larval death in honeybees, is one of the most devastating diseases in bee industry throughout the world. Lately the Korean Sacbrood virus (KSBV) induced great losses in Korean honeybee (*Apis cerana*) colonies. However, there is no culture system available for honeybee viruses, including SBV, therefore, the research on honeybee viruses is practically limited until present. In this study, we investigated the growth and replication of SBV in cell cultures. The replication signs of KSBV after passages from mammalian cells was identified and confirmed by using combined approaches with nested, quantitative, negative-strand PCR and electron microscopy along with in vivo experiment. The results revealed that mammalian cell lines, including Vero cells could support the replication KSBV. Although there was no signs of cytopathic effect (CPE) in cells, it was for the first time demonstrated that SBV could be replicated in cells through the sequential passages linked with cell adaptation. KSBV from the present study would be a valuable source to understand the mechanism of pathogenicity of sacbrood virus in the future.

BHO-071

Artificial infection of Korean Sacbrood virus to *Apis mellifer*a: Analysis on its capability of viral replication.

Joo Seong Lee, So JungYong, Giang Thi huong Luong, Ji Hee Wang, Sang Hyoun Min, Byoung Su Yoon

Kyounggi University, Republic of Korea

Sacbroood virus (SBV) is one of the most serious viral pathogen to honeybee larvae. Since a Korean type of SBV (kSBV) was isolated from *Apis cerana* in Korea (2010), it has caused the economic impact on beekeepers in Korea. Until now, around 95% of populations of *Apis cerana* might be killed by kSBV infection, however, kSBV-infection to *Apis mellifera* is not reported yet, in apiary field. In this study, we examined the artificial infection of kSBV, originated from *Apis cerana*, to larvae of *Apis mellifera*, which were cultivated artificially with standard condition. As results, the replication of kSBV was quantitatively increased in larvae of *Apis mellifera* after adding of kSBV, however, is decreased in several days later with unknown reasons. Based on quantifications of negative and positive strand of kSBV, artificial kSBV-infection to *Apis mellifera* is not observed yet. Natural infection of kSBV to *Apis mellifera* is of interesting fact in public of Korea. Why kSBV could not infect to *Apis mellifera* in nature? It should be revealed for the prevention and control of kSBV infection.

Development of Ultra-Rapid Real-Time PCR for detection against Korean Sacbrood Virus

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Sacbrood virus is one of viral pathogens in honeybee. The infection of Korean Sacbrood virus (kSBV) against *Apis cerana* was firstly recognized in Korea in 2010. Almost populations (over 90%) of A. cerana were destroyed until today in Korea. It is not clear yet, how to prevent it or how to control it or why infect only to A. cerana. These are why development of rapid and easy detection method is important. In this study, we designed the fastest and easy detection method against kSBV. Using Ultra-Rapid Real-Time PCR (URRT-PCR), reaction time of cDNA generation from kSBV-infected larvae was also minimalize. kSBV-specific target was located on VP1 gene, the size of amplicon were 528bp or 257bp long DNA. Using optimized kSBV-specific Ultra-rapid Reverse Transcription Real-Time PCR (kSBV-URRTRT PCR), minimum time for kSBV-specific detection was completed inner 18 minutes from kSBV-infected larvae. Minimum sensitivity was calculated as 2.5×101 copies, and quantitative PCR is also available. kSBV- URRTRT PCR might be very helpful method to detect and to monitor kSBV-infection quantitatively in laboratory, even in apiarian field.

BHO-074

Development of ultra-rapid real-time PCR for detection against black queen cell virus

Giang Thi Huong Luong, Joo-Seong Lee, So-Jung Yong, Sang-Hyoun Min, Ji-Hee Wang, Byoung-Su Yoon

Kyonggi University, Republic of Korea

Black Queen Cell Virus (BQCV) is one of the most prevalent viruses in Honeybee, and could not be recognized by any infected symptoms in the adult bees. Thus, a newly developed method for rapid RNA isolation and cDNA generation from Honeybee samples will be useful and easy to evaluate the presence of BQCV. A significant improvement by only one-step RNA isolation for 10 minutes made possible to detect BQCV RNAs at high quantity. cDNAs were also generated directly from isolated BQCV RNAs by different primer sets for 3 minutes and were applied subsequently to Ultra-Rapid Real-Time PCR by using microchip of 6 µl reaction volume with extremely short time in each step of PCR. This system provided the ultra-high speed reaction (30 cycles in less than 10 minutes) including melting temperature analysis for amplified BQCV products. These results suggest that BQCV detection can be completed within 15 minutes, and the Ultra-Rapid Real-time PCR is sensitive, reliable and time-saving for monitoring BQCV in Honeybee.

BHO-021

Infection of Apis cerana sacbrood virus in Apis mellifera

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Sacbrood virus (SBV) is one of the most serious threats to *Apis cerana* but is much less destructive to A. mellifera. In previous studies, SBV isolates infecting *A. cerana* and *A. mellifera* were identified as different serotypes, suggesting a species-barrier of SBV infection. In order to clarify whether *A. cerana* SBV isolates (AcSBV) can infect *A. mellifera*, we examined SBV infection in 318 A. mellifera colonies with PCR method and performed artificial infection experiments in lab and field conditions. Thirty- eight (11.95%) A. mellifera colonies were found to be positive with SBV infection. Phylogenetic analysis based on RdRp gene sequences indicated that 2 of the isolates were clustered into *A. cerana* clades. In the artificial infection experiments, negative- strand RNA of AcSBV could be detected both in adult bees and larvae of A. mellifera, although higher mortality and clinical symptoms of sacbrood disease were not observed in infected groups. Our results suggest that AcSBV is able to infect A. mellifera colonies with low prevalence (0.63% in this study) and pathogenicity. This work will help understand the different susceptibility of *A. cerana* and *A. mellifera* to sacbrood disease.

The more the merrier: deformed wing virus loads, clinical symptoms and longevity of honeybee workers

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Crippled wings and shortened abdomens are clear and obvious clinical symptoms of deformed wing virus (DWV) infections in honeybees. Since DWV is well vectored by Varroa destructor, DWV is now nearly ubiquitous. However, it is currently unknown what causes such striking differences in expression of DWV symptoms and how long such affected workers will actually live. Here, we measured DWV loads in winter bees without and with symptoms, which were quantified as wing area with deformities and length of the abdomen. We also recorded longevity and behavior of DWV diseased workers when paired in laboratory cages with healthy workers or just by themselves (N=6 cages with 20 bees each group). Finally, we also mark-recaptured freshly emerged deformed wing workers and healthy controls in N=3 field colonies to quantify their life expectancy (N=90 workers total). The results show that the expression of wing deformities and shortened abdomen is positively correlated with virus load. The more DWV, the more drastically were the symptoms. Older bees had higher DWV infections load both in symptomatic and asymptomatic bees. In the laboratory when caged with healthy workers, diseased bees had a significantly longer life suggesting that they were taken care of by their nestmates. In the field, all deformed workers were dead after six days. The data clearly show that higher DWV virus loads can have very strong effects on both clinical symptoms and longevity thereby underlining the importance of varroa control.

Symposium: Hygienic Management I

BHO-086

Foundation of natural bee comb

Youngseog Lee, Seungtae Kim

Diversity of cell size stimulates the instinct of bees for mite resistance. Dennice Murrell in Wyoming State, USA, noticed that natural comb bees had the instinct for mite resistance. After long observation, he concluded that the reciprocal actions between the diversity of cell size and uneven volumes of matured larvae stimulated this instinct of bees for mite resistance. Quoting this theory, I designed the foundation having 4.6 mm of cell diameter in lower part, enlarging the diameter consistently upwards, 6.0 mm diameter in upper part (already submitted for Patent Registration). And I pasted this foundation to Langstroth frame. I had observed bees building up their hives, their health, the activity and the distribution of the area of laying eggs, not treated with any chemicals. By using sugar shaking method, I checked the intensity of mites on this colony and the compared colony of conventional combs on 6th and 9th of July. No mite could be traced on mine, otherwise, 15-17 mites per 300 bees on the conventional comb. It is sure that mites on my colony was terminated, bees were healthier and more vigorous than bees on conventional comb. But confidently I could not define the course of terminating mites. For these works, it is necessary to collect the data until wintering

BHO-085

Mineral deficiencies in bees

Hossein Yeganehrad¹, Hamzeh Ramezani Karim²

¹ Caspian Apiaries ² University of British Columbia, Canada

In humans, potassium, Calcium and Iron deficiencies are problems that effect the global population. Bees also suffer the same deficiencies. In 2012 samples of honey were analyzed in order to accurately determine the amount of Vitamin C & D, Iron, Calcium and potassium in honey. The purpose of this observation is to effectively compare the deficiencies in bee colony's and humans. The results can be used to potentially replenish vitamins and minerals in humans with these deficiencies. The results were as follows: •Vitamin C - 0, •Vitamin D – 0, •Iron – 1/1000, •Calcium – 10/1000, •Potassium -2/1000, Colonies with deficiencies struggle to survive during winter months because of several reasons such as loss of flight, decreased population, lack of pollination, high rate of queen supercedures, and the effect of queen semen. By supplementing the diet of the honeybees with the desired vitamins or minerals, we can create a more efficient and effective mineral supplement for people. These supplement honeys are completely natural and entirely absorbed once consumed. In this presentation we discuss the results of our attempts to design and produce honeys to alleviate common nutrient deficiencies in humans. We elaborate on the production. We also discuss our method of colony management, to ensure optimal health of the bee colony.

Occurance of Eurpean foulbrood disease (EFB) during blueberry pollination in the Vancouver BC area

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¹ University of British Columbia, Canada
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 ³ Karaj, Branch, Islamic Azad University, Karaj, Iran

The bacterium Melissococcus pluton causes the brood disease European foulbrood (EFB). Research has shown a strong correlation between nutrition and EFB prevalence in honeybee colonies. Hives become symptomatic as available nutrient levels decrease and can rapidly reach epidemic levels of EFB. In British Columbia's Lower Mainland there can be substantial mount of rainfall during most seasons. These weather conditions can directly affect the number of bees available for pollination and nutrition of larva. Lab results have identified the presence of two bacteria, which cause EFB. By providing nutrients to the brood, it is possible to eliminate EFB naturally if the infection is not invasive. However, Antibiotics must be used to effectively treat severe conditions.

In this presentation, new disease control methods and management tactics will be presented. We report on tools developed for identification and monitoring of EFB. We will detail methods to treat diseased hives in the field, when movement of the hive is not recommended. We show how the use of bee products, a proprietary mixture of pheromones and bee pollen, stimulates the colony to consume pollen at a large rate, resulting in an increase in production of worker jelly for larvae. Worker jelly, a rich source of nutrients, grants to the larvae immunity from EFB and most pathogens. As a result, reduction or elimination of all signs of EFB and associated pathogens from diseased hives occurs without the mandatory use of antibiotics.

BHO-079

Master beekeeper education programs: Tool to support small scale beekeeper education

Mark Dykes

Texas Apiary Inspection Service, USA

In the United States the number of small scale beekeepers has increased in the past 5 years. The increase is thought to be the result of heightened awareness of the services honey bees provide and the publicizing of the increase in yearly colony loss. With this increase in numbers a need for science based education for these new beekeeper arose. To fill this gap many beekeepers have relied on local bee clubs and state Extension services. The issue that has arisen is that many state Extension personal are not trained in beekeeping and local clubs are often times made up entirely of novice beekeepers. This situation creates a vacuum of science based information on honey bee husbandry, nutrition and pest control. One solution that has shown success is the training and certifying of master beekeepers. In Texas, the Texas Apiary Inspection service in partnership with the Texas Beekeepers Association, and Texas A&M University have recently created such a program. This is not a novel model, but draws from other existing programs. By using this model the program was able to quickly progress from conception to execution. Master Beekeeper Programs have the ability to produce well educated beekeepers by providing the participants access to current science based beekeeping methods and encouraging them to share this information with other local beekeepers. By creating this conduit for information to flow the Master Beekeepers act as a force multiplier for education efforts.
Investigating the effect of high relative humidity and high carbon dioxide concentration in beehives on honeybees death rate in winter

Hossein Yeganehrad², Hamzeh Ramezani Karim¹, Sajad Jazani²

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We conducted a study to find out about the potential impact of honey bees winter loss in Vancouver in 2014, and it led to our realization that there is the likelihood of a link between the number of perished honey bees and the ventilation condition in the bee hives throughout winter time. Our study was at the effects of the extreme rate of humidity and carbon dioxide concentration as contributing factors to honey bee's death during winter. Hence, the amount of relative humidity and carbon dioxide concentration was measured in both deficiently and ideally ventilated beehives at different sites in British Columbia.

This resulted in our findings about the number of honey bee winter fatality in each beehive accordingly. The result of our study also indicated that % 90 of honey bees died of poor ventilation (%90 relative humidity). In contrast, the death rate of honey bees in well-ventilated beehives (%85 relative humidity) was remarkably down to % 15. Additionally, there were evident symptoms of the high moisture rate (over % 27) in the fermentation of honey in the open cells as well as extreme diarrhea on the front en trance of the hives, while the moisture rate is naturally anticipated to be % 17 to % 20. The results of *Nosema apis* and *Nosema ceranea* testing were either negative, or they demonstrated a slight amount. The study has revealed that lack of oxygen is deemed to be the major cause of honey bees 'death inside the hives during winter.

BHO-016

Pest surveillance in indigenous bee hives in subtropical hilly region of Nepal

Min Raj Pokhrel

Agriculture and Forestry University, Nepal

Pests and diseases are the major problems of bee keeping. Bee keeping is an age old business in Nepal but very limited studies have been done on infestation of insect pests in non-movable framed traditional hives. So, a survey was conducted to know the major constraints on *Apis cerana* rearing in Lamjung district, a subtropical area of central Nepal. Fifty beekeepers maintaining at least three non-movable framed beehives were randomly selected and face-to-face interviewed by using structured questionnaire. The bee hives, the chambers and bee frames were thoroughly observed to record bee pests. The pests were collected for further identification and preservation. The adoption of movable framed bee hives was low as only one-fifth of beekeepers were using movable frame hives and that were of less than ten years history. The annual average, maximum and minimum honey production was 6.82, 12 and 2.5 kg per hive per annum respectively. The beekeepers prioritized insect pests, use of pesticides, shortage of bee pasture, lack of technical know- how, the non-insect pests, diseases and marketing of honey as the major problems in beekeeping. Among insects, greater wax moth, hornets, bee beetle, death's head hawk moths and ants were the major pests in indigenous hives. Annual pest calendar was developed. Bee pest problem was

more prone in summer and rainy seasons than winter. December was the least pest infestation month. Bee keepers were found using various local methods based on indigenous knowledge.

Symposium: Bacterial Disease

BHO-053

Clinical veterinary bacteriology as reference for finding *Paenibacillus larvae* in apiaries

Violeta Santrac

Public Veterinary Institute, Bosnia and Herzegovina

In work authors summarized results that shows presence Paenibacillus larvae, cause of American foulbrood, during the period from January 2014 till May 2015th on the territory of Republic of Srpska, Bosnia and Herzegovina, Europe. Objective for this work was to determine geographical presence and prevalence of American foulbrood causalities in order to analyse data and use them as elements for future development and creation rational and applicable control program. Presence was established in clinical and sub-clinical forms of American foulbrood infections from honey bee brood, honey, wax, and honey bee artificial feed formulations. Materials are treated in standard requirements based on ISO 17 025, with an accredited method. 1118 samples of bee brood and honey were examined, from which 261 samples (23.3%) where positive. That concerned 68 apiaries with positive findings. Besides, we examined two wax samples and 44 samples feed what makes on the end, total 1164 samples that were done. Laboratory proof of presence Paenibacillus larvae in forms clinical also sub-clinical infections is step toward future work: first, a new Regulation for disease control, and second, no less significant need is strategic Ministry decision to continue good practice for finance this diagnostic approach. Legal status for AFB in B&H do not permits use antibiotics in disease control and also is known that there is no "vaccine protocol" for control reasons, remains fact that beekeepers need assistance to way they need program that would efficiently protected their production

BHO-051

In vitro evaluation of antimicrobial effect of propolis against *Paenibacillus larvae* genotypes in Turkey

Aygün Schiesser, Ö mür Gençay Ç elemli, Asl Ö zkrm, Nevin Keskin

Hacettepe University, Turkey

The European honey bee *Apis mellifera* L. is the most commonly managed useful insect in the world. Products of the honey bee and pollination with honey bees have great share within global economy. Also, fruit or seed set of many plants depend on honey bee pollination. Decline in colonies all over the world cause serious economic loss. There are several factors affecting the managed honey bee populations like pests, pathogens, pesticides, climate and poor beekeeping techniques. One of the most lethal of these factors is *Paenibacillus larvae*,

the agent of American Foulbrood disease. *Paenibacillus larvae* is a gram positive and spore forming bacteria that affects honey bee larvae. Due to increase of resistant AFB strains and residue problem in honey, it is restricted to use antibiotics for treatment. Therefore, scientists and Research & Development companies are seeking for natural compounds for AFB remedy. In this research, *Paenibacillus larvae* strains were isolated from field samples and their genotypes were determined by rep-PCR genotyping method. 14 propolis extracts were also tested for their antimicrobial activity against to 26 isolates of *P. larvae*. According to genotyping studies, two different genotypes (ERIC I and ERIC II) were identified within Turkish isolates. Results showed that, all propolis extracts have antimicrobial effect against to *P. larvae* in different grades. In conclusion, propolis could be an alternative treatment for the most dangerous disease of honey bee and in accordance with these data, protection management and treatment programs could be created.

BHO-067

In vitro assessment of the antibacterial potential of *Rhododendron* sp. extracts as an alternative remedy for American foulbrood disease

Aygun Schiesser¹, Sedat Sevin², Emine Baydan², Asl Ö zkrm¹

¹ Hacettepe University, Turkey ² Ankara University, Turkey

One of the most lethal pathogen of the European honey bee Apis mellifera L. is Paenibacillus larvae, the agent of American Foulbrood disease. Paenibacillus larvae is a gram positive bacteria that affects honey bee larvae. Due to resistance development of the pathogen and residue issues in bee products it is restricted to use of antibiotics in many countries. Therefore, natural compounds are being investigated as alternatives all over the world. The genus Rhododendron includes species that have been use in traditional medicine for centuries. Also species belong to this genus are well known for their toxicity and interesting cases of poisonous "mad honey". More than 850 Rhododendron species are distributed Himalayan region, North America and Europe. Five Rhododendron species grow in Turkey. The aim of the study is determine the antimicrobial activity of Rhododendron extracts against Paenibacillus larvae. In this research, flowers and leaves of Rhododendron ponticum, Rhododendron luteum, Rhododendron smirnovi and Rhododendron urgernii were used for extraction. Dried leaves and flower were macerated in five different solvent (Acetonitrile, Chloroform, Dimethyl-sulfoxide, Methanol and Water) than diluted to four concentration (100X, 50X, 25X and 12.5X). Three local strain and one culture collection strain of Paenibacillus larvae were used for analyses. Disc diffusion method was used to determine antimicrobial activity level of extracts. Solvents were used as negative and tetracycline discs were used as positive control. Collected data was analyzed by SPSS21 statistics software. Results showed that Rhododendron extracts has significant antibacterial effect in changing ratio based on the solvent, species and concentration.

BHO-015

In vitro evaluation of antimicrobial effect of propolis against *Paenibacillus larvae* genotypes in Turkey

Aygün Schiesser Ö mür Gençay Ç elemli, Asl Ö zkrm, Nevin Keskin

Hacettepe University, Turkey

The European honey bee *Apis mellifera* L. is the most commonly managed useful insect in the world. Products of the honey bee and pollination with honey bees have great share within global economy. Also, fruit or seed set of many plants depend on honey bee pollination.

Decline in colonies all over the world cause serious economic loss. There are several factors affecting the managed honey bee populations like pests, pathogens, pesticides, climate and poor beekeeping techniques. One of the most lethal of these factors is Paenibacillus larvae, the agent of American Foulbrood disease. Paenibacillus larvae is a gram positive and spore forming bacteria that affects honey bee larvae. Due to increase of resistant AFB strains and residue problem in honey, it is restricted to use antibiotics for treatment. Therefore, scientists and Research & Development companies are seeking for natural compounds for AFB remedy. In this research, Paenibacillus larvae strains were isolated from field samples and their genotypes were determined by rep-PCR genotyping method. 14 propolis extracts were also tested for their antimicrobial activity against to 26 isolates of P. larvae. According to genotyping studies, two different genotypes (ERIC I and ERIC II) were identified within Turkish isolates. Results showed that, all propolis extracts have antimicrobial effect against to P. larvae in different grades. In conclusion, propolis could be an alternative treatment for the most dangerous disease of honey bee and in accordance with these data, protection management and treatment programs could be created.

BHO-076 Investigating the genetic and environmental factors on the chalkbrood disease

Hossein Yeganehrad², Hamzeh Ramezani Karim¹, Sajad Jazani²

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Chalkbrood, caused by the *Ascosphaera apis* fungus, is easily identifiable by beekeepers. Mummified bee carcasses often litter the entrance of affected hives or lay dead in the cells of brood chambers. Drone larvae are particularly susceptible to this fungus. However, neither strong nor weak colonies are immune to Chalkbrood, even though weak colonies with population growth can overcome the pathogen. By implementing a new approach, we realized that weak colonies tend to have difficulties producing sufficient worker jelly for a colony's larva. The deficiency in nutrition renders the larva vulnerable to Chalkbrood fungus. Testing the honey bee's digestive systems and majoring amount of pollen in the metabolism and rectum led to our findings that the problem is genetic or nutrition (environmental factors) based. Proper queen and drone rearing can significantly assist in combating the fungus. Utilizing the genetic material from a weak colony and via either the natural or the artificial insemination of the resultant queen, we detected a reduction of 90 percent in Chalkbrood susceptible colonies by examining the metabolism and the pollen residue left in the bee's digestive system. Furthermore, the significance of proper nutrition in queen and drone rearing will be discussed. Also, the vital role that proper nutrition plays will specifically be examined as well as its relations to the larva prior to the grafting phase, in drone and semen production, and in the mating hive.

BHO-004

Fighting AFB: Sampling, sanitation and management strategies

Eva Forsgren

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American foulbrood (AFB) is one of the most serious diseases in apiculture worldwide. If the disease becomes established in a beekeeping operation, it is very difficult to get rid of. The consequences of disease outbreaks can become very costly for the beekeeper. Bees in general have a relatively high tolerance to the disease, but sometimes the infection pressure gets too high as disease symptoms develop. Infected dead larvae contain millions of infectious bacterial spores that can spread in a beekeeping operation or a geographical area. Therefore, early detection of the disease is important and sensitive methods to detect subclinical infection are important in order to monitor and prevent the spread of disease. As part of an ongoing project in collaboration with a commercial beekeeper with a history of AFB, we investigated whether composite samples of adult bees collected in autumn could be used as an indicator for which colonies are likely to develop disease symptoms next spring. Based on the bacterial levels in the sampled bees, a quarantine system was implemented where colonies with high levels of the bacteria were moved and kept isolated in restricted, geographical zones. Each zone had its own dedicated beekeeping material. Results from our study show i) that high bacterial levels in composite samples from apiaries (10 colonies) usually derived from one single colony within the apiary ii) that the proportion of colonies with high bacterial counts have decreased already after one season with the recommended quarantine procedure.

Symposium: Fungal Disease

BHO-065

Transmission of Nosema spores examined by using Cages

Asli Ozkirim, Aygun Schiesser

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The two Microsporidian species have been described as parasites of honey bees (*Apis mellifera* L.), *Nosema apis* and *Nosema ceranae*. Fries et al. reported that both species infect the ventriculus of adult honey bees and are transmitted to horizontally via spore ingestion, for example whilst workers clean combs of infected faeces. When we set up any kind of experiment about honey bee-pathogen relationship, we consider newly emerged bees as sterile (pathogen-free) adults. On the other hand, there might be a risk for young bees to be contaminated horizontally by ingestion just after emergion in hive. Aim of the study was to test the newly-emerged bees for their pathogen-free facilities by the cage experiments. Three hives were selected from the apiary and checked for Nosema infection by spore counting method. The two of them were found Nosema (+), one was Nosema (-). Then, the brood comb were transferred into the incubator at 350C from the Nosema (-) hive. All newly emerged bees were collected by sterile equipments and put into the sterillized cages. They were left at normal conditions (350C, 5mL sugar syrup etc.) in the incubator during the following two days. In one week, the high number of losses were observed in the cages. The results showed that the newly-emerged bees contained approx. 6x106 spore/bee at the first day and spore reproduction continued day by day. The conclusion vertical transmission is possible for Nosema spores, so it should be considered especially for cage experiments

Molecular identification of *Nosema ceranae* in East-Azerbaijan province, Iran

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Nosema is a genus of microsporidia, which have significant negative impacts on honeybees. The aim of this study is the epidemiological evaluation and molecular characterization of Nosema ceranae in various counties of East-Azerbaijan province (Northwest of Iran). 400 samples were collected from colonies maintained in various counties of East-Azerbaijan province. Samples after preparation were examined by a light microscope for resence of Nosema spores. PCR method (SSUrRNA gene) was used to diagnosis of Nosema. C. Descriptive statistics were used for data analysis. Total infection prevalence of the microscopic evaluation and PCR tests were 280 (70%) Nosema. C., total validity of PCR test against the microscopic test was computed equal to 1.1 in this case. Disease distribution in various counties of study area was variable. The high presence and different distribution of *Nosema C*. positive samples in various counties of East-Azerbaijan province may be due to multiple reasons. Furthermore, epidemiological information helps us to improve disease management practices in the studied area, apply new hygiene policy and reduce extra costs of production.

BHO-060

Screening and identification of microsporidia specific gene from Nosema ceranae infected honeybee and its application of microsporidium detection

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The microsporidium, Nosema ceranae, is considered to be one of most serious pathogens of the honeybee (*Apis mellifera*). However, the pathogenesis on the infected honeybees caused by N. ceranae is not well understood. Herein, suppressive subtractive hybridization (SSH) was performed to evaluate the differential expression genes of N. ceranae infected honeybees. Total 177 differentially expressed sequence tags (ESTs) were identified from subtracted libraries. 82% of these ESTs (146 ESTs) are belonging to *Apis* spp. insect hosts. 11.3% (20 ESTs) are microsporidia specific genes. A nosema specific gene, sr22, a putative structural gene, was selected and further investigated. Based on the detection of the experimental infections of honeybees with N. ceranae by PCR with a designated sr22 specific primer set, the gene expression of sr22 was initially detected at

3.5 days post inoculation (dpi) and reached a peak at 14 dpi, then declining slightly until 21 dpi. Furthermore, sr22 was found that this gene is a highly conservative gene within the genus Nosema. The efficiency of this specific primer set was also evaluated and found that up to the DNA from a purified spore and from the infected midguts at 3 dpi. Could be detected. Moreover, by absolute quantitative PCR, the copy number of sr22 could be represented the number of parasites. We suggest this diagnosis platform, based on sr22, can not only be applied to detect N. ceranae infection but also the level of infection (copy number determination) in the infected tissue and also be used for other Nosema spp.

BHO-066

Dynamic of honey bee mid-gut during *Nosema* spp. infections and after treatment

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Nosema spp. includes the two main species; Nosema apis and Nosema cerenae; cause Nosema infections in honey bee (Apis mellifera L.) mid-gut. Nosema spores can affect the epithelial cells and damage the digestive system of honey bees. Aim of the study was to investigate dynamic of honey bee mid-gut during Nosema infections for its content and the other kind of microbial growth after treatment against Nosema disease. 89 samples were collected from the different apiaries and analysed for Nosema infection between March and June 2015. 59 of them were found Nosema (+)(N. apis, N. cerenae or N. mix (cerenae+apis)) by heamocytometer spore counting method. Besides Nosema diagnosis, the slides were prepared from the same bees individually and examined for the content of mid-gut of honey bees Nosema (+). All matters observed on the slides were listed for each sample. At the end of the study, there are three common factors were found in all samples: 1. Undigested foods or pollen in the mid-gut causes typical symptomps of Nosema disease. 2. More bacterial growth in the samples after the treatment against Nosema disease. 3. Undigested foods originated from food supplements used by beekeepers to support infected colonies addition to the treatment. All data will be summarized in detail. These factors may have negative roles for the control of Nosema disease. These results confirm that beekeepers' complaining about the resistance of Nosema spores against the treatment and continue the symptoms of the disease even after that.

BHO-072

Development of molecular diagnostics of honeybee fungal diseases in field

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Kyonggi University, Republic of Korea

Because effective control methods of honeybee fungal diseases (*Ascosphaera apis*, *Aspergillus flavus*, *Nosema ceranae* and *Nosema apis*) have been unknown, the rapid detection of fungal pathogens should be important in hive management. In this study, we examined the LAMP (Loop-mediated Isothermal amplification) detection method against fungal diseases, and developed the new detection method which can be easy recognized

its result by naked eye instead of electrophoresis. Nucleic acid fluorescent dye, SYBR Green and Gene-FinderTM were adopted in this method and real-time thermal cycler and UF-PCR equipment were also used. The new method has an advantage that can successfully perform amplification of target DNA within 30 minutes. And, this method against each pathogen can be successfully amplified from 1×102 copies of template DNA with quantitative manner in real time. Moreover, the diagnostic method using GENECHECKERTM Ultra-Fast PCR system allowed direct observation of the reaction-density with semi-quantitative manner. The new method demonstrated to be a specific, sensitive and easy tool for on-site detection. Thus, it may be expected to be useful for the monitoring of natural infection in *Apis mellifera* by *A. Apis, A. flavus, N. apis* and *N. ceranae*.

BHO-073

Development of ultra-fast detection method for honeybee fungal pathogens in field

Ji-Hee Wang, Sang-Hyoun Min, So-Jung Yong, Joo-Seong Lee, Giang Thi Huong Luong, Byoung- Su Yoon

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Chalkbrood, Stonebrood and Nosema disease are major fungal diseases of honeybee. Pathogens causing Nosema disease are two species such as Nosema apis and Nosema ceranae, which are isolated originally by infected honeybee species. In this study, we developed a simple and rapid PCR method for detection of honeybee fungal pathogens in field, called Ultra-Fast (UF) PCR. Conventional detection methods based on genetic diagnosis take about 1 hour to complete detection, however UF PCR is capable of detecting in about 10 minutes. The major part of this technique is to detect by using SyBr Green fluorescence combined with nucleotides, to heat up and cool down up to 8°C per second, and to perform simply and quickly in field without electrophoresis. This technique is based on the 18S rRNA gene and 23S rRNA gene, producing 100-300bp PCR products, and capable of detecting up to 104 copies. In particular, this technique is designed to detect environmentally originated, chromosomal DNA as well as molecular cloned DNA. Further, the UF PCR method developed in this study might be applied for the detection of many other honeybee pathogens.

Symposium: Hygienic Management II

BHO-062

Remote monitoring system of the honeybee-controlled microenvironment in the hive for the precise apiculture

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The honey bee can control its within-hive environment to survive drastic changes in the field environment. To study the control of multiple environmental factors by honeybees, in this experiment, we employed a remote sensor monitoring system for physico- chemical factors (temperature, humidity, sound, and concentrations of CO2, NH3, H2S). The look of the device containing sensor board was designed to place it into the hive box wall of entrance side. The data is collected by central processing unit and transferred to server via CDMA modem. By

connecting to the bee-portal site, the user can monitor the within-hive environment with personal computer or smart-phone. In addition, the weight changes of bee housing box was monitored by load cell installed under the beehive. With this system, We expect the real-time prediction of the colony strength, cell opening, swarm remove, food saving and also diseased condition without inside inspection of beehive. Our results imply potential adjustment of micro-climate within the hive for maintaining optimal environmental factors investigated between the indicated that physical environmenal factors such as hive temperature and humidity are controlled by different mechanisms. Additional monitoring of the hive environment and honeybee behavoiral response for longer periods would enable us to understand the mechanisms control by honeybees, which is one of the behaviors that define honeybee as social insects. Remote sensor system is ultimately evaluated to be an efficient and promising monitoring system for keeping honeybee colony in best rearing condition.

BHO-054

Circumstances, constraints and prospects of honey-bee (Apis mellifera) conservation: The case of dale district, Sidama zone, Southern Ethiopia

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This scientific study was conducted in South Nation Nationalities and Peoples Regional Sate, Sidama zone, Dale district. It examines the major constraints and prospects of honey-bee (Apis mellifera) conservation at the grass root level. The study focused on identification of the constraints that hamper beekeeping practices and also serve as disincentives for non-beekeepers to participate in the activity. Data were collected from 36 bee keepers, 24 non-beekeepers and 11 peasant association chairmen and development agents. Combinations of RRA (Rapid Rural Appraisal) tools were employed to collect primary data from beekeepers, nonbeekeepers, and peasant association chairmen. Necessary secondary data were also collected from relevant sources. Honey-bee pests, high cost of modern beehives, lack of beekeeping equipment, dependence on traditional production system, and lack of market and credit access were the main constraints of beekeeping development in the area. Among the constraints honey- bee pests, cost of beehives and shortage of bee forage during dry season were the most pertinent factors accounting for 32%, 19.5% and 13% of the sample respondents, respectively. The study also revealed that poor extension method was the core feature hindering the non-beekeepers to participate in beekeeping activities. Even though several constraints stalled beekeeping development in the area, participatory water shed management, and traditional knowledge of farmers were among the aspects that encourages the activity. The study concluded that beekeeping practice in the district is more traditional and affected by main constraints. Hence, technical support from the government and provision of long-term credit could result for sustainable honey production.

BHO-052

Comparative hygienic behaviour of *Apis mellifera* L. and *Apis cerana* F.

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Hygienic behavior is considered as an important factor in selection and breeding programs of diseases resistance. Hygienic behavior of *Apis mellifera* L. and *Apis cerana* F. were investigated. Both species exhibited differential rate of hygienic behavior in terms of removal of pin pricked capped brood cells. After 24 h the removal of dead brood in *A. cerana* was significantly higher than that of *A. mellifera* being 94.00 and 88.00%, respectively. The *A. cerana* comparatively taken less time in differentiatin g and removing the dead brood in test colonies than A. mellifera. The differential hygienic behavior of *A. mellifera* and *A. cerana* may be due to its genetic factors, environmental factors (Temperature, humidity, comb condition, nectar flow), Chemical factors (Pheromones, dead brood odors, parasitic mite odors) Physical factors (Movements, vibration, light) as well as by interaction between all these factors. Hygienic behavior is a desirable trait in commercial beekeeping and would greatly benefit the beekeeping industry if beekeepers select and multiply productive, hygienic colonies.

BHO-049

Colony failure linked to low sperm viability in honey bee (*Apis mellifera*) queens and potential factors affecting viability.

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Queen health is closely linked to colony performance in honey bees as a single queen is normally responsible for all egg laying and brood production within the colony. In recent years within the U.S., queens have been failing at a high rate; with 50% or greater of queens replaced in colonies within 6 months when historically a queen might live one to two years. In the current research, surveys of sperm viability in US queens were made to determine if sperm viability could play a role in queen or colony failure. Wide variation was observed in sperm viability from four sets of queens removed from colonies that were in good health (92%) being re-queened (57%) or where two beekeepers provided queens from colonies they rated as failing (54% and 55%). Two additional paired set of queens showed a statistically significant difference in viability between queens from colonies rated as failing or in good health from the same apiaries. The queens removed from colonies rated as being in good health averaged high viability (ca. 85%) while those rated as failing or in poor health had significantly lower viability (ca. 50%). Thus low sperm viability was indicative of or linked to colony performance.

BHO-011

Genetically modified bees

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A breakthrough in the efforts to genetically modify honey bees was recently reported by researchers from Heinrich Heine University in Düsseldorf, Germany. At this stage, phosphorescent bees were created to demonstrate the ability manipulate the bee genome. But this is just the beginning. The European Food Safety Authority (EFSA) has included bees in their first documents about regulation of genetically modified insects. The idea of insecticide resistant bees can be found in these documents. The mapping of the genome of the honey bee has shown, that honey bees lack a number of detoxification genes frequently found in other insects. The genes of insects, which have become resistant to certain insecticides, may be used to fill this "gap" in the bees genome in order to create "NeonicReady" bees. The question is, if the way forward is to stop creating environments that are hostile to bees or to modify our bees to tolerate toxic environments. What will happen to bumble bees and solitary bees in such ecosystems? This development has consequences for the natural genetic diversity of our our bees. Also, the genome of honey bees has been influenced by the beekeeping community through traditional breeding programs. The genetics of honey bees resulting from these collaborative efforts are the intellectual property of the beekeeping community and should not be used to create genetically modified bees without the consent from the members of Apimondia.

BHO-010

Efficacy of HiveAlive[™] in increasing colony population during field trials

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Field trials were conducted to evaluate the effect of feeding HiveAlive[™] on honey bee populations and Nosema infestation levels, during winter and spring of two consecutive years. During November 2012, HiveAlive[™] was administered to 20 experimental honey bee colonies at a concentration of 2.5mL/L thick 66% w/v sugar syrup. The colonies were fed 1L of syrup, twice a week for 2 weeks (total: 4L syrup per colony). Another group of 20 colonies were fed plain syrup and served as a control group. All colonies overwintered with plain sugar candy. In the spring of 2013, the control colonies received 4 L of 33% w/v sugar syrup in total, in the same way as in November, while the experimental group received no treatment. During November 2013, the trial was repeated on the same colonies and the colonies overwintered again with sugar candy. However, in spring 2014, all colonies were fed 33% w/v sugar syrup, with the experimental ones given also HiveAlive[™] at the same concentrations as before. The number of adult honey bees as well as the number of Nosema spores on 60 honey bees per colony were recorded before and after the treatments. During the first year of the trial, the administration of HiveAlive[™] only during November did not have a significant effect on colony population or Nosema spores levels. However, the effect was significantly different during the second year's trial were the treated colonies were keeping higher populations of adult bees and lower populations of Nosema spores.

BHO-001

Collagen type I density on dental pulp inflammation of Sprague-Dawley rats following the application of *Trigona* sp propolis from south Sulawesi province, Indonesia

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The aim was to analyse the collagen type I density as the result of Trigona sp propolis application in the dental pulp inflammation of Sprague-Dawley rats.

Propolis was obtained from Luwu Regency, South Sulawesi Province, Indonesia. Flavonoid and non-flavonoid extracts were purified from propolis using the thin layer chromatography. Eighty male Sprague Dawley rats were used in this research. The rats were divided randomly and equally into 5 groups. At Group I (negative control) was not conducted any treatment. Group II, III, IV and V. A Class I cavity (Black Classification) were prepared on the occlusal surface of right maxillary first molar. The dental pulp was perforated using dental explorer and allowed to open in the oral cavity for 60 minutes, after that the ethanolic extract of propolis (EEP) (Group II), the extract of flavonoid-propolis (EFP) (Group V) were applied. All cavities were then filled with Glass Ionomer Cement. The rats being sacrificed in 6 hours, 2 days, 4 days and 7 days. Sample biopsy were obtained, staining using Mallory method and observation under light microscope. Data was analysed statistically with significance level of p<0.05. The result show that there is no significant difference of the collagen fibers density among 4 time periods of each group and among 5 groups of each time period. Although, numerically, there is the slight increase of the collagen fibers density along with the increase of the observation time period duration.

Symposium: Pest

BHO-081

Pupal development of *Aethina tumida* (Coleoptera: Nitidulidae) in Thermo-Hygrometric Soil Conditions Encountered in Temperate Climates

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The pupal development of Aethina tumida Murray (Coleoptera: Nitidulidae) was studied at various combinations of thermo- hygrometric soil conditions (temperatures of 16, 18, and 20°C and soil water content levels of 0.37, 0.56, and 0.73 m3 water per cubic meter of dry soil) representative of southeastern Canada. Survivorship and development duration of A. tumida pupae, as well as sex ratio and life span of emerging adults, were assessed. Assays were conducted in growth chambers on an average of 50 third-instar larvae per thermo-hygrometric combination. Results show that survivorship of pupae decreased with lower temperature and higher soil water content. Pupal development time shortened as temperature increased (69-78 d at 16°C, 47-54 d at 18°C, and 36-39 d at 20°C), but was longer in dryer soil. Optimal soil water content for pupal development was 0.56 m3 water per cubic meter of soil. We estimated that the minimum development temperature for pupae is between 10.2 and 13.2°C, depending on soil water content. The sex ratio of emerging adults was infuenced by soil water content. We measured one female to one male for dry and intermediately wet soils and three females to one male for wet soils. Higher soil water content reduced the life span of emerging adults by half. This study contributes to a better understanding of A. tumida population dynamics in eastern Canada.

Study by scanning electron microscopy of the antenna of the female bee louse fly *Braula coeca* Nitzsch (Diptera: braulidae)

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The antenna of the female bee louse Braula coeca consists of a scape, a pedicel and a Funicle (enlarged basal flagella subsegment). The scape is not visible and does not carry any type of sensilla. The pedical is approximately triangular in cross section and it carries a group of long grooved articulated bristles. The Funicle is cover with microtrichia; it contains three types of sensilla: long sharp-tipped sensilla, basiconica sensilla and ribbed peg sensilla. There are only one olfactory pit on the basal side of the Funicle and it contains 3 - 4 ribbed peg sensilla. The arista long, cylindrical, fringed and on the first quarter of the basal part, there are very small six cone-shaped sensilla on the dorsal surface. The suggested function of each sensilla was based on comparison with results of other investigation on similar sensilla.

BHO-055

Co-existence and interactions of pests with bee-wax baited *Gmelina arborea* (Roxb.) woodhives in Abeokuta, Nigeria

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Wooden hives set for honeybees' colonization are often attractive to pests. However, little is known about the interaction among these pests with the hives and more so, impacts of baiting materials on the attractiveness of these pests other than honeybees. Therefore, the interaction of other insects and colonization response of native honeybees to *Gmelina arborea* wood made hives baited with honey-wax and non-baited hives were investigated for comparison. Paired choice test of baited and non-baited hives with six replicates were strategically placed within four hectares of matured secondary forest between January and December, 2014 in Abeokuta, Nigeria. Two categories of pests were recognized; cavity nesting and cavity destroying organisms. There were remarkable differences in the pest species composition and their impacts. The use of bait influenced the attraction of honeybees' enemy pests first, and has negative impacts on colonization rate and economy of the hives. The study revealed October as the best colonization month with 7 hives colonized (58%), followed by December with 2 hives (16%), and February and March with 1 hive colonized (8%) in each month. Non-baited hives recorded faster and complete colonization than the baited hives. This study has demonstrated the non-usefulness of bait in modern beekeeping in South-western Nigeria.

Early reaction measures, management and surveillance of small hive beetle in Italy

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Aethina tumida Murray (Small hive beetle, SHB) was firstly reported in Italy on 5 September 2014. Three nuclei containing honey bees (*Apis mellifera*) in a clementine (citrus) orchard near the Gioia Tauro port in the Calabria region (South-west of Italy) were heavily infested with adults and larvae. A. tumida infestation is a notifiable disease of honey bees in the European Union as well as an OIE listed disease. Early reaction measures adopted in Italy require immediate notification of A. tumida discovery to the local veterinary services and cannot move their colonies. Furthermore, a protection area (20 km radius) and surveillance (100 km radius) zone were established. The surveillance zone includes the whole territory of Calabria region, and of Sicily region, following SHB detection in a single municipality in November 2014. Compulsory visits to all apiaries in the protection zone with georeferentiation and visual colony inspection according to 5% expected prevalence (95% CI) are applied. Destruction of infested apiaries is compulsory and the soil under the infested colonies must be ploughed and treated with pyrethroids. If apiaries in the protection zone are found to be negative, traps are placed. In the surveillance zone, apiaries are selected according to a risk analysis or randomly and colonies are inspected according to 2% expected prevalence (95% CI). No movement of colonies was allowed within the protection zone. In the surveillance zone, the movement of colonies was allowed only following two negative controls 21 days apart. SHB surveillance program is in progress at national level.

BHO-009

Pests and predators of honey bee species of Nepal

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A survey study was carried out to identify and categorize the pests and predators of honey bee species of Nepal during the year 2012 to 2014. Honey bee colonies both wild and domesticated in terai, mid hills and higher hills of Nepal were visited and studied. Forty five different types of pests and predators were identified out of which 14 were major and 31 minor. The mite Tropilaelaps clareae in *Apis mellifera*, A. dorsata and *A. laboriosa* and *Varroa destructor* in *A. cerana* were found the most challenging for the development of beekeeping in Nepal. Hornets, ants, bee eating birds and wax moths also found major threat to Nepalese honey bees. The pressure of pests and predators (12 major and 28 minor) followed by summer (12 major and 26 minor), autumn (10 major and 21 minor) and spring (5 major and 18 minor). Winter season had the lowest pressure of pests and predators (major 5 and minor 16). Birds, ants and hornets caused more loss of bees during rainy season when bee colonies were near forest. Population of mites was the lowest in summer which began to increase from

autumn and reached at damaging level in late winter. The eagle bird was found the most threat to A. dorsata bees. The native honey bees showed well developed survival mechanism from predators than the exotic bee A. mellifera.

BHO-080

Control of *Aethina tumida* (Coleoptera: Nitidulidae) using in-hive traps

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The small hive beetle (SHB), Aethina tumida Murray (Coleoptera: Nitidulidae), is a non-native pest of honey bees (*Apis mellifera* Linnaeus (Hymenoptera: Apidae)) newly introduced to Canada. The effectiveness of three inhive traps was tested in springtime in West-Montérégie (southern Québec, Canada) and in late summer in Essex County (southern Ontario, Canada): AJ's Beetle EaterTM (AJ's Beetle Eater), Beetle BarnTM (Rossmann Apiaries), and HoodTM trap (Brushy Mountain Bee Farm). Traps were placed in the brood chamber of 12 colonies in West-Montérégie, and in 48 colonies in the top honey super in Essex County. In- hive traps were effective in reducing SHB populations without compromising the bee population or colony weight gain. In West-Montérégie, the Beetle BarnTM was the most effective trap during the rst week, when SHB populations were high. It was less effective throughout the trial. There was no difference in efcacy between the various solutions used in the HoodTM trap (mineral oil versus mineral oil and apple cider vinegar).

Symposium: Hygienic Management III

BHO-047

Assessing risk factors associated with honey bee colony survival in Canada

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We undertook a large-scale experiment to determine what effect manipulation of management factors, specifically fall treatment for Nosema spp. with fumagillin and provision of supplemental nutrition, had on honey bee (Api s mellifera L.) colony productivity, pathogen levels and survival. The experiment was conducted under three diverse honey bee management paradigms in Canada, those being honey production in Northern Alberta, hybrid canola seed pollination in Southern Alberta, and lowbush blueberry pollination in Prince Edward Island. At each location, three apiaries of 40 colonies were used, for a total of 360 in the experiment. Colonies were intensively sampled at four time points per season to assess adult bee and brood areas, as well as parasite and pathogen loads, including all major honey bee viruses. Pollen was also collected throughout the season to determine agricultural pesticide

exposure and honey production was quantified. Changes in these variables were analyzed to determine which was most greatly associated with Nosema spp. and nutrition treatments, as well as overall colony loss. Results appear to be highly specific to the management paradigm in which the bees were situated, especially blueberry pollination. Supplemental protein feeding had no general effect on colony productivity measurements; increases were only detected during specific time points in regions where forage sources may be limiting. Increased incidence of clinical disease symptoms were associated with significant decreases in honey production and fall bee populations. Treatment with fumagillin increased colony survival whereas increased protein supplementation did not.

BHO-048

Do nanotechnology based formulations increase pesticide exposure to honey bees?

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Nanotechnology based pesticides (NBPs) are formulated from existing active ingredients and other materials into nano or micro- sized particles. These particles exhibit properties which may alter environmental fate and transport of pesticide active ingredients. Honey bees are covered in hairs, which attract particles such as pollen via electrostatic reactions. This suggests that compared to active ingredients alone, particulate pesticide formulations may be incidentally collected by foragers and transported into the colony. This mode of exposure may contribute to the complex mixtures of pesticides invariable found in bees, pollen, beeswax, and other hive matrices. We have characterized particles in diverse insecticide, herbicide, and fungicide pesticide products, including those with active ingredients frequently observed in hive materials. Those investigated to date range in size from 50 nm to several microns, and vary greatly in shape, homogeneity, and apparent composition. We have found that some NBP particles can easily transfer to bees from environmental surfaces such as foliage. Other particles appear to adhere tightly to foliage, and may also stick to pollen which may be transported into the colony. Our studies show that some of these formulations extend residual toxicity, lengthening the period of exposure and risk to adult honey bees. We are currently investigating whether these particles increase persistence within hive matrices, which may increase pesticide exposure within the colony. We conclude that the properties of NBPs that exacerbate pesticide exposure to bees and accumulation in hive materials should be considered in their development and application.

BHO-029

Unsustainable beekeeping is main cause for the decline of populations of honey bees in Orzhytsky district, Poltava region, Ukraine: results of epidemiological analysis

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Severe declines in honey bee populations in Orzhitsky district of Poltava region, with dramatic losses of colonies in 2014-2015 associated with colony collapse disorder, have made it imperative to understand key factors

impacting honey bee health. Production landscapes of Orzhytsky district can be considered as agricultural areas of high nature value because they maintain significant natural biological diversity.But today these lands are subject to overexploitation of agricultural production practice cultivation of a small number of monocultures (wheat, corn, sunflower, buckwheat) with using of herbicides and pesticides. To identify the risk factors that affect the health of bees, it was conducted epidemiological analysis of bee colonies losses in Orzhytsa district. The following causes of colonies losses were investigated: -location of the apiary: in productive agricultural landscape or in natural area; -diet of bees: sucrose syrup or honey; -transportation apiary: nomadic or stationary apiary; -degree of honey picking from the hive during pitching honey: almost full picking of honey or only picking honey frames (not more than 1/3 of honey). We looked at the possible causes of bees losses as the risk's factors associated with unsustainable beekeeping and compared them with opposing sustainable beekeeping approaches wich all together we call as 'a model of the apiary of humane treatment with the bees'. Our goal was to perform a broad unbiased survey for the effects of unsustainable beekeeping on the survival honey bee colonies. Our main result that feeding bees with sucrose syrop is the main risks factor for declines in honey bee populations.

BHO-022

Different hygienic performance of European honeybee (Apis mellifera L.) and Asian honeybee (Apis cerana Fabr.)

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The current health status of the European honeybee (*Apis mellifera*) is causing great concern worldwide, while its Asian counterpart (*A. cerana*) does not create such distress, suggesting a better health status. In these honeybee species, hygienic behavior is deemed to be an important mechanism that contributes to colony resistance against parasites and pathogens. However, little is yet known about the differences between the hygienic abilities of *A. mellifera* and *A. cerana*. The aim of this study was to compare for the first time hygienic behavior of these two honey bee species. For this, we used the freeze-killed brood (FKB) method in unselected colonies kept at a same location. We also compared FKB removal in observation hives to be able to have a higher time resolution. The removal rate of dead brood due to hygienic behavior in A. cerana colonies was significantly higher than in *A. mellifera* during the first 2 days (P < 0.05). In contrast, there was no difference between the species in observation hives (P > 0.05). Our results demonstrate that the hygienic ability of *A. cerana* in full sized colonies is higher than that of A. mellifera, but also show that colony size or the type of hives used to measure hygienic behavior may have an impact on the outcome of such observations. This information is conducive to study on the breeding of honey bee based on hygienic behavior and suggests that a weak hygienic behavior could be linked to the poorer health status of *A. mellifera*.

BHO-032

Super DFM - honey bee increases winter hive survival and reduces disease.

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¹ Strong Microbials Inc, USA ² Essential Honey Bees LLC

Commensal bacteria promote honeybee health and play an important role in inhibiting honeybee pathogens. Most commensal honeybee microorganisms, including Lactobacillus, are sensitive to antibiotics. We investigated diet supplementation with direct- fed microbial product containing Lactobacillus (LAB), SuperDFM-HoneyBee. We hypothesized that such supplementation combined with integrated pest management (IPM) strategies will result in significant increase in Lactobacillus population in honeybee gut and improve health. We compared untreated hives and hives supplemented with DFM and found 20-fold increase in Lactobacillus population in honeybees from supplemented hives compared to the control (p=0.043). Moreover, we found that DFM-supplemented hives had better 2014-2015 winter survival rate (79%) than control hives (60%). The study was extended to 10 U.S. states. Data on Nosema, Varroa, and colony health were collected. We demonstrate that diet supplementation can increa se LAB abundance in the bee gut. Our data support the hypothesis that increased LAB abundance positively impact honeybee health and survival.

BHO-089

Application of new type bee counter for monitoring the homing rate of microsporidian, *Nosema ceranae*, infected honeybee colonies

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Nosema ceranae has been considered as one of the key factors caused honeybee colony collapse disorder (CCD) in 2006. To better understand the negative effect of nosemosis on honeybee, we investigated the honeybee homing rate by using a new type bee counter after N. ceranae infection. The bee counter, which was developed by National Taiwan University, could keep recording honeybees departing and homing for 24hr. Four honeybee colonies were conducted to this experiment; Two colonies were fed with sugar syrup with N. ceranae spores (6×108 spores/mL, total= 500 mL) and the other two were fed with sugar syrup with fumagillin (3 g/500 mL); the homing rate of these experimental colonies were detected by using the bee counter for two weeks (one day per week). The result revealed that the homing rate of infected colonies showed a significant decrease (p< 0.05) compared to the control colonies (fumagillin treatment); otherwise, the fumagillin treatment colonies, the homing rate was up to 92%. This new equipment and experimental test provided a new insight for studying the interaction between honeybee and its pathogens more precisely in the natural conditions.

Symposium: Pesticides I

BHO-088

Neonicotinoids & Bees: A review of recent regulatory decisions & published literature

Peter Campbell

Syngenta, United Kingdom

Bee health may be affected by a number of different factors, for example the spread of parasites and pathogens, reduction in available forage, beekeeping management practices and weather. There has also been a focus on neonicotinoid insecticides as a potential contributing factor to declining bee health including resultant regulatory reviews in several jurisdictions. This presentation reviews key published studies on neonicotinoids and bees, and concludes that the laboratory conditions under which they have been carried out do not reflect realistic conditions in the field. Resultant regulatory restrictions may therefore be hazard rather than risk based. Recent honeybee monitoring data from Europe have shown that honeybee colony losses have been at an all-time low between 2013 and 2014, before the neonicotinoid restrictions came into effect. In addition, new Syngenta field studies establish that the risk to both honeybees and bumble bees from neonicotinoids is low. This suggests that neonicotinoids are not a main driver of bee health. Post restriction, European farmers in several countries have reported significant crop losses from infestation that would normally have been managed through the application of neonicotinoids. Syngenta's Operation Pollinator has shown that be health in the agricultural landscape can be improve through providing essential habitat and forage, and Syngenta is committed to working with farmers to improve pollinator habitats.

BHO-042

Field assessment of impacts of different neonicotinoids on honey bee queens and drones

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Hellenic Agricultural Org. 'DEMETER, Greece

Neonicotinoids have been among the most frequently used insecticides in the cultivation of several crops and orchards. Till 2012, imidacloprid represented 41.5% of the whole neonicotinoid market and thiamethoxam was the second biggest neonicotinoid, followed by clothianidin. However, almost two years ago, a decision was made by the EC parliament to ban the use of these three compounds for two years and this will soon be re-addressed. Our aim was to determine the effect of particular neonics on: the life span of queens, effects on egg laying or brood development, sperm viability and overwintering ability when particular neonicotinoids were fed to the colonies in low and very high sub-lethal field realistic doses (e.g. 5ppb and 200 ppb respectively for imidacloprid; 20 ppb, 200 ppb and 400 ppb respectively for clothianidin); a control group was also evaluated. Additionally we looked at the colony population dynamics. The experiment was set up in different countries using the local honeybee populations and it was run during spring –summer 2013 and 2014. The first comprehensive results are presented: they show a detrimental effect of the high doses of the neonicotinoids used, while the effects of the low doses were variable and dependent on the application dose, the year and the feeding quantity of the contaminated food. Further work is needed to be done on the same direction. This research work has been undertaken by members of COLOSS honey bee research association. All authors' names, apart from the representing author, are in alphabetical order.

BHO-056

Background concentrations of imidacloprid cause degradation of drone sperm in field studies

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Background concentrations of Imidacloprid in nectar and pollen contain from 1.5 to 10 ppb. It is proved that exposure to sublethal doses of Imidacloprid disturbs systems of individual immune and increases the susceptibility of bees to diseases. Earlier in laboratory studies, we showed that the chronic effect of Imidacloprid in 2 and 5 ppb concentrations reduces the lifespan of worker bees and causes the activation of their protective systems. However, many lethal and sublethal effects of neonicotinoids on bees have been described in laboratory studies, no effects were observed in field studies. Previously J. Pettis (2013) showed that one of the most vulnerable targets of neonicotinoids can be sperm in a spermatheca of Queen. This idea gt a sequel in our work. Our apiary experiment showed that a single exposure to Imidacloprid in June at concentrations of 5 ppb had no visible effect on colonies. However, the sperm of all the drones in the experiment proved to be unsuitable for fertilization of Queens, whereas in control, we observed exceptionally normal drones. The drone sperm was more liquid in the experiment that the sperm in control, spermatozoa were ring-spun (sign of toxicity), most of the spermatozoa deposited on the walls of the seed tube. Thus, the quality of drone sperm can serve as an important indicator of a colony condition and is one of factors of the colony losses at background levels Imidacloprid.

BHO-043

Acute oral toxicity of neonicotinoid insecticides on honey bees with different body sizes from different geographic distribution

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Honey bees are important pollinators in agriculture and natural ecosystem as well. Honey bees are exposed to various contaminations such as pesticides. We tested the susceptibility of neonicotinoid and carbamate pesticides to different sized honey bees, *Apis florea, A. cerena, A. mellifera, and A. dorsata* from two different geographic area of northern Thailand and South Korea. Formulated products of pesticides were serially diluted and subjected for oral toxicity test. Three neonicotinoids of Thiamethoxam, Imidacloprid, and Clothianidin and one Carbamate of Carbaryl showed higher LC50 values for larger honey bee species. Among A. mellifera from different localities, Korean population showed higher LC50 values for 4 pesticides over Thailand population. Also there were significant differences between test results in 2010 and in 2015, indicating that there might be complex interaction of differential exposures of those chemicals in agricultural fields and honey bees. Notable difference was found that A. florea was less susceptible to three neonicotinoid pesticides when accounting the body size.

BHO-041

Risk assessment of pesticides on bees – state of the art

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For many years, European and Mediterranean Plant Protection Organisation (EPPO) guidelines have been an international reference for honey bee toxicity evaluation and pesticide risk assessment. However, the risk assessment of pesticides on bees (incl. bumble and solitary bees) has been subject of extensive evolution in the recent years mainly in Europe and north America. In 2013 the European Food Safety Authority (EFSA) proposed a Guidance Document (GD) for this purpose with a number of recommendations and instructions for risk assessment, including methodologies for exposure and toxic effects evaluation (e.g. chronic toxicity testing in laboratory conditions, semi-field and field studies). This document goes beyond the EPPO recommendations and is proposed to be the guidance in the case no validated or standardised methodologies are available. The EFSA work triggered a feverish race towards the validation and standardisation of toxicological methodologies at the highest relevant entity, the OECD. Currently a number of methodologies are under ring-testing, namely the evaluation of chronic toxicity on honeybee adults and larvae, and the methodology for homing flight. Other extraofficial organisations, i.e. ICPPR, launched a ring-test for the standardisation of methodologies for toxicity testing on non-Apis bees. The COLOSS task force Apitox was recently created. Other tests like field trials remain neither validated nor standardised. The development of the dossier so far deserves a thorough analysis in regards its completeness, relevance, efficacy in identifying potential threats and independence. The objective in the long run is to prove the compatibility of pesticide use with pollinators survival and well-being.

BHO-020

Screening of natural herbs against *Nosema ceranae* in honeybees (*Apis mellifera* L.)

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Nosema ceranae, a microsporidia parasite recently transferred from *Apis cerana* to *A. mellifera*, has been suspected as one of the major culprits of the worldwide honeybee colony losses. Fumagilin-B is the only drug that is effective against Nosema disease in honeybees. To find alternative treatments, we screened 11 kinds of herb extractions on the effectivity against proliferation of N. ceranae spores and the toxicity to bees in lab conditions. Extractions of Andrographis paniculata, Vitis labruscana and Cortex Phellodendri significantly decreased N. ceranae spore productions at 7 dpi and 13 dpi without causing significantly higher mortality in bees under concentration of 1%. Further investigations revealed that the effects of these herb extractions were dosage-dependent. Our results indicate that these herb extractions are promising candidates in controlling Nosema disease in honeybees.

Are Varroa destructor mites resistant to acaricides in India?

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Apis mellifera was responsible for yellow-revolution in India. From 2004, it was ravaged by Korean haplotype of Varroa destructor resulting in usage of a barrage of chemicals for its control it in manners and doses not congruent with recommended conventions. World over, Varroa resistance to acaricides has become a major problem. *Investigations* on such crucial aspects lacked in India and Indian scenario could be more pathetic in absence of any regulatory mechanisms. It was therefore, decided to find out the base level of mite resistance in Indian conditions to fluvalinate and flumethrin. Apiary located in Hisar, Haryana, India with 42 colonies was selected for the study. Initially, to gauge the presence or absence of resistance Pettis test (Pettis et al., 1998) was conducted in 10 randomly selected colonies at monthly intervals from April, 2013 to March, 2014 using fluvalinate. Per cent efficacy of fluvalinate was found to be above 50 (69.2 to 98.0 %) throughout the experimental period which indicated likely absence of resistance. This was followed by a detailed laboratory bioassay (Milani, 1995). LC50 values of 14.701 PPM for fluvalinate and 0.460 PPM for flumethrin were obtained by probit analysis considering the natural mortality. This is the first such report from India and though the present values are congruent with those obtained for susceptible mite populations in the rest of the world, lowest efficacy of 69.2 % obtained in the field assay suggests the need for a constant vigil and preparedness in the future.

Symposium: Pesticides II

BHO-028

Neonicotinoids and bees: The worldwide integrated assessment of these insecticides reveals major impacts on pollinators and also on biodiversity

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High losses (e.g. 42% in USA) of honey bee colonies occur in countries where agriculture is intensive. There is no doubt that neonicotinoids which represent one third of the global insecticide market, constitute a major anthropogenic cause to bee disorders for both honey bees and wild bees such as bumblebees (DOI: 10.1016/j.cosust.2013.05.007, DOI: 10.1126/science.1259159, DOI: 10.1126/science.1255957, DOI: 10.1038/521S57a). Bee disorders are accompanied by a general collapse of entomofauna. A Worldwide Integrated Assessment on systemic pesticides was carried out to explore the role of neonicotinoids (DOI: 10.1007/s11356-014-3470-y). The environmental fate and exposures via these compartments (DOI: 10.1007/s11356-014-3332-7) have been linked to large effects on non target invertebrates (aquatic, terrestrial, including bees, DOI: 10.1007/s11356-014-3471-x), and on vertebrates such as fishes and birds, to a lesser extent (DOI: 10.1007/s11356-014-3180-5). Some uses of three neonicotinoids have been restricted (Italy: 2009, Europe 2013), but because they also threaten agricultural productivity through impacts on ecosystem functioning and

services (DOI: 10.1007/s11356-014-3277-x), our conclusions support further restrictions of their prophylactic uses in favor of integrated pest managements (IPM) practices or organic farming, which minimize pesticide use (DOI: 10.1007/s11356-014-3628-7, DOI: 10.1007/s11356-014-3229-5).

BHO-038

Neonicotinoid pesticides severely affect honey bee (Apis mellifera) queens

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In monogynous species of eusocial hymenoptera such as the honey bee, *Apis mellifera*, queen fate is a key element of colony survival and productivity. In both Europe and North America poor queen health appears to be a major driver of honey bee colony mortality; however, most studies investigating colony health have so far concentrated on workers. Here we exposed developing queens to sub-lethal field-realistic doses of the neonicotinoid pesticides thiamethoxam and clothiandin, and recorded multiple anatomical, physiological, and behavioural measures in the laboratory and field over a four week post-emergence period whereby queens were maintained in mating nucleus colonies (N = 30 & 28 for treatments and controls, respectively). The data show that the neonicotinoids had no significant influence on queen lifespan, emergence weight, spermathecal sperm viability, or number of flights, whereas they significantly affected queen success (i.e. production of worker brood progeny), spermathecal sperm count, ovariole number, and queen mating frequency. These results demonstrate that sub-lethal exposure to environmentally-relevant concentrations of neonicotinoid pesticides can have a profound effect on honey bee queens, and may at least partially help to explain the recent phenomenon of reduced queen health experienced by many beekeepers internationally.

BHO-019

Toxicity to honey bees *Apis mellifera adansonii* of some insecticides used in cotton production in Benin

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Protection and preservation of the bees are a pledge in a sustainable and environment-friendly agriculture. The economic contribution of the insect's pollinators specially, the bees to world agriculture is estimated at billions of dollars. However, non-judicious choice of pesticides and the absence of good plant protection practices, represent a real danger to bees. The objective of this study was to assess the toxicity of three insecticides commonly used

in cotton protection on bees Apis mellifera adansonii in Benin. In this context, bees were taken from the hives and transported to the laboratory. Active ingredients and different doses used, were as followed : Emamectin benzoate, betacyfluthrine + imidacloprid, and lamdex + chlorpyrifos, at the doses of : 2150 nanograms/bee ; 125 nanograms/bee; 75 ng/b; 50 ng/b; 25 ng/b; 12,5 103ng/b; 6 ng/b; 2,5 ng/b; 1,25 ng/b à 0,96 ng/b, depending on the active ingredient. Each treatment included three repetitions consisting of 25 bees. Bees were anaesthetized with ether before treatment. Each bee received by topical application on the pronotum, one microliter (01µl) of the tested formulation. Observations were made after two hours, 10 hours, 24 hours and 48 hours. The results showed that, even the lowest doses of the insecticides : 0.96 ng/b; 7,25 ng/b et 21,5 ng/b showed mortality higher than 90% to bees, 48 hours after the application. The results of the study indicated the urgent need of good plant protection practices in the frame of sustainable agriculture and bees' preservation and conservation.

BHO-013

French beekeepers against systemic insecticides: a 20years fight

Henri Clement

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In 1995, France produced 33,000 tonnes of honey and the honeybee annual mortality rate was around 5-10%. 20 years later, in 2015, the honey production was divided by three and the mortality rate is of 30%. Between these two dates, the neonicotinoids appeared in the French fields. From the beginning, producers of these new insecticides contradicted their effects on bees, despite increasingly sophisticated scientific studies demonstrating it. The scientific battle was starting. The government also acted with a high inertia, refusing to implement European regulations and being reluctant to give public information to beekeepers. Thus, French beekeepers decided to resolutely involve themselves in a fight at the media and legal scope. In several years, the legal battle has achieved many victories in the civil and administrative courts. All this was widely publicized and has led to the withdrawal from the market of the Gaucho on sunflower and corn (Imidacloprid) and of the Regent (Fipronil). More recently, this fight enabled in 2013 the French withdrawal of Cruiser (thiamethoxam) on rapeseed. Right after, the French Minister of Agriculture has been an "engine" for initiating at the European level a procedure to reassess the impact on bees of three active substances from the neonicotinoids family. Thanks to this and to the work of all European beekeepers, this lead to the 2 years European partial ban of three neonicotinoïdes. Today, the struggle continues in France against these products that are still used on million hectares.

BHO-037

Lethal and sub-lethal time-lag effects of neonicotinoids and Varroa destructor on western honey bees *Apis mellifera*

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Agro-chemicals and the mite Varroa destructor can have drastic effects on honey bees *Apis mellifera*; however, combined effects of both have so far been unexplored. Here, we evaluated possible sub-lethal (teneral body mass) and lethal (longevity) time-lag effects of two neonicotinoid pesticides (thiamethoxam and clothianadin) and V. destructor on individual workers alone and in combination. Queenright colonies of similar strength (N=20) were randomly allocated and exposed to one of two treatments (1. Both neonicotinoid pesticides or 2. No neonicotinoid pesticides) for 8 weeks in late Spring 2014 that represented environmentally relevant exposures. One (Summer 2014) and 16 (Fall 2014) weeks post treatment exposure, emerging workers from all colonies were individually screened for mite infestations and transferred to cages (N=3 cages per colony; 10 workers per cage) according to treatment group. In Summer 2014, longevity was reduced by V. destructor treatment. However, summer body mass of combined pesticides and V. destructor exposed bees was lower compared to all other treatments. Pesticide treatments alone had no significant influence when compared to the controls. In contrast, Fall 2014 bees exposed to both pesticides and V. destructor showed reduced longevity when compared to all other treatments from summer and fall. Our data suggest previously overlooked time-lag effects of combined neonicotinoid pesticide and V. destructor showed reduced longevity when compared to all other treatments from summer and fall. Our data suggest previously overlooked time-lag effects of combined neonicotinoid pesticide and V. destructor showed reduced longevity when compared to all other treatments from summer and fall. Our data suggest previously overlooked time-lag effects of combined neonicotinoid pesticide and V. destructor exposure.

A Risk assessment scheme to assess potential side effect of pesticide to honeybees

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Honeybees are an important part of agricultural ecosystems. Due to the colony losses reported in some regions, there is a discussion about factors potentially affecting bee health, including pesticides. Regulatory authorities are pondering the best ways to evaluate the safety of pesticides to bees. From the perspective of industry, risk assessment systems should be as globally consistent as possible. Moreover, they need to be scientifically robust, yet pragmatic and easily applicable. To provide support to regulators in this context, CropLife has developed a risk assessment scheme for bees which fulfills the above criteria, which we put forward to regulators. This system is based on the principles of the EPPO 170 Approach which has been successfully used in Europe. It is a tiered, hierarchical system which is relies on internationally validated study types. Protection goal of the scheme is the health and productivity of the bee colony. Foliar and soil-systemic uses are considered separately. The first-tier risk assessment is based on the Hazard Quotient Approach for foliar uses, one of the few empirically validated approaches in ecotoxicology; for soil-systemic uses, a TER system is applied. Higher-tier assessment is based on semi-field and field studies. These provide direct evidence in cases where the lower-tier assessment did not yield conclusive results, and include the option to consider local exposure scenarios in specific cases, e.g. in particular crops. Risk mitigation measures can be incorporated throughout the tiered risk assessment.

BHO-061

Molecular detection of honeybee disease in *Apis mellifera* and *Apis cerana* in Korean apiaries, the first half 2015

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The honeybee is a major pollinator of crops. The main species present in Korea are the European honeybee, A. mellifera, and the Asian honeybee A. cerana. The occurrence and distribution of twelve bee diseases was investigated in A.mellifera and A.cerana in Korea using PCR diagnostic method: american foulbrood (AFB), european foulbrood (EFB), chalkbrood, stonebrood, nosema, sacbrood virus (SBV), acute bee paralysis virus (ABPV), deformed wing virus (DWV), black queen cell virus (BQCV), kashmir bee virus (KBV), chronic bee paralysis virus (CBPV) and Israeli acute paralysis virus (IAPV). Samples were collected from 129 apiaries located in 10 different regions of the country in the first half 2015. BQCV was the most prevalent (identified in 85.27% of samp les), follo we d b y sto nebr ood (68. 99 %), sacbro od (62.79 %), No sema(31. 78%), DW V(30. 23 %), I AP V(17. 83%), chalkbrood(16.23%), EFB(12.40%), KBV(9.30%), AFB(7.75%) in honey bee samples(adult bee, larvae and comb), respectively. This results show that the rate of detection than previous year have gone up.

BHO-069

Prevalence and incidence of viruses in honey bee (Apis cerana cerana) in China

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In recently, there are increasing reports about the large loss or death of bee colonies in many areas in China. Especially in this spring suddenly loss or death in a great of colonies broken out. Samples of adult honey bees and larvae for seemingly healthy and shown disease syndrome from 73 apiaries of 10 provinces were tested. 9 honey bee viruses, 5 other insect viruses like red fire ant virus and 4 plants viruses were measured in the samples. All honey bee viruses were detected by PCR in bee samples, but the frequencies significantly different. The BQCV was detected in 27 apiaries, CSBV in 13 apiaries, CBPV in 10 apiaries, a DNA virus in 20 apiaries, SBV in 3 apiaries, IAPV in 1 apiary, and DWV in 6 apiaries. The most samples detected were infected with one or more viruses in bees, virus distribution is also varied in different geographical areas. Results from field surveys of these viruses indicate that mixed infections in honey bee probably arise. The prevalence of honey bee viruses has been implicated in recent honey bee colonies loss.

Current situation and development trends of risk assessment for bee pests and disease

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Abstract: In view of importance for bee industry health and sustainable development to carry out the bee pest risk assessment, this paper put forward the classification and fields of current risk assessment for bee health; meanwhile, introduce the main and operational methods, technologies and application for assessing the risk to bee, which are including using META method to evaluate pest & disease of bee, climate similarity principle to evaluate the effects of mites in Chinese bee, the risk index system to evaluate Saclike larva disease to West bee, scene modeling methods to evaluate the halkbrood disease, and cloud computing to assess the bee pest risk estimation; finally, raise the main bottleneck and the future development direction of bee pests risk assessment in China.

BHO-036

New biological threats to Uganda's beekeeping sector

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Globally, honeybees provide vital pollination services and direct incomes to beekeepers. Annual estimates of the value of world earnings from honeybees are over 180 billion US dollars. This clearly shows the importance of honeybees and point to the need to protect them. Currently, honeybees are threatened by human-mediated factors like pests, diseases and pesticides. These factors interact synergistically to cause honeybee colony losses, with their impacts varying depending on honeybee race and other stressing factors. Honeybee colony collapses have been reported in North America and Europe. We investigated biological threats to the beekeeping sector in Uganda by collecting honeybees and brood samples from two agro-ecological zones between December 2014 and February 2015. These samples were screened for varroa mites, Paenibacillus larvae, Melissococcus plutonius, Nosema and ten common honeybee viruses. Preliminary findings show new threats to the beekeeping industry in Uganda. First, the study re-confirmed the presence of varroa mites in the Eastern and Western highland agroecological zones of Uganda at prevalence rates close to 50%. In addition, we confirmed Paenibacillus larvae the causative agent for AFB in one apiary in the Western agro-ecological zone. Furthermore, presence of the microsporidian Nosema, and virus BQCV were also confirmed. Finally, four honeybee viruses new to Uganda were identified. The findings of this study point new threats to the health of honeybees in Uganda and highlight the need for a honeybee pest and disease surveillance system to be developed to monitor the health of honeybees for informed decision making.

Colony collapse incidents in Africanized honey bees in Brazil

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Beekeepers in southern Brazil have reported numerous incidents of honey bee colony collapse in recent years. One of the most prevalent syndromes in dry scrub forest regions (Cerrado) was named Brazilian Sacbrood-like Disease. It is due to toxic pollen from Stryphnodendron spp., with large-scale losses of up to 70-100% of colonies in apiaries since the 1980s. Other incidents of large-scale colony collapses and losses have been observed since 2004 in northeastern São Paulo state, an agricultural region rich in sugar cane, coffee, citrus, and eucalyptus plantings. These have been associated with pesticide applications, including fipronil and various neonicotinoids. In Santa Catarina state, approximately a third of the colonies (over 100,000) rapidly dwindled and were lost within a three month period in 2011, including many in non-agricultural areas, with no apparent cause. In close observations of a research apiary in São Paulo state, we documented colony collapse (like-CCD) in four colonies within a few days, with abnormal absconding of the bees, without any apparent cause. In this region, infestation with Varroa destructor on adult bees averages less than 5%, without treatment. Various viruses were identified in the bees, including IAPV. In most incidents, we found relatively low numbers of Nosema ceranae spores; but in one experimental apiary, bees collected from five collapsing colonies had a mean of more than 20 million spores. Other collapses causing serious colony losses have been attributed to a new disease affecting pupae, which we are calling Brown Bee Brood Disease, reflecting the main symptoms.

BHO-040

Build the buzz (the value of "big data")

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The status and dynamics of a honey bee colony are a powerful indicator of its relation to the physical and biological environment. A consensus of opinion exists within the scientific community that more field data is required to help understand the continuing decline in bee health. It is almost certain that current problems are caused by multiple parameters including pests and diseases, changes in land use, loss of habitat and climate change. Further, the responses of individual colonies to exogenous and endogenous factors are often variable. Studies focusing on single parameters, while informative, do not offer a complete picture. A response to this lies in continuous aggregation of field data over wide geographical area. "Big data" helps buffer variance and allows geographical trending of bee health with factors like plant protection products, pests, pathogens, in hive treatments, beekeeping practice etc.

Honey bees are remarkable sentinels of the environment, a single colony can thoroughly sample areas of up to 10km2, which has enabled scientists to track climate change and pollution using honey bee data. Therefore, the

"big data" can be utilised for environmental studies and its application is likely to evolve with use over time. A number of governments have organised portals for bee data. However, the main obstacle remains wide uptake by beekeepers who have little incentive to participate. Not only does Arnia's hive monitoring system offer a powerful tool for multi parameter data collection, it is also a useful beekeeping tool thus helping to recruit and maintain beekeepers involvement.

BHO-006

Evaluation of stingless bee propolis for the control of Nosemosis in dwarf honeybee, *Apis florea*

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The potential of natural product, propolis of stingless bee, Trigona apicalis was evaluated for the control of Nosema disease in Nosema ceranae infected bees, *Apis florea*. Newly emerge of Nosema free bees were individually inoculated with 2 l of 50% (W:V) sucrose solution containing 80,000 N. ceranae spores per bee and then fed them with 50% and 70% propolis extract compared to those of controls. The finding showed that all propolis treated bees had significantly higher survival rate than untreated bees (F5= 16.60, P< 0.0019). The significant reduction of infection ratio were found in propolis treated bees (F5=66.69, P<0.0001. The levels of trehalose in haemolymph and protease activity had significantly lower in propolis treated bees (F5=156.95., P<0.0001; F5=3.58., P<0.0326; F5= 4.97., P<0.0107), while protein contents of hypopharyngeal glands was significant higher compared to those of control. The results show that propolis treatments significantly reduced bee mortality, and also show concentration dependence. This result suggests that probably the chemical composition in propolis might have direct toxic to N. ceranae spores.

BHO-002

The role of vitellogenin gene expression level in Apis mellifera mellifera L. longevity

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Negative consequences of honeybee colonies increased mortality due to various reasons was unable to stabilize. The biological problem of the worker bee lifespan regulation also waits decision. The subspecies dark forest bee (*Apis mellifera mellifera* L.) which is the most adapted to the long wintering and other extreme environmental conditions is very promising for the solution of this problem. During the research in 2014, we analyzed the gene expression of vitellogenin in the winter generation of worker bees during three seasons of their life (autumnwinter-spring). The total RNA was isolated from the fat body from 5-10 daily worker bee imagoes that had been grown in the colonies in the queen presence and performed the beehive work according to their age.We established that the expression level of this gene in early winter in the winter generation of hive worker bees remains at the

expression level in the summer generation. Further it considerably increases by the end of wintering and correlates with high antioxidant enzyme activity. In a series of experiments using a laboratory model of a short temperature stress it has been shown indicated that oxidative stress caused by high temperature accompanied by an increased vitellogenin gene expression level. The appearance of oxidative stress had been confirming by the activation of antioxidant enzymes in worker bees during the whole winter period. The results indicate a significant antioxidant role of vitellogenin, as one of the mechanisms of honey bee lifespan regulation.

Symposium: Surveillance & Epidemiology II

BHO-027

Unexplained honeybee colony disorders: new research questions coming from field experience

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Honeybee colony losses and disorders have increased recently in Belgium. Some of the symptoms observed are unspecific and their causes remain still unknown. A field study was performed in 2011-2012 to determine the link between both pesticide exposure and virus load and unexplained honeybee colony disorders during/just after the winter. This field study showed that : (1) the main problems observed were linked to brood and queens; (2) BQCV, SBV and DWV were widely present, without a significant difference between healthy and colonies with disorders; (3) multiple pesticide residues were detected in the matrices and a significant relationship was only found between the presence of fungicide residues and colony disorders; (4) the analysis of the landscape composition around the apiary showed a significant positive relationship and a negative one between the presence of disorders and the surface of crops and that of grassland, respectively. Supplementary information can be provided by palynological and multiresidue analyses carried out on pollen pellet samples collected from July to October. During this time, 34 different botanical sources were collected and 62% of the samples were contaminated with at least one pesticide. Again, fungicide residues were the most frequently found substances together with one insecticide and specific correlations pollen-pesticide were described. The presence of pesticides that late in the season (October) raises questions about the origin of these contaminations. Although fungicides were studied predominantly through laboratory approaches on honeybee adult and larvae, we are far from understanding the impact of fungicides at colony level.

BHO-012

Bees and climate change

Henri Clement

National Union of French Beekeeping (UNAF), France

From November 30th to December 11th 2015, Paris will host the 21th United Nations conference on climate change. This is an opportunity for French Beekeepers to provide an overview of the impacts of this global phenomenon on bees and beekeeping. As flowering plants, the bee appeared on Earth for almost 80 million years. Thus, the bee survived the multiple planet climate changes and in particular the successive periods of glaciation. But the disturbances observed for about 50 years, accentuated in recent years, contribute to weaken this emblematic insect. They generate a considerable impact on the vitality of colonies as the production of honey and superimpose on the multiple aggressions which affect bees: pesticides, reductions of melliferous resources, diseases, mites, hornets. We will present the key elements of the links between climate change and bees and beekeeping: - Lower nectar resources. - Earlier and more ephemeral flowering. - Impact on the vitality of colonies. - Forest fires and floods. - Southern Europe and Northern Europe, climate paradox

BHO-014

Application of the electronic device "BEE ALERT" for registering death of honey bees, stingless bees in general and disappearance of honey bees (CCD) in Brazil.

Lionel Segui Goncalves, Dayson Castilhos

UFERSA

Beekeeping in Brazil has experienced in the last five years, a difficult period due to the decline of bee colonies, especially the indiscriminate use of highly toxic pesticides. Brazil is one of the largest pesticide applicators in agriculture. Deaths of *Apis mellifera*, stingless bees and CCD phenomenon is the main topic currently discussed between beekeepers. Among the leading causes of deaths of the bees are Varroa destructor mites, Nosema ceranae fungus, climate change, deforestation and pesticides, especially neonicotinoids. Many scientists point to a synergistic action of these factors in the decline of bee populations. Damage caused to the bees, to the environment and to beekeepers are notorious, mainly due to pesticides. In Brazil, the high frequency of bee deaths gave rise to the Bees Protection Campaign (BEE OR NOT TO BE) and the development of the BEE ALERT, an electronic device (www.semabelhasemalimento.com.br/beealert), which allows all beekeepers and researchers identify on a world map, on line, any occurrence of death or disappearance of *Apis mellifera* bees, stingless bees and bees in general. After 14 months of data the BEE ALERT device registred in Brazil losses of more than 15,000 bee colonies (13,000 colonies of *Apis mellifera* bees and 2,000 colonies of stingless bees) in 14 states (São Paulo state is responsible for 55% of the deaths).The number of lost colonies correspond to an alarming statistics of about 900 million bee deaths mainly due to pesticides, what reflects the current chaos that is today the Brazilian beekeeping and its questionable future.

BHO-034

Current status of honeybee diseases in Turkey

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Scientific reports and conversations with related researchers/beekeepers were used to determine the current status of all these diseases and pests in Turkey.

The major pests/diseases are Varroosis, foulbroods, Nosemosis, chalkbroods, viruses, wax moths and some other pests. Infestation of Varroosis caused by Varroa destructor is the major problem in Turkey. Some chemical and natural varroacides are currently used, but there are doubts to resistance of mites on some chemicals. The major bacterial diseases of honeybees affecting developing brood are the foulbroods: Common, European and American. All cause the death of infected brood but AFB is far more virulent and will ultimately result in colony death if uncontrolled. There are two forms of the microsporidian (fungus) Nosema associated with clinical signs of disease in honeybees: *Nosema apis* and *Nosema ceranae*. Especially N. ceranae is dominant on Turkish honeybees and it can collapse the colonies if they are not treated. Chalkbrood disease of broods caused by Ascosphaera species of fungus can sometime have problem and successful results can get if the poor conditions are changed. There are at least eight of viruses. Wax moths can seriously damage the stored combs if there are no physical, chemical or biological precautions. There are some other pests, birds and mammals in Turkey and informations about them will also be given. Parasites and diseases, particularly Varroa destructor had been reported frequently by beekeepers and bee scientists in Turkey.

BHO-087

Physico-chemical characteristics of honey from indigenous honey bee species from the island of Palawan, Southern Philippines

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Honey samples were obtained from three species of native bees, *Apis dorsata dorsata, Apis cerana* and *Apis andreniformis* from the island of Palawan during summer months in 2015. The parameters used in the analysis were moisture content, electrical conductivity, hmf, total reducing sugar, and apparent sucrose.

All parameters, except moisture content, conform to the standard set by Codex Alimentarius and European Honey Directive. Tropical wild honeys are usually high in moisture content due to the high humidity. Moreover, the nests of *Apis andreniformis* and *Apis dorsata dorsata* are exposed and tend to absorb the water vapor in the environment. One advantage of wild honey is the absence of residual sugar that is usually fed to the bees and contaminants from miticides that are applied to hived or domesticated colonies.

BHO-024

Identifying effectors of the honeybee immune response, through mass spectrometry, may represent a promising solution for bee health monitoring

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Reports forecast a pessimistic future for pollinators. Domestic bees have been subject to much research into a broad range of complex wellbeing issues, but this has failed to lead to the development of concrete solutions for beekeepers. Up to today, research and methodologies deployed against new challenges (such as use of pesticides, virus prevalence and other pathogens, climate and flora changes) have focused on evaluating and attempting to separately prevent and fight each factor. To date researches have focused on identifying and quantifying the presence of stress agents, instead of focusing on their impact on the colonies. The aim of the HematoBeeTest® project is to address these limitations by establishing robust, effective and sensitive technologies for profiling & deciphering bee immunity with regards to the host-pathogen interactions. The objective is to deliver practical applications for monitoring bee immunity for an integrated and adapted health management. The analyses of bee hemolymph by mass spectrometry (MS) resulted in visually different molecular profiles, in function of the bees' infectious conditions. These differences were confirmed by statistical comparison of MS profiles by PCA. Briefly, we demonstrated that virus-infected bees samples, with or without Varroa co-infection, ended up in a cluster of their own inside the overall Varroa cluster. This strongly supports the robustness of our monitoring approach in the case of co-infections, its potential as a plausible strategy to monitor honeybees' health, and a mean for a better understanding of the molecular immune response of this social insect, in the context of experimental/natural infections.

Appropriate linoleic acid supplemental level in larvae diet of *Apis mellifera lingustica*

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To study the appropriate linoleic acid levels in larvae dietetic supplementary of *Apis mellifera ligustica*, total of 1152 larvae were randomly assigned to 6 groups with 192 replicates in each treatment, added linoleic acid (0.02%, 0.04%, 0.06%, 0.08% and 0.1%, 0% as control) for 7 days. One-way ANOVA and Duncan t-test methods plugin SAS software 9.1v were used to evaluate treatment effects. 1) The 0.1% supplementary reduced the percentage of pupation (P<0.05). 2) The 0.04% supplementary significantly increased the total protein concentration of 5day-old larvae (P<0.05) , when the pupation occurred at 7-day-old, 0.1% supplementary significantly increased the pupae protein content (P<0.05) . 3) The 0.02% supplementary had significant suppressed effects on the activity of peroxisome proliferators-activated receptor (PPAR) (P<0.05), whereas 0.08% supplementary had stimulating effects on the activity of PAR and PPAR at 6-day-old. 4) The linoleic level at 0.04% and 0.08% improved the activity of fatty acid syntheses (FAS) of polypide at 6-day-old (P<0.05). Acetyl CoA carboxylase (ACC) protein content of polypide at 5-day-old was improved by 0.08% linoleic (P<0.05). and ACC protein content of polypide at 6-day-old (P<0.05). 5) Different level linoleic had no effect on the expression of FAS and ACC (P>0.05). According to the curve fitting results of the percentage of pupation and protein concentration, it is concluded that the appropriate linoleic additive level in A. m. ligustica worker larvae diet are 0.024% to 0.037%.





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Mission

Promote apicultural scientific, technical and economic development.

The role of bees as necessary pollinators for agricultural crops and natural flora.

The importance of plants as food sources, mainly for pollen and nectar, for bees.





Symposium: Pollination I

PBO-047

Drivers of pollinator health in the United States

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High levels of colony losses have been documented in the US over the last decade. While winter losses seem to be decreasing, summer losses have been increasing, with losses in summer exceeding winter losses for the first time in 2014-2015. A worrying trend considering summer traditionally is viewed as the "stress free" time for honey bees. Generally, the three major drivers of honey bee losses are thought to be Varroa mites, pesticides and poor nutrition. Here we will try evaluate the evidence for these drivers by presenting the results of 5 years of loss, management, and national honey bee disease surveys in the USA. While this talk will focus on honey bees, evidence for shifting populations of native bees in the US will also be considered, as will the factors that are most likely to drive these non-apis bee pollinators as well.

PBO-012

Flower resource utilization and seasonal growth of Japanese honeybee colonies in a SATOYAMA landscape in northern Japan.

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Like other honey bee species, Japanese honeybee (*Apis cerana japonica*) is thought to contribute to a number of important ecosystem services including pollination of wild and crop plants and honey production. In order to evaluate potential services provided by wild Japanese honey bee in a traditional rural landscape "Satoyama" qualitatively and quantitatively, we investigated floral resource utilization, and growth and honey accumulation in breeding colonies during April-September 2012 in a Satoyama landscape of Ichinoseki in Iwate Prefecture, northern Japan. Floral resource utilization by bees, which, in turn, suggests potential pollination for flowering plants, was studied by using two techniques: periodical route-census survey for bee visitation on flowers and analysis of pollen collected with a special type of pollen traps at the entrances of the colony nest. The colonies were periodically inspected for brood size area and honey storage area. Utilization of a total 61 foraging plant species is ascertained by either of two techniques. In April to May, corresponding to the major flowering season of forests, utilization of 33 tree species was identified only by the pollen analysis. During summer and autumn seasons, pollen of crop or herbaceous flowers of open habitats were mainly foraged. The inspected colonies steadily grew from June to September while halted the growth during July to August probably due to shortage of flower resources. Our results suggest that pollen analysis is more appropriate for evaluation of seasonal flower utilization by the bees, especially when the major foraging habitat is the canopy layer of forests.

Assessment of the floristic, nutritional and anti-nutritional composition of west-African honeybee "stored" pollen

Caroline Akachuku

Michael Okpara University of Agriculture Umudike, Nigeria

The study examined the floristic, nutritional and anti-nutritional composition of stored pollen pellets of *Apis mellifera adansonii* (West African Honeybee species) in rainforest and mangrove ecological zones of Nigeria. Stored pollen pellets extracted from honeycombs of randomly selected Kenya-top –bar hives within each of the ecological zones were analyzed in the laboratory using appropriate procedures. Variations occurred in weight within hive and between ecological zones with an average weight of 0.10g and 0.06g per hexagonal cell in rainforest and mangrove zones respectively. The result of the pollen count also showed that variation occurred in flora composition and frequency occurrence of each plant pollen. The rainforest zone recorded an average of 6 flora per pollen pellet and frequency of occurrence ranging from 1 to 2728. While mangrove zone recorded 5 at a frequency range of 1 to 2633. The common occurrence of some species such as Mimosa pudica, Citrus species, Elaeis guinensis in both zones indicates the flora richness of the two vegetation zones and species preference by honeybees. The stored pollen pellets were also found to be rich in nutrients such as protein (19.22 and 18.9%) carbohydrate (45.11 and 41.97%) in rainforest and mangrove zones respectively. The yalso contained macro and micro elements, vitamins and phytochemicals in various amounts. The identification of honeybee flora through pollen analysis could create awareness for their conservation. Pollen pellets also serve as good source of food supplements.

PBO-004

Pollination and Bee Flora

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Organisation pour la Promotion des Arts Apicole et Sylvicole (OPAAS), Togo

Flora ecosystem keeps his balance countless dependency relationships between its species. Also, the survival of each is she to seek with equal acuity. Now, such a perpetuation for living beings derives its efficiency from the regular recombination of genetic material disseminated in the subjects of different races and subspecies in the case of a species. And now in higher plants phanerogams this combination occurs most often on a large scale during the natural cross-pollination highly entomogamme especially Apidea. So the pollination efficiency of its species resulting stability of flora, a prerequisite for the conservation or regeneration of a large plant diversity guarantor itself does it report; regeneration of animal diversity because of the realities of the food chain. This is why the bees are to protect because when flowering of a species, usually grouped in one area, these small creatures roam many specimens in the space of a short time, dragging and interchanging pollen on very often ephemeral female organs nectar carrier. Observations show that honey is made of more or less grouped succession of flowering mass of various species and the honey take turns from one territory to another; beekeepers from all backgrounds should stick together and exchange their expertise to effectively contribute to the perpetuation of the pollination of plants for the survival of the global ecosystem.
The melliferous resourses of the Russia and a new criterion of the regions' melliferous value

Vladimir Kulakov

National Guild of Beekeepers, Moscow, Russia

The author proposes a model for evaluating potential honey reserves. We have calculated the potential reserves of honey from all melliferous lands and showed that in Russia 99% of potential honey reserves are produced by 26 types of melliferous lands: 13 natural and 13 cultivated. The potential honey reserves are: Linden tree–1994 thousand tonnes, Willow-703, Maple trees-68, Acacia White-24, Chestnut tree–2.4, Other shrublands-323, Felling, slash areas, sparse forests-2542, Underbrush and grass of coniferous forests-1660, Underbrush and grass of broadleaf forests-403, Marshlands-1530, Pastures-273, Meadows-168, Gullies–4.4, Sunflower-266, Alfalfa-195, Clover-185, Sainfoin-174, Other perennial grasses-529, Buckwheat-91, Colza-46, Mustard–8.7, Coriander–1.7, Melliferous plants among sowings of cereals-124, Fruit and berry–18, Set-aside lands-206, Melons–1.6. We have shown that melliferous resources of entomophilous plants in Russia allow to keep 26-30 millions bee colonies and annually produce 380-450 million kg of commercial honey. 2. Traditionally, the region's melliferous value is determined by the volume of potential honey reserves V=S*M, where S - area of melliferous land, M - honey productivity per unit of area. With the same honey reserves, the region with the higher melliferous productivity has greater value. We have proposed a new criterial coefficient K: K=S*M^3=V*M^2. The higher the value "K", the more valuable melliferous base of the region is. This coefficient allows to more objectively rank the regions by the melliferous value.

PBO-002

Role of honeybee (*Apis mellifera*) on the yield and yield contributing characteristics of rapeseed (mustard) variety BARI Sarisha-14

Rabiul Islam

Bangladesh Agricultural Research Institute, Bangladesh

The experiment was conducted in the field of Oilseed Research Centre, Bangladesh Agricultural Research Institute Joydebpur, Gazipur during rabi season 2013-14. This investigation consists of the experiment i.e. impact of honeybee (*Apis mellifera*) pollination on the yield and yield components of rapeseed Variety BARI Sarisha-14. In bee pollinated (BP) plants the number of siliqua per plant, number of seeds per siliqua, weight of 1000 seeds (g) and yield/ ha were 16.38%, 20.18.79%, 6.75% and 14.27% higher than naturally pollinated (NP) plants respectively. Without pollinators the number of siliqua per plant, number of seeds per siliqua, weight of 1000 seeds (g) and yield/ ha were 19.38%, 37.05%, 8.10% and 32.63% lower than naturally pollinated (NP) plants respectively. Bee pollination is most effective and cheaper device for seed production rapeseed and mustard.

Pollination of tomatoes by the stingless bee, *Tetragonula irridipenis*, Chikmagalore, India

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The pollination effectiveness of the stingless bee, Tetragonula irridipennis was undertaken in tomato plots at Chikmagalore, Karnataka India during 2013-15. The experiment was conducted in six greenhouses as well as in an open plot. The tomato (Solanum lycopersicum) plants were exposed to visits by T.irridipennis in four greenhouses, in another two greenhouses without bees (control) and an open field plot was exposed to pollinators an area where both stingless bee colonies and other insect pollinators are abundant. We have estimated the number of tomatoes produced in each of the experimental plots. Hundred tomatoes from each plot were weighed, their transversal and vertical circumference, were measured and the seeds were also counted. The data pertaining to number of fruits, size and seed sets were collected and analyzed. The results showed that, the mean transverse circumference was 16.90, 18.98 and 19.52 cm and weight was 83.83, 100.23 and 105.18 respectively. Further, the number of seeds of tomatoes were 77.75, 123.07 and 138.68 in control, open and greenhouse plots respectively. The results showed that, the stingless bee, T.irridipennis was significantly more efficient than control and other insects pollinating tomatoes.

PBO-008

Diversity and abundance of pollinating insects on cucumber and bittergourd flowers and their impact on quality and quantity of crop production

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Studies on diversity and abundance of pollinator fauna on cucumber and Bittergourd revealed that honeybees were the most predominant and comprised more than 74 per cent of and 69 per cent the total flower visiting insects. There abundance was in the order *Apis mellifera* > *A. cerana* > *A.dorsata* > *A. florea*. The other important insects visiting cucumber flower were *Xylocopa fenestrata*, *X. pubescens*, *Pithitus smaragdula*, *Halictus* spp, *Lasioglosium* spp., *Anthophora* spp. and *Andrena* spp. which collected nectar and pollen and constituted important pollinators of cucurbits. Observation on diurnal pattern of flower visiting insects revealed that in case of Cucumber, maximum population of A.mellifera was observed between 0900 – 1000h when relative humidity was 76 per cent, temperature 340c, nectar sugar concentration 34.5 per cent, solar radiation 36 mW/cm2 and light intensity 40 lx.

Another peak was observed in the evening between 1600 - 1700 h when the relative humidity was 68 per cent, temperature 36 0c, nectar sugar concentration 36 per cent, solar radiation 42mW/cm2 and light intensity 28 lx. A similar pattern was observed in Bittergourd also. Studies on seasonal pattern revealed that insect visitation increased during different weeks commencing from Ist week to 9th week and declined thereafter. The studies revealed that percentage fruit set was significantly higher (84.14%) in bee pollinated followed by hand (76%) and open pollination (74.76%). In case of treatments, where insecticides were used, all the treatments were superior over control.

PBO-027

Colony multiplication and management of stingless bees to provide crop pollination services

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Stingless bees have been studied as alternative pollinators of several crops in tropical and subtropical areas, such as tomato, strawberry, macadamia, coffee and assai berry. Although they are efficient pollinators of around 30 crops, management techniques and multiplication methods still require improvements to attend the demand of growers. In the last decade, we have studied several aspects of basic biology and management of the stingless bee Scaptotrigona depilis, which allowed us to start a colony production system in Brazil. A technique to produce large number of in vitro queens has been developed; queen mating has been successfully managed; an artificial diet for replacing nectar and pollen has been achieved; and incubation techniques have been improved to produce colonies under laboratory conditions. The production system still require improvements to increase productivity, but nowadays from 300 mother colonies, we are able to produce around 40 new colonies per month. We have also studied the management of this species at strawberry crops and developed techniques to transport and protect colonies from environment stress. These techniques are now being tested in other crops such as macadamia, lychee and coffee. We have also studied the toxicity of the main pesticides used at strawberry crops under laboratory conditions (LD50). We will start now semi-field experiments to know the sub-lethal effects of these chemicals. The advances achieved so far allow us to establish a production system of stingless bee colonies and also an instruction guide to offer colonies for pollination services to growers.

PBO-010

Differentiation of Omani acacia (Acacia tortilis) and white acacia (Robinia pseudoacacia) honeys using botanical and physicochemical analysis

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¹ Ministry of Education (formal) / Sultan Qaboos University (informal), Oman ² Sultan Qaboos University, Oman In the market, two types of Acacia honeys are available i.e. 'Acacia honey' produced from the nectar of Acacia sp. and 'white acacia' honey produced from Robinia pseudoacaia flowers. In fact Robinia honey is a false acacia honey and confuses the consumers because of the commercial name 'Acacia honey'. In Oman, bees produce true Acacia honey in summer from a native wild plant Acacia tortilis. The present study was undertaken to evaluate, characterize and differentiate Omani Acacia honey from Robinia honey. The analysis was carried out on 80 Omani Acacia honey samples and 14 imported (European) Robinia honeys. Studies on pollen concentration showed that 64% of the Omani Acacia and 79% of Robinia are classified within the Group II. This indicates that they are produced from normal floral source. The following physicochemical properties of Acacia and Robinia honeys were studied: pH, moisture content, free acidity, electrical conductivity (EC), diastase and invertase activities were analyzed. The results indicate that the values are within the permitted specifications except for EC and free acidity in Acacia honeys, which are higher than Robinia honeys. The EC of Acacia honeys were found to correlate significantly and positively with pH, moisture content, free acidity, diastase and invertase activities. This may point out the influence of these parameters in enhancing the EC of this honey and indicate the richness of Acacia honey with mineral and organic acid contents. This study emphasizes on a serious need to construct database and standards for the honeys from Arabian Peninsula region.

The status of bee pollination on oilseed rape in China

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As a kind of annual or biennial herbaceous plant, oilseed rape is an important crop, as well as the main nectar plant during the winter and spring time of Southern China, and the summer time of Northern China. Bee pollination applied in vegetables, fruit trees, pasture and other green house crops or field crops to increase production has been approved in and out of China. Chinese scientists has conducted multiple tests in different areas of China on different types of bees for years, and the results sho w that bee pollination can increase the amount of pollinated seeds, seeds output and the average oil extraction rate. At present, bee pollination on oilseeds rape has been applied widely in China. (Supported by projects MOA.2130315 and No.2130135, CAAS-ASTIP-2015-IAR)

PBO-006

Melissopalynology of stingless bees (Hymenoptera: Apidae: Hetrotrigona itama) at Taman Tropika Kenyir (TTK), Terengganu

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A study on melissopalynology of Heterotrigona itama was conducted in a Taman Tropika Kenyir (TTK), Terengganu from April until September 2013. The objective of this study was to identify pollen grains species

collected by H. itama foragers at TTK. In this study, 360 H. itama foragers were collected throughout study period. A total of 59 plants species were visited by H. itama. However, only 27 plant species belonging to 24 families were successfully identified which include of native species, ruderal species that consist of ornamental trees, underutilised trees, and agriculture crops. The overall result shows that Flacourtia jangomas was the highest pollens collected by H. itama followed by Lithocarpus sp, and Mimusops elengi. There were significant differences in total species of pollens and total abundance of pollens collected by Heterotrigona itama in different months (F5,35 pollen species =11.710, P < 0.05), (F5,354 pollen abundances=17.939, P < 0.05). May and June collected lower of pollen types compared to other months, however May and June collected the highest abundance of pollens collected. This finding also shows that H. itama is a flexible pollinator in which they could collect small pollens and larger size of pollens. Outcomes from this are important in order to understand which plants are utilized as a food for H. itama which provides information needed in bee management and sustainability of meliponinie culture industry for tropical regions.

PBO-035

Researching pollination effect of honeybees (*Apis mellifera* L.) on almond

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Developed countries in agriculture have attached much importance to optimum level of pollination in plants. Although Turkey has a great potential of beekeeping with the presence of about 6 million colonies, honeybees are not being used widely and deliberately in pollination. Therefore, an economic loss hundreds of times more than the revenue generated by the bee products comes into question. The aim in fruit cultivation is to get plenty and quality products. An important way to ensure this is that pollination and fertilization can occur in a healthy way. This study has examined the effects of honeybees over the yield and quality components on almond plant. Three different points were determined from the beginning, middle and end of the experiment field, and 6 Ferranges tree and 6 Ferredual tree which had the same characteristics were chosen from each point. 3 trees from each determined points were taken into a cage covered with netting that had pores with the parameters of 3.8 mm x 3.8 mm 1 week before blossoming. It was determined that the honeybees heavily visited the almond flowers and that they carried a great deal of pollen from these plants. It was found that the honeybees are completely effective on the fruit set and yield.

Symposium: Pollination III

PBO-046

Effects of stingless bees, *Heterotrigiona Itama* (Apidae: Meliponinae) pollination on greenhouse rock melon (*Cucumis melo* var. glamour)

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Rock melon (Cucumis melo var. glamour) is one of the important cultivated crops in Malaysia and is a source of income for hundreds of Malaysian farmers. The present study was conducted to determine the effects of stingless bees, Heterotrigona itama pollination on greenhouse rock melon. There were three types of pollination treatments - hand cross pollination, pollination without stingless bee and pollination by stingless bees, H. itama. The results showed that the rock melon benefits from pollination by stingless bees where the produced fruits were significantly larger, heavier, containing a greater sweetness and more thickness of flesh than pollination without stingless bees. The results also showed that the effects of stingless bees, H. itama on the quality of fruits were similar to the effects that showed on the fruits produced from hand cross pollination. Thus, it is hoped that the current study will throw some light on the stingless bees contribution to enhance crop productions and increase the income of local rock melon farmers.

PBO-013

A pollination method for using bumblebees in onion (*Allium cepa* L.) seed production

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Recently, the flies are used to pollinate onion for seed production in Korea. However, the use of flies for pollination has caused complaints by local residents in onion seed production owing to sanitation issues and smell. Therefore, we studied the effects of pollination with bumblebee (Bombus terrestris) and flies (e.g., houseflies, flesh flies, blue bottle flies and blowflies) in small net $(1.8m\times2.3m\times1.8m)$ for onion seed production. Although the number of flies was about 70 times than number of bumblebee workers, flies and bumblebees showed equivalent pollination efficiency. Therefore, pollination by B. terrestris can be used as an alternative approach in seed production of onion. An analysis of the most appropriate colony of B. terrestris for seed production of onion in small net showed that colony composed of fifty to eighty workers per small net was the most efficient level. When early maturing onion cultivars 'Salad-5', and 'Yeonsinwhang', and mid-late maturing onion cultivar 'Colossus' were pollinated by B. terrestris and files in small net, B. terrestris showed rather efficient pollination efficiency than flies or was equivalent to flies. In addition, B. terrestris were not affected, but flies were affected by pollinating effects of different onion cultivars.

Bombiculture in India: Present status and future prospects

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Biodiversity and its conservation are nowadays vital emerging issues of international concern around the world. Over the past decade, the international community has increasingly recognized the importance of pollinators as an element of agricultural diversity. Many insects such as honey bees, bumble bees, and solitary bees are in commercial use for pollination. In India very little attention was paid in respect of their biology, nest architecture, nesting habitat, domestication of bumble bee colonies artificially and utilization of laboratory reared bumble bees in pollination of crops till beginning of this century when the research efforts commenced. Study of nest architecture was made during different years from 2000 to 2015 and natural bumble bees nests were located in the abandoned rodents nests sites consisting of dried leaves, grass and rotten wood. An attempt was made to rear over wintered queens of bumble bees in artificial domicile under laboratory conditions. Overwintered bumble bee queens were captured and held in domiciles of different dimensions at different temperatures and at 65-85% RH. Bumblebee floral calendar was prepared which facilitated the easy capturing of fecundated queens during onset of the spring. Bumble bees were found foraging on various horticulture, vegetable, medicinal and wild plants. Studies were conducted on mating behaviour and developmental period and utilization under polyhouse coditions. Due to increasing acreage of poly house cultivation in India, there is immense potential for Bombiculture and utilization of bumble bees as pollinating agents effectively as more and more crops are being grown as off season crops.

PBO-021

Can differences in pollinator communities and consequent crop pollination deficits be detected?

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Habitat conversion in urban area, mainly from remaining natural habitat as well as agricultural land to housing area cause declining ecosystem services such as pollination services for crop plants in agricultural landscapes. In addition, monoculture system and agricultural intensification with high intensity of pesticide application are the most important factors for pollinator decline. In this research, we investigated the pollination pattern in agricultural landscape to get evidence about pollinatio n decline in the tropic. Ecological observation was conducted in agricultural area of Bogor, Indonesia which was classified into two different groups i.e. agricultural area near (less than 200m) and far (more than 1000m) from natural habitat. Pollinator insects were observed in cucumber field during flowering season. We found that the density of pollinators significantly higher in agricultural area that located far from natural habitat. Crop fields near natural habitat, have similar pollinator diversity than far from

natural habitat. Our findings suggest that tropical landscape with a lot of patchy natural habitat obscure the density and diversity of pollinators. It will need to more investigation to get information about pollinator decline with considering the quantity of natural habitat in agricultural landscape.

PBO-025

Morphological, organoleptical and starch analysis of the pollen grains collected in ardahan region by honey bees

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The pollen samples used in this research were collected from 6 different districts of Ardahan in 2010 and 2011 (from May to September). Microscopic analyses of the pollen samples were carried out. However, organoleptical and starch content analyses were done on the pollen samples of at least 5 grams.

As a result of microscopic analysis, 37.05% of pollen samples were determined as Fabaceae. The most detected taxa, after Fabaceae, belong to Cistaceae, Rosaceae, Asteraceae, Dipsacaceae, Boraginaceae and Brassicaceae. Organoleptical analysis showed that 40% of pollen samples got the best point whereas 16% got the worst point in respect of odour. When the samples were examined in terms of taste, 8% got the best while 4% got the worst point. Trifolium spp. and Liliaceae family received 4 full points in terms of both taste and odour and ranked at the top, as well as Solanaceae and Poaceae families ranked at the bottom with 1 - 2 grades. It was observed that 24% of pollen samples were in shades of orange, 20% in shades of brown, 16% in shades of yellow and 16% in shades of green. Beside these, pollens in shades of purple, dark red, beige and black were also determined. According to the starch analysis, it was found that 72% of the taxa did not contain any starch granules whereas Cistaceae, Pyrus spp., Poaceae, Epilobium spp. and Rosaceae taxa contain starch. In addition to all, some species of Fabaceae and Dipsacaceae contained starch, while others did not.

PBO-023

Native bees of Mt. Banahaw-San Cristobal protected landscape, Philippines

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The study was conducted to determine the native species of bees in Mt. Banahaw-San Cristobal Protected Landscape. The study used Descriptive method of research. Combination of transect, quadrats and opportunistic sampling were employed. GPS was used to determine the specific locations of bee nests. Results of the study revealed that native bees were belonging to different families such as Apidae, Halictidae, Megachilidae and Trigonidae. Bees are found most from 500 meters above sea level (masl) to 1000 meters above sea level (masl). The affinity of bees to food sources may have influence the distribution of bee nests which appeared to be clustered.

Symposium: Pollination IV

PBO-024

Comparative productivity of common evening primrose (Oenothera biennis) from different ecologic-geographical zones

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Introduction. Common evening primrose is a plant of the willowherb family. In the first year it forms the root rosette from leaves and an incrassate taproot up to 3-5 cm thick and 25-40 cm or more long. In the second year a direct non-branchy stem grows up to 100-180 cm high. Flowers are large and yellow, actinomorphic, having 4 petals, free. They have 8 stamens and 1 pistil, the stigma is quadrifid. The fruit is an elongate, cylindrical, quadrivalve seed case. The seeds are ungeometrical, small, sized up to 1 -2 mm and bare. Research Methodology. We had our investigations at the experiment field of FSBSI "RI of Beekeeping" in 2012-2014 on gray forest loamy soil. We have determined sugar in the flower nectar with the help of a washing method and estimated in the lab by the method of chemical analysis by Gagendorn-Jensen. We have studied 3 types of the primrose gathered in different ecologic-geographical zones: southern, central and western. Research Results. All ecotypes are characterized by: - long flowering period: central - 57, southern - 62, western - 75 days; - high content of sugar in one plant: central - 10.55, southern - 15.1, western - 31.2 mgr; - honey productivity: central - 196.2, southern - 478.3, western - 979.3 kg/he. Thus, the most valuable plants for beekeepers are common evening primrose types having southern and western ecologic-geographical origins.

PBO-051

The effect of climate change on the predicted spring emergence of *Osmia cornifrons* Radoszkowski in Korea, China and Japan

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The Japanese hornfaced bee, Osmia cornifrons Radoszkowski (Hymenoptera: Megachilidae), which overwinter as diapausing adult in cocoon, is an important pollinator of apple, blueberry and lettuce in China, Japan, Korea and United States. The synchronization of spring emergence of O. cornifrons with apple blossom is critical for successful pollination. In present study, we predicted spring emergence of O. cornifrons in Korea, China and Japan based on the degree day model using a two-parameter Weibull function in 2020, 2030, 2040, 2050, 2060, and 2080, with temperature prediction of Representative Concentration Pathway (RCP) 2.6 and 8.5 climate scenario. The predicted average temperature increases 1.8, 2.75 and 1.17, and 4.94, 5.51 and 5.48 in Korea, China and Japan from 2020 to 2080 under RCP 2.6 and 8.5. The predicted average emergence dates of O.cornifrons were not significant different under RCP 2.6 scenario, while those were significant different under RCP8.5 scenario. Compared to 2020, the emergence Julian dates in Korea, China and Japan were predicted to occur 10.7, 24.3 and

14.5 days, 10, 4.3 and 15.5 days, and 27, 40.8 and 25 days earlier in 2050, 2060 and 2080, respectively, under RCP 8.5 scenario. Our predictions could help to develop the pollination strategy under the climate change conditions.

Thuringer mallow as a perspective honey plant of Russia

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Thuringer mallow (Lavatera thuringiaca L.) is a perennial plant of the malvaceous family (Malvaceae). It is widely spread in the European part of Russia, Siberia. Growing in light forests, in weedy grounds and on dry slopes it forms powerful bushes up to 1.5 m. This is a multi-purpose plant can be used both in cattle breeding and beekeeping. The value of lavatera for beekeeping is in long flowering. Bees gather not only nectar but whitish pollen as well. We had our investigations at the experiment field of FSBSI "RI of Beekeeping" in 2012-2014 on gray forest loamy soil. It was the 2011 pre-winter sowing. In central Russia Thuringer mallow in a case of pre-winter sowing flowers in the first year at the end of July and at the end of June next years. The flowering period is about two months. This plant is responsive to mineral fertilizers. On the average during 3 years the sugar in the flower nectar has varied from 1.59 to 2.06 mgr depending on mineral fertilizers doses. The nectar productivity has been from 125 to 231 kg/ha (sugar in nectar). Bees visit the flowers well. Their number has been from 92 to 144 bees/100 m2 per one observation. Thus, Thuringer mallow is a valuable nectari- and polliniferous plant for beekeeping with a long flowering period.

PBO-009

Pollen distribution of *Apis mellifera* in the east coast of peninsular Malaysia.

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Terengganu which is situated in the the North-Eastern part of Peninsular Malaysia has a combination of coastal vegetation that line the beaches and lush tropical rainforest (secondary and virgin forest) further mainland. *Melaleuca cajuputi* and *Acacia mangium* dominate the coastal area. Apiculture activities of *Apis mellifera* by locals and small-scale enterprises can be found in both areas with different success rate, sustainability and honey production. A study on pollen distribution from two sampling sites that represented different geographical locations (coastal area and rainforest vegetation) was initiated. The two sampling sites which are Sekayu - a reserve forest surrounded by secondary and virgin tropical jungle whereas Marang is surrounded by Melaleuca and Acacia vegetation, 4 km from the coastal area. The study was to establish the annual bee foraging calendar from both locations. Results showed in Sekayu, pollen from *Mimosa pudica* (sensitive plant) was a dominant flower frequently visited by *Apis mellifera*. *Elaeis guineensis* (oil palm) was the second preferred flower. In Marang has a mix flower preference by *A. mellifera* where in the first quarter of the year *Elaies guineensis* was the dominant flower. This trend and preference gradually changed with *Acacia* sp., *Cocos nucifera* and in the fourth quarter of the year *Melaleuca* sp. during its full bloom became the preferred one.

National assessment of native pollinator abundance: status, trends, and impact in the United States.

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Native bees are important pollinators and provide efficient pollination services for many crops. Their populations are largely determined by the spatial distribution of nesting and floral resources. While most studies of native bee population occur at landscape or farm scales, the White House has recently called for a national assessment of native pollinators. Such an assessment can point to general trends and identify spatial priorities for research and conservation but it will be challenging because of increased uncertainty in the evaluation of habitat resources. We evaluated resource availability and its uncertainty for representative land-uses from croplands to natural areas using expert knowledge. We then used a spatially explicit pollination model that predicts relative pollinator abundance based on a distance-weighted measure of foraging resources. Using 2008 and 2013 National Cropland Data Layers we mapped native pollinator abundance and its uncertainty. We found both abundance and uncertainty increased mostly in eastern forested regions and desert shrub lands. Abundance decreased largely where dramatic land-use changes occurred in U.S. Corn Belts. We identified 244 counties that have 45% of the U.S. pollinator dependent crop area had relatively low native pollinator abundance but relatively high pollination demand. Lastly, we identified crops that are highly dependent on pollination such as pumpkins, blueberries, and watermelons that have experienced in the decline of pollinator supply compared with the increase of demand for the five years. These results and approaches will help to inform management and policy decisions for native bees at the national level.

PBO-011

The importance of pollination on pomiculture and its effects on yield and quality

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Honey bees (*Apis mellifera*) are considered as important pollinators of fruit species and essential component of agriculture. In apiculture, pollen and nectar are considered to be an important source. While collecting pollen and nectar, honey bees carry pollen taken from the anthers of flowers to the pistil of the same flower or another flower of the same species; and this process is referred to as pollination. In fact, honey bees carry out a very important task by pollination. Since pollination ensures the continuity of nature, besides quality and quantity of the product are increased in pomiculture, earlier and more uniform product is obtained, the shape of the product is properly formed, storage life is increased, and high quality hybrid seed that has a high germination quality is obtained. For some fruit species, fruit yield depends on honey bees and insects in a %100 rate and it shows how important the pollination is.

The favorite plants of honey bees in Turkey

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Turkey is a large peninsula with a land surface of 779.452 km² and it is divided into 7 geographical regions "Mediterranean, Marmara, Aegean, Black Sea, East Anatolia, Central Anatolia, Southern Anatolia" Phytogeographical point of view, Turkey falls 3 distinctive floristic regions: 1. Euro-Siberian; 2. Mediterranean; 3. Irano-Turanian that tie in closely with the three climatic zones, and these are the key to understanding the floristic richness of Turkey. Turkey's location, climate, topography and its encirclement by three sees have resulted in high plant diversity of over 10,000 known native vascular plants, one third are endemic. The main focus of this study is the identification of the most common and important plant sources for honey in Turkey. Precision in interpreting pollen data recovered from honey has always been a primary goal of those who study pollen and honey. In order to contribute to the knowledge of floral honeys Turkey, 20 honey samples were gathered from the seven geographical regions and analysed for their melissopalynological characteristics. 200 pollen grains have been counted for each sample and 15 pollen types were identified. The results showed that the pollen grains types of Rosaceae, Brassicaceae, Apiaceae, Lamiaceae, Fabaceae, Fagaceae, Asteraceae, Malvaceae, Boraginaceae, Poaceae, Ericaceae, Cistaceae, Liliaceae, Ranunculaceae and Geraniaceae were the most abundant among the samples. The ratio number of taxa per sample varied from 2–45%.

PBO-015

Traditional and Ethnobotanical Honey Plants List in South Korea

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There are 4,500 plants species living in South Korea, almost 500 species are regarded as honey plants. The black locust (Robinia pseudoacacia) is the most important tree in the field of honey production in South Korea (its ratio is approximately 70%). The black locust was introduced for erosion control and fuel 100 years ago. Today, black locust was faced with etiolation. Therefore, it is necessary to search for honey plant instead of black locust. This study investigated the traditional and ethnobotanical use of honey plant in South Korea. The available literature (Ethnobotany in Korea, Sallimgyeongje and Imwongyeongjeji) was reviewed and analysed. As a result the traditional and ethnobotanical honey plant list are 15 species 9 family (5 species in Leguminosae and 3 species in Rosaceae). We considered that Codonopsis lanceolata (herb) and Paulownia coreana (tree) have a high potential values in these list, because already C. lanceolata cultivated at the large area for medicinal and edible use, and Paulownia are in great demands for wood in South Korea.

Impact of different feeding strategies on honey bees during cranberry pollination

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Over the past years, many beekeepers reported that their colonies weakened during cranberry pollination. The idea of weakening their colonies refrains beekeepers to rent them for cranberry pollination, which in turn reduce the growing potential of the cranberry industry in Canada. This study had 3 objectives : 1-Evaluate the impact of doing the cranberry pollination on honey bee colonies, 2-Determine if feeding pollen supplement and/or sugar syrup would prevent the weakening of the colonies and 3-Verify if feeding the bees have a negative impact on cranberry pollination. Three feeding strategies were used with 5 experimental groups of 9 colonies: 1. No feeding, no pollination. 2. No feeding. 3. 15L of 1:1 syrup. 4. 2.25kg of pollen supplement . 5. 15L of 1:1 syrup and 2.25 kg of pollen supplement. The brood and honey productions were monitored for each colonies and pollen traps were installed for a short period on 3 colonies in each experimental group with the exception of group 1. Results showed that the cranberry pollination was not detrimental to honey bee colonies on the brood production but honey production and it did not refrain bees from foraging on cranberry blossom. Sugar syrup feeding even enhance cranberry foraging; the ratio of pollen collected coming from cranberry was 19% for the control group and rise to 57% for the syrup feed group.

PBO-018

Protein and mineral contents of pollen that is important for honey bees

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This study was conducted in spring period of 2013 in the Ordu Region. In the starting time of flight activity, in the flowering period of March, April and May, pollen traps were attached to 3 colonies between the time of 07:00-15:00. In this period, the reference preparations were prepared with pollens that were taken from flowers in the flora. Plant species of pollens collected from traps were determined with reference preparations via microscopic examination and quality (protein, K, Ca, Mg, Na, Fe, Cu contents) features of pollens belong to determined species were evaluated. Honey bees preferred mostly the pollens of cherry laurel (*Laurocerasus officinalis*), star of bethlehem (*Ornithogalum* sp.), dandelion (*Taraxacum officinale*) in March, walnut tree (*Juglans regia*), daisy (*Bellis perennis*) in April, date plum (*Diospyros lotus*), white clover (*Trifolium repens*) in May. The highest protein content was determined in the species of deadnettle (*Lamium purpureum*).

The characterization of Petroselinum crispum L. honey from Hatay-Turkey

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Petroselinum crispum L., the parsley, is a commonly grown culinary and medicinal herb that is often used in domestic medicine. It is native to Europe and Western Asia and cultivated in the United States. We aimed to determine the HMF, fructose, glucose, ash, electrical conductivity, moisture content and chemical composition of parsley honey by this research. For this purpose we collected honey samples from Hatay-Turkey. The microscopic analysis of honey samples were carried out and samples were determined as parsley honey according to its dominant pollen content. Besides the determination of botanical origin, the total pollen number (TPN) of the sample was calculated. After microscopic analysis the fructose, glucose and HMF contents were determined by High Performance Liquid Chromatography (HPLC), moisture by refractometer, ash by muffle furnace and volatile compounds by Gas Chromatography-Mass Spectrometry (GC-MS). As a result of microscopic analysis, TPN10 value is calculated as 137 144 and evaluated as rich for pollen content. According to the chemical analysis results, fructose content was 33,46g/100g, glucose 40,13g/100g, HMF value was 2.54 ppm, moisture 14.2%, ash content 0.25% and electrical conductivity was found to be 0.57µS/cm. Furthermore, "1,4-Bis[(3-methyl-5-oxo-1-phenyl-2- pyrazolin-4-ylidene) methyl] benzen" compound was found in highest ratio (9.69%) by GC-MS analysis. The hypoglycaemic, antimicrobial, antianaemic, anticoagulant, anti-hyperlipaemic, antihepatotoxic, diuretic and rheumatoid effects of Petroselinum crispum L.have been known already. For further researchers the biological activity of Petroselinum crispum honey can be investigated and the results would be helpful for future studies

PBO-020

The characterization of Anzer pollen collected by honey bees

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Anzer valley is situated in the Black Sea Region of Turkey, which is at over 2300 m altitude. The valley has a potential for beekeeping and is renown by its honey (Anzer honey). In this study we aimed to analyse Anzer pollen microscopically and chemically. For this purpose we collected pollen samples from the beehives from Anzer Valley in June-July 2013. As a result of microscopic analysis, we found pollen of Carduus spp, Trifolium spp., Onobrychis spp., Ranunculus spp., Geranium spp. and taxa belonging to the Apiaceae, Campanulaceae, Cistaceae, Dipsecaeae, Ericaceae families. According to the chemical content analysis of pollen samples "Heptadecane,2-methyl- (%6,87)" was found in highest ratio in Carduus spp. pollen, "Pentane,2,4-dimethyl- (%1,66)" in Trifolium spp. pollen, " 9,12,15-Octadecatrienoic acid, ethyl ester (%61,12)" in Onobrychis spp., "Hydroxylamine,0-(2-methylpropyl)- (%2,59)" in Ranunculus spp., "1-Tetradecane (%31,42)" in Geranium spp. pollen, "1-Pentanol,5-(methylenecyclopropyl) (%4,31)" in Apiaceae pollen, "Ethane,1,1,1-triethoxy (%16,14)" in Dipsacaeae pollen "Iso Amyl alcohol (%3,08)", in Ericaeae were found in highest ratios by Gas Chromatography-Mass Spectrometry. By this research the microscopic and chemical analyses of Anzer pollen were evaluated together. The results will be more valuable for further research.

The flowering pattern of Korean *Robinia pseudoacacia* L. during recent 10 Years

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Robinia pseudoacacia L. is a very important tree for the honey production in our country's beekeeping industry. However, owing to the climate change, the actual circumstances are that as the difference of flowering time between southern- and northern area decreased, the decline in honey production is concerned. Thus, this study aims to investigate the flowering time of R. pseudoacacia in southern- and northern area in our country and the factors effecting on the flowering, by which to provide basic information related to the honey production R. pseudoacacia. In the case of 2008, the year of the earliest flowering time, it was May 6, and the latest was June 11, 2011. As the flowering time continuously decreased, in the case of 2015, it decreased as 12 days, which is judged that the flowering time was expected earlier due to the higher temperature of early winter than average year, but the temperatures before the flowering time of the end of April were lower than average year, consequently the flowering time decreased. Furthermore, as there was high correlation among mean temperature, minimum temperature and precipitation, it showed that they were climatic factors effecting on the flowering time.

PBO-036

The value of honey plants of *Styrax japonicus* Sieb. & Zucc. based on honeybee visit and nectar secretion characteristics

Hyeusoo Kim, Moon Sup Kim, Jeong Ho Song, Sea Hyun Kim

Division of Special Purpose Trees, Korea Forest Research Institute, Republic of Korea

Japanese Snowbell is a deciduous tree, which is endemic to eastern Asia and is frequently planted in gardens because it bears beautiful white flowers in the early summer season. This study was conducted to prove possibility of honey tree, which analyzed the visited number of honeybees, secreted nectar volume, nectar sugar contents and amino acid in addition to estimating honey quantities that can ultimately reap in flowers of S. japonicus. The surveyed tree's flowers bloom during 12 days and maximum blooming period of flowers was on 23rd to 25th May in 2013. Honeybee visited flowers in priority and visited number of honeybee per flowering lateral bunch can be assumed 290 honeybees for a day. Honeybee visiting was concentrated at around 10~11 a.m. On average, nectar volume secreted by nectary was 1.13 ul from one flower and nectar concentration presented 39.6%. Sugar contents were calculated at 71.0 ug per flower. The minimum estimate of honey harvest for official tree(15 years, Height 3 m, DBH 12 cm) in this study was 3,032 mg. Result of amino acid contents ratio showed that Proline, Glutamate, Hydroproline, Serine, Asparagine were more abundant than others. Especially, Proline percentages (40.4%) were highest among the other amino acids. Finally, the surveyed tree is considered as possible honey plant because of its nectar characteristics and honeybee visiting.

Analysis of secreted nectar characteristics, sugar and amino acid content in floral nectar of Korean and Chinese hawthorn, *Crataegus pinnatifida* Bunge

Moon-Sup Kim, Hyeusoo Kim, Jeong-Ho Song, Sea-Hyun Kim

Division of Special Purpose Trees, Korea Forest Research Institute, Republic of Korea

This study was to analyze secreted nectar character, sugar and amino acid content of Korean and Chinese hawthorn, Crataegus pinnatifida Bunge. On average, nectar volume secreted by nectary was 1.43 ul in flower of Korean C. pinnatifida and nectar concentration showed 27.2%. Among the Chinese C. pinnatifida varieties, nectar volume showed 3.65~5.39 ul which presented 11.3~12.6% concentration. However, nectar sugar content was calculated at 69.2 ug per flower of Korean C. pinnatifida and 50.6~79.0 ug per flower of Chinese C. pinnatifida varieties, which meant that all values were not significantly different. The minimum estimates of honey harvest for a flower of Korean C. pinnatifida was 81.4 ug and Chinese C. pinnatifida varieties estimate from 59.5 ug to 92.9 ug. Analysis of amino acid showed that Asparagine, Glutamine, Glutamic acid, Proline and Serine were more abundant that account for more than 65% of total amino acid ratio in flower of Korean and Chinese C. pinnatifida. Arginine and Lysine were significantly different about all hawthorns. Overall, Korean and Chinese hawthorn are different from nectar volume, concentration, amount of free sugar and amino acid ratio but those aren't different from sugar composition and nectar sugar content of flower which are factor on breeding by selection of honey tree.

PBO-039

The value of honey plants of *Tilia amurensis* Rupr. and *T. mandshurica* Rupr. & Maxim based on nectar secretion characteristics

Uk Lee, Jeong Ho Song, Hyeusoo Kim, Moon Sup Kim, Sea Hyun Kim,

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T. amurensis and T. manshurica are used in the production of timber and honey in Korea. This study was conducted to provide a basic data such as secreted nectar characteristic for possibility of development as honey plants, T. amurensis and T. mandshurica. Clonal archive of these species has been established on the Korea Forest Research Institute in Suwon. All our results were analysed by using the centrifuge and HPLC. On average, nectar volume of T. amurensis and T. mandshurica secreted by nectary were 1.6 ul and 2.2 ul from one flower, respectively. Total amount of free sugars showed 39.5 ug/ ul in nectar of T. amurensis and 18.2 ug/ ul in nectar of T. mandshurica by using HPLC. Amount of nectar sugars was 69.0 ug from one flower of T. amurensis and the amount of nectar sugars per flower of T. mandshurica was 36.1 ug. The number of flowers in an inflorescence of T. amurensis were 8.3 and the number of flowers in an inflorescence of T. mandshurica were 15.0. Mean value of amount of nectar sugars multiplied by each flower potential per inflorescence, which was the estimated 0.57 mg sugar per inflorescence of T. amurensis and 0.54 mg sugar per inflorescence of T. mandshurica. We found that amount of nectar sugars per inflorescence showed that these values were not significantly different.

Honey and nectar plants of Turkey

Nazim Sekeroglu

Kilis Aralik University, Turkey

Having huge plant diversity Turkey has a number of honey and nectar plants in its flora. Most of these plants are important nectar and pollen plants for honey and other bee products production. Nectar and pollen potentials of plants both wild grown and cultivated plants have been investigated and some reports released in Turkey, recently. In these reports nectar plants, pollen plants and nectar-pollen plants of Turkey were determined by different scientific techniques. According to these reports important nectar pollen and nectar-pollen plants could mainly be groupped. Both nectar and pollen plants are Castanea sativa, Duacus carota L., Diospyros kaki L., Diospyros lotus L., Diplotaxis tenuifolia (L.) DC., Erica arborea L., Erica manipuliflora, Eucalyptus camaldulensis, Hedera helix L., Hedysarum varium, Onobrychis caput-galli (L.) LAM., Onobrychis tournefortii, Onobrychis argyrea BOISS. subsp. argyrea BOISS., Onobrychis viciifolia, Rubus canescens DC., Rubus idaeus L., Salix sp., Salvia sp., Taraxacum officinale, Trifolium campestre (OGM, 2015). Besides mentioned wild plant species growing in Turkey, cultivated medicinal and aromatic plants have supported honey/pollen production. Plant-named honey production such as Lavender Honey, Chestnut Honey, Black cumin Honey, Linden tree Honey, Pine tree, Thyme / Oregano Honey have gradually increased in Turkey. Moreover, honey forests have been established in different parts of Turkey by Forest and Water Affairs Ministry and more than 200 Honey Forests were established throughout Turkey. Related to interest in Api-therapy, it is expected that medicinal and aromatic plants in wild and cultivation would be important honey and nectar plants in Turkey and around the world.

PBO-049

Classification according to flower morphological characteristics of genus *Actinidia* selected from Korea

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In this study, we examined 9 flower morphological characteristics 8 clones of genus Actinidia to investigate the taxonomic relationships. We analyzed the flower morphological characteristics of 5 hardy kiwifruit (A. arguta) clones and 3 hybrid kiwifruit clones to investigate the species classification and the potential for using honey plants. Actinidia arguta, called hardy kiwifruit, has an edible smooth skin and contains high amounts of sugar and ascorbic acid. As result of principal component (PC) analysis using 9 variables from 8 clones, eigenvalue of the first principal component was 4.430 and the first two PCs was accountable for 78.30% of the total variance. The first PC was correlated with those characteristics that were mainly related to the length of inflorescence, width of inflorescence and length of peduncle. From the cluster analysis using unweighted pair group method using arithmetic mean (UPGMA) method, we can assumed that these 8 clones could be clustered into two groups. Group I comprises 7 clones included with male and female A. aruguta and hybrid kiwifruit (A. arguta × A. deliciosa). The other one, Group II consists of 1 clone, hybrid kiwi (A. deliciosa × A. arguta).

Honeybee visiting and secreted nectar characteristics of *Tilia insularis nakai* and relation with meteorologic traits

Su Gwang Lee, Sea Hyun Kim, Moon Sup Kim, Hyeusoo Kim, Jeong Ho Song

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Korea Linden is the only native of Ulleung Island of South Korea. It can be found in streets or parks owing to the beautiful crown shape and sweet smell of flowers. This study was conducted to provide a basic data such as honeybee visiting and secreted nectar for possibility of development as honey plant, T. insularis. The surveyed tree's flowers bloom and secrete nectar during 7 days in 2012. One of the flowers secretes and absorbs nectar, which lasted for 2 days. *Apis mellifera* and *Bombus ignitus* visited flowers in priority, number of visited pollinator per flowering lateral bunch can be assumed 160 honeybees and 46 carpenter bees for a day. Honeybee visiting was concentrated at around 3 pm. On average, volume of total and dry nectar secreted by nectary were 12.0 and 1.0 from one flower, respectively. As results of correlation analysis between the meteorological traits and surveyed data, we found that honeybee's activity was influenced by air temperature and relative humidity. Volume of total nectar was influenced by mostly meteorological traits and volume of dry nectar was less influenced by air temperature and relative humidity, respectively. To select honey plant or individual tree, volume of dry nectar must be major judgement factor on breeding because of it was less influenced by meteorological traits than volume of total nectar. Finally, the surveyed T. insularis is considered as possible honey plant because of its nectar volume and honeybee visiting.

Symposium: Pollination V

PBO-030

Enhancing strawberry productivity through bee pollination

Grace Asiko, Jane Oketch, Jared Mochorwa, Patricia Nzano, Dinah Momanyi, Teresa Okecha, Blaise Okinyi, Christine Koech, Ruth Yego, David Palla

National Beekeeping Institute, Nairobi, Kenya

Bees play a vital role in strawberry pollination, for fruit quality and increased productivity. Greenhouse experiments conducted at the National Beekeeping Institute, in collaboration with EU- AU Sponsored ICIPE Bee health Project, using honeybee pollinators, revealed an increase in super quality fruits (over 80% total). Harvested industry fruits were absent in the open field plants, outside the greenhouse, with multi-pollinators, but greatly reduced in the harvested fruits, inside the greenhouse (4.3% total), with the honeybee as the sole pollinator. Results indicated 80.3 percent total increase, with honeybee pollination.

Beekeeping and bee pollination services in pesticide application context: case study in Benin, West Africa

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¹ University of Agriculture, Kétou, Benin ² Laboratory of Applied Ecology, Benin

Beekeeping helps conserving honey bees which are major pollinators both for wild and cultivated plants to support humans' food security. Crops production in general and cotton cultivation in particular nowadays necessitate the use of pesticides. The present study measured in Dogo village territories (Kétou district), the honey production in experimental beehives, food resources availability at each site, pesticide traces search in honey and bee tissue samples as well as dead bee number monitoring. 10 experimental beehives (9 colonized) were installed in agrosystem, 10 in the buffer zone of the Dogo forest (8 colonized) and 10 in the core zone of the forest (8 colonized) far from cropping activities. Colonized beehives were monthly weighted during 20 consecutive months to monitor honey production year round. The phenology of the plants on which honeybees forage were monitored monthly and the dead bees were trapped per site to explain possible fluctuation of beehive weight progress. At the same time honey and bee tissue samples were collected during and after the pesticide application periods for pesticide traces search in laboratory also to link findings with dead bee number or honey production patterns. Results revealed the contamination of samples from all sites. The dead bee number overall increases during the pesticide application periods whereas the beehive weight didn't show such clear pattern. The food availability seems to influence most the beehives' weight. We concluded of general contamination of bees and honey but at this stage the beekeeping and the bee pollination service seems not yet altered.

PBO-033

Arbutus pavarii Shrub a nectar and pollen source for Apis mellifera in EL-Jabal EL-Akhdar region in Libya

Alhashmi Agleyo

Misrata University, Libya

EL-Jabal EL-Akhdar (Green mountain) locates in Northern East of Libya with a Mediterranean climate and it is rich of many kinds of plants, but it considered to be the only area in Libya where Arbutus pavarii shrub grows which is the source of producing a bittern hony. This plant is evergreen shrub and its flowers are drooping bells blossoms in the most cold winter months. The honey of this plant is very rare and expensive. This plant is not only a good source of nectar and pollen grains for honeybee *Apis mellifera* but also has many different uses for the locals

Influence of elevation on honeybees *Apis mellifera syriaca* (Hymenoptera: Apidae) flight activities and its impact on fruit set and quality of watermelon (*Citrullus lanatus*, Cucurbitaceae)

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¹ AlBalqa Applied University, Jordan ² Jordan University of Science and Technology, Jordan

A field experiment was conducted to monitor the flight activities of the worker bees and their impact on pollination of watermelon Citrullus lanatus as affected by the growing area elevations. The experiment composed of three treatments, the control (covered plants); in which the plants were caged before flowering to prevent any contact with insect pollinators, the second treatment the plants were left opened to permit contact with honeybees (uncovere d plants) and the third treatment the plants were supplementary pollinated with pollen from other plant (hand pollination). The results of this experiment showed that the viability of female flower stigmas lasted mostly to the early hours of the day at 11:00 am for flowers produced in Madaba (780 m above sea level), and lasted to the afternoon of the day at 14:00 pm for flowers produced in Wadi Araba, Al Safi village (350 m below sea level). In general fruit set, seed set, fruit weight, fruit circumference, and fruit sugar content were significantly higher in uncovered plants. Furthermore, fruit set, seed set, fruit weight, fruit circumference, and fruit total soluble solids percentage was significantly higher in plant grown above sea level than below sea level. Honey bees play an important role in the production of high quality and quantity of watermelon fruits for plants grown above or below sea level.

PBO-001

Important bee forage plants of African honey bee *Apis mellifera* Sculleta. (Hymenoptera: Apidae) in Southern Rangelands of Kenya

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¹ Kenya Agricultural and Livestock Research Organization (KALRO), Kenya ² Ministry of Agriculture Livestock and Fisheries, Kenya

The study was conducted in Makueni County, southern rangelands of Kenya during 2011/2013. The objective of the study was to identify and document the existing forage plants for African honeybee *Apis mellifera* Scutellata and also develop bee floral calendar of the study site. Based on the interview of the beekeepers and visual observations, a total of 56 vascular plant taxa belonging to 15 families which are important bee forage plant species were recorded, out of which 39 species were found to be major sources of nectar and pollen for honeybees. Long rain season (Apri l to June) and short rain season (November to December) were identified as honey flow periods having a number of floral plants such as Acacia mellifera, acacia tortilis, Albizia anthelmintica, Terminalia brownii and Combretum spp. Dry season (June to October) is the critical dearth period with a few flowering plants like Commiphora spp, Agave sisalana, and Papaya carica.

of planting multipurpose plants has been discussed. Based on available flora, major characteristics of these plant species, utility status and flowering duration a bee floral calendar was developed for the study site. To conserve these floras, consideration must be made to preserve and multiply the existing flora.

PBO-016

Literature Review for Complied List of Nectar, Pollen and Propolis Sources for Honey Bees (*Apis mellifera*) Throughout the World

Megan Wannarka

Peace Corps, Grenada

RATIONALE FOR THE STUDY: A review of various research papers, manuals, beekeeping books, and journals to acquire a full list of nectar sources through-out the world. Dr. Crane's work important world honey sources and their geographical distribution. In Bees and Beekeeping: Science, Practice and World Resources is very valuable but with more citizen scientists and new publications, more and more work is slowly being done in this area and is important to capture, share and use to create more pollinator habitat and to inform public and private partners. METHODOLOGY: Literature review and research documenting nectar, pollen, and propolis sources from world sources (i.e. Eva Crane) to location specific plants, trees and shrubs. If given bloom calendar information was provided also documented. RESULTS: Many publications have been found, researched and of those 22 of have been used and sited to comprise a list of 940 plants that are sources for nectar, pollen, propolis and honey dew. Some geographical and bloom calendar information has also been captured along with some local plant names. CONCLUSIONS: Ongoing research into this topic of plant sources of honey, pollen, propolis, and honey dew for bees is important to educate public, farmers, and government in conserve, create and increase honey bee habitat. Through identification, seeds can be saved, cuttings taken and education on how to best propagate for location specific uses. Local common names and bloom calendar will vary based on region, usage and language needs to be taken into consideration.

Symposium: Pollination VI

PBO-040

The Pollination industry in Africa, challenges and options for enhancement

Jacqueline Gowe

Sweet Maungwe Honey P/L, Zimbabwe

Crop pollination is vital for sustenance of food security on the African continent. The state of the beekeeping industry is proof enough that very few African countries realize the importance of pollination in increasing crop yields and food production there off. A Zimbabwean farmer with 300 hives generates more income from hiring out hives for pollination of runner beans, granadillas, strawberries, peaches and onions than from selling the honey produced by these bees. A decline in honeybee colonies in North America and Europe has been shown to be

directly correlated with a decrease in almond production. Honey bees are the pivotal pollinator species in Africa. 40 - 70% of indigenous flowering plants are pollinated by bees. In South Africa 50 crops are insect pollinated with much of the service provided by beekeepers. Africa needs to recognize and embrace pollination as a vital service for the agriculture sector in order to maintain food security for the continent. Member states should have policies for crop production which incorporate pollination as a service. Many African countries are facing food shortages that could be resolved by increasing crop production through use of pollinators. A decline in bee colonies, a decrease in nectar and pollen sources, a failure in forest conservation and the uncontrolled use of pesticides on crops that serve as nectar and pollen source for bees are some of the challenges faced by African countries.

PBO-041

Assessing pollination efficiency of European honey bee (*Apis mellifera* L.), fruit yield and mono-floral honey production of litchi (*Litchi chinensis* Sonn.) in Indian Subtropics.

Rajesh Kumar

ICAR-NRC on Litchi, India

Studies conducted at ICAR-National Research Centre on litchi, Muzaffarpur, Bihar, India for the period of two years i.e., 2011-12 and 2012-13 to investigate the effect of pollination by European Honey Bee (Apis mellifera L.) on fruit set and quality fruit yield and also monofloral honey production under controlled and open pollination. The treatments facilitating pollination on litchi have properly addressed the role of European honeybee as pollinators in pollination during flowering phases and colony placement. The study indicated pollination benefits, fruit set and quality fruit yield along with added advantage of high quality honey production by particular set of honeybee colonies. Pollinator responses, such as altered foraging activity, body size, and life span affected patterns of pollen flow and pollination success in case of litchi blooming period. A nine frame honey bee colony for a period of 35 days during litchi bloom produced 10.5kg honey (1.05t/100 colonies). The physicochemical properties of litchi honey samples of treatments differed significantly for their polyphenol content, ascorbic acid (Vitamin-C) and flavonoid contents. In organoleptic test, the monofloral honey was found better with high consumer preference. The litchi honey samples when tested showed low moisture (<20%), low ash content (<0.6%), low pH and slightly low TSS content indicating good honey quality and flavour. This study clearly indicated that programmed pollination activity improved the fruit set (1.68% from 1.03%), fruit yield (9.18t/ha from 5.60t/ha with percentage increase 93.11 over control) and quality with added advantage of high quality monoflo ral honey for premium price and potential export.

PBO-028

Mapping and distribution of native bees in Mt. Banahaw-San Cristobal protected landscape, Philippines

Ronald Garcia, Cecilia Gascon, Amalia Almazol, Maynard Vitoriano

Southern Luzon State University, Philippines

Mt. Banahaw-San Cristobal Protected Landscape is one of the remaining forested areas in Southern Luzon. It serves as life support system for more than one million people of the provinces of Laguna and Quezon. This mountain is known for its floral and faunal diversity and endemicity. Bees as pollinators are very important in the proliferation of several plants such as forest trees, ornamental, weeds, and agricultural crops. Food sources of bees influences the Location of their nests. The study was conducted to determine and mapping the location of bee nests in the area. Descriptive method of research was used with the combined transect, quadrat and opportunistic sampling. GPS was used to record the specific location of the nests and forage species were determines. Maps were generated through ArcGIS 9.3GIS software. Study showed that bees were distributed within different land uses, sharing the forage area and altitude of Mt. Banahaw. They found thriving in various habitats such as trees, crevices and in the ground. They found within the proximity of the location of its food source.

PBO-045

Mellissopalynological analysis of *Apis dorsata* honey from Coonoor and Kotagiri regions in the Nilgiris, India

Shiny Rehel¹

Keystone Foundation, India

The study was carried out during 2010-2013 in Coonoor and Kotagiri region of the Nilgiris. Coonoor lies in the southern part while Kotagiri lies in the eastern part of the Nilgiris. Coonoor and Kotagiri are home to a large number of traditional honey collectors who are expert at collecting honey from trees as well as cliffs. Investigations of pollen analysis in honey samplesare fragmentary and the field of mellissopalynology is not much explored in the Nilgiris District of Tamil Nadu. The information on plant sources has not been well documented, which underlines the rationale for such a study being initiated in this region. Specifically, this study aims to determine the pollen spectrum of *Apis dorsata* honey from the forests of Coonoor and Kotagiri region in the Nilgiris. Objective of the study: •To identify the pollen composition in the honey. •To understand the inter-annual variation in bee forage plants during the study period. A total of 20 pollen types were identified as bee foraging species. Of the 46 samples of A. dorsata honey, 66% were unifloral, having a predominant pollen types belonging to Myrtaceae (Syzygium cumini). The remaining 34% samples were multifloral consisting of two or more pollen types, forming the secondary pollen types Caesalpinaceae, Sapindaceae and Acanthaceae (Pterolobium hexapetalum and Schleichera oleosa and Strobilanthes sp). The other pollen types include Acacia sp., Cocos nucifera, Eucalyptus sp., Terminalia sp., Ligustrum perrottettii, and Rhodomyrtus tomentosa, Asteraceae, Rubiaceae, Verbenaceae, Malvaceae and Poaceae were identified as important minor and minor pollen types.

PBO-048

Salicin is not detected in propolis from stingless bee, *Tetragonula biro*i, from the Bicol region, Luzon island, Philippines

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¹ Institute of Biological Sciences, College of Arts and Sciences, Philippines ² University of the Philippines Los Baños, College, Laguna, Philippines Propolis samples were gathered from hived stingless bee (*Tetragonula biroi* Friese) in the Bicol Region. The Propolis extract was obtained using ethanol as solvent. High Pressure Liquid Chromatography (UV) was used in the detection of Salicin. All samples were found negative to Salicin, a compound that is known to cause allergies, similar to Salicylic acid. This shows that the propolis tested has great potential for clinical use.

PBO-029

Trophic niche of *Melipona (Melikerria) interrupta* (Apidae: Meliponini) bred in Central Amazon, Brazil.

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Stingless bees are particularly diverse and widespread in the Neotropics where they play an important role as pollinators. This study aims to identify the pollen collected by stingless bees in the Amazon. The exploitation of trophic resources by Melipona (Melikerria) interrupta (Apidae: Meliponini) in Central Amazon was determined from identification of the corbicular pollen samples during the period from January to December 2012. Corbicular monthly samples were analyzed from homogenized weekly samples. A total of 16 pollen types distributed in 11 botanical families were identified. The families: Arecaceae, Fabaceae, Melastomataceae and Solanaceae were the most representative in the sample s being detected four specialization temporary events (>90%) by type Miconia (Melastomataceae) with 93.00% in November; Solanum aculeatissimum (Solanaceae) in February with 99.50% and in July with 99.33% and Solanum type (Solanaceae) with 99.67% in December. The low richness (n = 16) of pollen types in corbicular pollen samples, in which the highest diversity was observed in August (H = 1,082), suggests that M. interrupta may act as a specialist, due to the low availability of resources in solid ground (terra firme) environments, where intraspecific competition could compromise not only the maintenance of these colonies in this environment, as well as the honey production. The importance of bees in the preservation of many species of plants through pollination is without doubt one of the most important alternatives for the development of meliponiculture as a sustainable activity in the Amazon.

PBO-050

Bee diversity, bee pollination and seed set of *Trigonella moabitica* Zoh. (Leguminosae) as a native range plant grown under semiarid Mediterranean conditions

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This investigation was conducted during the growing seasons 2013 and 2014 at Jordan University of Science and Technology campus (32°30" N, 35°59" E), Irbid, Jordan, to identify the different bee visitors and to assess their accountability in seed set of Trigonella moabitica grown under semiarid Mediterranean conditions. Two treatments were forced on T. moabitica plants before flowering: 1) Plants were covered as (control) or 2) Plants were left uncovered to permit bee visiting. A total of 904 specimens were collected during the study period. They represent five families: Apidae, Megachilidae, Halictidae, Andrenidae and Colletidae. 37 bee species were

identified visiting T. moabitica flowers during the study period. Also the results showed that a single plant produced on average 38 clusters, 13 flowers per cluster and 13 ovaries per flower. Open pollinated flowers produced higher significant pods and seeds than covered flowers. Furthermore, weight of 10 pods as well as the weight of 100 seeds, seed weight per pod and total seed weight was also significantly higher under open pollinated treatment compared to covered treatment. Good management program is needed to conserve the diversity of wild bee flower visitors and to improve their value in flowers pollination.

Beekeeping Technology and Quality



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Mission

Collection of information relating to the technologies and equipment used for apiary activities in temperate, cold and tropical climates, both for honey production and other additional products: wax, pollen, royal jelly, propolis, venom and brood-comb

2015, 44th APIMONDIA International Apicultural Congress Scientific Program



Plenary Session

TQO-041

Single-flower honeys as aromatic references for honey wheel

Etienne Bruneau, Marie Warnier, Carine Massaux

CARI, Belgium

Aromatic honey wheel is now use for more than 10 years. To train taster and to see their ability to describe correctly the aromas of honey samples, specific chemical aromas are usually used. Even if this approach is essential, it's very difficult to find appropriate substances to illustrate certain type of aromas that we can find in honeys. Another approach is to use single-flower honey who present clearly subfamilies and descriptor of the honey wheel. This presentation gives a first descriptive list of single-flower honeys that can be used as references for training tasters and the criteria that must be used to select the samples. A call is made internationally to develop a single-flower honeys organoleptic catalog.

TQO-033

Fast authenticity and quality profiling of honey by NMR spectroscopy

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Nuclear Magnetic Resonance (NMR) spectroscopy is a powerful technology that allows rapid verification of quality and authenticity of honey. NMR spectroscopy, which has a dynamic range of five orders of magnitude, permits detection of quantitative molecular finger prints representing ingredients of mixtures down to the mg/kg range. An important advantage of the method is the simple sample preparation involving only dissolution of the analyte. As a result, it is possible to derive a large number of quality parameters from a single NMR measurement in a short measurement lasting only a few minutes. Specifically, we present excellent correlations of NMR spectra with chemical quality parameters such as glucose, fructose, HMF, citric acid, enzyme activity etc., but also with conductivity, color, moisture, and acid number. It is further shown that the moisture should be determined differently for floral honey and for honey-dew honey. In addition, we demonstrate that it is possible to test for authenticity in the same NMR experiment. This is achieved by comparison of an unknown sample with a large reference data base of authentic honey samples. We show that it is possibly to verify the geographic origin of the sample as well as the detection of addition of syrups or bee-feed at concentrations as low as 10 percent.

TQO-013 Immunological discrimination of honey by honey major protein

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Honey is the natural sweetener that is gathered and storage, ripen procedure flower nectar, secrete of botanical tissue by honeybee such as *Apis cerana* or *Apis mellifera*. Honey is composed by multiple sugars mainly fructose and glucose with aromatic components, organic acid, enzyme and pollen. The Korean honey is classified as two sorts depending upon the honeybee species that produced honey. The major sorts of honeybee are *Apis cerana* or *Apis mellifera*. It is known *Apis cerana* as indigenous strain, *Apis mellifera* as western strain. The each honey produced separative honeybee strain is sold in different sorts of honey. The physicochemical and morphological difference of two sorts of honey is discriminated with difficultly. Two sorts of honey contain each major proteins (majo r royal jelly protein 1) produced by *Apis cerana* or *Apis mellifera*, although these proteins had equivalent primary structure, they showed different molecular weights as 56, 59 kDa. These proteins can be in use marker proteins to discriminate the honeybee species producing honey using SDS-PAGE. Furthermore each purified major protein from two sorts of honey was injected in rats and after repeated immunization. Each antibodies were obtained and verified with Western-blot. Although honey samples used in this study differ geographical variations, storage periods, botanical origins, each antibody was reacted specifically to antigen of honey samples with high affinity. All these results of this study showed ELISA (Enzyme linked immunosorbent assay) with each antibody can be applied for immunological discrimination of honey by different honeybee species.

TQO-016

Production of propolis in accordence with food safety and security with contracted beekeping model

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SBS Scientific Bio Solutions LLC is the first and only company so far that works with contracted beekeeping model in the world. Many beekeepers in Turkey started production of propolis with contracted beekeeping with us. We work with beekeepers in different regions of Turkey. We have contracted for about 20.000 hives up to now and this number is growing. Our beekeepers are not allowed to use drugs or chemicals during production season. They have to land their hives away from industrial zones, highways or cities. We collect propolis with our own traps. We are able to trace our products back to each beekeeper and even back to each hive. Our beekeepers place propolis traps that we provide on the top of their hives. When the trap is full, they inform us and we collect traps. We test each product for residues of antibiotics, pesticides and heavy metals. We also test the quality parameters and biological activity of propolis.Besides our own lab, we work with stanbul Technical University Food Engineering Department, Intertek and Eurofins. We can also process propolis with different techniques to different forms such as extracts, powder, spissum etc. in a high biological activity.

TQO-024

Effects of bee feed patties with different protein ratios on overwintering abilities of honey bee colonies

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This study was carried out to determine the effects of 5%, 10%, 15% protein ratio of pollen supplement feeding and none feeding on overwintering ability of honey bee colonies (*A. mellifer, A. carnica*). Protein source is a trade secret. This study has been performed under winter conditions of Thrace region, Turkey. Total of 38 honey bee colonies, standardized for queen age, genotype, number of frames covered with adult bees, brood areas and food stocks were used in this study. Average overwintering ability of colonies in the 5%, 10%, 15% protein ratio supplement feeding and control groups were found to be 128.57%, 80%, 84%, and 62%, respectively. Differences among the group means for overwintering ability were found significant (P<0.05). The colonies fed with %5 protein ratio pollen supplement showed better wintering ability than colonies fed with 10%, 15% protein ratio pollen supplement and control colonies. Experimental colonies showed a significant (P<0.05) difference in pollen supplement consumption. Average daily pollen supplement consumption of colonies in the 5%, 10%, 15% protein ratio supplement feeding groups were found to be 11,5g, 4,67g, 1,57g respectively. Present results demonstrate that %5 protein ratio can be used in feed patties for feeding colonies in winter season.

TQO-017

All the colonies of any apiary in one compact hive.

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The present work consists of two parts: 1-Compact two and three queen colony hives: Compact two and three queen colony hives were achieved and evaluated. The two - queen colonies hive divided with two movable frames, with queen excluder to three chambers, each chamber has a separated entrance and the middle chamber provided with sliding cover. The three queen colonies hive is using the same previous hive in addition a third hive was situated and inserted at its center. The following parameters were achieved: weight of queens, royal jelly production, mean yield of honey and brood rearing activity. Evaluation of the three models indicated that three queen colony hive was the best one, followed by two queen colonies, while the lowest records were obtained from one queen colony hive (Langstroth).2-Compact colony hive contains all the colonies. The three queen colonies hive was developed to four queen colonies (four units with sixteen queen colonies were used in the current study). Evaluation of the multiple compact colonies and one queen colony hives indicated that the new design was the better. * Patent No.19457 from Egyptian Patent Office, won the national prize of environmental development.

Honeybee managment in a climatologically variable environemnt in Jordan

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JUST, Jordan

Beekeeping is an emerging sector in Jordan mainly centered in Northern Jordan where 75% of bee colonies are located. Beekeeping contributes to the national economy directly and indirectly through crop pollination and biodiversity conservation. Like several beekeeping sectors worldwide, beekeeping in Jordan is threatened by disease outbreak, loss of habitat and exposure to agrochemical. However, Jordan climate is extremely variable which makes beekeeping more chalenging. Given the fact that beekeepers lack appropriate beekeeping management basics, therefore, beekeeper economic return are threatened by this extreme variation. Therefore, this study was conducted to (1) find out the relationship between honey production and variation in seasonal rainfall and temperature regime in northern Jordan for 10 seasons, and (2) to explore the impact of thermal insulation on the productivity of bee colonies. The study was based on collecting weather and honey productivity data to find statistical correlation between them, and (2) conducting field experiment on bee colonies under thermal insulation treatments and compare it to the control colonies. Climatological data showed strong statistical correlation between rainfall and temperature (especially rainfall in November and March) on honey production per colony. The results also showed that the use of thermal insulation in colonies resulted in better colony survival, early brood and bee build-up in the spring and more honey production per colony. The results were discussed and solutions were suggested to resolve constraints of beekeeping. The study also recommended the use of colony thermal insulation for the advancement of beekeeping sector and development.

TQO-006

Effective Vasyl Priyatelenko's three-strorey beehive with unique frames

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THE GOAL OF STUDY: 1) to find and describe peculiarities of natural honeybee nests; 2) to test efficiency of V.Priyatelenko's beehive; 3) to test and develop efficient healthy beekeeping technology using V.Priyatelenko's beehive. MATERIAL AND METHODS. Fifty beehives with 50 bee colonies were used for this study in private apiary near Kiev (Ukraine) during 9 years. RESULTS. Nine years of tests and observations showed us that V.Priyatelenko's model of beehive is close to natural construction of honeybee nest in a tree hollows. It allows the bee colony to develop in a natural way. Effective V.Priyatelenko's beehive has characteristics: 1) three movable storeys with a removable stand and roof; 2) shallow bottom body (8 frames) and a deeper central hive body which act as brood chambers (12 frames), and a shallow standard upper "super" for storage of honey (8 frames); 3) total 28 frames; 4) absence of bee space between frames in storeys both below and above the middle box; 5) use of modified Dadant frames with metal 'n' cross-section top bars, and wooden end and bottom bars; 6) cross-way positioning of frames to frames in other chamber. Advantages of V.Priyatelenko's beehive: 1) significant improvement in dynamics of development of honey bee colony; 2) decreased tendency to swarm; 3) increased resistance to diseases; 4) reduced labor costs for apiary management and hive maintenance; 5) increased

productivity that allows beekeeper to harvest 50-60 kg of honey per season from one super at a static apiary. This beehive provides new efficient beekeeping technology.

TQO-005 The biological potential of bee colonies is the base of the intensive beekeeping

Nadiia Semeniuk, Valerii Semeniuk

Union of Beekeepers of Ukraine, Ukraine

Own experience of beekeeping in the conditions of the middle geographical zone, where bees spend the winter in a state of the bee club, gives you the opportunity to define the rules of intensive beekeeping:-Wintering under the open sky, on its own honey and under thermal comfort when the excess metabolic moisture removed from the bees nest and their colony is insulated as much as possible. Moisture evacuated outside the nest by using a capillary mechanism. -The early revision after the spring fly-around is not fulfilled. When spring warming occurs it is enough verify that the uterus is under the upper insulation. In 40 ... 45 days after the final cleaning flying should immediately proceed to the expansion of bee nest for the spring build-up strength of the family. -Using the two-colonies keeping bees, but with the spatial differentiation of the two bee colonies during the active period of their vital activity. -Annual replacement of the uteruses on the own uteruses at such time, that the bees that will go into winter and will develop a colony in the spring, become sisters by both the mother and father. - Necessarily to carry out the autumn weight gain of the colony to 2...2.5 kg before wintering. Implementation of these rules makes it possible to increase the honey yield in half to two times.

TQO-001

Potential impacts of climate change on managed honey bee colonies in Egypt

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Damanhour University, Egypt

There are enormous challenges for managed honey bee, *Apis mellifera*, colonies in the world. Climate change is expected to be the major threat for them in the future. Climate change can impact honey bee colonies negatively and/or positively. Unfortunately, few studies have been done on impacts of climate change on beekeeping. In this research, the possible changes in temperature and some bioclimatic factors in Egypt during near future 2070 were investigated using available datasets. Geographical information system (GIS) was used to perform the study. Potential impacts of climate change on honey bee colonies were then expected. It is expected that thermal stress on honey bee colonies in Egypt will be the major problem for beekeepers especially during summer. No major changes are expected to happen in other bioclimatic factors including precipitation. Beekeepers are advised to harvest honey from their colonies earlier than current time. Some honey bee diseases and pests are not expected to be a great challenge in the near future. For future challenges, studies towards obtaining heat tolerant bees are very essential. Developing suitable methods for protecting honey bee colonies from thermal stress during summer are required.

TQO-038

Coumaphos in wax and honey

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Concern for safety and quality of bee products begins in primary production. Beekeepers do not really have control over what the bees bring to the hives, or their control is very small. However the research shows that honey rarely contains traces of pesticides or other toxic substances, when other bee products contain a little more. Acaricides that beekeepers place into the hive represent a higher risk for bee products safety. One of the greatest threats is coumaphos. Coumaphos can quite unpredictably spread throughout the hive. The more we use coumpahos the more of them stay in bee wax and even honey. Bees transmit wax and with it also coumaphos, if it is present, over the hive. After bee treatment with Ckeckmite is also virgin wax and even caps on honey combs contaminated with coumpahos. We determined the difference in the levels of coumaphos in honey wax depending on how many times they were used. 34 samples of honey and wax of different type of combs (brood chamber combs, virgin comb) were analyzed. Concentration of coumpahos in wax and also honey and honey caps from that wax that honey was harvested were determined. LC-MS/MS was used, LOQ was 0,005 mg/kg for honey and 0,02 mg/kg for wax. Caps on honey from old combs after using Checkmite three times had the highest values of coumaphos (max 102 mg/kg, average 33,37 mg/kg), honey from that combs had in average 0,040 mg/kg coumaphos, max 0,120 mg/kg.

TQO-030

Comparison of transfer of different sulfonamides from contaminated beeswax to honey

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Sulfonamides are not authorised for the treatment of honey bees in the European Union because there are no Maximum Residue Limits (MRLs) for these drugs in honey. However, they can be found in honey largely because they are illegally used in apiculture to prevent and control bacterial and protozoan diseases. Moreover, as it has been found, the residues of sulfamethazine can migrate from honey to beeswax and accumulate for long time which can lead to contamination of honey during the next honey season. Therefore, the aim of the study was to examine the possible transfer of 10 most frequently used sulfonamides (sulfacetamide, sulfadiazine, sulfadimethoxine, sulfadoxine. sulfamerazine, sulfameter, sulfamethazine, sulfamethoxazole, sulfamonomethoxine and sulfathiazole) from contaminated beeswax to honey. We placed sulfonamide-containing wax foundations in beehives. At 1 month from the start, the frames filled with capped honey were removed from the hives for a first sampling of honey. Next, the honeycombs were further incubated for 6 months in the laboratory at 35 °C and sampled monthly. In the sampled honey, the quantity of sulfonamides was determined by LC-MS/MS and compared to those determined in the sulfonamide-containing wax foundations. The results of this study showed that each of the tested sulfonamide could migrate from beeswax to honey kept in the contaminated combs. However, the highest percentage of transfer from contaminated beeswax to honey was observed for sulfadimethoxine. The project was funded by the National Scoemce Cenre allocated on the basis of the decision number DEC -2011/03/D/NZ7/03767.

The use of chemical profiling and contemporary data interpretation methods to quantify Manuka honey

John Rawcliffe¹, Terry Braggins², Tony Wright³, Ralf Schlothauer³, Jonathan Stephens³

¹ UMFHA, New Zealand ² Analytica Laboratories ³ Comvita Ltd

Internationally Manuka honey commands a premium price, however, there is a limited supply. This may have led to passing-off of lower-value New Zealand honeys as Manuka. Concern over this has led to the development of a method to differentiate New Zealand Manuka honey using chemical profiling. The UMF Honey Association, in collaboration with Analytica Laboratories and a number of overseas research institutions, have over the last four years researched the use of chemical profiling to quantify Manuka honey for the consumer. The key to this research was understanding the relationship between nectar and honey. The techniques of collecting authentic Manuka nectar from the flower were proposed by Dr Jonathan Stephens and Dr Ralf Schlothauer, while the collection of authentic Manuka honey was commissioned by the UMF Honey Association. The analysis techniques were developed by Dr Terry Braggins of Analytica Laboratories. The relationship between the nectar and the honey has provided the basis from which the use of mass spectrometry technology has identified chemical markers that are characteristic of Manuka honey. The use of statistical tools has provided the mechanisms to quantify the proportion of a New Zealand honey from a Manuka floral source. This body of research will be able to assist in determining provenance, the detection of adulteration, and providing a key to understanding the chemical profile of the honey, so enabling future research.

TQO-010

Sources of contamination of honey with genetically modified material.

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EPBA, Germany

GMO-contamination can make it all but impossible to market the bee products in certain markets, because they no longer meet regulatory standards or are rejected by retailers and consumers. The introduction of GMOcultivation creates additional cost for analysis and careful separation of GM and non-GM products in the logistics of the food, feed and seed business. The honey sector is no exception, but the open production system presents many significant additional challenges beyond the control of the individual beekeeper. So far, most of the discussion has revolved around the presence of GMO pollen from GMO crops. But there are several additional sources for GMO cultivation, which have been mostly overlooked. After GMO contamination was found in canola honey of a professional beekeeper in Germany, it was possible to trace the problem back to the commercially available pollen substitute used by the beekeeper. The product tested positive for GMOs in analysis conducted by several independent labs. Many bekeepers have relied on the manufacturer's false claim that this product is GMOfree. In yet another case of contaminated honey found in Germany, the source is most likely not pollen or pollen substitue, but animal feed containing genetically modified material from soy and maize. This material was actively collected by bees confusing it with pollen. Both cases are not covered by the recent change in the EU honey directive. The discussion of GMO-contamination of honey needs to take not just pollen but also pollen substitute and animal feed into account.

TQO-015 Effect of honeybee wax processing on toxic metal content

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Beeswax as honeybee product is an important ingredient in different kinds of cosmetics or food. Considering biological functions of combs in honeybee colonies it is important to know their contamination. Old combs routinely processed in comb foundations by casting originate from different areas exposed to different kinds and levels of pollution. Heavy metals are pollutants emitted in a continuous manner by various natural sources and anthropological activity and since they are not degraded they are continuously kept present, thus entering the physical and biological cycles. There is very few studies on metal contamination of beeswax and lack of data about the effectiveness of performing casting comb foundations production technology on reducing heavy metal concentrations. At processing beeswax or production of comb foundations during cooling period the few layers of wax are sedimented inside container. To compare the concentrations of Pb, Cd and Hg in different layers beeswax samples were digested using microwave closed system and analyses were conducted by graphite furnaceatomic absorption spectroscopy. Concentrations of examined metals were at average ($\mu g/kg$): 58,144; 1,610; 1,195 after resolving and homogenization of combs at superficial layer; 48,043; 1,466; 0,669 after sterilization at middle layer; and 6311,82; 83,99; 9,49 after sedimentation in bottom of the container, respectively. Average value of lead in new produced comb foundation was 114, 73; 2,241; and 0,827, respectively. The obtained results indicate tendency to reduce the toxic metal content in the processed wax and comb foundations as final product contain lowest concentrations and material was used just from superficial layer.

Symposium: Analytical Techniques

TQO-045

Nuclear Magnetic Resonance (NMR) applied to honey testing: New analytical perspectives.

Eric Jamin

Eurofins, France

Honey has often been the victim of economic adulteration by addition of cheaper extenders such as sugar, or by mislabelling the declared floral or geographical origin. Although a range of analytical techniques are available to ensure compliance with regulatory or trade compositional guidelines, the addition of cheap sugar sources can prove difficult to detect as these closely mimic the composition of the main sugars in honey. The use of pollen analysis is also limited by relative pollen abundance among plant species and possible processing effects. High throughput profiling using 1H Nuclear Magnetic Resonance spectroscopy is now becoming an established and accepted method for the rapid screening of food products to demonstrate their authenticity and detect adulteration.

This presentation will show how the combination of proton-NMR profiling together with suitable quantification procedures and a robust statistical model built up from a worldwide collection of honey samples is a particularly sensitive method for the detection of exogenous sugar, especially for C3 plant sources. In addition the possibility of identifying country of origin and floral mislabelling will be illustrated through recent findings regarding New-Zealand and Australia "high-value" honeys.

TQO-004

Identification of subtypes and plant sources of Kangaroo Island propolis through statistical and similarity scoring methods

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Introduction: Propolis from Kangaroo Island, South Australia, (KI) has previously been shown to be of interest medicinally. At least six reproducible single-plant-source propolis types have been identified from KI so far, as well as mixed propolis samples from these sources. There is broad consensus that plant resins, beyond admixture with beeswax, are not appreciably chemically changed by honeybees to produce propolis. Previously, identification and evaluation of KI propolis samples has been by thin-layer chromatography (TLC) and 'H NMR through visual comparison with results for standard samples. Processes utilising statistical and similarity scoring methods to 'H NMR spectra have been previously demonstrated to be of use in identifying subtypes, purity and constituent compounds of biological products, including propolis.

Methods and Results: Previous identification of single-plant-source KI propolis samples was confirmed by the statistical method of hierarchical clustering of ⁴H NMR spectra of over 400 ethanolic extracts of propolis and plant samples. A novel calculator tool for similarity scoring of ⁴H NMR spectra of KI propolis samples to both plant resins and average pure-plant-source propolis types identified was created. An advanced calculator tool for identifying and predicting percentages of single-plant-source propolis types in mixed propolis was also created. Applicability of these methods to high-performance liquid chromatography (HPLC) chromatograms of propolis samples has also been demonstrated. This suite of statistical and similarity scoring methods of KI propolis is readily applicable to other propolis and resinous plants; and could be of use in identifying plant sources and constituent compounds of propolis samples or extracts.

TQO-031

Monofloral citrus honeys: The use of near infrared spectroscopy (NIR) and volatile composition to use as markers of botanical origin

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Volatile organic compounds in honey are grouped into different chemical categories and represent a fingerprint. They could be used to differentiate monofloral honeys, providing valuable information concerning their botanical and geographical origin. Argentina and Uruguay are countries producing high quality honeys, from which about 95% is exported to markets where the botanical and geographical origins differentiate the products. Usually, the assessment of honey's botanical and geographical origin is very complex. Particulary, citrus honeys present a limited number of pollen granules making difficult the interpretation of the results of microscopic analysis. The volatile compounds of honeys from two vicinal citrus producing regions of both countries were analysed to identify volatile marker compounds specific for citrus honeys. The analysis of their pollen contents allowed to characterize their association with Citrus sp., Echium plantagineum, Eucalyptus sp., Schinus sp., Acicarpha tribuloides and Baccharis sp. The volatile compounds were extracted by solid-phase extraction and analyzed by gas chromatography-mass spectrometry (Shimadzu GC-MS 5050), higher concentrations of terpenes (cis- and trans-8-hidroxilinalol) furanoids and shikimic acid derivatives (methyl anthranilate) were evidenced. The use of gas chromatography-olfactometry (GC-O) allowed identifying sensory active compounds whose descriptors were associated to pleasant aromas as floral, caramel, spices and others less pleasant, as medical and animal. Finally, NIR was evaluated for the authentication of different honey types previously classified using traditional methods (chemical, pollen, and sensory analysis). Chemometric evaluation of the spectra by applying principal component analysis showed that NIR spectra were closely related, allowing to differentiate the citrus honeys.

TQO-022

Issues about the informational quality of bee products, as evidenced by sensitive crystallization

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In this paper we present the synthesis of research results for the period 2006-2014 using the method of sensitive crystallization for qualitative analysis to determine the informational quality of the bee products. It is well known that the growth of crystals results, when the growth is slow, in well defined macro-crystalline forms (e.g. quartz). These forms can allow, in some cases, the identification of the message imprinted in the crystalline growth at the microscopic scale, because the microscopic information can be transmitted to the macroscopic scale. The pure hydrated cupric chloride crystallizes in 100 mm - Petri dishes as very small grains of fine needles, without any dendrite-like shape. The organic additive has an inhibiting effect on the nucleation generation, amplifying the crystal volume few thousand times, the crystals are growing in three concentric circles generated by the radial growth of the dendrites formed from the initial growth point. This phenomenon can be used as well as a morphogenetic qualitative method for analyzing the biological quality of the added additive. Unlike other r qualitative methods, sensitive crystallization illustrates the action of external factors on informational energy matrix of bee products and foods. This method is able to show influence of various factors on quality of bee products. The fine differences between samples of honey, bee-pollen, royal jelly may be measured and evidenced as informational quality. Sensitive crystallization method has already become a useful tool in the api-quality, serving both producers and consumers and adds the informational dimension to api-quality.
HPLC method for determination of melittin in individual honeybee (*Apis mellifera*) venom sac

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Melittin is the major toxin peptide in bee venom which has diverse biological effects. In this paper, melittin was separated by reverse-phase HPLC and detected by the intrinsic fluorescence signal of tryptophan residue. Results indicated that the intrinsic fluorescence signal of melittin was linear ranged from 0.04 to 20 μ g/mL with the LOQ of 0.04 μ g/mL. The recovery range of spiked samples was between 81.93 % and 105.25 %. Since the large linear dynamic range and the sensitivity enhancement by using intrinsic fluorescence detection, this method can be used for analyzing melittin contents in individual venom sac of honeybee (*Apis mellifera*). Results indicated that there was large bee-to-bee difference in melittin contents.

TQO-008

Analysis of phenolic compounds and abscisic acid of acacia honey by solid-phase extraction coupled with HPLC

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The major components of honey are sugar and water, but some phenolic compounds may be responsible for honey quality. We investigated effects of four reversed phase (RP) and four reversed phase & anion-exchange (RP-AE) solid-phase extraction (SPE) cartridges as a pre-concentration technique for honey phenolics. Eleven acacia honey samples were collected from different apiaries of China and their phenolics and abscisic acid were analysed by high-performance liquid chromatography. Our results reveal that RP-AE SPE cartridges are better than RP SPE cartridges for the pre-concentration of honey phenolics. This better pre- concentration effect of RP-AE SPE cartridges might be a novel finding of our research. Strata-X-A cartridge may be a prime candidate among all investigated SPE cartridges. We identified cis-trans-abscisic acid and 19 phenolics occurring in acacia honey samples. Moreover, we infer that abscisic acid could be the landmark ingredient for quality control of acacia honey.

Methodological study on quantitative analysis of the royal jellyprotein apisin.

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Royal jelly is secreted by young worker bees to exclusively nourish queen bees. RJ consists primarily of water (60-70%), proteins (9-18%), lipids (3-8%), and carbohydrates (7-18%). RJ protein includes the major royal jelly protein (MRJP) family (i.e., MRJP1-9), apisin, and apisimin etc. Apisin forms the greater part of RJ protein and exists in nature as a protein complex consisting of MRJP 1 and apisimin. Thus, apisin should be quantitatively regulated as well as 10-hydroxy-2-decenoic acid, a fatty acid unique to RJ. However, there are only a few reports on the quantification method of apisin, especially no reports about a high- performance liquid chromatography (HPLC) analysis. For these reasons, we tried to develop the HPLC method for quantitative analysis of apisin. First, we isolated apisin by isoelectric precipitation, follo wed by purification with size-exclusion chromatography to make a reference standard for quantitative analysis with HPLC. The purified apisin was detected as a single peak on HPLC chromatogram and as the component proteins MRJP1 and apisimin on SDS-PAGE and LC-MS analysis. Second, apisin was dried by a lyophilization treatment with trehalose to obtain its stable powder. Trehalose is usually used to prevent lyophilization-induced denaturation of protein. The apisin powder obtained was stable for at least twelve months at 4 and -20. Finally, the apisin content in several RJ products was quantified by HPLC-size-exclusion chromatography using the apisin powder as a standard in order to investigate the possibility of utilizing apisin as a specific marker for quality control of RJ.

Symposium: Breeding and Selection

TQO-047

Hive double queen as a tool to increase the honey production and requeening in *Apis mellifera* in subtroplical climate

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In the province of Chaco with a subtropical climate, with temperatures reaching 45 °C, and rainfall averages between 800 and 1000 mm by year with very irregular distribution. The objective of this work was to develop the technical production with double queens of *Apis melifera* under the conditions of the Argentinean Chaco which shares with much of Latin America and the Caribbean (LAC). 60-70 days before the honey flow when hives are 6 - 7 frames of brood (FB). Day 0: are split into two chambers on the top (HT) is placed the mated queens with 4 FB in the bottom (HB) 2 capped FB and a queen cell.are separated with double mesh, both hives have entrance to the outdoors. Day 17 days when the queens are mated move 2 FB without the bees are move from HT to HB. Average of mated rate in the last three seasons 84%. Day 25 FB HT are lowered to HB. Day 42-50 adding HT HB reach 14 - 15 FB, then the old mated queens is killed (HT) and join in one. The average performance over the past three seasons has been 68 kg beehive year, compared with the control 23 kg. Considering that production costs to be added three additional visits to the apiary, the cost of a cell and cost of a real cell. Obtaining a 47.8% more production increase and having the hives with new queens.

TQO-048 The roles of pollen consumption on queen introduction

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The age of the queen is fundamental to beekeeping success. Take this hypothetical scenario into consideration. In a beekeeping operation of 50 hives, half of queens are over two years old and the remaining 25 queens, 10 out of the 25 remaining queens have fertility problems. These queens are likely to be superseded by their colonies, while the remaining 15 queens will function at % 75 capacity. Subsequently, half of beekeeper's colonies are either failing or have failed. The ramification of failing queens is enormous as they are a strain not only to the beekeeper's finances and honey yield, but also to the beekeeper's time. Therefore, the colonies are required to be requeened. Requeening in early spring amidst the honey and pollen flows is easier than at the end of the honey flow; it is more difficult to introduce queens in dependent on pheromones and the colony's diet. Furthermore, colonies require a great deal of nourishment to produce worker and royal jellies. In the course of our study, we were able to produce high levels of worker jelly and royal jelly with the nutritional supplements including royal jelly, pheromones, pollen and honey. We introduced over 1000 queens, and the rate of queen acceptance was between 97 to 100 percent in Canada in 2014. Remarkably, when queens were introduced to a colony at the end of honey flow, their acceptance was nearly % 100. Ultimately, this study demonstrates how supplying a hive with adequate nutrition can enhance the acceptance of queens.

TQO-042

New strategies of beekeeping production – Genetic variability Evaluation of hygienic behavior and its relationship to varroosis

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One hundred colonies of honey bees bred by beekeepers in different regions of the Argentine Republic were evaluated in the Apiary Pedro J. Bover, General Belgrano, BA Province, through their hygienic behavior and related with their infection rate of Varroasis; for whose evaluation the method of nitrogen liquid was used. Likewise, mitochondrial DNA was determined. To observe their correlation, 89% of the colonies, in the first year of evaluation (spring 2012) exceeded the threshold of collapse (UC) (more than 10% in adult bee infection rate) with a hygienic behavior (CH) average of 87%. 11% of the colonies, evaluated in the second year (spring 2013) were also overcome by the UC with a CH average of 90%. It is discussed the lower significance of the CH surpassing the strictness of the selection of 85% with an index of correlation of the 0.33 (R = 0.33). Although there is a weak association between the CH and the percentage of Varroa, that association is not present when analyzing data to haplotypes level or provincial level. This leads us to think that CH is a response to the presence of Varroosis, but it fails to be effective enough to reduce the infection rate of the illness. The haplotypes found were C1a, C2c and C2j in 97% of the samples, while 3% corresponded to Africanised haplotype A1.

This primary information is essential to determine the interaction, A. mellifera - Varroa destructor – haplotypes, in different kinds of bees in the country, in the same surrounding.

TQO-026 Effective technology of mother of god's bee-direction, with high productivity of honeybee rearing

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Technology of intensive beekeeping, named "The Mother of God's bee-direction" or "Virgin Mary's beekeeping" was tested during 22 years of beekeeping experience. It is proposed for wide application. The Mother of God's beekeeping system includes three united blocks of-storey beehives. Unique construction of beehive's frame has Patent 2218757 "Construction for handling honeybees". It was registrated in Russian Federation 20.12.2003. New bee-keeping technology consists in original construction of unique Mother of God's frame. The size of frame is 290 mm x 215 mm that is half of Dadant's frame size. This size is the most productive for bees brood growth. The Mother of God's frame are united in three-frame blocks, or unites, through use of side brackets. Separate beehive body consists of 12 frames which are united in 4 blocks. Advantages of block of three Mother of God's frames are: 1) opportunity to make beehive in any hive, log hive or box with free space, or even without box; 2) easy removal of blocks from hive or transferration inside hive; 3) easy inspection of beehive; 4) easy making new nucleuses or separation of colonies; 5) easy for work of ageing beekeepers. Queen must be isolated in two bottom brood's boxes by Hanneman's division board. Honey is harvested only in upper boxes. Original construction or 4-storey beehive was created. The idea of unification of several 4-storey beehives in one "multi-beehive complex" was created. The advantage of this "complex" is prevention of swarming, very high productivity of bees rearing and honey harvesting.

TQO-002

Natural nest characteristics of *Apis mellifera jemenitica* (Hymenoptera; Apidae) and its implications in frame hive adoption

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Apis mellefera jemenitica is the smallest race of A.mellifera both in its body and colony sizes. In the current study we assessed the natural nest volume, workers brood cell dimensions and bee space of the race through measuring their dimensions from naturally build combs in log hives. The optimum box hive volume of the race assessed by keeping colonies at different volumes of frames hives with four replications and monitored for a period of one

year. The occupied nest volume and comb surface area of the race in log hives were 12.28 ± 5.981 and 8017.2 ± 3110.60 cm2 respectively which are significantly smaller than other A.mellifera races. The work brood cells width and depth of the race were 4.07 ± 0.17 mm and 9.39 ± 0.42 mm respectively and the race builds an average of 262.5 more worker brood cells/dm2 than build on embossed foundation sheet. The race maintains an average of 7.27 ± 1.35 mm bee space and naturally builds 30% more combs/unit length than other races. Based on the study; box hive with seven frames found to be an optimum for the race in the region. The study indicates the importance of designing box hives and accessories that match with the natural nest conditions, their body and colony sizes which may contribute to enhance their productivities.

TQO-025

A GIS approach for determination of the optimum beekeeping density and productivity during Talh (Acacia gerrardii Benth.) flow

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King Saud University

Bee forage is the most important factor deciding beekeeping and honey productivity. Therefore, beekeeping must be spatially planned to be compatible with bee forage. Extremely rare efforts have been done to employ GIS and remote sensing (RS) in apiculture. We used these tools to map the optimum beekeeping density and productivity during Talh (Acacia gerrardii Benth.) flow. The areas of interest were two Talh prairies (Rawdhat-Khoraim and Huraymila) in Saudi Arabia. Spot 5 imageries (2.5 m resolution) were classified to get the distribution of Talh trees. ArcGIS 10.2.1 was used in image processing, and data management, analysis, and presentation. The outputs were mainly maps of Talh distribution, the optimum beekeeping sites, and the optimum predicted honey yield of these sites. Each Talh tree produced nectar that adequate to create 45 kg of Talh honey seasonally. Nevertheless, only 8.5 kg/tree/season of Talh honey could be harvested (yield). Currently, Rawdhat-Khoraim carries 1011 colonies (in non-optimum distribution) and produces 4852 kg/season. Optimally, it should carry 1413 colonies distributed in 12 beekeeping sites to produce 9619 kg/season. Huraymila should carry 2202 colonies distributed in 9 beekeeping sites, and they are supposed to produce 14992 kg/season. The current beekeeping scheme is extremely far less productive than the optimum. The resulted data and maps represent guide to the apiculturists for the best beekeeping plans during Talh flow. The study present an approach to use RS and GIS in describing, planning and managing of bee flows and predicting their honeys yields.

TQO-027

Effects of division management of colony

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Through more than 50 years of keeping northeastern black bee (*Apis mellifera* ssp.) in National Natural Conservation Area of Northeastern Black Bee in Raohe County, Heilongjiang Province of China, and through years of practice and research, I invented a new beekeeping mode—Division Management of Colony, which is

easy to practice, more efficient, more productive and can save time. We divide the hive into spawning area, brood area and honey storing area according to the different functions of bees, each area with different ways of management. Bees with different ages and duties work in different areas in a well-sequenced order. Through the division management of colony, the biological characteristics of bees, beekeeping environment and the production of beekeepers are harmoniously united, production cost and labor intensity are reduced and the optimum economical benefits is achieved.

Symposium: Characterization of Honey and Bee Products I

TQO-023

Phenolic compounds identified as markers of origin in honey from Colombian coffee crops

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Colombia is worldwide known for the production of high quality coffee; the crops are in continuous improvement towards sustainability. Agricultural practices, environmental conditions and management systems support its Designation of Origin, Certification of Mark and Protected Geographic Indication. To the north of the country, in Sierra Nevada de Santa Marta, coffee crops have Organic Certification; in addition, beekeeping is practiced there because of the important service of pollination. Therefore, honey collected in this area has a unique identity, associated with that environment. To demonstrate its singularities, 70 honey samples from apiaries located in coffee crops in that region, were subjected to extraction, identification and quantification of the content of flavonoids and phenolic acids by HPLC-DAD and MS-UFLC confirmation. 12 compounds were identified. Among them was permanent the presence of caffeic acid, coumaric acid, and cinnamic acid and in concentrations from 0.10 to 1.83 g / g honey and the flavonoids luteolin, quercetin, and isorhamnetin, in concentrations between 0.10 to 29.66 g / g honey; isorhamnetin was predominant in all samples. It was evident the same chromatographic profile for all honeys, with variation in signal strength, fact that can be considered as a fingerprint of these honeys. Together with other proofs related with composition and safety, this information supports the special features and quality labels for these honeys, related with the unique character of Colombia coffee.

TQO-035

Flavonoid compounds propolis

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Studied propolis harvested in 2011-2014, apiaries on a number of subjects of the Russian Federation and Belarus, which are located in natural zones: forest, steppe and deciduous forests. Total flavonoid compounds (which include natural pigments anthocyanins, anthocyanidins and leukoanthocyanidins) in propolis samples averaged 36.82% with fluctuations of samples from 15.6 to 88.5%. The number of routine in the samples of propolis averaged 2.42% with fluctuations of samples from 0.05 to 4.5%; the largest number of routine found in propolis from the Ryazan region (3.5-4.0%) and Belarus (3.5%). The amount of quercetin - an average of 4.92% with

fluctuations on samples from 0.7 to 14.97%, the largest found in propolis from the Ryazan region (8,34-14,97%), Belarus (12.28%) and Krasnodar Region (9,3-12,75%);naringenin - an average of 7.73% with fluctuations on samples from 4.2 to 12.9%, the largest amount determined in propolis from the Kursk region (9.1%), the Republic of Chuvashia (8.8%), Mari El (9,0%), Udmurt (9.9%), the Krasnodar Territory (12.9%), polyphenolic compounds - an average of 12.23% with a range from 5.9 to 20.9%, the largest amount found in propolis Krasnodar Territory (20.9%), the Republic of Adygea (19.8%), the Kursk region (16.5%), Altai Territory (16.7%). The investigations have shown that propolis from Ryazan, Nizhny Novgorod, Vologda, Voronezh regions, the Republic of Adygea, Chuvashia, Udmurtia, Mari El, Krasnodar region, contains a large number of biologically active flavonoid compounds, and is a valuable resource for the creation of medicines and dietary supplements.

TQO-039

Polyphenolic and sugar profiles of nectars of some melliferous plants

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Honey is the natural sweet substance produced by Apis mellifera bees mainly from the nectar of plants. In chemical sense, honey is a concentrated aqueous solution of different carbohydrates, which also contains a very complex mixture of amino and organic acids, minerals, aroma compounds, polyphenolics, vitamins, enzymes and other phytochemicals. These phytochemicals are responsible for known the health benefits of honey, especially its antioxidant, protective or disease preventive properties. Chemical composition of honey is very dependent on nectar-providing plant species. In order to trace the most important phytochemicals that characterize honey, the aim of this work was characterization of nectar polyphenolics and sugars in some melliferous plants from Serbia. Phenolic acids, flavonoids, and their glycosides in acacia (Robinia pseudoacacia), lime (Tilia cordata), and oilseed rape (Brassica napus) nectars were analyzed by using Ultra High-Performance Liquid Chromatography coupled with hybrid mass spectrometer (UHPLC-OrbiTrap). Quantification was done using 25 available standards. In the absence of standards, a UHPLC LTQ OrbiTrap was utilized for the identification of the individual polyphenolic compounds, mainly flavonol glycosides. A total of 21 compounds were identified based on the search for the [M-H]- deprotonated molecule and its MS4 fragmentation. Sugar profile was determined using High-Performance Anion-Exchange Chromatography (HPAEC/PAD). A total of 15 sugars were quantified using available standards. Fructose and glucose were the major constituents of all nectar samples. Sucrose content was significant in the lime nectar sample (190 mg/kg), while in acacia and oilseed rape nectars were lower, 22 mg/kg and 3 mg/kg, respectively.

TQO-043

"An analysis of the challenges faced by SMES in marketing honey in the third world countries", a case study of Nairobi, Kenya.

Benson Wainaina

National Beekeeping Institute, Kenya

Understanding the dynamics and challenges faced by honey traders in marketing their honey products is an important component in the battle against sale of sub standard products in the Kenyan markets. Yet policy makers in the developing countries particularly in Africa have often overlooked the important role that the bee keeping industry plays in the provision of social and economic lifeline particularly for communities living in the ASAL regions.

Despite the increasing awareness of the role the honey entrepreneurs can play in availing this vital commodity in our daily food intake, research on honey marketing has been limited. In response to this gap, a study of the challenges facing honey traders in Nairobi was undertaken. The overall goals of the study were to understand the extent to which these challenges impact on the performance of honey marketers as a whole, identify the factors associated with adulteration of honey, and identify honey traders information requirement in order to develop appropriate intervention mechanisms.

The survey method was used in the systematic data collection of 40 honey traders. A purposive sampling of all dealers of honey selling their merchandise in Nairobi was selected for the study and the three week period census of all honey traders trading in honey offered the interview guide.

Symposium: Characterization of honey and bee products II

TQO-032

Chemical properties of Portuguese lavender honey

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Consumer's preference for unifloral honeys is becoming more and more important in the international trade. As a direct impact, the quality parameters of honey and its specifications became a decision factor in its valorization, inducing a specialization trend in the production husbandry of unifloral honeys. Lavender honey is one of the most common honeys in Portugal due to the wide spontaneous dispersion of different Lavandula species: L. pedunculata (Mill.) Cav., the most abundant, L. stoechas with the subspecies stoechas and luisieri, and L. viridis. The quality standards for lavender honey are internationally established, nevertheless, Portuguese honeys faces sometimes difficulties to fit within those parameters. This work (funded by PAN 2014-2016) present a survey on Portuguese lavender honey, with 75 samples collected in 2014, from regions with high potential for this type of unifloral honey. All the analysis where made according to the harmonized methods of IHC, after melissopalynology confirmation. The color of Portuguese Lavender honey falls between white and extra light amber, with a moisture content below 17%. This is a low conductivity honey with 0.27 mS/cm on average, and a free acidity between 18-39 meq/kg. Unlike the international standards for lavender honey, the results for diastase are very low, with more than 55% of samples remaining below 8 DN, revealing the low enzymatic content of Portuguese lavender honey, corroborate by the HMF values, on average around 11 mg/kg. The sugar profile analysis, confirmed the monosaccharides fructose and glucose above 60 % but also the presence of sucrose.

TQO-034

New approach on sensory analysis of honey, according to Ayurvedic knowledge

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Sensory analysis is today a standardized method, very important to establish the quality of a honey sample. On the other hand, in Ayurveda, ancient Indian Traditional Medicine, the sensorial approach of a product is much more complex: it takes into consideration a combination of six tastes (sweet, salty, bitter, sour, spicy and astringent), as well as the perception and d escription of other inner effects on emotional level and on physical body (vitality, circulation, digestion, respiration and other functions of the body). This article is the first to apply Ayurvedic approach to sensory analysis of honey samples in order to obtain a better characterization of medicinal and nutritive qualities of different types of honey. Ayurveda recommends personalized recipes for every health problems and every person, taking into consideration also, constitutional types of people. Using its criteria of value for honey samples, it becomes possible to understand better the qualities of some types of honey which are not so appreciated today, even they are more valuable and useful for specific conditions.

TQO-011

Functional and physicochemical properties of pine honeys collected between 2010 and 2014 from Turkey

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8750 pine honey samples from Aegean coast of Turkey were collected between 2010 and 2014. These samples were evaluated for their physicochemical (moisture, electrical conductivity, free acidity, diastase activity, HMF, proline, sugar profile, C4 sugar values) and melissopalynological properities (starch/pollen and honeydewelements/pollen) and some of them were evaluated for functional proper ities (miner alcontent, total phenolic contents, a ntio xid ant activity, a nti micro bia l activity and fructooligosacharides). The minerals were determined by ICPMS. Samples contained high amounts of K, Ca, Fe and Zn. Potassium was quantitatively the most important mineral. Total phenolic contents were evaluated using Folin Ciocalteu method. Antioxidant activities were evaluated based on the ability of the extracts to scavenge DPPH. All samples showed results between 67,7% and 77,0%. Antimicrobial activities were evaluated based on the ability of the extracts to inhibite the growth of some bacteria. And fructooligosacharides were determined by HPLC-RI dedectors. All samples showed Raffinose, 1-Kestose and Nystose. Average values were 0,5%, 0,6%, 1,8% respectively. C4 sugars were analyzed with IRMS-EA and 88,5% of the samples showed C4 sugar values below 7,0%. Most often seen value for C4 sugar was 0% (22,3% of samples). Average values for moisture, electrical conductivity, free acidity, diastase activity, hydroxymethylfurfural and proline were 17,03%, 1,12 mS/cm, 24,75 meq/kg, 18,53 DN, 2,92 mg/kg and 589,9 mg/kg respectively. The sugar profile analysis were analyzed by HPLC-RI. The minimum value for sum of Fructose and Glucose was 45,4% and the average was 58,32%. The maximum value for Fructose/Glucose ratio was 1,41 and the average was 1,21.

TQO-020

Chemical analyses of bee collected pollen from Slovenia (Sustainable project honey future)

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Bee collected pollen can be used for monitoring of the environmental pollution and also represents a good source of different nutrients important for bees and humans. Bee pollen composition varies depending on its botanical origin and country. Twelve samples of bee pollen from Carniolan bee (*Apis mellifera carnica*) were collected during the 2014 season from April to September. For analyses mixed bee pollen samples were used. That kind of bee pollen is also collected by the beekeepers. The contents of water, protein, fat, ash and heavy metals were determined, and the total carbohydrate content and energy value were calculated. Fifty-three different botanical families or species were identified in these bee pollen samples. Fresh bee pollen contained on average 25.0% of water, 20.2% of proteins, 7.2% of fat, 2.0% of ash, and 45.0% of total carbohydrate, with an average energy value of 13.7 MJ/kg. Average contents of heavy metals were in these fresh bee pollens for AI (38.50 mg/kg), Cu (9.37 mg/kg), Zn (32.20 mg/kg), Cd (0.09 mg/kg), Co (0.12 mg/kg) and Au (<0.05 mg/kg). Pe (69.24 mg/kg), Pd (<1.0 mg/kg), Pt (<0.10 mg/kg), Rh (<5.0 mg/kg), Ag (<0.05 mg/kg) and Au (<0.05 mg/kg). PAH, PBC and pesticide residues were under detection limits (<0.05 mg/kg). Existing data show one-year study which will be continued in the future. The results from this study were obtained within the sustainability project on the Future of honey, supported by the company Hofer from Slovenia and shows good practice between socially beneficial company and beekeepers.

TQO-009

Physical properties, hydroxymethylfurfural and sugars profile of Ethiopian honey

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Background. Ethiopia is 1st in Africa, and one of the largest producers of honey in the world. The objective of this paper was to describe the physical properties, hydroxymethylfurfural (HMF) and sugar profile of Ethiopian honey. Methodology . Honey samples were described as mono and polyfloral, using Harmonized methods of Melissopalynology. Thirty six honey samples for physical properties and HMF, and seventy two for sugar profile were investigated in Bundang, South Korea. Result and discussion. Honey samples were found to be Schefflera abyssinica, Croton macrostachys, Eucalyptus globules, polyfloral I, Acacia Senegal, polyfloral II, Hypoestes and Syzygium guineense. Mean±sd values were described below based on sequence of these botanical origin. Moisture and aw were 20.54±1.28and0.60±0.02, 18.56±1.45and0.58±0.03, 14.14±0.19and0.48±0.01, 14.79±0.25and 0.51± $0.01, 15.75 \pm 0.42 and 0.53 \pm 0, 16.53 \pm 0.13 and 0.54 \pm 0.01, 14.97 \pm 0.14 and 0.52 \pm 0.00; 15.26 \pm 0.01 and 0.54 \pm 0, 0.01 + 0.01 \pm$ respectively. L*(lightness/darkness), a*(redness/greenness) and b*(yellowness/blueness) color were 50.72±0.35,0.06±0.13,3.29±1.10; 39.82±1.82,1.45±0.71,11.57±2.06; 44.81±1.12, $-0.13\pm0.23, 6.40\pm0.73;$ $49.15 \pm 4.04, -0.27 \pm 0.57, \ 3.79 \pm 2.21; \ 51.09 \pm 0.08, \ -0.45 \pm 0.01, \ 4.60 \pm 0.10; \ 49.99 \pm 0.27, \ 0.09 \pm 0.11, \ 2.21 \pm 0.32;$ 56.28±0.36,0. 23±0.10, 0.79±0.18; 44.51±0.52, 0.15±0.01, 6.70±0.26, respectively. pH and acidity were 3.77 ± 0.23 and 23.90 ± 1.85 , 3.61 ± 0.07 and 54.88 ± 6.66 , 4.57 ± 0.07 and 21.0 ± 0.82 , 3.83 ± 0.12 and 23.50 ± 3.51 , 3.52±0.41 and 21.50±0.71, 3.63±0.021 and 25.00±0, 3.38±0.06 and 20.00±0, 3.68±0.035 and 22.50±0.71 respectively. HMF was 1.13 ± 0.31 , 3.37 ± 1.73 , 0.68 ± 0.04 , 0.48 ± 0.16 , 0.91 ± 0.37 , 0, 0 and 2.09 ± 0.21 , respectively. Fructose, glucose, sucrose, maltose, turanose, isomaltose and total sugars were 38.80 ± 1.18 , 30.54 ± 2.68 , 2.14 ± 0.15 , 0.33 ± 0.35 , 0.54 ± 0.33 , 0, 72.37 ± 3.80 ; 38.85 ± 0.81 , 31.64 ± 1.37 , 2.56 ± 0.21 , 0.82 ± 0.36 , 1.40 ± 0.96 , 0.01 ± 0.02 , 75.30 ± 2.24 ; 40.26 ± 0.25 , 30.55 ± 0.32 , 1.92 ± 0.13 , 1.72 ± 0.36 , 2.04 ± 0.45 , 0.15 ± 0.09 , 76.67 ± 0.99 ; 35.29 ± 3.52 , 29.33 ± 2.74 , 2.75 ± 0.64 , 1.03 ± 0.25 , 1.78 ± 0.15 , 1.52 ± 1.01 , 71.72 ± 4.39 ; 43.07 ± 0.37 , 33.27 ± 0.58 , 1.22 ± 0.10 , 0.43 ± 0.29 , 1.19 ± 0.48 , 0.01 ± 0.01 , 79.20 ± 0.96 ; 38.64 ± 0.22 , 37.20 ± 0.35 , 1.32 ± 0.05 , 0.92 ± 0.24 , 1.36 ± 0.28 , 0.19 ± 0.10 , 79.64 ± 1.11 ; 38.14 ± 0.52 , 36.16 ± 0.60 , 1.84 ± 0.02 , 0.86 ± 0.05 , 1.26 ± 0.07 , 0.48 ± 0.04 , 78.77 ± 1.12 ; and 41.01 ± 0.30 , 34.32 ± 0.38 , 1.12 ± 0.01 , 1.34 ± 0.11 , 1.77 ± 0.33 , 0.12 ± 0.09 , 79.71 ± 0.90 respectively. A significant (p<0.0001) relation between moisture content and aw was expressed by r2=0.923, goodness of fit for regression equation was aw=0.264+0.016*moisture%. Conclusion. All mean values of Ethiopian honey qualify Codex and European Union standards. In almost all quality standard authorities, moisture content is considered as the quality authentication parameter, but the determination of moisture alone could not sufficiently describe the quality of honey for storage, processing and use; unless aw is considered.

TQO-021

China's royal jelly export in 2014

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China is a major beekeeping country in the world. It is also the most productive beekeeping country in the world in terms of production of honeybee products that include royal jelly. Almost 90% of the world total royal jelly was produced in China. Its fresh royal jelly production reached historical high of up to 4,000 tons in 2010. The royal jelly is not only meant for domestic consumption, but also for export in exchange for foreign currency. Japan, Europe, the United States, Southeast Asia are the major market for China's royal jelly. Over the decades, domestically consumed royal jelly was more than that of the exported royal jelly. But in 2013, for the first time, the volume of export royal jelly reached 1,620 tons, surpassed that sold in domestic market, up 33.4% than previous year, though the year's total fresh royal jelly production reduced to 3,000 tons. The article elaborated the performance of royal jelly export market in 2014 based on statistic data from Customs of China and Apicultural Sciences Association of China.

New Technology and Good Beekeeping I

TQO-051

Electronic bee hive monitoring for scientists

Huw Evans, Sandra Kordic

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Electronic bee-hive monitoring has evolved relatively recently as the technology has become available to allow economic, non- intrusive and user-friendly data collection. Traditional honey bee studies tend to involve frequent physical manipulations, however honeybees do not benefit from being disturbed by frequent examinations; their

normal activities are disrupted potentially biasing results. Non-intrusive data collection using electronic bee hive monitors greatly reduces this problem. The hive monitors can reliably, frequently, consistently and objectively measure parameters such as hive homeostasis (brood temperature/humidity), bee activity (flight/foraging and fanning acoustics) and productivity (hive weight). When considering the foragers daily flight profile, t he need to consider parameters such as activity and colony strength at the same point in time becomes evident. Most often this is not practical by manual inspection, however electronic monitors allow simultaneous measurement of such parameters. In addition, the automation of data collection and data management removes the errors associated with manual record logging. Metrological data such as apiary air temperature, rainfall, humidity, sunshine and cloud cover are also collected. Electronic hive monitoring offers scientists a truly scalable solution, from semi-field trials to full-scale field trials involving hundreds or thousands of colonies across various geographical areas, over extended periods, thus facilitating pooling of diverse sets of data and reducing human resource. Finally, the accumulating data are potentially an invaluable resource for retro evaluating the cause and effect relationships. The monitors can provide "black box" data, offering an audit log of the events leading up to a colony's failure.

TQO-046

Method of operating commercial venom collection

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Apitoxin, or honeybee venom can be described as a bitter colorless liquid. The active ingredients in apitoxin consist of a complex mixture of proteins, which cause local inflammation and acts as an anticoagulant. Bee venom is produced in the abdomen of worker bees from a mixture of acidic and basic secretions. A honeybee can inject 0.1 mg of venom with its stinger. Bee venom has many commercial, medicinal and therapeutic properties. Among the growing list of uses; Bee Venom Therapy (BVT) has been used to treat arthritis, rheumatism, skin diseases, Lyme disease and chronic fatigue syndrome. Historically, collecting bee venom was a tedious procedure, requiring careful handling of each individual bee. Recently, developments in electrostimulation of worker bees have led to a revolution in bee venom collection, allowing for large-scale commercial bee venom collection operations. By stimulating bees to release Nasamov pheromone the effects of the alarm pheromone released as a byproduct .The pacifying effect makes the environment around the collecting device safer, as well as allows for the rapid redeployment of electro-stimulation equipment to other colonies. This presentation will include a description of bee byproducts and their effects as well as the techniques used in Bee operation management, including donor hive selection, proper parameters for the electro-stimulation, a working time-frame for efficient and scalable collection and the hygienic, collection, transportation, desiccation and storage of bee venom.

TQO-029

Electronic bee hive monitoring for beekeepers

Huw Antony Evans, Sandra Kordic

Arnia Ltd, United Kingdom

Arnia's remote bee hive monitoring system is aimed at minimising disruption to honey bees while actually increasing the amount of information a beekeeper gains. Benefits to a beekeeper in the active season are the ability to remotely track colonies' spring build up and ongoing development, manage swarming, verify queen status and

track nectar flow, better manage feeding and hive ventilation. Moreover, the system offers a series of alerts that are automatically sent to the beekeeper. These include: theft or hive fallen over, colony swarmed or being robbed, colony broodless, need to add/remove super or simply that the bees collected a lot of honey that day, if the hive needs ventilating or the bees need feeding during winter. Arnia's bee hive monitors feature multiple sensors (temperature, humidity, acoustics, and weight) which when combined give a detailed picture of the colony at any given time. Weight data provides invaluable information on a colony's status and productivity while temperature and humidity are indicative of the hive's homeostasis. The addition of acoustic data completes the picture by adding an element of day to day behaviour while enhancing the other data. Algorithms are currently being developed to interpret the acoustic data in relation to swarm prediction, disease detection and management. An intuitive user interface offering historical and real time data is central to beekeeper's much greater involvement. Electronic monitoring changes the way bees are managed. Furthermore, the increased intimacy fundamentally changes the relationship between beekeeper and bees.

TQO-049

Record keeping is for everyone!

James Wilkes

Hive Tracks, USA

The rapid development of computing technologies and the ever increasing availability of mobile access to the internet has created a great opportunity to leverage technology to improve beekeeping and the health of honey bees around the world. Cloud based software for record keeping offers a convenient, secure, and valuable tool for beekeepers in the complex world of managing healthy and productive honey bees. Storing a variety of data including observations, inspections, management actions, photos, videos, instrumented hive data, lab reports, and more, these software tools give a beekeeper the information needed to make wise management decisions. As the largest provider of beekeeping software in the world, Hive Tracks currently has over 17,000 registered users in over 140 countries and caters to any size beekeeper with customized software development available for commercial and government applications. Hive Tracks software is accessed through a web address, hivetracks.com, using any internet enabled device including smart phones and tablets. The benefits of using Hive Tracks include tracking the health of hives via inspections, effective queen logging, honey production, efficacy of varroa control, and feed management. For larger beekeeping operations, knowing hive locations and strength for pollination are critical as well as recording management actions of work crews like inspecting, feeding, and treating. Whether you have a couple of hives in your backyard or a couple of hundred in varietal honey production or several thousand colonies for pollination, knowing the current state your bees is essential to being a successful beekeeper.

TQO-050

The development of a beekeeping innovation, "Flow"

Stuart Anderson, Cedar Anderson

BeeInventive Pty Ltd, Australia

Over a ten year period a father-son team, Stuart and Cedar Anderson, developed a way to extract honey from a standard Langstroth hive without opening the hive and with minimal disturbance of the bees. They called this innovation the "Flow Hive" Earlier this year the pair put the invention on a crowdfunding site and were surprised

at the huge response. Many crowdfunding records were broken and tens of thousands of Flow hives have been ordered. The first deliveries went out in June. In this presentation Stuart will tell some of the story of the development of the Flow frames and how they work. He will outline the significant implications of this invention for amateur and professional apiarists and in relation to bee colony health.

TQO-040

First steps for good beekeeping practices guide for apitherapy products

Etienne Bruneau

CARI, Belgium

The level of quality required to produce apitherapy products is different from the general level required by the usual good beekeeping practice guide. We have to take into account different factors. As for other guides HACCP approach is used. In this case, the risks are linked to contaminants and degradation. Botanical origin can influence effective components. The topic is to arrive to the conservation of a maximum of active ingredients. In this frame, general recommendations are formulated for the beekeeper to produce very high level of quality products. Each product (honey, pollen, bee bread, royal jelly, propolis, apilarnil, wax) requires specific conditions for the harvest, packaging and storage.

Symposium: New Technology and Good Beekeeping II

TQO-028

Structural disruption and bioactive effect on bee-pollen treated by proteolytic enzymes

Carlos Zuluaga, Marta Quicazán

Universidad Nacional de Colombia, Colombia

Bee-pollen possesses a broad range of biological activities. It is recognized as a valuable nutritional source of protein and fat, and bioactive compounds such carotenoids, vitamins, flavonoids and phenolic compounds. In particular, to these bioactive compounds have been attributed beneficial properties, suggesting its use as a dietary supplement. However, nutrient absorption and biological activities of bee-pollen may be restricted due to its complex pollen wall, composed of sporopollenin, a lipid copolymer of p- hydroxycinnamic acids and fatty acids, cross-linked with ethers and esters, and some types of carotenoids, tocopherols, pro- vitamin A and vitamin D. Several reports indicate a breakdown of the sporopollenin would enhance availability of biological compounds. Enzymatic hydrolysates are proposed as a strategy to increase digestibility of bee-pollen with potential beneficial effects on bioactive compounds and antioxidant activity. The aim of this study was to assess the effect on parameters such protein, total phenolics and antioxidant activity, when a combination of thermal treatment and commercial proteases are employed to obtain bee-pollen hydrolysates were proved: alcalase, neutrase and protamex. In addition, a Scanning Electron Microscopy (SEM) was performed in order to visualize the structural

modification of the grain. It was found that the a thermal treatment and hydrolysis carried out by protamex, could improve the protein content in about 18%, phenolic compounds 106% and the antioxidant activity in 68%. SEM showed how the exine of bee-pollen was disrupted into fragments, eventually freeing compounds with nutritional and bioactive potential.

TQO-012

Some challenges and achievements in the development of Brazilian green propolis

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Brazilian green propolis is mainly produced in the States of Minas Gerais and São Paulo. Its main botanical source is Baccharis dracunculifolia (Asteraceae), a shrub that grows in the "cerrado" vegetation of Southeastern of Brazil. Its major compounds are flavonoids and phenylpropanoids, from which the prenylated derivatives of p-coumaric acid, such as artepillin C stands out. We have developed HPLC validated analytical methods for the quantitative analysis of the phenolic compounds (phenylpropanoids caffeic, ferulic and coumaric acids; flavonoids aromadendrin and isosakuranetin; prenylated phenylpropanoids artepillin C, baccharin and 2,2-Dimethyl-6-carboxyethenyl-2H-1-benzopyran) in both green propolis and B. dracunculifolia, which allowed the standardization of green propolis extract. Also, we have found green propolis active as antimicrobial, wound healing, antiulcerogenic, anti-inflammatory, immunomodulatory, antiviral, antigenotoxic and antileishmanial. The standardized extract was evaluated in pre-clinical and phase one clinical assays, and was found save for human uses. Aiming to increase the production of green propolis we have undertaken the cultivation of 10 different populations of B. dracunculifolia, allowing to develop the agrotechnology for the creation of a bee pasture for the production of green propolis to ensure the availability of this raw material to supply the market in the future. The challenge of creating a bee pasture are underway and the preliminary results are very promising.

TQO-036

Different types of traps collecting propolis by honey bees: Do they affect quantity and quality of propolis?

Antonios Tsagkarakis¹, Konstantinos Gardikis², Ioannis Katsenios², Sotirios Strigkos², Maria-Ioanna Stavropoulou³, Konstantina Stathopoulou³, Nektarios Aligiannis³, Georgios Balotis¹

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Honey bee, *Apis mellifera* L. (Hymenoptera: Apidae), is a beneficial insect which serves the environment by pollinating plants and by collecting/modificating a variety of products: honey, wax, venom, royal jelly, propolis.

Among bee products, propolis has attracted the attention of scientists due mainly to the antibacterial, antifungal and antiviral properties, while recent stud ies revealed that it po ssesses many other beneficial bio logical activities such as antiinflammator y, antiulcer, local anaesthetic, immunostimulating, hepatoprotective and anti-tumor. Only a few scientific studies related to techniques for propolis collection by honey bees have been previously reported. In the present series of experiments, three different types of propolis collection traps (0.1 mm and 0.2mm hand-made plastic screens, plus a market-style plastic grid) were used and quantitative and qualitative composition of the collected propolis was evaluated using High Performance Thin Layer Chromatography (HPTLC) and Nuclear Magnetic Resonance (NMR) techniques. All the traps were attached on Langstroth bee hives and five replications per treatment were used. Results and discussion will be presented.

TQO-037

Stability of hormone components in products based on drone brood

Dmitrii Mitrofanov, Nataliya Budnikova, Liliya Burmistrova

FSBSI "RI of Beekeeping", Russia

Homogenat of the drone brood contains sex hormones and other components able to regulate the human endocrine system. Based on the drone brood they have created in Russia some drugs used when metabolism violation, anergy, sexual dysfunction, mineral metabolism violation and other states caused by endocrine pathology. This causes actuality of studying the hormone components safety in drugs based on the drone brood. But there have not been enough researches showing stability of hormones while processing the drone brood and characterizing comparative content of hormones in different drugs to standardize and ground specific medical use indications. We have studied the safety of drone brood hormone components when stabilizing by adsorption with the use of different adsorbents as compared with native and cool-dehumidified drone brood. One can see considerably better safety of testosterone and oestradiol in the adsorbed drone brood as compared with cool-dehumidified one. While comparing sex hormones content in the drone brood adsorbed with different adsorbents we have discovered that adding bees extract to the classic lactose-glucose adsorbent promotes better testosterone stabilization as progesterone and oestradiol are better saved while using the adsorbent containing equal glucose and lactose. Thus, the content of the hormones being studied strongly depends on the stabilization conditions necessary to consider while evaluating the biological activity of the drugs.

TQO-003

Gentle Beekeeping® : a brand-new certification scheme for happy bees and happy beekeepers

Catherine Flurin

Institut pour l'Apiculture Douce, France

Gentle Beekeeping[®] is a new, bold and holistic approach of beekeeping. It sets an utmost priority to the respect of bees. It leverages the new health sciences and state-of-the-art research on beekeeping pratices and bees wellbeing. The Alternative Beekeeping addresses all beekeepers and induces a new model for beekeeping. Gentle Beekeeping® is articulated around 3 principles : 1.Full respect of the hive. 2.Gentle collecting of honey and other hive products

3.Enhanced hive environment. To qualify all these principles, the Gentle Beekeeping® is developing a voluntary scheme standard based on precise, objective and measurable criteria, as well as scientific analysis of both the products and the soil where the hives are implanted. This scheme will be annually audited by an independent certificator. It will allow the committed beekeepers to obtain an aggregated rate based on a series of indicators defined by the Institute for Gentle Beekeeping® and their Scientific Committee. The Institute for Gentle Beekeeping® , through this voluntary scheme, accompanies beekeepers around the world throughout an improvement process. The Institute for Gentle Beekeeping® also brings them a state-of-the-art expertise on the many dimensions of their beekeeping practices, biodynamic conservation and transformation processes in order to preserve the vital energy of the products, etc.). This expertise is based on collaborations with scientists and researchers from different backgrounds. Gentle Beekeeping® at last offers a range of therapeutic practices, based on a sensitive approach of bees and their vibratio ns.



Apitherapy

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Mission

Issued from the beekeeping world, its scientific and humanitarian mission is to promote the development and the application, at international level, of the researches using beehive products with medical destination. It promotes the recognition of Apiculture as a link of the therapeutic chain.





Plenary Session I

ATO-059

Honey – a sweet solution for problem pathogens and promoting digestive health

Shona Blair

i3 Research Institute - University of Technology Sydney, Australia

Honey has been used therapeutically throughout the history of the human race, by an extremely diverse array of cultures. Ailments traditionally treated with honey ranged from diseases of the gastric and respiratory systems to burns, wounds and eye infections. Honey has been especially persistent as a wound dressing, probably because it exhibits significant antimicrobial activity due to high sugar content, low pH, hydrogen peroxide production and floral factors. However, activity levels vary greatly from honey to honey depending on the floral source. Usually active honeys are such because of the enzymatic production of hydrogen peroxide. However, a few rare honeys, from certain species of Leptospermum flora native to New Zealand and Australia, also contain additional antibacterial properties. Various honeys have significant activity against problematic pathogens, including antibiotic-resistant "super bugs", bacteria living in biofilms and fungal pathogens – all of which are becoming increasingly difficult to treat with conventional medicine. Honey also promotes wound healing, regardless of infection status, and there are many studies showing the benefits of honey as a modern wound dressing. For example, certain honeys are being used to dress chronic ulcers, with remarkable results, as well as on other infected wounds and burns. Recent work also suggests that eating honey could have a beneficial effect on the human intestinal flora, with subsequent positive health impacts. The potential benefits of an increased medicinal use of honey cannot be ignored, and there are now significant data that argue for a greater use of selected honeys in modern medical practices.

ATO-060

Proposal for standardization of propolis: International standards - how is it possible

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Proposal for standardization of propolis: international standards - how is it possible. Propolis is a plant derived bee product and its chemical composition is highly variable, depending on the local flora and the resinous plant materials available to honeybees. There are many different chemical types of propolis, having completely different chemical composition and containing different bioactive compounds. This fact makes the elaboration of a uniform international standard for propolis impossible. For most of the distinct propolis types, the most important bioactive constituents are well known and proved. The way to achieve reasonable standardization of propolis is to apply the approach used for standardization of medicinal plants. Thus, it is possible to formulate international standards for different propolis chemical types based on the content of the corresponding active principles, measured by specific and appropriate analytical procedures. Such procedures and values have already been proposed for poplar type (European) propolis, Brazilian green (Baccharis) propolis and for Pacific (Macaranga) type propolis. More work has to be done in order to formulate standards for other propolis types, e.g. red South American or some African

propolis types. Important point is the recognition (dereplication) of the chemical type of the particular propolis sample/batch.

The therapeutic effects of bee venom on liver fibrosis

Kwan kyu Park

Catholic University of Daegu, Republic of Korea

Bee venom (BV) therapy is the therapeutic application of honeybee venom. This has been used as a traditional medicine to treat a variety of conditions. Many studies on the biological and pharmacological activities of BV have been carried out. However, the cellular mechanism and anti-fibrotic effect of BV on liver fibrosis are not fully understood. In the past few years, we investigated the various effects of bee venom on liver fibrosis. Liver fibrosis is initiated when liver injury stimulates cells in the liver to synthesize and secrete proteins and other soluble mediators. Therefore, we investigated the anti-apoptotic effect of BV on TGF-1- induces apoptosis in hepatocytes. Our results showed significant protection from DNA damage by BV treatment. Furthermore, BV suppressed TGF-1-induced activation of bcl-2 family and caspase family of proteins, which resulted in inhibition of hepatocyte apoptosis. Also, we examined whether BV regulates the pro-inflammation and fibrosis related genes against a CCl4- induced hepatic fibrosis mouse model. BV suppressed the secretion of inflammatory cytokines such as IL-1 and TNF-. Moreover, BV inhibited expression of TGF-1, smooth muscle actin and fibronectin in CCl4-induced mouse model. These results demonstrate the potential of BV for the prevention of hepatocyte apoptosis and fibrosis induced by TGF-1 in vitro and CCl4-injected in vivo.

Plenary Session II

ATO-068

Apitherapy in the world. present situation and perspectives

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¹ International Federation of Apitherapy, Romania ² Research and Development Beekeeping Institute, Romania

We appreciate that in the whole world there are at least 10,000 apitherapy practitioners, most of them being beekeepers that has got a short local/regional training in this method. There are also around 1,000 medical doctors that are practicing apitherapy in their private or government own offices/clinics. Some countries, like Korea, Romania, Germany, France, Italy, Slovenia, Serbia, Hungary, Lithuania, Ecuador, United States of America, United Kingdom, Malaysia, China, Japan, Chile, Argentina, Brazil, Colombia, to cite only a few of these countries, have their own national apitherapy associations/societies that organizes regularly various events like courses, symposia, congresses. Since 2012 it was created in Germany the International Federation of Apitherapy having as main goal to create an international bridge between scientists, apitherapists and beekeepers from all over the world. The perspectives of apitherapy development are very good, due to the late excellent technological communication advancements (Internet, Google, Facebook, PUBMED, etc.). We consider as extremely important that Apimondia

continues to help the development of apitherapy in all Apimondia related countries, including by organizing several courses/workshops/round tables, several times each year, with recognized national and international experts in apitherapy. Only with such more frequent international events can be the scientific findings and the relevant information on bee products and apitherapy be really put in practice and thus help millions of human beings that are still suffering of thousands of various diseases, all over the world.

ATO-018 Therapeutic properties of Moroccan bee products

Badiaa Lyoussi

University of Fez, Morocco

There is an increasing interest of the consumers, pharmaceutical and food industries in products originating from the honeybees, for their promising nutraceutical and medicinal benefits, such as antioxidant effect for health sustaining and disease prevention, safe and effective food preservation activity, and as medicinals. Bee products and some of their constituents exhibit a variety of biological and pharmacological activities, and it has had an ancient history as a curative agent in human health. Honey, Propolis, royal jelly and pollen has several pharmacological activities, including diuretic, vasodilator/hypotensive, anti anemia and anti-diabetes in rats, rabbits experiments, promotes endothelial health, antihypertensive, antihyperlipidemia. Antioxidant activity of honey, Propolis samples from diverse places of Morocco were investigated (DPPH, ABTS, ORAC and chelating activities). The capacity for preventing lipid peroxidation and scavenging free radicals was generally correlated with the phenol and flavones content. Some of the Propolis samples were also able to inhibit lipoxygenase and acetylcholinesterase. In vivo, Propolis and honey preparations are able to attenuate diabetic hepatorenal damage, probably through its anti-oxidative action and its detoxification process. The protective role of some bee products against the ROS induced damages in diabetic rats and nephrotoxicity models gives a hope that they may have similar protective action in humans. The study in diabetic rats, nephropathy model reveals that honey, Propolis, pollen has a remarkable effect on glucose homeostasis and kidney function A review on therapeutic properties of bee products in experimental animal's model and human health will be presented

Symposium: A Potential Therapeutic Agents, Honey

ATO-054

Honey and runner

Abdolkarim Salehnezhad², Saleh Saleh Nezhad¹, Majid Akef³, Mashallah Jamshidi

¹ University of Malaya, Malaysia ² Shahd Golha

Honey is a natural tasty food which has many uses. There are many drug products, supplements and energizer which are used by runners today. In many numerous studies and clinical trials has been proven the positive honey properties in sport. Many runners and athletics are curious about diets and there are remedies and recipes to make food supplements and drinks from honey which can be consumed before, during and after running. Accordingly,

Honey contains different nutrients and provided a powerful energy boost. Honey heightens runner performance and help runners in running activities such as 5K, 10km, half marathon and full marathon.

ATO-042 Honey: A complementary therapy in managing acute infant diarrhea

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Aim: to compare the outcomes of Oral Rehydration Solution (ORS) supplemented with natural honey versus ORS alone. Method: A placebo single blind trial was performed in Omdurman pediatric teaching hospital from March to August 2014, involving 90 children aged from 1 to 5 years suffering from acute watery diarrhea. The control group consisted of 30 patients who received conventional WHO ORS, and the test group consisted of 60 patients who received ORS supplemented with natural honey in a dose of 2g/ kg/day. Results: In test group, there was significant improved ORS intake orally compared to control group (P < 0.01). Also there were significant improvements in diarrheal: frequency (P < 0.001), consistency (P < 0.042), and amount (P < 0.035) during follow up of the patients. There was significant weight gaining (9.02 ± 1.28 Kg) after rehydration in honey treated group compared to control group (9.13 ± 1.5 Kg) with probability value < 0.001. Analysis of the studied honey, confirmed absence of pathogenic bacteria such as E. coli, Salmonella spp., Clostridium botulinum, only Staphylococcus aureus was detected in a non infective titer of $3.0 - 4.0 \times 102$ cfu. Also the chemical composition of the studied honey was in compliance with the world standards for honey and its mean caloric value was 11.33 k cal. Conclusion: Due to potential antibacterial, antiviral, antiprotozoal, and anti-inflammatory properties of honey, when honey added to conventional WHO ORS shortened the diarrhea illness duration "hospital stay" and prevented progression to malnutrition

ATO-040

An evaluation of sperm morphology assay in mice exposed to Rhododendron honey

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Rhododendron honey (RH) is especially obtained from Rhododendron plant situated in Black Sea Region of Turkey and also called as "mad honey" among the public. It causes poisoning in humans due to grayanotoxin in its structure. However it commonly has use as curative at some diseases among public. The present study was undertaken to investigate the mutagenic effect of RH in mice germ cells using sperm morphology assay. In present study, concentrations 25, 50 and 75 mg/kg of RH were used as test material. For the sperm morphology assay,

mice were intraperitoneally injected with these concentrations of RH for 24h. The animals were sacrificed by cervical dislocation. Both of the cauda epididymis was dissected out, cut into pieces in physiological saline, filtered and smears were fixed in methanol and were stained with Giemsa. One thousand sperms per animal were scored and sperm abnormalities were determined at a magnification of x1000. RH induced different types of sperm abnormalities such as "hookless", "banana", "amorphous", and "folded" sperms at all concentrations for 24h when compared with the negative control, but these increases were not statistically significant. The results of the present study show that the concentrations 25, 50 and 75 mg/kg of RH didn't cause genetic damage in the male mice germ cells. Acknowledgment: This study was a part of scientific research titled "The Genotoxic and Cytotoxic Effects of Rhododendron Honey on Bone Marrow and Sperm Cells of Mice" and it was supported by Duzce University Scientific Research Fund [Project Number= 2013.01.01.199].

ATO-047

Honey from Uncaria tomentosa (Willd.) DC: A new organic functional product that protects natural immunity and prevents premature radiation aging - Background and problem formulation

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Background. The predominant scientific theory of premature radiation aging is that induced by ionizing radiation oxidative stress produces oxygen centered radicals that damage key macromolecules essential to life such as DNA, RNA and proteins. The oxidative modification hypothesis of atherosclerosis predicts that low-density lipoprotein oxidation is an early event in atherosclerosis. Three possible ways exist to intervene in the aging process: by antioxidant intervention, by DNA repair enhancing intervention, by combinations thereof. The connection between DNA damage and immunity is via the knowledge that immunity is dependent on antigenic stimulation of growth. Cell proliferation cannot proceed in presence of DNA lesions. From this follows that if immune cells cannot grow, then there will be immune suppression. Carboxy alkyl esters (CAEs) a new class of actives isolated from Uncaria tomentosa, are like molecular soaps that cleanse cell membranes by competing with phospholipids in membrane and improve microviscosity and the cholesterol-to-phospholipid ratio within the cell membranes, which determines whether exists efficient transport of chemical messengers or signals into cells that govern growth, function (DNA repair and immune cell metabolism) of exposed cells. CAE strongly influences and regulates DNA repair and apoptosis. Problem formulation. The goal is to "nourish" cell membranes with CAEs to improve the cholesterol-to-phospholipid ratio. So the problem is to get a new functional product the high-quality honey with predefined properties, which would contain active ingredients from Uncaria tomentosa, coupled with active substances from the body of bees, to prevent premature aging caused by radiation and to enhance natural immunity.

ATO-016

Microscopic and microbiological analysis of thyme honey in Turkey

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Thyme honey is the best quality honey which is produced by the bees using the nectar of pure thyme flower. It is clear and full of thyme aroma. It is produced from plants of the Lamiaceae family. The presence of pure thyme honey in Turkey is fairly rare because thyme collected prior to the flowering period of the planted areas used in the production. As a Long term microscopic examination results pure thyme honey were cultivated in the province of Denizli. The density of thyme honey were determined and 50% (v/v) stock solution prepared by weighing and dissolving the thyme honey in Mueller-Hinton broth (Oxoid, Hampshire, UK) and investigated microbiological effect of thyme honey. Reference two Gram- positive and three Gram-negative bacterial strains which mostly cause nosocomial infections were obtained from the American Type Culture Collection (ATCC): Methicillin-Resistant Staphylococcus aereus, MRSA (ATCC 33591), Vancomycin Resistant Enterococcus faecalis, VRE (ATCC 51575), Extended Spectrum Beta-Lactamase (ESBL) Klebsiella pneumoniae (ATCC 700603), Acinetobacter baumannii (ATCC 17978), Pseudomonas aeruginosa (ATCC 27853). Thyme honey inhibited the growth of all five bacterial isolates at concentration ranging from 6.3% to 12.5% (v/v). In our study, different extracts of the thyme honey were prepared and used for microbiological analysis. This investigation important because a microorganism, even in the observation of the antimicrobial effect, use plants containing etheric oil can be used for therapeutic purposes and have shown that can be an alternative to synthetic antibiotics.

ATO-010

Development of natural honey containing powder products as a sweetener

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There is a growing interest in natural and healthy foods in the world market. The objective of this research is to develop new sweet products in powder form based on honey as a sweetener. In addition, honey having a high moisture content, which is commonly used in bakery, will be utilized in product formulations and thereby contribute to its added value. It is necessary to add carbohydrate polymers due to high stickiness problem associated with honey during drying operations to obtain a powdered product. In this project, a variety of honey types, especially the ones having high moisture contents, and different drying techniques (vacuum drying, spray drying, freeze drying, etc.) were evaluated for obtaining a desired powdered product. The product with aimed quality attributes depending on its targeted utilization was developed based on determination of its physical, chemical and sensorial properties. Furthermore, healthy bioactive constituents of product such as phenolics and antioxidant capacity were elucidated and its addition to targeted foodstuffs were evaluated.

ATO-002

Evaluation of honey as antibacterial agent

Ahmed Hegazi, Eman Abdel- Rahman, Fayrouz Abd Allah

National Research Centre

Medical importance of honeybee products has been take the interest of medical and biologist scientists. The history of apitherapy extends back to ancient Egypt, China and Greece. Apitherapy (the term comes from the Latin apis, which means "bee."), or bee therapy, is the use of honeybee venom for therapeutic purposes. The healing property of honey is due to the fact that it offers antibacterial activity. The antimicrobial activity in most honeys is due to the enzymatic production of hydrogen peroxide. Researchers have been interested in the investigation of isolated compounds responsible for honey action; since honey-containing products have been marketed and humans have used honey for different purposes. The efficacy of honey in different protocols in vitro and in vivo suggests its therapeutic identification and characterization of the active principle(s) may provide valuable information on the quality and possible therapeutic potential of honeys (against several health disorders of humans), and hence we discussed the medicinal property of honeys with emphasis on their antibacterial activities. The goal of this review is to discuss the potential of honey for the development of new drugs, by comparing data from the literature that suggest candidate areas for the establishment of drugs due to bactericidal activity against antibiotic-resistant bacteria causing several life-threatening infections to humans.

ATO-022

Evaluation of antibacterial activity of honey samples collected from *A. florea* combs in District Khairpur

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Honey is a prospective competitor for fighting antimicrobial resistance in view of the fact that it contains an ample range of antibacterial compounds working at multiple sites. This work was directed to study the inhibitory effects of honey collected from different geographical regions of District Khairpur against certain pathogenic bacteria. It has been observed that the valuable use of honey in the management of bacterial infection is when it can be applied directly to the bacteria without dilution. There are few published reports on the physicochemical and antibacterial characteristics of honey from A. florea, the dwarf honeybee native to Pakistan. Current study explores the variation in physicochemical properties and the level of antimicrobial potential of honey samples collected from wild bee combs of *A. florea* showing potential genetic diversity from District Khairpur. The acacia honey found effective to stop growth of isolates except Proteus and Shigella. The antibacterial action of honey was attained in high concentrations of honey both in well diffusion as well as disc diffusion methods.

Effects of honey addition on antioxidative properties of different herbal teas

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Tea and herbal infusions are among the major contributors of phenolic compounds, specifically flavonoids, in our daily diet. Honey is another antioxidant-rich food that is widely used as a natural sweetener. In this work, the effects of honey addition on antioxidant properties of different herbal teas were investigated. For this purpose, 2 different types of honey (flower and pine honey) were added into 9 different herbal teas (melissa, green tea, rosehip, sage, echinacea, fennel, linden, daisy, and ginger) at 4 different temperatures (55°C, 65°C, 75°C, and 85°C), and the changes in the content of total pheolics, total flavonoids, and total antioxidant capacity were determined. The total phenolic content and the total antioxidant capacity of the honey-added-tea samples were found to be increased (up to 57% for both), especially with pine honey and at higher temperatures of honey addition. The findings of this study supported the use of honey as a natural sweetener in tea in order to be able to benefit the health-enhancing antioxidative properties of these two promising food products

ATO-019

Antifungal activity of Melipona honey and its morphological effect

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Infections caused by Candida albicans have increased in the last years, due to its natural resistance against several antibiotics and the low specificity of these compounds. Based on the empirical knowledge of antifungal activity about honey from stingless bee, we determined the necessary concentration of Melipona beecheii honey from Yucatan to inhibit Candida albicans growth. Melipona honey samples were directly collected from hives in Yucatan. For antifungal assays, we used three strains of C. albicans, two clinical-isolated (LMAM-CAY; LMAM-CAS) and ATCC 10231; the antifungal activity was determined using CLSI macro-dilution protocol and agar diffusion assay. The incubation periods were 24 and 48 hours at 37 °C. Fungal growth was evaluated by optical density at 600nm. Additional morphological analysis was performed by microscopy and karyotype of the aforementioned yeasts was carried out by PFGE. The Melipona honey showed antifungal activity against the three pathogenic yeast strains. MICs of C. albicans ATCC, LMAM- CAY and LMAM-CAS were 35, 30 and 33 % respectively. Microscopic analysis revealed that this honey causes damage at cell wall level. However, karyotypic analysis did not show significant difference among the treatments and control. The effectiveness of Melipona beecheii honey from Yucatan to inhibit the growth of the opportunistic and pathogenic microorganism Candida albicans was determined for the first time. The morphological changes of the cells suggest an interaction of the honey with some fungal metabolic mechanisms. Based on these results we conclude that Melipona honey could be an alternative treatment against Candida albicans.

Evaluation of the phenolic contents and antioxidant capacities of honey

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Honey antioxidant in nutrition and medical properties for analysis has been used recently. Antioxidant activities of two Iranian honey were investigated with other types of honey. The antioxidant activity was determined on the basis of their anti-radical, such as capture of DPPH radical measurement and evaluates the total antioxidant power, as FRAP assay. Total phenolic content of the extract was with the Folin-Ciocalteu method. A common mistake is that most scientists has focused much attention on common analytical methods and neglected antioxidant activity. Honey from Iran showed various antioxidant activities, depending on the botanical sources. The main purpose of this study was to evaluate the antioxidant capacity of the honey and may provide useful data for the potential medicinal uses

ATO-009 Antioxidant activities and chromatographic phytochemical analysis of propolis derived from Malaysian *Trigona apicalis*

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Background: Propolis is a sticky, dark-coloured, resinous substance found in beehives that is used as a protective layer against invaders such as bacteria, viruses and fungi. Currently, there is substantial evidence indicating that propolis acquires many beneficial biological properties such as anti-bacterial, anti-fungal, anti-viral, antiinflammatory, anti-ulcer, antioxidative and immunomodulating activities. Nevertheless it is believed that its bioactivities are reliant on the unique phytochemical contents of each propolis extract. Objective: This study aimed to analyze the phytochemical compositions and evaluate the antioxidant activities of hydroethanolic extracts of propolis derived from local stingless bee species, Trigona apicalis. Method: The ethanolic extracts of propolis from five different locations were analyzed using High Performance Liquid Chromatography (HPLC). The chromatographic separation was performed by using Elipse XDB-C18 column with optimized gradient method. Antioxidant activities were evaluated using the 1,1-diphenyl-2-picryl-hydrazyl (DPPH), 2,2'-azinobis-(3ethylbenzothiazoline-6-sulfonic acid (ABTS) radical scavenging and Ferric Reducing Ability of Plasma (FRAP) assays. Result: Despite the extraction method and bee species were similar, the phytochemical contents exhibited by HPLC analysis were found to be different between samples. It is assumed that the chemical composition mainly dependent on the geographical origin, seasonal factors, and local flora at the site of collection. Due to the dissimilarities in their chemical compositions, the antioxidant activities of propolis from different areas were therefore found to be diverse. Conclusion: These findings highlighted the importance of quality analysis and quality assurance technology in order to ensure the consistency of biological effects or therapy of a natural product, such as propolis.

ATO-015

Total Polyphenols and Chemical Properties of Turkish Propolis

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Propolis samples were collected in 2012 and 2013 from non-migratory beekeepers located in Sinop, Mula, Sivas, Ordu and Mersin cities which have intensive chestnut, pine, poplar, eucalyptus and acacia flora. Total polyphenols and chemical properties via GC-MS were analysed and study was repeated on following year.

Mean values of propolis samples, collected from poplar, eucalyptus, chestnut, acacia and pine flora, were found 177.49, 126.12, 119.25, 112.16, 48.73 mg GAE/g for total polyphenols. According to GC-MS analyses, mean values of % TIC (total ion chromatogram) contents found in the same order 6.58, 7.76, 6.45, 6.03, 2.28 for aliphatic acids; 15.04, 11.37, 4.53, 6.40, 3.88 for aromatic acids; 2.95, 2.26, 0.57, 1.43, 0.19 for flavonoids. We observed that chemical contents of propolis changed significantly in following two years. Propolis collecting tendency of honey bees from the same plant source varies according to plant preference, climatic conditions, species and colony requirements can be some responsible for that differences.

ATO-063

Identification of the Active Compounds and their Anti-Alzheimer's Disease (AD) Activities of Propolis

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Propolis is known to have diverse biological activities and thus it is used in various commercial products. We prepared propolis extracts from different sources(Chinese and Korean) and screened them for their biological activities such as antioxidative, antiinflammatory, and enzyme inhibitory activities to develop anti-Alzheimer's disease agents. One of the four Chinese propolis fractions was selected to isolate flavonoids compounds, ferulic acid. Alzheimer's disease (AD) is an irreversible, progressive neurodegenerative disorder resulting in memory loss, behavior disturbances, personality changes and a decline in cognitive abilities. So far, the therapeutic paradigm, one-compound-one-target has failed. This could be due to the multiple pathogenic mechanisms involved in AD including decrease of acetylcholine(ACh), amyloid (A) aggregation to form plaques, hyperphosphorylation to disrupt microtubule to form neurofibrillary tangles, calcium imbalance, enhanced oxidative stress, impaired mitochondrial function, apoptotic neuronal death, and deterioration of synaptic transmission, particularly at cholinergic neurons. It is now clear that in order to prevent the rapid progression of AD, new therapeutic approaches should target multiple AD pathways as opposed to the traditional "one drug, one target" approach. Thus, it is needed to develop safe and effective anti- AD drugs having multifunctional activities from natural resources. In continuing search for anti-AD compounds from natural sources, we found antioxidative, anticholinesterases (AChE, BuChE), anti-inflammatory, and enzymes associated with APP degradation such as

beta-secretase(BACE) inhibitory activities and GSK-3 inhibitory activities of tau protein involved in the hyperphosphorylation of the organic solvents extracts of propolis samples.

ATO-058

Geographical variation of antiviral activity of propolis against herpes simplex virus type 1 & 2.

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Herpes simplex virus-1 (HSV-1) and herpes simplex virus-2 (HSV-2) infect humans at high frequency and persist within the host for life by establishing latency in neurons. Acyclovir and its nucleoside analogues have been licensed for the therapy that target viral DNA polymerase. Although these drugs are currently effective against HSV infections, the intensive use of these drugs has led to the problem of drug-resistant strains. Therefore, the search for new sources to develop new antiherpetic agents has gained major priority to overcome the problem. Propolis were collected from Korea, China, and Brazil, respectively. Three propolis were added to Vero cells at various concentrations off 0.1-100 g/ml, HSV-1 or HSV-2 virus were infected into Vero cell at the same times, respectively. All of prolpolis extract were showed cytotoxic effect at a concentration of 100g/ml, but all of propolis extract were not showed cytotoxic effect at a concentration of 0.1-10 g/ml. Three propolis were showed antiviral activities both HSV-1 and HSV-2, and antiherpetic acitivites were slightly different in three countries. These results suggested that propolis may be use a therapeutic tool against herpes virus infections.

ATO-020

Transparent soap containing Indonesian propolis wax againts *Candida albicans* in leukorrhea patients

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Candida albicans is a major cause of pathological leukorrhea due to microbial infection. Propolis wax is a portion of propolis and thus its remains as the waste product of refined propolis are effective to inhibit growth of C. albicans, Pseudomonas aeruginosa, Staphylococcus aureus, and Streptococcus mutans. In this study we used transparent solid soap containing Indonesian propolis wax to treated patients with leukorrhea diseases. Quasi-Experimental designs that use the Pre - Experimental design One Group Pretest - posttest design with a control group who performed on patients with pathological leukorrhea in January 2014 in Tasikmalaya (West Java, Indonesia) district health center by using statistical analysis of test T Test Dependent. The negative control group was also designed. The study was conducted on 36 patients with leukorrhea were positive for C. albicans. Giving propolis wax 1% and 2% in the preparation of transparent soap made to group I (20 respondents) and group II (10 respondents). A total of 6 respondents used as the negative control group. The results showed that both treatment groups experienced a decrease in the number of C. albicans was significantly. While 6 respondents in the control

group also showed a significant result to the increase in the number of C. albicans. The results showed that the content of propolis wax 1% and 2% in the preparation of transparent soap is statistically significant influence on the subtraction of the number of patients with C. albicans leukorrhea.

ATO-003

Polyphenol-rich propolis extracts from China and Brazil exert anti- inflammatory effects by modulating ubiquitination of TRAF6 during the activation of NF-B

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Propolis is a resinous product collected by honeybees from polyphenol-rich plants. It has documented antiinflammatory properties although its mechanisms of action are understood poorly. In this study, the antiinflammatory effects of polyphenol-rich propolis extracts (PPE) from China (CPPE) and Brazil (BPPE) were examined. Oral administration of PPE to LPS-challenged mice decreased serum proinflammatory cytokine concentrations and inhibited pulmonary nuclear factor (NF)-B activation. Both PPE types modulated LPS-induced key inflammatory mediators and cytokine gene expressions in RAW 264.7 macrophages. Reactive oxygen species (ROS) production and several inflammatory mediators were suppressed by PPE in a time and dose- dependent manner. Both PPE types suppressed NF-B activation in HEK 293T cells which correlated well with their inhibitory effects on IB phosphorylation and p65 nuclear translocation in LPS-activated macrophages. However, only BPPE blocked IB degradation. In HeLa-T6RZC stable cells that NF-B signaling initiated at the level of TNF receptor-associated factor 6 (TRAF6), we found PPE suppressed NF-B activation by delaying the ubiquitination of TRAF6. In an in vitro system, both PPE types directly disrupted polyubiquitin synthesis by TRAF6. Overall, our findings indicate that despite the compositional differences, both PPE displayed similar anti-inflammatory properties through NF-B-responsive inflammatory gene expressions by inhibiting TRAF6 dependent canonical NF-B pathway.

ATO-033

Preliminary safety data with a standard propolis extract (EPP- AF®). A Phase I clinical trial in healthily volunteers

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Background: Propolis has been used to treat a gamma of diseases, especially acute inflammatory conditions. However, since the chemical composition of propolis varies according the local of its origin, clinical trial investigating the safety and efficacy of propolis are scarce. The aim of this study was to investigate the safety of a standard propolis extract, obtained from Brazilian flora. Methods: An open-label, non-randomized, single arm, multiple doses of propolis (EPP-AF®; 375 mg/day, t.i.d, 5d, p.o.) was done on 14 healthily white volunteers (6 male; 8 female). Biochemical blood and urine tests (blood counts, hepatic enzymes, bilirubin, electrolytes, creatinin, urea, glucose, creatin-phosphokinase, lipids and urinary analyzes) and 12 lead-ECG (measurement of QT and PR intervals) were done after and before the use of EPP-AF. The data was compared using Wilcoxon-matched test. P<0.05 was set as a significant value. Results: All the volunteers completed the trial. No serious adverse event (SAE) was observed and just one volunteer showed a transient elevation of CPK that returned to basal level one week after the end of propolis use. Blood pressure and cardiac frequency and ECG parameters did not change during the trial. Regarding biochemical tests, there was a small but significant elevation of HDL [41 (35-54) vs. 45 (37-56), P=0.04, baseline vs propolis) without any other change. Conclusion: This preliminary clinical trial shows that the use of 375 mg/d of EPP-AF p.o. is safe and well tolerated. The elevation of HDL is a promising result but needs further studies to be clarified.

ATO-049

Evaluation of Antioxidant polyphenols in Brazilian green propolis through spectrum-effect relationships and off-line HPLC-DPPH

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Brazilian green propolis (BGP) is a well-known natural product with many health benefits due to an abundance of polyphenolic compounds. In this study, an off-line analysis of coupling high performance liquid chromatography separation with 1,1-diphenyl-2-picrylhydrazyl free radical reaction system (HPLC-DPPH) was applied to investigate and evaluate antioxidant material basis of BGP. We identified 18 common chromatographic peaks in 22 BGP and 14 of them were further determined as chlorogenic acid, caffeic acid, p-cumaric acid, 3,5di- caffeoylquinic acid, 4,5-dicaffeoylquinic acid, aromadendrin-4'-methyl ether, 3,4,5- tricaffeoyl- quinic acid, 3-prenyl-4-hydroxycinnamic acid, kaempferide, betuletol, artepillin C, 3-prenyl-4kaempferol, dihydrocinnamoyloxycinnamic acid and 2,2-dimethoxy-8-prenylchromene-6- propenoic acid by comparing their retention times, UV spectra and molecular mass with standard compounds or referring to previous studies. Subsequently, ten predominant antioxidant polypheolic compounds were screened from propolis samples by DPPH assay. 3,4,5- Tricaffeoylquinic acid, which was found in BGP at a low level proved to be with the most potent antioxidant potentials, while Artepillin C, one of the most widely investigated Brazilian green propolis isolated compound displayed a fair antioxidant potency. Phenolic acids especially chlorogenic acid and its derivatives accounts for the major contributors to the total antioxidant activity of Brazilian green propolis (r = 0.506, p<0.01). Overall, these results indicated that the combination of the off-line HPLC-DPPH assay could be used for assessing the biological activity and chemical characterization of Brazilian green propolis and its derived products. Our method could also provide a comprehensive evaluation of antioxidant material basis for quality control on Brazilian green propolis and other types of propolis.

ATO-043

Innovative release carriers for the oral administration of propolis: a promising medicine to Diabettes treatment

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Currently, reports have claimed the attractive proposal of employing green propolis to treat Diabettes, as well as, other metabolic diseases. However, not only Artepillin C (ARC, major compound), but also, other compounds are usually of medium to high lipophilicity presenting extremely low "in vivo" bioavailability. Therefore, we have envisioned the encapsulation of propolis extract (PE) in a new particulate carrier system with mucoadesive properties. Next, PE-based nanopaticulate carrier system (NCS) was prepared to obtain monodisperse and stable nanoparticles, with diameter in the range 150-200 nm. Chitosan coating was conducted in order to confer positively charged particles and increased mucoadesion. Encapsulation efficiency reached around 95% on ARC basis. Kinetics release studies demonstrated that ARC followed zero order model release with sustained profile for up to 48 h. In addition, not only, safety in cell culture and potential antimicrobial activity, but also improved ARC stability after PE encapsulation in NCS was observed. Finally, ARC absorption was investigated with "in vitro"-everted intestinal sac model and NCS played a dominant role in its absorption rate. Therefore, enhanced "in vivo" propolis compounds bioavailability is expected for this new carrier. This outcome is attributed to direct uptake of particles through the GI tract, increased permeability by surfactants present in NCS, and decreased degradation and clearance. In conclusion, this study open s up new perspectives for the increased bioavaliability of ARC and other propolis compounds in pre-clincal studies and paves the way towards elaborating an innovative medicine to diabettes treatment.

ATO-070

Analysis the expression of transforming growth factorbeta (TGF- β) in inflamed rat dental pulp tissue following application of *Trigona* sp propolis from south Sulawesi province, Undonesia (An immunohistochemistry study)

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The aim of the study was to analyse the expression of Transforming Growth Factor-Beta (TGF-) in inflamed rat dental pulp tissue following application of propolis.

Trigona sp propolis was obtained from Luwu Regency, South Sulawesi Province, Indonesia. Flavonoid and nonflavonoid extracts were purified from propolis using thin layer chromatography. The study was applied on 80 male Sprague Dawley rats, 10-12 weeks of age, divided randomly and equally into 5 groups. Group I, as negative control group was not conducted any treatment. At group II, III, IV and V. A Class I cavity (Black Classification) were made on the occlusal surface of right maxillary first molar. The dental pulp was perforated using dental explorer and allowed in the oral environment for 1 hour, after that,Ethanolic Extract Propolis (EEP) (Group II), Extract Flavonoid-Propolis (EFP) (Group III), Extract Non-Flavonoid Propolis (ENFP) (Group IV), or Calcium Hydroxide (Ca(OH)2) (Group V) were applied. All cavities were then filled with permanent filling. The rats being sacrificed in 6 hours, 2 days, 4 days and 7 days. Sample biopsy were obtained, TGF- expression was detected by using immunohistochemistry method. Data was analysed statistically using the Freidman and Kruskal Wallis tests with significance level of p<0.05.

The result of this study demonstrated that all agent showed TGF- expression in rat dental pulp tissue, and this expression was increase with the longer of observation time. There is significant difference (p<0.05) of TGF-expression between group I and other groups in each time period.

ATO-055

Effects of propolis on the streptozotocin-induced diabetic rats and insulin-independent diabetes mellitus mice

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Propolis is well known for its anti-oxidative, antibiotic, anti-inflammatory, antimycotic, antiviral, immunomodulatory and anti- diabetic properties. Especially, the hypo-glycemic effect has been evaluated by using various propolis. For this study, streptozotocin(STZ) was administered to 4-week old, male Sprague-Dawley rats(body weight 80~110g) to induce type 1 diabetes, then ethanol-extracted propolis(total flavonoid 1.13 w/v%) was given. On the other hand, 8-week old, insulin- independent type 2 diabetic mice(body weight 35~40g, C57BLKS/J Iar-+Leprdb/+Leprdb) were treated with nonalcoholic water- soluble propolis(total flavonoid 1.06 w/v%). The mice and rats were divided into 4 groups (low, medium, high-dose group and control group). Based on total flavonoid contents, three different concentrations of propolis(1:3:9 ratio) were given to low, medium and the high-dose group respectively. The weight, blood sugar level, serum lipid level (T-CHO, TG) and oral glucose tolerance (OGTT) was measured. In addition, histopathological and immunohistochemical assessments were performed on the pancreases. In type 1 diabetes rats, the body weight increased in 3 groups compared to the control group. A hypoglycemic effect was observed in the high, medium and low-dose groups. Histopathologically, STZ-induced shrunken Langerhan's islets recovered to normal size and damaged beta cells were regenerated by propolis. In type 2 diabetes mice, hypoglycemic effects were significantly observed in 3 groups compared to the control group. No significant difference was noticed among the 4 groups immunohistochemically. In conclusion, these results suggest that ethanol extract and nonalcoholic water-soluble propolis has a hypoglycemic property and a regenerative effect on the damaged -cells in diabetic rats and mice.

ATO-067

Role of propolis as anti apoptotic agent in cisplatininduced nephrotoxicity in mice

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Cisplatin, an antineoplastic drug, it's one of the most widely used and most potent chemotherapy drugs. However, its use is limited by side effects in normal tissues, particularly nephrotoxicity in the kidney. Propolis, a natural product derived from plant resins collected by honeybees, has been known as strong antioxidants and free radical scavengers. The objectives of the study were to explain the renoprotection effect of propolis on cisplatin-induced nephrotoxicity. The study used thirtieth (30) of mice that divided in three group, controle, cisplatin and propolis-cisplatin group were observed in 3 rd day afther cisplatin injection, expression of p53 and caspase3 in renal tubule cells were measured as cisplatin apoptotic phatway related oxidative stress. MANOVA and t-test were used to analyze the data. The study indicated that Propolis knowed has anti oxidant actifity was proved decrease expression of p53 and caspase 3 statistically significant just than controle and cisplatin group (p < 0,05). This study concluded that propolis protect nephrotoxicity effect of cisplatin by the decreasing expression of p53 and caspase3 in renal tubule cells.

ATO-024

The potency of Trigona's propolis extract as reactive oxygen species inhibitor in diabetic mice

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Abstract. Diabetes mellitus (DM) is a chronic disease characterized by hyperglycemia for a long time. In this study, the effect of propolis on ROS was observed. Fifty five (55) male mice (Mus musculus SW.) were divided into 5 groups, ie; groups of KN (normal control), KDM (diabetes control) mice induced to be diabetes by using alloxan dose 200 mg/kg body weight intraperitoneally.P1, P2, and P3 which is group diabetic mice treated by propolis. Propolis solution 50, 100 and 175 mg/kg bw were given to P1, P2 and P3, while distilled water was given to the KN and KDM by oral gavage for 21 days. ROS density were measured every 7 days, while the measurement of plasma insulin was carried out every 3 days. The results showed that the lowest density of ROS was found in pancreas of KN group ($9.32 \pm 1.59 \text{ mm}^2/\text{mg}$ tissue), followed by P3 ($44.85 \pm 22.55 \text{ mm}^2/\text{mg}$ tissue), P1 ($54.41 \pm 23.73 \text{ mm}^2/\text{mg}$ tissue), P2 ($79.13 \pm 38.08 \text{ mm}^2/\text{mg}$ tissue) and DM (109.58 $\pm 20.77 \text{ mm}^2$ mg tissue). The highest plasma insulin levels was found in KN group ($3.50 \pm 0.370 \text{ µg/mL}$) followed by P3 ($02.44 \pm 0.146 \text{ µg/mL}$), P1 ($2.44 \pm 0.453 \text{µg/mL}$) and P2 ($2.22 \pm 0.333 \text{ µg/mL}$). KDM has the lowest plasma insulin levels, $1.41 \pm 0.286 \text{ µg/mL}$. From this study, we concluded that propolis can decrease ROS density and causing an increase plasma insulin levels

East Java propolis extract as potential intracanal medicament in chronic apical periodontitis caused by *Enterococcus faecalis* infections

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A persistent infection after cleaning and shaping the root canal is the main etiology of root canal treatment failured. Enterococcus faecalis (E. faecalis) has been considered one of the most resistant species in the oral cavity.. E. faecalis can stimulate TLR-2 which can increase NF-kB in Cronic Apical Periodontitis. East Java Propolis shown to have antibacterial effect and biocompatible in in-vitro. Aim : is to analysis East Java propolis extract as potential intracanal medicament in Chronic Apical Periodontitis caused by E faecalis bacterial infection. Methods : This study used 24 Wistar rats were divided into three groups, Group I, first upper right molar tooth did as healthy tooth used for negative control group. Group II, first upper right molar tooth did a prepared root canal and 10ml BHI contain E faecalis ATCC29212 106 CFU injected into the canal and restoration with Glass Ionomer Cement (GIC) for positive control group. In the group III, after prepared root canal, then injected E faecalis ATCC29212 106 CFU then applicated 10 μ l Propolis and restoration with GIC. It takes 21 days to get periapical lesions after pulp infection. Mice were sacrificed and then immunohistochemical examination was measured the expression of TLR-2 and NF-B. Result : the average of TLR-2 and NF-kB on group III significantly lower than control group (p<0,05). Conclusions : East Java Propolis extract is potential intracanal medicament in Chronic Apical

Symposium: Use of Propolis as a Natural Antibiotics

ATO-065

Bee hive air therapy in Europe

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It is over a century ago, that the beekeepers in Hungary noted, that sleeping in bee houses has healing effects. Also in Slovenia are similar observations noted. In the recent times, Austrian and German beekeepers are also using the bee hive air for inhalation. One medical team in Germany observed the healing effects of the inhaled beehive air on 66 Patients. Allergy (46%), Asthma (24%), Bronchitis (13%) and COPD (9%) were treated. The treatment was evaluated with professional questionnaire and lung function measurement. Best results are for children, and for asthma or allergy to achieve. There is another approach in Ukraine and Hungary, sleeping on the hives. Single observations showed besides the lung treatments, the pain killing effect of the bee hive air too. Previously we evaluated the detoxification effects of the honey massage [1,2]. We combined of inhaling the bee hive air with the honey massage. The patient lies on the bee hives during the massage with honey. Results will be presented. We suggest a common protocol for using the healing effects of the bee hive air. For bee-keepers, who would like to join, the common protocol is in an internet site available: www.bienenluft.org. This site gives the

professional questionnares for every disease and makes also reservation for the patient. The system makes scientific evaluations too.

ATO-057

Anti-helicobacter pylori activities of a new non-alcoholic water- soluble propolis (WEEP-3®)

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Infections by Helicobacter pylori are very common and can cause gastroduodenal inflammation leading to peptic ulcers and the increased risk of gastric neoplasia. Gastric infection of Helicobacter pylori increases urease activity which generates ammonia, neutralizes gastric acidity, and promotes inflammation. Previously, we have developed the process to produce non-alcoholic water-soluble propolis (WEEP) from ethanol-extracted propolis. Recently, we produced a new product of water-soluble propolis (WEEP-3®) to have both anti-inflammatory and anti-Helicobacter pylori activities for improvement of stomach problems. In this study, we examined the anti-Helicobacter pylori activities of a new product (WEEP-3®) using several strains of Helicobacter pylori (ATC C 26695, 52, CH150, SS1). Anti-Helicobacter pylori activities were determined by disc diffusion assay and antimicrobial-linked urease inhibition assay. In the disc diffusion assay, WEEP-3® showed a clear dose-dependent inhibition on Helicobacter pylori. In the urease inhibition assay, several products of WEEP showed 35~78% inhibition on urease activity at 1 mg/ml. Among them, WEEP-3® showed strongest inhibition (78%) on urease activity. These results indicated that WEEP-3® has the highest anti-Helicobacter pylori activity among our several products of water-soluble propolis (WEEP).

ATO-056

Anti-inflammatory activities of a new non-alcoholic watersoluble propolis (WEEP-3[®])

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Previously, we have developed the process to produce non-alcoholic water-soluble propolis (WEEP) from ethanol-extracted propolis. Recently, we produced a new product of water-soluble propolis (WEEP-3®) to have both anti-inflammatory and anti- Helicobacter pylori activities for improvement of stomach problems. In this study, we examined the anti-inflammatory activities of a new product (WEEP-3®). For determining in vitro anti-inflammatory activities, RAW 264.7 macrophage cells were treated with LPS and WEEP-3® for 24hr and the
production of nitric oxide and mRNA levels of proinflammatory cytokines (TNF-, IL-1, IL-6) were measured. WEEP-3® treatment greatly reduced the production of nitric oxide; 56.0% inhibition at 50 g/ml and 86.7% inhibition at 100 g/ml. Also, mRNA levels of proinflammatory cytokines (TNF-, IL-1, IL-6) were significantly inhibited by WEEP-3® treatment. In vivo anti-inflammatory activity was confirmed in alcohol-induced gastric inflammation model of rat. After oral intubation of ethanol, WEEP-3® was administered twice at 175 mg/kg body weight and the gastric ulcer area was determined 24hr after ethanol treatment. The ulcer area was 20.7% of total area of stomach in ethanol control group, but it was greatly reduced to 9.9% by oral administration of WEEP-3®. These results demonstrated that WEEP-3® greatly reduced the in vitro inflammatory response and the alcohol-induced gastric inflammation. Therefore, WEEP-3® can be used as an excellent agent to improve the stomach problems.

ATO-027

The inhibition of inflammasome by Brazilian propolis (EPP-AF)

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Propolis extracts have gained attention of consumers and researchers due to their unique chemical compositions and functional properties such as its anti-inflammatory activity. Recently, it was described a complex that is also important in inflammatory processes, named inflammasome. The inflammasomes are a large molecular platform formed in the cell cytosol in response to stress signals, toxins and microbial infections. Once activated, the inflammasome induces caspase-1, which in turn induces the processing of inflammatory cytokines such as IL-1 and IL-18. So, to understand about inflammasomes regulation becomes crucial to treat several disorders including auto-inflammatory diseases. Since green propolis extracts is able to regulate inflammatory pathways, this work purpose was investigating if this extract could also act on inflammasomes regulation. First, the extract was characterized and it demonstrated the presence of important compounds, especially Artepillin C. This extract was effective in reducing the IL-1 secretion in mouse macrophages and this reduction was correlated with a decrease in activation of the protease caspase-1. Furthermore, we found that the extract at concentration of 30 g/mL was not toxic to the cells even after 18 hours treatment. Altogether, these data indicate for the first time that Brazilian green propolis (EPP-AF®) extract has a role in regulating the inflammasomes.

ATO-028

Antimicrobial properties of propolis soaps against selected microorganisms

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The antimicrobial activity of the ethanol extract of propolis (EEP) from stingless bee, Tetragonula biroi Friese was screened for activity against Escherichia coli, Pseudomonas aeruginosa, Bacillus cereus, Candida krusei, Staphylococcus aureus, and Penicillium chrysogenum using the disk diffusion method and agar-well assay. The most efficient propolis extract was then combined with soaps derived from coffee (Coffea arabica), tomato (Lycopersicon esculentum), papaya (Carica papaya) + carrot (Daucus carota), and guava (Psidium guava) + acapulco (Casia alata). Similar formulation of soap but without propolis and a commercial soap were used as control. The activities of the soaps were determined using the filter disc assay. Highest inhibitory activities of EEP was observed at 30% on Bacillus cereus (14.70 mm), followed by Staphylococcus aureus (13.22mm), Penicillium chrysogenum (11.11mm), and Candida krusei (1.67mm) . The EEP has no significant effect on Escherechia coli and Psedomonas aeruginosa. When 30% EEP was added to the different soap variants, the antimicrobial activity of the formulation was higher than the commercial soap with trichlocarban against Bacillus cereus, Staphylococcus aureus, Candida krusei and Penicillium chrysogenum. Highest zones of inhibition were observed against Bacillus cereus. The gram- negative bacteria, Escherichia coli and Psedomona aureginosa, did not exhibit any activity in all the soaps tested. The data generated from this study will be useful in harnessing the potential of bee products, like propolis in soap production, and other related cosmetic products.

ATO-005

The effect of propolis on oral pathogens and human gingival fibroblasts

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Propolis is one of the few natural remedies that have maintained its popularity over a long period of time. The aim of this study is to investigate the antimicrobial properties of six propolis solutions and evaluate their cytotoxicity on gingival fibroblasts at different dilutions. Two different solutions of powder propolis (Sigma) and propolis obtained from pine (Pinus brutia) trees of Turkey were prepared and propylene glycol (PG) and alcohol were used as solvents for each propolis sample. In addition to the four propolis solutions, two other propolis samples of far geographic regions (USA and Australia) were included in the study. The antibacterial effects of six solutions on oral pathogen microorganisms were tested and their cytotoxic effects on human gingival fibroblasts were evaluated by MTT assay. The effective dilutions of the six propolis samples on periodontopathogen microorganisms were found to be cytotoxic to gingival fibroblasts. All solutions had strong antifungal activity and the effective dilutions were safe for gingival fibroblasts. Propolis could have a promising role in the future medicine, if appropriate solutions can be prepared being strongly antibacterial and non-cytotoxic as well.

ATO-001

Effects of dietary propolis supplementation on nonspecific immune response and disease resistance of olive flounder (*Paralichthys olivaceus*)

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The study was conducted to investigate the effects of dietary propolis supplementation on non-specific immune responses and disease resistance of olive flounder and evaluate effects of solid and liquid forms of propolis simultaneously. A total of 600 fish averaging 30g were randomly distributed into 24 tanks in group of 25, and each tank was assigned to one of three replicates of eight diets containing 0 (Control), 0.25, 0.5, 0.75 and 1 % from propolis powder form and 0.25, 0.5 and 1 % from liquid form (PP 0.25, PP 0.5, PP 0.75, PP 1, PL 0.25, PL 0.5 and PL 1). Fish was fed each experimental diet twice daily for four weeks to apparent satiation. At the end of the feeding trial, Lysozyme activity Myeloperoxidase, and total immunoglobulin was significantly higher in fish fed PP 1 and PL 0.5 diets. However superoxide dismutase did not significantly differ compared to the control. PP1 showed a significant increase in anti-protease activities compared to the other groups. In the conclusion, non-specific immune responses of olive flounder can be enhanced by dietary supplementation of powder and liquid forms of propolis and optimum level of propolis supplementation for olive flounder would be 1% from powder form or 0.5% from liquid form in diets. Dietary supplementation of several types of propolis seems to improve innate immunity and disease resistance of marine fish.

ATO-066

Propolis inhibits the adipogenesis of 3T3-L1 cells through down-regulation of PPAR

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Obesity is a major risk factor in the improvement of human health in both developed and developing countries, and it induces a lot of pathological disorders such as diabetes, hypertension, cancer, and heart disease. Obesity is induced by the differentiation of new adipocytes from preadipocyte. Propolis is a resinous material collected by bees from exudates, and has plenty of biological and pharmacological properties. In the present study, We tested whether propolis could inhibit the adipogenesis of 3T3-L1 preadipocyte. Treatment with propolis (1 ~ 10 M) during the 14-day differentiation period significantly decreased the accumulation of intracellular triglyceride of differentiating 3T3-L1 adipocytes in dose dependent manner.Glycerol 3-phosphate dehydrogenase activity, a marker of late adipocyte differentiation, was also decreased in differentiating 3T3-L1 adipocyte treated with

propolis in a dose dependent manner. Propolis suppressed the expression of PPARg, adipocyte-related proteins of differentiating 3T3-L1 cells. In addition, inhibitory action of propolis on differentiating 3T3-L1 cells was effective only at the initial stage of 3T3-L1 adipocyte differentiation. These results suggested that propolis might have the anti-obesity effect by the inhibition of adipocyte differentiation.

ATO-023

Effects of propolis on skin cells: the promising material for cosmeceuticals

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orea

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Propolis is a natural resinous mixture produced by honey bees from substances collected from parts of plants, buds, and exudates. Propolis is used for many dermatological purposes, such as wound healing, burns, acne, herpes simplex and neurodermatitis. Although propolis is widely used practically, little is known about the potential effects of propolis on skin cells. In this study, we investigated the effects of propolis on various skin cells, including keratinocytes, melanoma cells and sebocytes. First, we examined the effect of propolis on skin hydration in human keratinocytes. Propolis increased glycerol uptake and mRNA expression of aquaporin 3 (AQP3) in human keratinocytes. When topically applied onto the tape-stripped mouse skins, however propolis did not affect transepidermal water loss (TEWL). Second, we examined the effect of propolis on skin inflammation in human keratinocytes. In poly(I:C) induced-innate immune response, propolis significantly decreased the mRNA expression of pro-inflammatory cytokines, such as IL-8 and TNF. Third, we assessed the effect of propolis on melanogenesis in human melanoma cell lines. Propolis reduced tyrosinase activity and melanin synthesis, indicating that it has the whitening effect. Finally, we determined the effect of propolis on lipogenesis in human sebocytes. Based on a lipogenesis study using Oil Red O staining and thin-layered chromatography (TLC), propolis strongly downregulated IGF-induced lipid production. Taken together, our data suggest that propolis can be used as an ingredient for cosmeceuticals, targeting various dermatological events such as inflammation, pigmentation and lipogenesis.

ATO-069

Brazilian propolis induces arginine-dependent insulin secretion.

Takeshi Imai

NCGG, Japan

Arginine, a semi-essential amino acid, is known as one of the most strongest insulin secretagogues in a glucosedependent manner. Arginine induced insulin secretion in mice as well as cell line, NIT-1. We established the screening system for identifying the arginine-induced insulin secretion. First we selected some foods which may have anti-DM activities, and made extracts from these foods. The extracts were administrated to NIT-1 cells, and screened as arginine-induced insulin secretagogues. Brazilian propolis induced insulin secretion higher than arginine did. Surprisingly Chinese propolis had no activity for insulin production.

Propolis is a resinous mixture that bees collect from tree buds, sap flows, or other botanical sources, suggested that the contents of propolis are different from the places. We focused Drupanin and Artepillin C, which are small chemical compounds and found in Brazilian propolis specifically. They had some insulin secretion activity, similar to arginine, indicated that there were some other factors, which were the arginine mimetics for insulin secretion.

To identify target factor(s) of arginine/Brazilian-propolis induced insulin secretion, our previous study was that nanobeads technology facilitated us to purify chemical-target factors. This time we chose the other way, insulin-associated factor purification. Two insulin-associated factors were purified and identified. Latest results will be present and discussed.

ATO-026

Anti-parasitic activity of propolis

Eman Abdel- Rahman, Ahmed Hegazi

National Research Centre, Egypt

Propolis (bee glue) is a resinous hive product, collected from various plant sources. It has been long used in folk medicine of different nations as early in Egypt as 3000 BC. It has attracted much attention as a useful material applied in medicine due to its pharmacological and biological activities. Researchers have been interested in the investigation of isolated compounds responsible for propolis action; since propolis-containing products have been marketed and humans have used propolis for different purposes. The efficacy of propolis in different protocols in vitro and in vivo suggests its therapeutic properties. Recently, attention is being focused on the antiparasitic activity of propolis, the goal of this review is to discuss the potential of propolis for the development of new drugs, by comparing data from the literature that suggest candidate areas for the establishment of drugs against parasites.

ATO-045

Biological activity of Artepillin C obtained from Brazilian green propolis

Byungyoon Cha

CHUBU University, Japan

Brazilian green propolis, which is produced by bees that collect exudates from Baccharis dracunculifolia DC in southern and southeastern regions of Brazil, contains high levels of Artepillin C (ARC) and other flavonoids. Studies have demonstrated that ARC possesses antimicrobial, antioxidant and antitumor activities. ARC also exhibits anti-inflammatory effects in vitro and in vivo. In our previous study, we demonstrated that ARC induces adipocyte differentiation and stimulates glucose uptake in 3T3-L1 adipocytes by activating peroxisome proliferator-activated receptor (PPAR) as a ligand (Choi SS et al. 2011. Biochem Pharmacol.81:925-33). In the present study, we investigated the comprehensive effects of ARC on metabolic functions in the diabetic obese ob/ob mouse model, and in a co-culture system of adipocytes and macrophages. We demonstrated that ARC suppressed the production of proinflammatory mediators such as monocyte chemotactic protein 1 (MCP -1) and

interleukin 6 (IL-6), and decreased the development of insulin resistance by regulating inflammatory interactions between adipocytes and macrophages in adipose tissue. ARC also blocked the expression of these proinflammatory mediators in TNF-stimulated adipocytes and fatty acid-stimulated macrophages. In a rodent model of diabetes and insulin resistance (ob/ob mice), ARC ameliorated abnormalities in plasma glucose and lipid levels. In vivo, ARC reduced the level of inflammatory cytokines. These results indicate that ARC may have beneficial effects for the prevention and/or treatment of insulin resistance.

Symposium: Clinical Studies of Bee Venom

ATO-006

Treatment of neuralgia with microdoses of bee venom

Cristina Pavel

Romanian Apitherapy Society, Romania

Bee venom is powerful analgesic and can replace successfully classic medication for pain management. The paper presents 6 cases of neuralgia (trigeminal neuralgia, lombosciatica, acute lumbago, pudendal neuralgia and lumbar hernia 2 cases) which were helped by only few sessions of bee venom in microdoses. In all cases, patients tried before several other treatments, even surgery (for lumbar hernia), but pain persisted. Because of acute pain, the doses of bee venom were very small, otherwise pain would have been aggravated. The advantage of bee venom treatment is very fast but also long lasting therapeutic response.

ATO-029

Effect of Bee venom acupuncture as a complementary modality for treatment of chronic low back pain

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National Research Centre, Egypt

Bee venom acupuncture (BVA) from honeybee (*Apis mellifera*) was assessed for their potential use as a complementary modality for treatment of chronic low back pain (CLBP). The purpose of this study is to determine whether BVA is effective at improving pain intensity, functional status and quality of life in patients with CLBP. This study is a randomized, controlled clinical trial with two parallel arms. We intend to compare the effects of BVA by bee sting or bee venom collected by the electric shock device and pharmacotherapy with pharmacotherapy only in patients with CLBP Patients with chronic LBP will be recruited with a target sample size of 40 participants (18 and 65 years of age, experiencing LBP lasting for at least the previous three months, scoring 4 points on a 10-cm visual analog scale (VAS) of LBP at the time of screening). The results revealed that the bee venom apiacupuncture showed significant improvement in patients received bee venom group compare to patients received pharmacotherapy only. It is concluded that both modes of treatment for CLBP gave improvement regarding pain intensity, disability and quality of life being more evident in bee venom group supported with improved serum (IL1 and NF-KB).

Apitherapy in diabetes

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The paper investigated the effects of bee products for the maintenance of blood glucose levels when modeling rats diabetes 1 and 2 types. Experimental modeling of diabetes was conducted on 70 rats. Type 2 diabetes in animals caused per os administration of 40% glucose for 14 days. Type 1 diabetes cause ip administration of alloxan (130 mg / kg). Therapy bee products (propolis (per os 100 mg / kg), royal jelly (per os 100 mg / kg), bee venom, (i p 0,1 mg / kg) was performed 10 days. Control animals were simulated in which the diabetes without further apitherapy and rats not exposed. The results showed that in type 1 diabetes glucose in the blood of rats was $32,47 \pm 1,08 \text{ mmol} / 1$, with type 2 diabetes - $25,15 \pm 1,92 \text{ mmol} / 1$, in the normal - $5,22 \pm 0.21 \text{ mmol} / 1$. Apitherapy defined decrease in blood glucose in rats. Propolis reduced concentration of glucose in the blood in type 2 diabetes by 50% in a week, royal jelly by 58% relative to the control group. With type 1 diabetes a decrease in concentration of glucose in the blood for a group of "propolis" - 38% "royal jelly" - 41%. The maximum decrease of glucose recorded in animals injected ip bee venom. A week before the rate was restored to normal in type 2 diabetes, and approaches to normal in the group with type 1 diabetes. In control rats, there was no spontaneous lowering blood glucose.

ATO-044

Anti-wrinkle effects of honeybee venom serum on facial wrinkles

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Acial wrinkles are an undesirable outcome caused by extrinsic photodamage and intrinsic aging process. Currently, no effective strategies are known to prevent facial wrinkles. The main aim of the present study was to evaluate the clinical effects of bee venom serum by measuring the clinical wrinkles objectively with a device that converts the wrinkle roughness to numerical values. This is the first clinical study to determine the effects of bee venom containing cosmetics on facial wrinkles in human skin. The main aim of this study was to evaluate the clinical effects of bee venom serum. We analyzed images using replica and a device of Visioline which is an objective technique to reproduce changes in photodamaged skin. The image analysis using replicas was performed at week 12 when significant differences in total wrinkle area, total wrinkle count and average wrinkle depth were observed. This analysis correlated well with the clinical findings. Moreover, the significant difference in visual grade was observed after 8 weeks with bee venom serum indicating the faster effect of bee venom serum on wrinkle improvement. Our findings suggest that bee venom plays an important role in the improvement of skin wrinkles which is used in the cosmetics industry as an anti-wrinkle agent. Bee venom serum provided a greater efficacy in terms of total wrinkle area, total wrinkle count and total wrinkle area in subjects with photodamaged skin. Long-term treatment with bee venom containing cosmetics could be safe because the irritation potential of bee venom is negligible.

Comprehensive and functional venomics of social wasps Vespa crabro flavofasciate Cameron and Vespa analis parallela Andre

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Vespa crabro is a cosmopolitan social wasp species whereas Vespa analis is commonly found in Asia. Both species are widely distributed in Korea and known to be aggressive when disturbed, resulting in frequent sting accidents. Although major venom components of well-known Vespa wasps have been reported, no comparative transcriptomic analysis of venom gland between V. crabro and V. analis has been conducted to date. To investigate the differences in venom properties between these two wasps, total RNA was extracted from each venom gland and used for RNA-sequencing. A total of 36 and 37 venom-specific genes were identified in venom gland transcriptomes from V. crabro and V. analis and their expression profiles were different.Prepromastoparan A, Vespid chemotactic precursor and vespakinin-T were the top three genes that were most prevalently transcribed in the venom gland of V. crabro, and their transcription rates were 112-, 16- and 161-fold higher compared with V. analis, respectively, as judged by FPKM values. Their differential transcription profiles were confirmed by quantitative real-time PCR. Our findings suggest that V. crabro produce venom with much more enriched venom components, thereby resulting in higher toxicity compared with V. analis. In an attempt for the functional analysis of venom components, mastoparans of both V. crabro and V. analis were synthesized and their bio-activities were compared. The V. analis mastoparan exhibited similar levels of antimicrobial activities against model bacteria and fungi but significantly higher antitumor activities against human ovarian tumor cell lines compared with the V. crabro mastoparan.

ATO-062

Bee bread–Various usage of bee bread and clinical experiences

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Bee bread is the pollen which the bees process in their hives. There it suffers a process of fermentation in a stable condition of temperature and humidity, wich gives it some different characteristic. For example, bee bread contains more reducing sugars than pollen. It has higher acidity due to the presence of lactic acid and larger amount of vitamin K. The quality of lactic acid is by sixfold higher as compared with pollen. Also, bee bread contains a milk-digesting enzyme which pollen does not. Another important thing to be mentioned is that the outer

shell of pollen (exine) is broken during this process, releasing nutrients. All these factors makes from bee bread a precious and valuable product which can be used in medical practice and also in our diet. Bee bread has high antioxidant and scavenging abilities against free radicals. At present, consumer's demand for natural foods with the effect of a medicine is increasing. Bee bread is a food containing naturally occurring compounds. In the future, bee bread will apply more and more as health food and medicine due to its functional properties. In the final of our presentation we present some clinical cases and experiences using bee bread as remedy and superfood as well.

Symposium: Pharmacological Effects of Bee Venom

ATO-032 Integrated apitherapy treatment of chronic osteomyelitis

Siu Wan Ip, Yui-Chung Chang

Asia Pacific Apitherapy Association, Taiwan

PURPOSE: To investigate the effects of integrated medical treatment of Apitherapy (Bee venom Treatment), bee propolis, royal jelly and Medical Nutrition Therapy(MNT) on chronic Osteomyelitis patient. METHOD: A 22-year-old female motorcycle rider had a severe traffic accident in Chang-Hua City, TAIWAN. Her left leg was hurt by a vehicle and broken into three parts with open wounds fractures. Patient was admitted to Taiwan Chang-hua Christian Hospital. Amputation of left leg was advised because of severe soft tissue infections spreading to bone. She refused for amputation and she was transferred to National Tri-Service Military Hospital (NTMH) After debridement of necrotic bone and prolonged nine months administration of antibiotics, she was discharged from NTMH. However, she found that she had chronic Osteomyelitis. Purulent fluids was found over left leg in every summer. She visited our Apitherapy clinic and received three times of BVT weekly combined with high protein diet Medical Nutrition Therapy (MNT), bee propolis and royal jelly. RESULT: After received six months of integrated Apitherapy treatment, she found that she do not had purulent fluids in her leg. CONCLUSION: Integrated Apitherapy with BVT, bee propolis and royal jelly combined with MNT with high protein diets during the course of Apitherapy can increase the effect of Bee venom Treatment in chronic Osteomyelitis.

ATO-031

Hypolipidemic and blood glucose lowering activity of honey bee venom (*Apis mellifera*) in alloxan induced diabetic rabbits

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Introduction: In diabetes therapy, a great attention is paid on lowering blood glucose levels and lipid regulating mechanisms of various medical agents including animal toxins. Honey bee venom (BV) reduces blood glucose level through increased insulin secretion and glucose take-up.BV also has lipid regulating activity verified in

several other studies. Thus bee venom could be considered as a potential remedy for diabetes. This study aims to investigate the effect of Mongolian honey bee venom on hyperglycemia and hyperlipidemia in alloxan induced diabetic rabbits. Material and Method: Twenty two Chinchilla rabbits were divided into groups: the control (n=6), the diabetic (n=8), and the bee venom treated (n=8) groups. In diabetic group iabets was induced with Alloxan monohydrate. The bee venom treated group received a bee sting (a sting contains 0.2-0.5 ml of bee venom) on their hind paw every other day after the confirmation of diabetes. Result: Bee venom treatment (BVT) led to the following changes: compared to the diabetic group, the bee venom treated group's blood glucose levels decreased by 14.9% -26.5%; blood cholesterol levels reduced by 12.5%-19.1%; low density lipoproteins (LDL) levels lowered by 11.2%-14.2% ; and high density lipoproteins (HDL) levels increased by 2.5% - 26.25%. Conclusion: Bee venom lowers blood glucose levels and improves lipid profile in alloxan-induced diabetic rabbits and can be considered as a therapeutic agent for diabetes. Further studies should be carried out to determine the most appropriate bee venom dose for the best therapeutic effect.

ATO-030

Effect of Indian honey bee venom (*Apis cerana*) on wound healing efficacy, anti-bacterial activity and purification of peptide components

Bhargava Hunkunda Radhakrishna

SASTRA University, India

Introduction: The main components of Apis bee venom are melittin, apamin, phospholipase A2, Hyaluronidase and amino acids which have diverse pharmacological properties and biological activities. Melittin has shown significant results against several pathogens. For this reason, bee venom could be considered as a potential anti- bacterial and anti-inflammatory property. The purification of the peptide compounds can be done by the gel filtration chromatography and SDS PAGE. This study aims to investigate the wound healing, antibacterial and purification of peptide components from Indian honey bee venom. Materials and Methods: Eighteen Wistar rats were divided into three groups (n=6): the control, the standard and the treated groups. The antibacterial activity was determined using disc diffusion. The components were separated from the bee venom by gel filtration chromatography on Sephadex G-50 column and confirmed through SDS PAGE. Results: The wound contraction was superior in animals treated with bee venom with a significant increase in the level of serum albumin than other groups. The histopathological studies revealed confirmatory evidence and enhanced epithelialization in the animals treated with bee venom. The 5mg.mL-1 showed significant results for antibacterial activity. The fractions obtained were melittin, phospholipase A2 and other higher fractions analysed by SDS PAGE. Conclusion: Apitoxin (honey bee venom) can be used as an alternative to treat different kinds of wounds and due to significant anti-bacterial efficacy it can be an alternative to antibiotics and it will have a great impact in the near future.

ATO-008

The regulatory effects of purified bee venom on Propionibacterium acnes-induced inflammatory responses *in vitro* and *in vivo*

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Purified bee venom (BV) is a natural toxin produced by honeybees. BV has been widely used as a traditional medicine for various diseases. However, the anti-inflammatory mechanisms of BV have not been elucidated in the Propionibactierium acnes (P. acnes) induced keratinocyte or inflammatory skin disease animal models. In this study we examined the effects of BV on the production of inflammatory cytokines in heat-killed P. acnes-induced HaCaT cells. Heat-killed P. acnes treated keratinocytes were increased expression of pro-inflammatory cytokines. However, BV treatment significantly suppressed the expression of these cytokines. Subsequently, we examined the effect of living P. acnes (1×107 CFU) intradermally injected into the ear of mice. Living P. acnes injected ears showed cutaneous erythema, swelling, and granulomatous response at 24 h after injection. However, BV-treated ears showed markedly reduced swelling and granulomatous responses compared with the ears injected with only living P. acnes. These results demonstrate the feasibility of applying BV for the prevention of the progression of inflammatory skin diseases induced by P. acnes in vitro and in vivo inflammatory models.

ATO-039

Bioactive properties of honey bee products and their mixtures

Sibel Silici

Erciyes University, Turkey

Four honey, four bee pollen, propolis, royal jelly and 4 different their mixture (honey, polen, royal jelly and propolis) samples obtained form Turkey were screened for total phenolic content by the modified Folin–Ciocalteu method, for potential antioxidant activity using phosphomolybdenum assay and by the 1,1-diphenyl-2-picryl hydrazyl (DPPH) method for antiradical activity. Total phenolic content of samples ranged from 0.58 to 320.83 mg GAE/100 g honey. Antioxidant activity of samples was between 29.05 and 267.37 mg AAE/g honey. Radical scavenging activities of the samples were varied between 5.72 % and 96.13 %. Propolis, castanea honey, castanea pollen and honey-RJ-bee pollen mixture were the most active among samples.

Symposium: Pharmacological Effects of Royal Jelly, Bee Pollen

ATO-061

The effects of N•Chromosome royal jelly & bee products on diabetes type 2

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DIABETES TYPE 2 is a chronic condition that effects the body's natural ability to metabolize glucose (sugar). This may be the result of insulin resistance, which can prevent the pancreas from making enough insulin or effectively utilizing it. This illness is also known as noninsulin dependent diabetes because insulin is still produced

within the bodies of individuals with this disease. If a build up of glucose occurs, the cells in the body are unable to function properly. This can lead to protein deficiencies and many other disorders since Diabetes sufferers are unable to effectively utilize protein it leaves them susceptible to many autoimmune disorders. We recently tested a new method of treatment with N-Chromosome Royal Jelly in conjunction with other bee products.On 536 insulin dependent diabetics (70% of which require amputations,) each individual was suffering from at least one other auto immune disorders directly related to the severe symptoms of their condition.After the first 10 weeks of treatment (dependent on severity) amputations were not required in 100% patients and pancreas was able to effectively produce and utilize insulin, therefore insulin injection was no longer required for over 90% of patients after 3 months of treatment. During this presentation we will explain the external & internal use of N-chromosome royal jelly as an anti-inflectional supplementary recovery to treat certain deficiencies, and autoimmune disorders in the body

ATO-048

MRJP-1 multimer activates cell proliferation of fibroblasts originated from gingiva and periodontal ligament

Kikuji Yamaguchi¹, Toru Suzuki², Kiyoshi Murata², Akira Fujii³, Yoshihisa Yamaguchi⁴

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OBJECT: Periodontitis is an inflammatory disease affecting the periodontium, the tissues that surround and support the teeth, such as alveolar bone, periodontal ligament, and gingiva. Significant associations between periodontal disease and cardiovascular disease, diabetes mellitus, preterm low birth weight, and osteoporosis have been discovered. Therefore, the prevention of periodontitis is very important not only oral disease but also severe systemic disease. We have reported that royal jelly inhibits the growth of Porphyromonas gingivalis and could be applied for periodontitis. The production of connective tissue is one of the important factors to prevent the progression of periodontitis. Therefore, it was very interesting to clarify if MRJP-1 multimer, a major protein component in royal jelly (RJ), affects the cell growth of fibroblasts in periodontium. METHOD: Cells originated from gingiva and periodontal ligament were grown in DMEM-10 supplemented with 10% FCS and antibiotics (streptomycin, penicillin G, amphotericin B) under 5% CO-95% air at 37. Cells were plated in 96-well plate, adjusted growth phase with DMEM-0.5, and then treated in serum-free DMEM supplemented with antibiotics, and RJ or MRJP-1 multimer (0 to 400 /). The cell growth was measured using CCK-8(cell counting kit-8, DOJINDO, Japan) on 2nd, 4th, 6th, and 8th days. RESULTS: Both MRJP-1 multimer and RJ enhanced the cell growth in dose dependent manner in both fibroblasts originated from gingiva and periodontal ligament. This might indicate that RJ and MRJP-1 multimer is useful to strengthen periodontium and prevent the progression of periodontitis.

ATO-004

Royal jelly inhibits the growth of breast cancer in mice

Zhang Shuang, Su Songkun

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Royal Jelly (RJ) is widely consumed in diets in many countries due to its various pharmacological properties: anti-oxidative, anti- hypertensive, anti-inflammatory, antibiotic-resistant bacteria, etc. We have investigated the role of RJ in the development of breast cancer in mice. Normal BALB/c female mice were injected 4T1 cell at 0.1mL per mouse. The animals orally treated with RJ (0, 0.5, 1.0, or 1.5g/kg Body weight) for 28 days. Internal organizations of the animal were collected for the weight. ELISA assay were used to detect the antioxidant assays of the blood serum, the liver and the kidney; and the immunity of the blood serum. The liver, the kidney and the tumor were taken for histological analyses. Our study showed that the weight of internal organs was different. Treatment with RJ significantly reduced the increase of breast tumor (p<0.05), spleen (p<0.01) and thymus (p<0.01). The antioxidant capacity of the blood serum, the liver and the kidney was increased in mice fed RJ. RJ treatment enhanced the level of immunity of RJ may play an important role of anti-tumor growth.

ATO-011

Transylvanian raw pollen – inhibiting effect on murine colon carcinoma culture cells; clinical case

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Raw pollen, by its composition and properties is a great food for human being, even a super-food. The pollen is a product made from male reproductive cells of the flowers whose role is to perpetuate the genetic information. Until some years ago, the standard way of preserving the pollen over the years was to dry it off. No one contested the benefits it brought, but dried in heat the lactobacils, bifidobacils, yeast, a large amount of vitamins, enzymes, pro-enzymes and antibiotics properties - most of its active principles are destroyed. To sum up, the experience shows: the raw pollen is highly superior to the dry one. RAW POLLEN is better and more efficient in treating colon and bowel disorders, as much as other illnesses and its attributes are undeniable. Raw pollen is a "living" food, charged with enzymes, friendly bacteria, proteins, minerals, vitamins, antioxidants and a natural delicious taste. Recently, in Veterinary Medicine and Agriculture University from Cluj-Napoca was made an experiment with methanol extract of raw pollen which showed anti tumor effect on murine colon carcinoma by inhibiting cell proliferation and induced apoptosis. Our findings suggest that the effects of polyphenols and flavonoids on colon cancer cells were observed in a dose-dependent manner. On a clinical case, the results suggest that this effect may be eloquent on human being. We tested a recipe for eliminating body toxins based on raw pollen and healthy diet.

ATO-052

Proteomic research on the effect of royal jelly on carbon tetrachloride-induced liver injury in rats

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Many studies have confirmed that royal jelly has hepatoprotective effect, the purpose of this study is to investigate protective effects of royal jelly against carbon tetrachloride-induced liver injury in rats by proteomics. The hepatic model developed by injection of 15% CCl4 corn oil (2 mL•kg-1) in the first, forth, seventh and tenth day, for 4 times. The level of serum ALT, AST, ALP and MDA in liver homogenates were determined, and the liver histopathology of each group was observed; the different proteins of normal group, model group and treatment group (royal jelly) were analyzed by two-dimensional electrophoresis and MALDI-TOF/TOF-MS. The results of liver histopathology showed that: compared with normal control group, we found edema lesions and severe inflammatory cell infiltration in model group, and these phenomena were improved in each group of royal jelly. In addition, the proteins with significantly different expression were identified by MALDI-TOF/TOF-MS, and 32 proteins were successfully determined. The results showed that most of determined proteins were associated with metabolism (suc h as regucalcin), and some proteins (such as cytokeratin 18, heat shock proteins) that can be used as bio-marker of the protective effect of royal jelly on carbon tetrachloride-induced liver injury in rats. The results revealed the pathways and mechanisms of the protective effect of royal jelly on liver damage in some degree.

ATO-038

Studies on estrogenic activities of royal jelly and its fatty acids in vitro and in vivo

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Royal jelly (RJ) has been used as a nutrition supplement for relief of menopausal symptoms among Japanese women. Previous studies have demonstrated that RJ possesses estrogenic activity in vitro and in vivo. In addition, fatty acids derived from RJ have been reported to modulate estrogen receptor-mediated functions. On the other hand, the stimulation of estrogen receptors might increase the risk of disease exacerbation in patients with breast cancer, uterine cancer (type I), or endometriosis. In this context, we reevaluated the possible estrogenic activity of RJ in vitro and in vivo. The RJ fatty acids such as 10-hydroxy-2-decenoic acid, 10-hydroxydecanoic acid, 2-decene-1,10-dioic acid, and sebacic acid did not show apparent responses associated with the activation of estrogen receptor in a nuclear receptor cofactor assay, in estrogen receptor-mediated gene expression using a luciferase reporter gene assay, and in an estrogen-dependent proliferation assay with MCF-7 human breast cancer cells. The RJ sterol 24-methylenecholesterol enhanced estrogen receptor-mediated gene expression but not the MCF-7 cell proliferation. Then, the in vivo study was conducted using a novel transgenic mouse (E-Rep mouse), which sensitively detects the kinetics of gene activation by estrogenic compounds. The result is that any estrogenic activity could not be found in E-Rep mice fed a diet containing 4% (w/w) freeze-dried RJ for 7 days. Taken together, we concluded that RJ probably does not cause estrogen receptor activation which leads to worsening estrogen-dependent diseases.

ATO-021

A suggestion for royal jelly specifications

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In order to suggest standards for royal jelly (RJ), we first studied the factors that may affect its chemical composition and then we analyzed 176 samples from 34 different areas of Greece, to trace the natural variability that may exist for this product. We compared our findings with the adopted national limits of Argentina, Bulgaria, Brazil, Poland, Japan, Serbia and Turkey, the proposals of the working group of the International Honey Commission (IHC) and the draft proposal of the International Organization of Standardization (ISO/DIS). The parameters that were studied were the moisture, the total protein content, the sugar content (fructose, glucose, sucrose and total sugars), the lipids % and the 10-hydroxy-2-decenoic acid content (10-HDA). Our results indicate that the national limits of RJ in some countries should be revised and the proposals of the IHC and the ISO/DIS should be reviewed considering the recent data regarding the variability of the chemical synthesis of the product. The suggestions of this paper could very well be considered for setting global standards for RJ, since they were based on national legislations, proposals of scientific groups, experimental data and updated published information.

ATO-046

Royal jelly normalizes microcirculation in the treatment of thermal injury in rats

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The main purpose of the research was the study of microcirculation near the burn zone at the application of Royal jelly (RJ) and complex RJ with ubiquinone-10 (Q-10) in the therapy of experimental thermal trauma. The experiments were performed on 50 white Wistar rats male weighing 250-300g, in 5 groups: intact; control (thermal burn, 20% 70 C); and 3 experimental groups: animals with the burn, which were given orally RJ at a dose of 100 mg/kg daily; Q-10 at a dose of 15 mg/kg; and RJ and Q-10 together. Assessment of the microcirculation was performed by the method of laser Doppler flowmetry for 10 days from the moment of drawing animals contact burn. It were registered the microcirculation index (MI, perfusion units) and the rate of shunting (SR, standard units). It is shown the decreasing MI on 19% and increasing SR by 22% simulated by the thermal trauma in comparison with intact animals. It was shown a distinct positive dynamics of normalization of MI when using research drugs, when applying the composition of the "Q-10+RJ" most pronounced. The usage of Royal jelly has contributed to the normalization of microcirculation, including endothelial and neurogenic (active components), as well as the values of pulse and respiratory waves (passive components). There was a statistically significant improvement of the condition of precapillaries muscle tone by 79%, which regulates blood flow in the nutritive vascular bed.

10-Hydroxy-2-decenoic acid, a unique fatty acid in royal jelly, extends lifespan in Nematode *Caenorhabditis elegans*

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Royal jelly (RJ) induces queen differentiation in honeybees. Queen bees, exclusively fed RJ throughout their lives, have a greatly prolonged lifespan compared with worker bees. Interestingly, it has been reported that dietary RJ prolongs lifespan in mice (Inoue et al. 2003). We also found that RJ and protease-treated RJ extended life-span in Caenorhabditis elegans, and that 10-hydroxy-2- decenoic acid (10H2DA), a unique ingredient in RJ, was one of the key ingredients to promote lifespan extension in the nematodes (Honda et al, 2011). In the present study, we further examined the mechanisms of action of 10H2DA using available C. elegans mutants in longevity-regulated genes. The longevity effect of 10H2DA disappeared completely in C. elegans eat-2 mutants, which display a long lifespan induced by caloric restriction. Moreover, 10H2DA did not extend lifespan in the long-lived mutants in daf-15 gene, which encodes the TORC1 component raptor. On the other hand, the 10H2DA-indused increase in lifespan was also found in the daf-2 mutants, which exhibit a long lifespan through decreased insulin-like signaling (ILS). These findings indicate that 10H2DA extend lifespan through gene networks regulated by caloric restriction, independently of ILS, in C. elegans. Further studies broaden our understanding of gene signaling pathways involved in longevity in diverse species and may lead to the possibility of nutraceutical interventions with RJ in the human aging process.

ATO-036

Activity-guided isolation and identification of hepatoprotective components in Rape bee pollen

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National Research Centre of Bee Product Processing, Bee Research Institute, Chinese Academy of Agricult ural Sciences, China

To investigate the hepatoprotective components in rape bee pollena vitro model of L-02 hepatocytes injured by CC14 was established. Cell survival rate measured by M1"1' assay was considered as the screening criterionsolvent extraction and reversed phase column chromatography were used as the separation method. TLC was used as a detection and analysis method. The result showed that the appropriate concentration of CC14 that could induce hepatocytes injury was determined as 10 mmol/L. N-butanol extract group showed the highest hepatoprotective effect that the cell survival rate of 100g/mL group and 200g/mL group was 60.65% and 76.98% respectively. Component A separated from N-butanol extract showed the highest hepatoprotective effect that the cell survival rate of 200 g/mL group was 76.66% and 64.47%. The result of qualitative analysis and earlier research suggested that A was flavonoids.

ATO-012 Apilarnil (triturated drone larvae) – practical experience treating patients

Cristina Aosan

Apitherapy Commission of Apimondia, Romania

Apilarnil is a bio-active product of the hive, obtained by trituration of the drone larvae harvested in the seventh day of life. Then it is freeze and used on different ways for maintenance, prophylaxis or curative treatments. The product appeared publicly in 1980 and the invention patented in Romania, is due to a Romanian beekeeper Nicolae Iliesiu who was the manager of Apicola (the beekeeping commercial net) at his time. The name Apilarnil established by author, is made of three particles: API + LAR (larvae),+ NIL (N_icolae II_iesiu). The product is rich in amino-acids including all essentials, contains the minerals necessary for life, vitamins, enzymes, co-enzymes, few high quality lipids. One drone larva at 7 days of life already contains about 10.000.000 spermatozoa, which means richness in nutrients, pure DNA and information. The product was much studied and used until 1989; then after the political change in Romania, was unfairly almost forgotten. We started to recommend it again to patients three years ago. The clinical experience accumulated confirms it acts as regenerator, energizer, anti-viral, anti-microbial, general regulator for the functions and structures of the body; general tonic, specially for liver, blood, muscles, brain, improving the sexual dynamic, sperm quality. Clinical cases: the effects are exemplified for different sufferance, on children and adults. E.g. respiratory matters, enuresis, sexual disorders, multiple sclerosis. Apilarnil a powerful bees product, rich in bio-active compounds, simple to obtain, worth more attention in laboratory and clinical use.

ATO-064 Comparative lipidomics analysis of queen larvae and royal jelly from honeybee (*Apis mellifera*)

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China is the biggest RJ producing country with an output of greater than 90% of the world's total productions. Honeybee queen larvae (QL), the byproduct of royal jelly (RJ) production, have not been fully utilized as a food resource. The present work was undertaken to explore the lipid profiles of QL with RJ as a reference. The lipid of QL and RJ was extracted and was separated by column chromatography. A comprehensive analysis of the composition of fatty acids and other lipophilic compounds content was carried out by matrix-assisted laser desorption/ionization time of flight mass spectrometry. QL yielded higher amount of lipid (3.43%) than RJ (3.06 %). Lipid components in QL included hydrocarbons, triacylglycerols, free fatty acids, sterols, diacylglycerols and phospholipids. Triacylglycerols covered over 79% of the total lipids. In contrast, RJ showed a different lipid composition and fatty acid profiles. The predominant components were middle carbon chain fatty acids. It is easily accountable due to the high HDA content in RJ (about 2% of fresh weight). The data provide new evidence for the biological activities of QL and RJ on human health. Both QL and RJ are the abundant sources of lipids that are rich in health-promoting lipophilic components. QL contained a high level of phospholipids while RJ was rich in hydroxy fatty acids. Twelve sterols were identified and clerosterol, 7-sitosterol and

cycloartenol were reported for the first time in QL. Our results emphasized the nutraceutical properties and potential application of QL and RJ as apitherapy ingredients.

Symposium: Present Situation and Perspectives of Apitherapy

ATO-014

The Apiceuticals: Geographic medicine

James Fearnley

ARC (Apiceutical Research Centre), United Kingdom

•James Fearnley (Director of ARC - Apiceutical Research Centre) has collected hundreds of samples of propolis from all over the world. •Each sample has been examined chemically (HPLC analysis) and biologically (anti bacterial properties) at the Strathclyde Institute of Biological Sciences Glasgow under the direction of Dr Dave Watson. •Greater 'antibacterial activity' (chemical components in propolis inhibit the development of bacteria rather than simply killing them) was found in propolis produced in hot and wet climates i.e. where the bacterial challenge is greatest. •Quite by chance the research team discovered that in dry and hot (savannah) areas where there was an incidence of sleeping sickness the propolis analysed contained antitrypanosomal chemicals. •Analysis of propolis from similar climatic zones where there was no incidence of Sleeping Sickness did not contain the antitrypanosomal chemicals. •Thesis: 1.That the honey bee is collecting resins which contain the chemical disease response/signature of plants in the region and elevates /transforms these into its own local immune defence/protection system. 2.That the bee hive maintains a homeostatic temperature mechanism closely related to the human homeostatic system. 3.That the behive is potentially a source of local human disease control relating to those specific health challenges in the geographic area in which it has grown accustomed to. •BeePharmaAfrica is a development project exploring ways in which bee products in areas in Africa subject to Trypanosomiasis, Malaria and Leishmania may help provide local protection/treatment of those diseases.

ATO-017

21 Century: Apitherapy development in China

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China is the biggest beekeeping country in the world. China is also a big apitherapy country with a long history in the world. In recent years, China government pays more attention and issued some police on apitherapy and apitherapy has been taken quite great development in China. According to the semi-official estimated by Apicultural Science Association of China in 2014, there are approximately 300,000 beekeepers in the whole country. Thereinto, there are more than 1000 beekeepers and hundreds institutes and hospitals carry on the apitherapy. Nowadays, apitherapy technique has been used in not only medical clinic by bee- sting acupuncture with Chinese traditional medicine especial for arthritis and rheumatism but also in health care by bee-products such as honey, royal jelly, propolis, bee pollen and beeswax for diabetes mellitus, cardiovascular disease, hypertension, hyperlipidemia, hepatopathy, cancer, ulcer and antioxidant, anti radiation, anti fatigue, anti

aging and some foot sick. Bee- products apitherapy is also used for lady beauty. Supported by MOA project No.2130135, CAAS-ASTIP-2015-IAR

Development and recent legislative process on apitherapy in Turkey

Mehmet Tanyuksel

Gulhane Military Medical Academy, Turkey

Approaches and practices of apitherapy have been accumulated over the centuries since the times of very first ancient Anatolian civilization. Although many international organizations in the field of beekeeping have been set up in Turkey, interest of medical professionals in the field of apitherapy has turned to scientific research very recently and in a limited manner. In Turkey, the Department of Traditional, Complementary and Alternative Medicine was established under Health Services Directorship of Ministry of Health by the lawful background dated just November 2011. The dedicated commission which was created under the Department of Traditional, Complementary and Alternative Medicine carried out a scientific investigation on traditional, complementary and alternative medicine (CAM) practices, and the related scientific publications presented in Turkey and in the world. As a result of the study, the Turkish government has passed a new law on Regulation of Traditional and Complementary Medicine Practice by the Turkish Ministry of Health on October 27, 2014. The most important outcomes of this effort are setting up a legal basis for these practices, following the ongoing applications and sharing the outcomes in scientifically manner. Studies performed based on a robust scientific method that accompanied with comparative statistics will result a rise more qualified publications. As a conclusion, the recent regulation on traditional and CAM practices of the Ministry of Health of Turkey gave a legal status for some traditional, complementary medicine treatments including apitherapy, maggot therapy, hirudotherapy and acupuncture, etc.

ATO-025

Public knowledge, attitude, practice and constraints of apitherapy: A complementary remedy in health care delivery in Nigeria

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Globally, people developed unique indigenous healing traditions adapted and defined by their culture, beliefs and environment, to satisfy the health needs of their communities. Apitherapy a complementary diverse health practices and beliefs incorporate the use of bees, plant and animal products to maintain well-being, prevent, diagnose and treat illness. ATO-035

Possible use of apitoxins in normalization of alcohol drinking

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The Institute of Clinical Apitherapy, Russia

More than 15 years we have successfully been using the apinarcotherapy method at the treatment of alcohol dependence syndrome and alcohol abuse. The programme is divided into 3 stages: the 1st stage: recovery after alcohol excesses; the 2nd stage: total abstinence with the suppression of compulsive alcohol; the 3rd stage: rehabilitation, including the course of normalization of alcohol usage. The main agent in apinarcotherapy is bee venom. The complexity of bee venom provides health benefit at all treatment and rehabilitation stages of alcohol dependence. According to the api-kinesitherapy programme an abstinence syndrome grows twice less beside medicinal treatment. The craving for alcohol decreases from the first treatment day without medicinal substances usage. Such curative effect allows proceeding to total abstinence from alcohol more quickly. Bee venom provides psycho- corrective, rehabilitative programs for alcohol-dependent patients more effective. On the 3rd stage of the alcohol drinking normalization programme apitoxins accomplish an enabling function and help to fix acquired reflexes in normalization of alcohol drinking. 5674 patients have been treated in the clinic "API". 5101 patients kept from alcohol for a year. 1218 people with primary and secondary dependent stage were on the 3rd stage. The effectiveness of the programme has been estimated by the absence of alcohol excesses during 6 months, 1 and 3 years after the treatment. Remission of 6 months was observed in 88,9% patients, 1 year: 78,3%, 3 years: 57,8%. Gathered experience entitles us to claim about apinarcotherapy method as a complex program, combining either alcohol- dependent patients' treatment or rehabilitation.

ATO-013 Clinical efficacy of an Ayurvedic Bee Product Siktha Taila & Bee Stings in Allergic contact eczema (dermatitis)

Sanjeev Sood

Dayanand Ayurvedic College, Jalandhar, India

Background: Eczema is "a general term for any superficial inflammatory reaction where the skin has come into contact with a substance that the immune system recognizes as foreign. It is believed to result due to a combination of hereditary and environmental factors. A number of medicines like corticosteroids, antihistaminics, calcineurin inhibitors, moisturizers, and phototherapy are available but have its limitations and recurrence rate is very high. Keeping in view the above situation and long back mentioned references of apitherapy in Charak Samhita (200 B.C.), may play a significant role in this disorder. Material and methods: In present study author had formulated a cream from wax of beehive named Siktha Taila and with Bee Stings after Panchkarma on a group of 26 patients suffering from eczemas. Results: In this study 80% subjects demonstrated very good relief in 30 days of Trial. Conclusion: Use of Siktha Tail, Bee Stings & Panchkarma can be a promising remedy for Eczema and may be extended for other chronic autoimmune disorders.



Beekeeping for Rural Development

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Mission

Sharing information on how apiculture contributes to the development of sustainable livelihoods, world-wide.

Look after their local habitats.

Provides people with valuable sources of income and nutrition, yet the input costs can be very low.





Plenary Session

BRO-059

Api-tourism: an innovative beekeeping offering for visitors to Trinidad and Tobago

Gladstone Solomon

Association of Caribbean Beekeepers, Trinidad and Tobago

Given its inherent assets of sun, sea and sand, Trinidad and Tobago has had a longstanding appeal as a tourism destination for visitors resident in temperate regions. Even so, increasing market demands of discrimination visitors to the destination have encouraged the diversification of the classical tourism product away from its traditional offerings. Consistent with that trend, Trinidad and Tobago beekeepers have been partnering with the international beekeeping development entity, 'Bees for Development', by hosting beekeepers safari to the destination. These safaris are exclusive beekeeping centered holidays, flavoured with a sprinkling of non beekeeping tourism offerings that are market exclusively in the United Kingdom. Safaris are a unique brand of tourism that can aptly be described as api-tourism. The presentations shares with viewers the experiences of participants who visited Trinidad and Tobago on beekeepers safaris and establishes that api-tourism is a viable addition to the mix of tourism offerings for visitors to Trinidad and Tobago.

BRO-070

Apitourism & Apiwellness, a promising beekeeping economy on a rise

Tanja Arih Korosec

Aritours, ApiRoutes, Slovenia

Apitourism is a new discipline and very fresh approach to sustainability. It aims at raising awareness as to the importance of bees to mankind, enriching knowledge about the use and effects of bee products and apitherapy, and enhancing people's well-being. Api tours create a new dimension of travel that raises awareness as to the importance of our natural world, together with such fundamental values as health, family, creativity, connection, and harmony. These tours combine country's distinctive heritage and rich beekeeping tradition and is aimed at travellers who favour healthy and eco-friendly pursuits. Apitourism was develeped in Slovenia as a result of strategic partnership between Slovenian Beekeepers Association and Aritours, ApiRoutes Travel Agency. AritoursApiRoutes was named for coordinator of Apimondia working group for apitourism aiming to implement the model in other countries around the globe. The model is offering the add value to classical way of beekeeping, it is providing opportunity specially for young or unemployed people to decide for beekeeping as proffesional carier, it is raising awarness about the importance of the bees to the mankind through its educational aproach. In recent times Apiwelnness has been developed as answer to every day more demanding comunity striving for better, healthier life style, adopting local philosophy, eat local and healthy products. Apitpurism can be opportunity for all beekeepers around the world.

Urban Beekeeping in London

Nicholas Bishop

London Honey Company, United Kingdom

Introduction: From Rome to Seoul, from Paris to Bangkok, Urban beekeeping has slowly become for more and more people a sustainable and accessible way of making a living in cities throughout the world. The London Honey Company has been one of the first companies in the UK to manage hives on rooftops all around London. This presentation will offer the audience a complete visual journey through the joys, pains and mysteries of keeping bees in a metropolitan area. Presentation will cover the following aspects: -Introduction to Urban Beekeeping. -Bees & Hives. -Gardens & Rooftops. -Materials & Equipment. -Do's & Don'ts. -A Year of Beekeeping in the City. -Benefits of keeping bees in London. -Challenges of Urban Beekeeping. -Marketing & Branding. -Conclusion

The international meeting of young beekeepers (IMYB)

Jiri Piza

Czech Association of Beekeepers, Czech Republic

The International Meeting of Young Beekeepers (IMYB) is an annual meeting organized by beekeepers associations. The event started in 2010 as an initiative of a few countries under the leadership of the Czech Republic. It has gradually gained great popularity and has become the largest international meeting for young beekeepers worldwide. The meeting is a combination of a beekeeping competition and a diverse social and cultural program. The competition consists of several practical and academic disciplines, testing the knowledge and skills of young participants. However, the goal of the meetings is not just the competition itself, but primarily to motivate young beekeepers, promoting the idea of beekeeping amongst them as well as providing them with social and cultural experience. It is designed for participants between the ages of 12 to 16. Apart from comparing knowledge and skills, they also establish new friendships over the four-day meeting and learn more about beekeeping and other countries and cultures. So far, six IMYB events have already been held and hosted by Austria, Czech Republic (2x), Germany, Poland and Slovakia. 28 countries from around the world have already taken part in IMYB. Among these countries are the following: Albania, Austria, Belarus, Bosnia and Herzegovina, Czech Republic, Denmark, England, Germany, Israel, Ireland, Italy, Kazakhstan, Latvia, Lebanon, Liechtenstein, Lithuania, Moldova, the Netherlands, Nigeria, Poland, Romania, Russia, Scotland, Slovakia, Slovenia, Switzerland, Ukraine and Wales. The future of beekeeping is in hands of the young generation and IMYB helps them discover its beauty.

BRO-073

Introduction and development of western honeybee (Apis mellifera) industry in Korea

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¹ Yongsu Honeyfarm, Republic of Korea ² Seoul National University, Republic of Korea

The Western Honeybee, Apis mellifera (Hymenoptera: Apidae), was introduced in to Korea in early 1910s. After introduction, the beekeeping industry and the number of honeybee colonies has been rapidly increased since 1990's, by 20% yield growth every year and resulting ca. 2 million in 2002. We discuss the history of beekeeping industry and technology development in Korea.

Symposium: Beekeeping for Rural Development I (Europe and Asia)

BRO-054

Queen bee science spurs entrepreneurship

Meral Kekeçolu, P Goç Rasgele

Düzce University, Turkey

The Van city in Eastern Turkey has been subjected to force emigration for decades. The newcomers had very little, if any, skills relevant to an urban environment at best unskilled labor for the men and nothing for the women. This space is not sufficient to review the impact of this on family structures but the outcome was that girls were seldom let out from the home, even for education, married off young at very early ages in Van and became even further marginalized in communal life. We cannot affor d this waste of families either economically or humanely. We design a bee Project to empower young women of the families that are forced to migrate to urban area of Van city. The Project builds on by making girls "asset owners" and entrepreneurs running their own business. We have more than 180 girls involved in our project. But practice beekeeping activity was given a pilo t group of 20 girls. We set up modern apiary and we educated the girls to produce queen bees under optimal condition. Also young girls were learned honey and other bee production and harvesting methods. 500 queen bees in one season were produced. The girls were educated in managerial and organizing marketing activities. It was gained economic sustainability, the revenues was raised to \$140.000. As the girls become earners, they become active decision makers within the Family and Community. The girls have been the sole bread earners in the family and hence have a different status.

BRO-008

Apitherapy for rural development

Cristina Pavel, Stefan Stangaciu

Romanian Apitherapy Society, Romania

Bees are the main pollinators both for food crops and medicinal herbs. This is one of the reasons why traditional, classical beekeeping should be complemented by the use of bee products for prevention and treatment of human and animal diseases. From all the over 15 useful bee products, the main one collected nowadays is honey. For the future development of rural communities that needs not only food, but also health, a very important idea is to implement good practices for producing, using and marketing of the other bee products (pollen, bee bread, propolis, wax, royal jelly, apilarnil, bee venom, etc.). First step is learning the direct, medical

use of the raw bee products and later, learning how to produce simple recipes (ex propolis ethanolic extract). Rural communities could become easier financially auto-sustainable and healthier in the same time, because many diseases are prevented and treated with apitherapy. From the economical point of view, apitherapy knowledge transmitted to the whole population of a region/country can increase the market value of the bee products. Also, knowledge of medicinal uses of melliferous medicinal herbs and later their cultivation and trading may contribute to the increase of income for rural communities worldwide.

BRO-027 Beekeeping, a part of improvements of livelihoods in rural areas of Nepal

Ram Keshari Duwal¹, Seunghwan Lee²

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Nepal, the Himalayan Kingdom boarded Oriental and Palearctic region. Geographically, this country has five vertical divisions from South to North: terai plains, siwalik range, middle mountains, high mountains and high Himalayas respectively. Due to such wide range of altitudinal gap, it exhibits various climatic conditions which flourish various flora and fauna. As a result, this small territory is distributed with four species of honey bees, Apis laboriosa Smith, 1871, A. dorsata Fabricius, 1793, A. cerana Fabricius, 1793 and A. florea Fabricius, 1787. In Nepal, Apis cerana and A. mellifera Linnaeus, 1758 are popular among beekeepers for commercial bee farming. Beekeeping practice is considered as one of the important economic source to develop rural areas of Nepal with the concept of socialization in mountains, where Apis cerana are traditionally reared. Later on, with the vision of income raising source in rural areas, Nepal government and private sectors (including NGO's and INGO's) approach the villagers, by providing necessary vocational training and infrastructural development for beekeepers. Though, the program was overwhelming, satisfactory implementation was not found. Therefore, only certain community and/or persons were benefited by establishing small cottage industries while large number of beekeepers did not get goodwill due to lack of market. Therefore, it is important that planning committee of government should bring visionary concept on commercial beekeeping, its beneficiary aspects and quality maintenance, and proper market and market price through which both producers and consumers are encouraged to enhance the sustainable development of bee farming, honey production and consumption.

BRO-010

Meliponiculture for sustainable rural development of northeastern India

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Six species of stingless bees- Tetragonula iridipennis, Tetragonula laviceps, Tetragonula gressitti, Lophotrigona canifrons, Lepidotrigona arcifera and Lepidotrigona ventralis have been reported from north- eastern region of India. Stingless bees' honey is sold about 4 to 5 times higher than *Apis cerana* honey due to its nutraceutical value. Its honey show great promises of therapeutic properties; which is mainly used for the treatment of burns, wounds,

eye infections and ulcer by the tribal communities. Stingless bees play a vital role as pollinators in agricultural ecosystem. They can be an ideal pollinators for green house crops due to their restricted flight range. Their use as crop pollinators can open up new vistas in boosting rural economy and as an alternate livelihood option, which is already a traditional activity of various tribes. The tribal communities are beautifully maintaining stingless bee hives around their houses and in the gardens. They are leaving the empty hives in in the forests and after occupation the hives are brought back. Rural people are selling highly medicinal honey and pollen at better price from their homes because of increased demand. Endowed with diverse flora of evergreen sub-tropical forests, North eastern region has ample scope for developing and popularizing Meliponiculture. The wide range of flora offer incessant food sources and make congenial habitat for stingless bees rearing. All above explained offers enormous potential for meliponiculture and a livelihood option to peasantry through enhanced crop productivity, biodiversity conservation and harvesting of hive products for sustainable rural development in this region.

BRO-007

Apiculture for sustainable rural development and increased crop productivity in India

Raj Kumar Thakur, PK Chakrabarty, Surbhi Gupta, Neha Palliwal

Indian Council of Agricultural Research, New Delhi, India

Beekeeping has been practiced in India since ages by rural people with wild honey bee species (Apis dorsata Fabricius and Apis florea Fabricius) for honey hunting and with Apis cerana Fabricius in semi-domesticated conditions in wall hives, log hives and as underground beekeeping. Apis mellifera introduction success was finally achieved in 1964 when imported European queens were introduced to young brood of A. cerana which was gradually replaced by A. mellifera cell size foundations though the efforts initiated in 1880. In July 1981, All India Coordinated Research Project on Honeybee Research and Training was initiated by Indian Council of Agricultural Research (ICAR), with eight different cooperating centers which has increased to 27 now. It is a central scheme and a constituent programme under the ICAR, Ministry of Agriculture, Government of India. Development goal of the project is to conserve, sustainably manage and use pollinators for promoting green agriculture and sustainable crop production systems. Pollination requirements of important crops has been worked out under the project. Introduction and evaluation of performance of Apis mellifera in various states along with the standardization of management practices is being carried. Extension activities at the local level, resulted improved agricultural productivity, increase in farmer incomes and enhanced food quality, reduced use of pesticides and improved management of ecosystem services. The field demonstrations have increased awareness among farmers regarding use of pollinators in agriculture. This paper elaborates the research activity of the project over the past 35 years and its role in empowering the rural development.

Symposium: Beekeeping for Rural Development II (Africa)

BRO-068

Hives for the handicapped:-beekeeping on the island of Rodrigues

Paul Draper

Care-Co(Rodrigues), Mauritius

The Island of Rodrigues in the Indian Ocean is well off the beaten track of worldwide routes. Rodrigues is one of the outer Islands of the Mauritian Republic and is only accessible by Air From Mauritius and lacks behind the 'mother ' island in almost all respects. Unemployment is severe and thus poverty is rampant. Beekeeping has therefore been a source of income for some islanders who have been encouraged to take up beekeeping. The CARE-CO organization was set up in 1990 as a privately run NGO which develops income earning activities for people with disabilities, and started a beekeeping training project in 1994. This has developed into a well structured programme with two model teaching apiaries and a fully equipped Honey bottling plant where up to 20 beekeepers, all with disabilities are active. Care-co also has two sales outlets on the Island and there is a success story to be told of the 20 beekeepers who are now benefitting from this initiative of Care-Co. Paul.Draper MBE. Director Care-Co.Rodrigues.

BRO-015

Keeping Quality in Comoros: using bees to create livelihoods and change destructive practices

Ellen Geisler

Peace Corps, Comoros

Between 1990 and 2005, Comoros lost 58.3% of its forest cover, around 7,000 hectares; and the highest rate of loss of the Western Indian Ocean islands. Causes of deforestation include charcoal making and wood extraction, agricultural expansion, and infrastructure development. Beekeeping is a sustainable development strategy used around the world to provide alternative sustainable livelihoods and change destructive practices. Environmental education in Comoros, taught through beekeeping, creates value for forests as honey bee habitat and generates income. Traditional honey harvesting practices in Comoros involve robbing honey and nectar from wild hives, resulting in hive destruction, personal safety risks, and poor quality honey. We created a pilot project using a train-the-trainers approach involving men and women to improve beehive management techniques, enhance honey quality and income generation, and introduce value for the ecosystem through environmental education. Environmental education will empower communities to become stewards of their natural resources and demand more protection, which may create a local grassroots movement towards good governance. This community-led initiative creates local experts who have knowledge and skills to continue educating other community members to improve livelihoods and biodiversity conservation in the forest around Karthala Volcano and across the islands. We anticipate this pilot project will be scaled to create a beekeeping industry in Comoros that will provide alternative livelihoods and reduce deforestation from destructive agricultural practices.

BRO-060

Beekeeping for Rural Development

Kodjo Logou Agossou¹

¹ Organisation pour la Promotion des Arts Apicole et Sylvicole (OPAAS), Togo

Rural areas are full of typical problems: rapid population growth; low per capita arable land; overexploitation of land; poor soils; declining agricultural yields; poverty and malnutrition; rural exodus migration and exploitation of fragile ecosystems (forest, mines) or traffic in human organs. More general problems like irregular seasons due to climate change; lack of clean water and energy come amplify the effect of previous

Beekeeping contains values that can alleviate these ills. On the one hand any beekeeper protects and strengthens the canopy from the vicinity (neigbhour) of the apiary. The medium is gaining firewood, dietary fruits, pharmacopeia bodies and even animals to medium term micro forest with multiple effects: correction of the local climate, soil stabilization and water courses, restoration of soil fertility, accelerating infiltration of storm water limiting flooding. Moreover, this breeding can be done on any type of soil even smaller thanks to the possibilities of concentration of hives, it reduces land disputes. Finally, because of its direct effects, including increased crop yields (due to the participation of bees for pollination) especially the highly mercantile bee products (honey, propolis, wax, royal jelly) is currency source and more attractive food for less painful and often on the margins of growing seasons often marked by the exodus

BRO-012

Beekeeping schools – A great chance for rural and sustainable development

Zlatko Tomljanovic¹, Ivana Tlak-Gajger², Itana Bukovac³, Suncica Stanic-Gluhinic³, Dario Frangen⁴

¹ Advisory service, Zagreb, Croatia
 ² Veterinary faculty University of Zagreb
 ³ Public Open University Samobor
 ⁴ Croatian institute of rural development, beekeeping, gamekeeping and ecology

During the last few years the number of beekeepers in Croatia increased by one-third. The causes for increase can be explained by ecological and economic reasons. Unfortunately, many beginners ventured into beekeeping adventure without any practical and theoretical knowledge. Hence a large amount of mistakes in beekeeping management and honey bee health have been made by inexperienced beekeepers. Spreading of honey bee diseases and ignoring the general guidelines of Good beekeeping practice in apiaries are common errors by young beekeepers. Those beekeepers present high risk to all other educated beekeepers. Given this and to avoid such unwanted circumstances, we established beekeeping schools based on program approved by the Ministry of Science and Education. Likewise, local government joined the project and gave the opportunity to the beekeepers to be reimbursed the course fees. The beekeeping school lasts three months and attendants will have thirty hours of theoretical lessons and ninety hours of practical works as well. After finishing the course, attendants should be able to understand and explain basics of honey bee biology, recognize most common management systems and explain their benefits and drawbacks, assess general health of honey bee colonies and recognize common health problems. Consequently, we expect fewer problems in apiaries concerning beekeeping management and honey bee health than before. Finally, transferring the know-how technology to the beekeepers puts modern beekeeping in the centre of rural and sustainable development. The beekeepers will be ready to take care for nature and earn spare money at the same time.

Beekeeping as a livelihood strategy for women in rural Zambia.

Muule Moonga

Meshearles Ent. Ltd, Zambia

It is well understood that social and economic development can only be attained with equal participation of both men and women in the development process of any given country.For the rural poor in Zambia,especially women, ensuring food security for their families is a constant struggle as they live in situations of abject poverty. A social crisis in which the majority of people are denied a minimum decent living standard, poverty is and continues to be, the most profound challenge that Zambia faces today and it is becoming more and more difficult for the majority of people to meet basic needs as food costs continue rising while wages are in some cases unexistant and even where they do exist remain static and too far below the food cost. The impacts of poverty, structural adjustment programs and shifting patterns of farming have all drawn women in rural areas away from their more traditional roles in subsistence agriculture and honey extraction towards a more income dependent honey trading occupation. Beekeeping in Zambia is quite a significant contributor to the economic and social well being of many people and rural households in Northwestern province and other areas which are hardly reached by agencies responsible for the delivery of essential public services. The strengthening and capacity building of all stakeholders in the honey value chain will significantly contribute to the reduction of rural poverty in Zambia and in turn contribute to sustainable national development as the apiculture industry has great potential for sustained economic growth.

BRO-050 Beekeeping for rural development in Nigeria: A case study of my involvment in training five hundred farmers.

Oluwaseun Johnson

Bargong Farms, Nigeria

Nigeria's middle belt region is rich in diversity and density of angiosperms which bees need to support themselves. Unfourtunatly, local bee hunters burn bees to harvest honey. This is not only a bad practice, it is also not good for pollination, conservation and any agro related venture. In the past years I have been involved in training farmers, students of tertiary and secondary schools in Nigeria on the practice of beekeeping. A rescent training of 500 farmers in five states of Nigeria was sponsored by USAID MARKETS 2 project. This project focused on three major area of beekeeping for revenue generation, beekeeping for pollination intervention and beekeeping for household nutrition. The emerging findings has proved that in beekeeping for revenue generation alone, farmers got more money per capital invested in beekeeping compared to conventional farming. The practise of Apitherapy was the stongest gains in household health and nutrition and the impact of pollination on an experimental pepper (Capsicum Spp) patch was phenominal. Only about 1% of the potential in beekeeping in Nigeria in curently been taped and thus providing an oppurtunity for the evolution of allied industries if the potential is well harnersed. The hope that other related issues like use of insecticides, bush burning leading to environmental degradation will further be reduced. We also for-see bees been used for environmental impact analysis My recommendation therefore based on my findings and research over the years is that a comprehensive beekeeping policy bee legislated in our government.

Queen bee rearing in Africa: Its impacts in bee population, pollination and increase of bee products.

Philemon Kiemi¹, Prof. Bernad Chove², Shimon Barrel³

¹ Singida Youth entrepreneurs and Consultants Cooperative Society, Tanzania
 ² Sokoine University of Agriculture, Tanzania
 ³ Hebrew University of Jerusalem, Israel

Beekeeping sector in Africa continent is growing rapid as measure of solving extreme poverty in rural and urban Areas. One of the world problem in beekeeping sector is Absconding and low hive occupancy. In Africa we have African Killer bees which are aggressive and giant venom. We started First Queen bee rearing project in Africa which is located at Kisaki Village, Singida- Tanzania. Philemon Kiemi (27) is a young scientist intends to serve his Nation through beekeeping sector. He is graduate of international postgraduate course on Commercial Beekeeping in Modern Agriculture from Hebrew University of Jerusalem and founder of Singida Youth Entrepreneurs and Consultants Cooperative Society. He started Queen bee rearing projects in Africa will be measure to solve existing problem of low hive occupancy which results to low yields in agriculture production and bee products.As Africa is dark continent in terms of its nature we want to exercise "Commercial Beekeeping for Rural Development" which will increase bee products feed the world (global market)in rural and urban Areas. In collaboration with Academic institutions we have done number of researches in Beekeeping for rural Development and we like to share with others in Apimondia in daejeon, Korea this year. "Karibu Africa"

Symposium: Beekeeping for Rural Development III

BRO-058

Socio Economic barriers to increased honey production among rural households: Case of Northern Uganda

Deborah Ruth Amulen¹, Guy Smagghe², Paul Cross³

¹ College of Veterinary medicine, Makerere University, Uganda
 ² Department of Crop Protection, Faculty of Bioscience Engineering, Ghent University Belgium
 ³ Faculty Environment and Natural Sciences, Bangor University UK

Honey production in Uganda is sub optimal, average hive yield is estimated at 3.9kg per hive. This is below projected potential of 6-10kg per traditional beehive, 8-15kg per Kenya Top Bar and 15 kg per Langstroth. (Uganda Bureau of Statistics, 2008). Various factors influence honey yield that is, type of beehive, ecological location, management practices, health status of honey bees and beekeepers knowledge. There is limited understanding of socio economic barriers from the beekeepers' perspective. In a bid to contextualize the beekeepers working challenges and devise approaches to increased honey production in Northern Uganda. The study examined knowledge perceptions and attitudes towards beekeeping, extent to which ones' gender influenced participation in beekeeping and assess the status of extension services for beekeepers in that region. Nine focus groups, 12 key informant interviews and 304 household survey questionnaire interviews were conducted from December 2014 to February 2015 in Northern Uganda. Findings indicate that knowledge on hive management remains inadequate among many beekeepers varying by years of experience in beekeeping, age of beekeeper and social network in terms of linkage to extension services. Women feared hive management citing reasons like

limited knowledge and lack of protective clothing. Extension service delivery for beekeepers was inadequate in terms of frequency of delivery and quality of service. These findings infer that socio-economic factors still play a significant role in deterring increased honey production in Northern Uganda

BRO-065

Beekeeping for rural development

Venance Ntahondi

Mpita Enterprises, Tanzania

It is my plan to assist the rural residents around the project in Manyoni District in Singida region in Tanzania where my project is set just to commence with. These residents are poor, They almost live under 1 USD per day, therefore by staying with them.

BRO-064

Socio-economic and technical characteristics of beekeeping in the divisions of Bamboutos, MiFi and Menoua in Western Cameroon

Romuald Patrick Kenmogne Fotso¹, Meutchieye Félix¹, Youbissi Annie², Tchoumboué Joseph¹

> ¹ FASA, Cameroon ² MINEPIA

Socio-economic and technical characteristics of 113 beekeepers selected randomly in three divisions were accessed through survey using semi-structural questionnaire, direct interviews and observations from April to July 2014. The main results were as follow: beekeeping is mostly done by men (79.6%) aged between 50-60 years. Many of them are Christians (75.2%), married (88.5%) and taking care of more than 5 persons. Some of them have not received a proper training but have been exercising for more than 15 years. Beekeeping is the main activity for only few of them (13.3%). The number of hives varies from 1 to more than 101, with an average of 40 hives per beekeeper. The hives are mainly installed throughout the year (54.0%) on stilt (55.8%) less than one meter above the ground (61.9%). The bait used is mainly wax (91.2%). The interval between hives installation and bee populating is not evaluated by beekeepers. The rate of non-colonised hives is relatively high (29.0%). A high proportion of beekeepers does not have the essential equipment like protecting clothes (38.9%), smoker (41.6%) and do not carry out regular monitoring of apiary (47.8%). Harvesting is done 2 times (49.6%) per year from February to May mostly during the day (54.9%). The products harvested are honey (100.0%), wax (69.9%), propolis (44.2%), pollen (15.9%) and royal jelly (3.5%). The average amount of honey harvest varies from 4 to 7 liters per colony. Honey is kept within the comb or stored in a filtered form. Honey colors were light amber (36.7%).

Agriculture, socio-economic development through beekeeping of rural Indian women.

Sarika Saswade

Prasari Honey Bee's Pvt. Ltd., India

In India very less no of women involved in this industry so motivate the women to do beekeeping. In India large no of farmers don't know about Beekeeping for importance of pollination. Indian women status is secondary in social economic than men, but we see developmental rays of hopes in beekeeping through women. Indian rural women working in farm & forest, they look after bees & care of them. Women also migrate the bee hives in various flora fauna area in India. As social Entrepreneur our main motto is give them Scientific & Modern Training in Beekeeping. So they develop themselves in various areas like economic social development 1 they will get empowerment through Beekeeping Industry. We gave beekeeping training to tribes & non tribe's women in rural area. Some Role models actually developed through beekeeping. Rural women developed beekeeping skills, Knowledge & information. Women will get economical power through beekeeping. In very hygienic conditions women collect the pure honey. We see in women special skills, research attitude & method of handling the bees & they have patience, caring nature & main is less addiction than men. Name: Sarika Saswade Education: Master of Social Work Social field Experience: 18 years, Beekeeping Experience: 6 years. Certified as a "Kendra chalak" by Khadi &Village Industry Board of Maharashtra. Member of National Bee Board, Govt. of India. Experience: Cateringas a Resource Person in National Bee Board seminars. Supported by Women Entrepreneur at 'Goldman Sach' – 10k Women in India by International School of Business.

BRO-061

Beekeeping for Rural Development in Uganda

Sarah Ankunda

Royal Tropical honey

Beekeeping for rural development in my country is practised on large and smmall scale. Some time back traditional methods of bee keeping were still predominant in Uganda where it remained an important seasonal activity in many regions. Rural people had a good knowledge of bees, plants and places favoured by bees but hives were usually destroyed and colonies often killed in the process of collecting honey. Contamination and fermentation of honey is also common. Despite the diversity of vegetation suitable for bees in the region, a shortage of bees means that beekeepers are dependent on collecting swarming bee stock. The current shortage is also limiting production of honey and by-products for which there is considerable potentrial However with all those challanges the local peoples have improved their standards of living in both health and finace using the coperatives they formed and saving schemes. Farmers have acquired new technology with the help of agricultural organisations on how to mantain thier bee colonies, using modernised beehives and equipments, handling honey in its purest form. This has improved honey quality production in Uganda. Demand for apicultural products has increased in our country, since people are taking honey instead of sugar.

BRO-049

Accessibility to livelihood amenities among women and youth in western Tanzania: The case of beekeeping activities

Angela Mwakatobe¹, Janemary Ntalwila¹, Mwanahamisi Mapolu², Edward Kohi¹, Steven Nindi¹

¹ Tanzania Wildlife Research Institute, Tanzania ² Tanzania Forestry Services

Participation of rural women and youth in beekeeping activities provides a unique opportunity to improve rural livelihoods and hence poverty reduction. This paper explores the extent of accessibility of women and youth in beekeeping industry in Tanzania. Data were collected from Kigoma Region in Western Tanzania through Participatory questionnaire survey, Focus Group Discussions and Key Informant Interviews. Results indicate that women have explored their own niche in beekeeping industry by actively engaging in post harvesting of bee products. Income generation was the major reason for participating in beekeeping activities and beekeeping was ranked number one at the same level as agriculture as major sources of income. Post harvesting beekeeping, however, needs liquid capital investment which, limit women and youth to participate fully in the business. Cultural practices were also mentioned as other main hindrance for adult women and youth to participate in beekeeping activities. Nonetheless, presence of beekeeping groups and associations, community banks, forest reserves and beekeeping awareness campaigns in the areas provided opportunities for women and youth to participate in beekeeping. We recommend for strengthening and empowerment of beekeeping groups, associations and cooperatives with particular emphasis to women and youth to access credits facilities, donor supports and training. In order to increase income accrued from beekeeping activities, promoting and support of training on processing of secondary bee products to women and youth beekeepers are important. Stakeholder's involvement in promoting and support beekeeping awareness campaigns is crucial to enhance the contribution of the sector for livelihood improvement and environmental conservation.

BRO-045

Assessment of the utilisation of beekeeping technologies in ekiti state, Nigeria: implications for enhancing rural women livelihoods

Bamigboye Emmanuel¹, Yusuf Olayinka²

¹ Ladoke Akintola University of Technology, Ogbomoso, Nigeria ² Kwara State University, Malete, Nigera

The study was designed to assess the utilisation of Beekeeping Technologies (BT) among rural women in Ekiti State of Nigeria. Specifically, the personal attributes of respondents were described, profitability of beekeeping enterprise was evaluated, utilisation level of beekeeping technologies were determined, constraints inhibiting successful beekeeping were identified and implications drawn for enhancing rural women livelihoods. One

hundred and twenty women beekeepers were purposively sampled from five Local Government Areas (LGAs) of the state based on the concentration of apiary farms in the LGAs. Validated and structured interview schedule was used to elicit requisite information from the respondents. Simple descriptive statistical techniques were used to summarize the data, while Pearson correlation analysis was used to make inferential deductions. The results showed that majority (81.7%) of the respondents were aware of the modern beekeeping technologies introduced to them. It was also revealed that the beekeeping enterprise was found to have low capital outlay, and average net profit per hive was N6,566 per annum. In addition, there was positive and significant relationship between BT utilisation and house hold size (r = 0.339), educational level (r = 0.380) and farm size (r = 0.327) at P<0.05 significant level. It was therefore concluded that with continuous enlightenment and training, beekeeping would become a very viable enterprise capable of enhancing rural women livelihoods.

BRO-062

Beekeeping empowerment in India

Satyen Yaadav

Horticulture Produce Management Institute, India

I am an Agribusiness Professional, engaged in addressing the value chain of various agribusiness models to strengthen the rural economy of India through productivity enhancement and providing additional income option. APICULTURE is a very strong and sustainable option to achieve our goals of farmers & agripreneures empowerment.

I am heading a organization called HPMI (www.hpmi.co.in) which is a permanent member of National Bee Board, which is promoted by Government of India. I am engaged in supporting bee keepers through complete technical as well as commercial support with market access for all the vale added products. I wish to participate in APIMONDIA, to gain more exposure in order to increase my vision and capabilities through interaction with other participants through their experience in their respective countries. I am also assisting in developing a GLOBAL FARMERS FORUM under which all the farmers and agriprenures of the world through their producer organizations or producer companies will get associated for close relationship and bridging the gap. I can even present the model, if given an opportunity during the conference. The model is in participatory mode with TAGS (Transparent Agribusiness Guarantee System) and all the value chain partners have winsituation. Through this model, we plan to connect 10,000 bee keepers every year with complete hand holding and value addition options.

BRO-043 Bee keeping source of income in Ilam Municipality, Nepal

Nrishima Khatri

Padma Kanya Multiple Campus, Bagbazar Kathmandu, Nepal

Bee keeping as income source is suitable in a place having richness of forages, forest and appropriate landscape. Ilam municipality the second cleanest green city ward no 3, 4, and 5 are most favorable area for bee keeping. The research indicates that one hive can earn 24 Kilo honey worth of 1000 US\$ from one hive of apes Cerena. There is value add and chain through intervention processing and packaging technology. Large area of community forest and tea garden are around the municipality. This virgin area has not been tabbed by community people and neither the policy bodies have paid attention to utilize it. Even local community have interest to adopt it as profession but

lack of financial resources, training and security do not support them to adopt. Set up of resource center and incentive to farmers in community basis is urgent need of the study area. The community forest and bee keeping with floriculture education can be equally introduced in Nepal selecting such viable area in which such project can develop the economic condition of people and maintains the environmental conservation thereto. Indigenous and Dalits. So called caste oppressed and excluded community can be pursed and enticed in such economically profitable profession that booms entrepreneurships, linkages with market, climate change effect mitigation and keeps up the food security. Bee keeping resource center in multicultural approach can be set up coordinating with tourism, horticulture and floriculture in the study area. It becomes an integrated development model.

BRO-038

Good news about beekeeping in Afghanistan

Reza Shahrouzi

International Counsellor for beekeeping, Iran

For over three decades, Afgha n living in a per manent state of war. Fortunatel y depuis 2004 the opium is fallen increasingly,NGOs have made great efforts to reduce hectares of opium.It is therefore necessary that this country is helping to enable it to cope. The development and modernization of agriculture Afghan much needed, during my visits from 2004 to 2015 the author was able to establish the existence of a very large economic potential in many agricultural areas dominated most important are the following: - breeding sheep and cattle (bovin&Ovin) - green house, - processing of agricultural products, - Arboriculture, - Beekeeping, - poultry, - breeding of fish. - Technology of Irrigation By applying a rational development plan spread by 2020 could easily get jobs to at least 300,000 peoples in domains agriculture.New beekeeping technologies since 2004 until '2014 using all NGOs (of after my report in 2004 Beekeeping field .) There was a ' roughly 30,000 hives in 2004, in 2015 currently there are over 600,000 hives and 8000 beekeepers. For 2020 Afhganistan will increase to get more then 1.000.000 hives and more then20.000 beekeepers. Afghan beekeepers still need to learn beekeeping intensive production methods! In this country where fruit growing is an important part, it is essential to teach and develop everything related to pollinate orchards to increase and improve yields. This really is essential for this country.

BRO-037

Beekeeping organizations in Colombia and the application level of quality managment systems for rural development.

Lopez Carmenza

University of Cauca, Colombia

This work provides results from a research project called "The evaluation of Management System implementation in apiculture organizations and their occurence in the development of rural communities in Colombia". This project is motivated by the need to know the state of Management Systems in apiculture, in order to demonstrate that the bulk of apiculture production in the country is provided by small-scale producers who do not abide by the conditions required by the law (Decree 3075 of 1997), while industrial producers are able to comply. The project was carried out initially by a diagnostic pilot study with beekeepers organized in the Apiculture Cooperative of Cauca, COOAPICA, where we obtained some suggestions from specific participants for the improvement of their own systems and those of the state. Subsequently we implemented an online survey which focused on the
Beekeeping and Bee Network (CPAA). The results of the survey showed that according to a ranking system of low, medium, high, and very high, based on the practices used and stipulated by the Decree, the majority of respondents are found within the medium level, while the rest are divided between high and very high and none are in the low level. These results demonstrate that the majority of the organizations that responded to the survey report that their beekeepers implement at least some of the required management activities.

Symposium: Indigenous Bees and Conservation I

BRO-013

The status and prospects of Apis cerana

Kaspar Bienefeld, Holly Jones

Institute for Bee Research Hohen Neuendorf, Germany

Although A. cerana produces less honey per colony than A. mellifera, it is well-acclimated to its native environment, gentle, and resistant to honey bees' main threat: Varroa destructor. These factors seems A. cerana optimal for beekeeping within its natural habitat A survey was sent to 30 apiculturists throughout Asia to assess their observations of current A. cerana populations, population changes, influences of A. mellifera, and other aspects of beekeeping in their respective countries. On average, A. cerana populations have decreased by 55%, but up to 95% in some areas of its range, due partially to imports of European *Apis mellifera* and the resulting exchange of diseases. In 62,5% (10 of 16) of the countries in question, an even further decline in A. cerana populations is to be expected. Nearly all participants expressed support for A. cerana conservation measures and a third specifically emphasized the necessity of breeding programs. As the superior performance of A. mellifera relies largely on breeding programs, similar practices with A. cerana should improve traits which beekeepers have previously considered to be insufficient. The substantial genetic improvement in terms of productivity, behavior, and disease resistance observed in A. mellifera following the introduction of new Beeding strategies attests to the effectiveness and sustainability of this option. In reference to the concepts of the new EU "Smartbees" project (www.smartbees-fp7.eu), which uses modern breeding strategies to adapt endangered A. mellifera subspecies to beekeepers'needsand thus preserve these native populations, we suggest creating a similar initiative for A. cerana.

BRO-020

Quality of honey as an indicator of the health of bee colonies and sustainable production approaches and biodiversity conservation in beekeeping: International pilot project "more than honey"

Viacheslav Tsuprykov¹, Carlos Desmaison Elespuru², Ruslan Nesterenko³

¹ Environmental NGO "Gogolmed" (GogolHoney), National Research Centre for Radiation Medicine (Nation. Acad. of Med. Sciences of Ukraine), Ukraine ² Liofilizadora del Pacifico, S.R.Ltda ³ Environmental NGO "Gogolmed" - "Gogolhoney"

1. The issue. The quality of honey depends on the state of health of the bees colonies and its environment. In our many years of beekeeping experience, we concluded that the quality of honey and its healing properties directly

depend on the quality of habitat and the state of bee colonies and, vice versa, the presence of high-quality honey proves the quality of habitat, health and strength of bee colonies. So every activity that aims to produce of high-grade honey inevitably leads to the creation and ideal conditions for the existence of bees, the strengthening of the colonies, that helps solve the actual problem of saving the bees. There are many barriers that impede development in Ukraine, Georgia and Peru producing of high-grade organic honey. These include lack of government policy on the systems of quality certification of honey, limited access to information and low awareness of society about exceptional value for the health of modern man the presence of high-grade honey in daily diet and related this lack of incentives to increase demand for high quality organic honey. But the main barrier is a purely economic: for now the production of high-quality honey is not economically profitable business. 2. Proposed response. The project aims to: • address and overcome environmental, economic, technological, market and policy barriers that exist in Ukraine, Georgia and Peru to increase production of organic high-quality honey and to share our experience, our know-how and "success" with other beekeepers in the area, region, country and abroad.

BRO-001

Mainstreaming conservation and sustainable use of biodiversity pollinators into Ukrainian production landscapes. An attempt to spread the successful experience and new knowledge from small local project to national level

Viacheslav Tsuprykov, Ruslan Nesterenko

Environmental NGO, Ukraina

The long-term challenge for Environmental NGO "Gogolmed" is to ensure that Biodiversity of pollinators conservation is mainstreamed into production and marketing of agricultural business, in order to create community incentives to conserve and enhance pollinators biodiversity including honey bees in Ukrainian land while maintaining appropriate incomes to satisfy beekeepers family needs for livelihood and wellbeing. There are three main barriers to achieve this: -the institutional framework is not sufficiently capacitated to address the needs of an emerging biodiversity-based beekeeping business sector, based on sustainable harvesting and production principles; -at the community-level, sustainable beekeeping production approaches and biodiversity conservation efforts are inadequate due to low incomes from present product categories; -community revenues are limited due to low prices in honey market, due to the fact that high-quality honey, produced using sustainable methods of beekeeping in natural area, beekeepers are forced to sell as a regular honey. The project will directly address these barriers through three major components of the project: 1. Building national capacity for support of Biodiversity Beekeeping Business. 2. Piloting Community-based Social Enterprises in valuable Ecoregions. 3. Mainstreaming Biodiversity Business into the supply chains of high-value consumer markets. Our strategy addresses the most critical underlying driver of biodiversity pollinators loss; the failure to account for and price the full economic and human health value of ecosystem pollination service and goods. Especially, it concerns of high-quality honey, an essential functional product in the diet of every modern person, one of the last surviving natural products on planet Earth.

BRO-063

Scenario of indigenous honeybee species of Nepal

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Nepal is one of the richest country in honeybee species diversity in the world. *Apis laboriosa, A. dorsata, A. cerana, A florea* and stingless bees *Trigona* and *Melipona* and their various ecotypes are living friendly by partitioning different geographical zones of Nepal since time long ago. Beekeeping with A. cerana in wooden log hive or mud wall hive and honey hunting from the wild honey bees are the cultural heritage and an integral part of Nepalese farmers. Catching feral colonies and introducing them into the log hive and hunting honey are the only practices done in traditional way of beekeeping. Very few beekeepers are practicing *A. cerana* beekeeping for honey production in modern bee hives. There are 0.1 million A. cerana colonies with an average honey production of 2.0 to 3.0 kg per hive. Lack of information and suitable technology are the major problems to exploit them for the benefits of farmers. The honey from the native honey bee species is highly valued however, their pollination importance is underestimated which is highly vital from the food security point of view. The population of native honey bee species is declining sharply every year and are at risk due to deforestations, fire in the forest, use of pesticides, unscientific honey harvest, urbanization, changes in cropping systems and emergence of new pests and predators. So, there is an urgent felt need to study the native honey bee species of Nepal and conserve and promote them for the welfare of future generations.

BRO-066

Differential nest site preference of giant honey bee, *Apis dorsata* in Bengaluru, India

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The giant honey bee, *Apis dorsata* is one of the largest producer of honey in India. The number of nests ranges from solitary to as high as and world's highest number of 630 colonies in a Banyan tree, *Ficus benghalensis* were reported in and around Bengaluru, India (Reddy and Stephen, 2014). The nests of *A. dorsata* were usually observed on rock cliffs, trees, buildings, bill boards, water tanks etc., quite large number of behavioural traits have been observed from the past 15 years. One of the unique traits we observed was nest site selection in urban Bengaluru. When the avenue trees such as *F.benghalensis* and other species of trees were in large number, *A. dorsata* chose nesting sites for colonization. Due to the urbanization many trees where *A. dorsata* was housed were cut down and bees started shifting to city of Bengaluru and nests on multistoried buildings and of late underneath metro train fly overs. It was found out that, while selecting the nesting sites of *A. dorsata* two discrete types of behavioural traits were observed ie one which selects along the grooves and others selected the plain/flat surface underneath the metro fly over. The survey conducted during 2013-15 on nestsite preference of 525 colonies of *A. dorsata*, it was observed that, 405(77.14%) nests selected groove where two concrete blocks are joined and the rest 120 (22.86%) nests selected smooth surface. The observation clearly demonstrates that, two traits select differential nest sites for colonization. Further studies on its genetic variation are in progress.

Treasuring beekeeping for livelihood transformation and park conservation: A case study of communities around Bwindi National Park, South West Uganda

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Beekeeping is vital for communities living close to Bwindi Forest conservation area in South Western Uganda. Inaccessibility limit access to adequate beeping services and this forced rural people to exploit resources unsustainably. Realizing this, International Gorilla Conservation Program (IGCP) initiated a beekeeping project to help people improve their livelihood and enhance conservation of Bwindi National park, home for mountain gorilla and vital for tourism. This presentation therefore, a) Highlights how private sector led market based approach has resulted into the community transformation - from traditional honey hunters to a formidable beekeeping force with better understanding, appreciation and practical management response to beekeeping for livelihood enhancement and conservation of the Park. b) States how linkages between poor micro-entrepreneurs in the informal sector and the formal private sector have been formed based on demand-driven rather than supplyled market approach. c) Emphasizes partnership and networking between the private sector led businesses and honey producers. d) The use of viable groups for training and information dissemination which led to the appreciation of beekeeping as a source of livelihood improvement and a tool for the protection of Bwindi National Park. e) Illustrates approach for collection of bee products for onward sale to the private company. f) Shows an increase in the volume of honey bought by Golden bees Ltd over the last four years. g) Indicates the promotion of park conservation and tourism through branding of bee products with Silver Back Mountain Gorilla. This way, both communities and product consumers appreciate the treasure in beekeeping.

Symposium: Indigenous Bees and Conservation II

BRO-003

Beekeeping industry in Cambodia and Laos (habitat losses of wild bees)

Jinyeong choi, Seunghwan Lee

Seoul National University, Republic of Korea

The Laos and Cambodia are located in the middle of the Indo-China Penninsula, where the climate is the typical tropical/subtropical with the high diversity of indigeneous bee species, especially the honeybee spp.: *Apis cerana*, *Apis dorsata*, *Apis florea*, and Apis andreniformis and also many species of stingless bees. However, due to the human activities in the natural forest, mostly the slash and fire-burn farming and hunting in the forest, the natural habitats of these indegenous wild bees have been destroyed, inducing the population declining severely. With the experience of last 5 year's expedition, we report the diversity of honeybees and the habitat declining in these countries.

Forest beekeeping system of *Apis cerana* colonies by Todas: A community based conservation approach.

Robert Leo

Keystone Foundation, India

The study was conducted in on of the village is inhabited by Todas, an indigenous community of the Nilgiri Biosphere Reserve (NBR). The NBR is part of the Western and Eastern Ghats chain of mountains of the Indian peninsula, and lies between 100 45'N to 12 0 N and 760 E to 770 15' E with a total area of 5520 km2 spread across the three southern states of Karnataka, Kerala and Tamil Nadu. A random 10x10m plots were laid to determine the density of *Apis cerana* bee colonies. Each plot was intensively searched for nests among the vegetation and on the ground with the assistance of experienced honey gatherers from the local community. A total of 53 colonies were located and tagged. The traditional system of wild bee rearing is practiced within the Toda community. However, the study showed that in recent times these trends have changed to a certain extent, wherein the cavities are not maintained and in certain cases subject to predation by animals and humans.we envisage that a participatory method of community based monitoring is initiated. The community have marked the boundaries and are involved in regular monitoring of the bee population within the village. The study was initiated to encourage the community and as a role model to other regions to undertake conservation measures for bee population and habitats.

BRO-024

Community organizing strategies for the conservation of Scaptotrigona mexicana: a perspective from the Totonac culture for the appropriation of nature.

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Universidad Veracruzana, Mexico

The research is situated within the biocultural ecology and defined by a set of relationships between a community located in the region of Totonacapan, in the northern state of Veracruz (Mexico) and their local environment. To approach this phenomenon has been selected as a gateway to stingless bee Scaptotrigona mexicana, commonly known as Melipona bee. There are two implicit questions in selecting the object of study: why this community?, and why the bee? The interaction Man-Bee, which has remained for generations, have created a structural link that involves the relationship between species, landscapes, and local physical elements. They are maintaining the conditions that allow the exchange of mutual benefits. This is based on a theoretical and methodological effort to design conservation strategies of Scaptotrigona mexicana communities in Totonacs.

BRO-031

Evaluation of Performance of Different Beehives Types used in Uganda

Robert Kajobe

National Agricultural Research Organisation (NARO), Uganda

Beekeeping offers enormous potential for income generation, export diversification, pollination and sustainable use of forest resources. In 2005, Uganda was licensed to export honey to the EU, creating immense opportunity. However, the potential for beekeeping is not yet fully exploited. Hive colonisation rates in many parts of Uganda are low (30 - 50%), leading to low productivity. This study described the performance of most important beehives types used in Uganda. In this study, performance is based on honey yield. The study was conducted from February 2011 to June 2013 in the different agro-ecological zones of Uganda. The zones are classified on basis of distinct vegetation type, elevation and climate. The three major types of beehives used in Uganda are traditional hives, top bar hives and frame hives. Most beekeepers use traditional hives; this was followed by top bar hives. Frame hives were used by few beekeepers. The type of hive used determined the whole approach to beekeeping. Most beekeepers using traditional hives follow nature-based systems of beekeeping in which little colony management and manipulation are practiced. Factors that influenced performance of beehives include richness of forage, status of the colony, number of colonies within forage range, management practices of beekeeper, appropriate hive design, equipment costs that affect productivity and pests. The major challenges faced by beekeepers in management of beehives include bush fires, high costs of beehives, improper apiary siting, low durability of traditional hives, theft, difficulty in harvesting, difficulty in honey extraction, pests, inadequate knowledge on beekeeping management practices.

BRO-004

Honeybee forage plants, bee visitation counts and properties of honey from different agro- ecological zones of Uganda

Alice Kangave

Minsitry of Agriculture Animal Industry And Fisheries, Uganda

The current study was conducted in selected agro-ecological zones of Uganda. The aim was to document honeybee forage plants, assess honeybee visitation counts on different forage plants and properties of honey from selected agro-ecological zones of Uganda. In order to achieve the objectives of the study, a survey of about two kilometers radius of each apiary and beekeepers was done by selecting fifteen bee farmers with established colonies per agro-ecological zone. The preferred forage plants were established by questionnaires and independent field observations on plants that where visited by honeybees. Samples of honey were collected from apiaries in the selected agro-ecological zones for laboratory analyses. Specifically, honey: colour, water content, pH, acidity and sugars were analysed in the laboratory. The results indicate that a total of forty six plant species belonging to twenty families were identified as honeybee forage sources. Honeybee visitation counts on forage plants during the different times of the day varied significantly in some forage species The chemical properties of honey (water, sugar and pH and acidity) varied among the agro-ecological zones but in all cases met the UNBS and international standards. From this study, I recommend that beekeepers should plant more honeybee forage plants that have been indentified in this study or crops that can act as sources of forage in cases where the natural honeybee forage has been cut down. In addition, bee farmers should maintain proper honey harvesting and processing techniques so that they can ensure no contamination of honey.

BRO-035

An Integrated technique of sustainable honey harvesting from the nests of *Apis dorsata* in plains of Karnataka, India

Narayanappa Nagaraja

Bangalore University, India

The common giant honeybee, *Apis dorsata* is a major honey producer in India in general and Karnataka region in particular for the past few decades. Attempts were made to develop an accurate and sustainable techniques of honey harvesting from the nests of A. dorsata in plains of Karnataka, India. The results showed that, an integrated method of honey harvesting technology such as harvesting honey during dusk, topical application of *Amomum aculeatum* Roxb. plant extract on body parts followed by short time exposure of bee nests to sufficient quantities of smoke generated by a handy smoker during harvesting made the bees of the colonies to calm down for a period of 30 to 40 minutes. A rapid harvesting of honey from the honey comb portion preferably in pieces without destabilizing the strength of the combs within 30 to 40 minutes made the bees to restore honey within 2 to 3 days by rebuilding removed honey comb portion. This method of sustainable honey harvesting did not affect either the process of honey harvesting or destroyed/killed A. dorsata colonies. Furthermore, the repeated re-harvesting of honey from these colonies did not affect the performance of the colonies. Based on the results obtained, it is concluded that, use of these integrated techniques of sustainable honey harvesting are effective in conserving A. dorsata colonies by enhancing honey production and crop pollination.

BRO-017

Oku white honey production from Kilum-Ijim forest-Cameroon

Wirsiy Emmanuel Binyuy

Cameroon Gender and Environment Watch-CAMGEW, Cameroon

Oku White Honey is produced from Kilum-Ijim Mountain forest in Cameroon. It has been certified as Geographical Indication Product. Oku White Honey (OWH) gained local, national and international attention because of its delicious nature, its ability in promoting participatory forest management-fighting poverty and unemployment. Ownership of beehives in the forest prevents bushfires and deforestation. OWH sells at higher prices (3000 FCFA from 2500 FCFA). More bee wax is produced and sold. Many trained bee farmers get upfront payment for honey from Oku Honey Cooperative. About 347 bee farmers have been trained. Trained persons act as trainers for others.400 hives have been shared to those trained to serve as starting point. More than 1200 children made lovers of nature. CAMGEW forest radio programmes reaches about 400000 people. About 850 people have been trained on bee loving tree nursery development and tree planting. Some of the 317 persons trained on bee farming have taken beehive construction as profession. After CAMGEW training on nursery development, many persons and schools now own bee loving tree nurseries. Forest education is done in CAMGEW tree nursery and in forest. 20124 native apiculture trees (Carapa grandifolia, Prunus africana, Schefflera, and Nuxia congesta) have been planted in the forest. Women are encouraged in apiculture by giving women participants' two beehives

instead of one received by men. Honey harvesting is done by two persons. Men always hire a second male to do honey harvesting and this reduces family income. The involvement of women in apiculture increases family income.

BRO-021 Beekeeping in the Czech Republic and Czech Association of beekeepers

Jaroslav Hrabak

Czech Association of Beekeepers, Czech Republic

Beekeeping in the area of current Czech Republic has been documented since 10th century. The first law regarding beekeeping was issued by the empress Maria Teresia in the year 1775. Between 1871 and 1898, beekeeping unions for the regions of Bohemia, Moravia and Silesia were established. In the mid of 20th century, all regional organisations merged to one beekeeping union. In 2014, Czech Association of Beekeepers organized 51 651 members of total 53 447 beekeepers owned 603 392 bee- colonies (2014). Members of Czech Beekeeping Union possessed 579 319 bee-colonies. The most common type of bee-hives has the frame measurement of 39×24 cm. Based on the certified breeding program, only Carniolan bee is allowed to be bred in the Czech Republic. Since 1922, specialized research center (Research Institute in Dol) is continuously active in a research of diseases of bees, improvement of breeding, pesticides, pollination, etc. Czech Association of Beekeepers together with the Ministry of Agriculture of the Czech Republic is a co-founder of Secondary Beekeeping Trade School-the Beekeeping Education Center in Nasavrky. The school prepares qualified workers for beekeeping, organizes education of new teachers of beekeeping, serves as a methodological center for leaders of beekeeping interest groups, etc. Since 2005, Czech Association of Beekeepers collaborates with Czech government on a preparation and administration of Czech Beekeeping Programme co-financed by European Union. Financial support is provided to technical assistance (organisation of courses, seminars and lectures; acquisition of new precisely defined equipment; acquisition of new bee-hives), treatment of varroasis, and hive revival.

BRO-072

The potential for wild bee honey production

Mochammad Junus

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The study was enacted in Sungai Pagar Village, Kiri Hilir Riau regency, Riau Province in July 2014 in cooperation with the area wild bee honey Co-operative Society. The aim of this study was obstain an accurate estimate of the economic potential at local wild bee honey (*Apis dorsata*) and its products of the above area. In order to draw was appropriate laws and regulations for its sustainable exploitation. A survey method was employed, which found that there were two types honey of wild honey bees, one black ini colour and the other yellow, and that of the total number of hives 1320 colony were of the black variety. Regarding honey production and harvesting, it was found that black bee hives produced 3 - 8 kgs of honey and could be harvested from between 8 and 10 times a year. The local of method of harvesting, namely the taking of only 25 % - 30 % if any one hive was unlikely to cause the bees to abandon the hive, and is thus fully sustainable.

Sizes of artificial hive and the performance of the stingless bee *Heterotrigona itama* in Agropolis Unisza apiary.

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University Sultan Zainal Abidin, Malaysia

A study was conducted in the Agropolis UniSZA Apiary Malaysia located near the coastline where the soil texture consists of 90% sand. In the first study, 16 natural stinglessbee hives found in tree trunk were cut open to investigate the hive morphology and the colonies were transferred into artificial hives of volumes of 2925, 4050, 6300 and 10350 cm3. The quantities of honey produced from the different sizes of artificial hives were determined. Four replicates of artificial hive were prepared and arranged in CRD under the natural shaded areas in the apiary. In the second study we investigated the influence of time of day and weathe r conditions on the foraging performances of H. itama. The results indicated that in the tree trunk the hive was found to be oval in shape with the central width dimension of 9.6 cm and 17.0 cm long. However the trunk cavities have the width of 10.8 cm wide and 45.1 cm long. The artificial hives of volume 6300 cm3 (15x15x28 cm) produced the highest amount of honey. The number of foragers for both honey and pollen were peak at 7-10 am and declined sharply after that. The proportions of pollen foragers accounted to about one-fifth of honey foragers. The foraging activity was the highest during sunny morning and greatly reduced during cloudy and rainy periods. Results from these studies provided basic understanding of the potential of rearing the H. itama in the infertile BRIS soil along the beach in Malaysia.

BRO-016

Perceptions and adaptations of beekeepers and honey hunters to climate change in the Communes Djidja, Dassa and Tchaourou located south, center and northern part of Benin

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Climate change and his effects, today constituted a major threat to the environment and sustainable development. Perceptions and adaptation strategies developed by beekeepers and honey hunters to climate change are not enough explored. The objective of this study aimed at analyzing their perceptions on climate change with a focus on their strategies of adaptations. A survey was conducted among three hundred and sixty (360) beekeepers and honey hunters within three Communes, located in the south and Northern part of Benin. Data on demographic characteristics, perceptions and strategies for adaptations. Triangulation of information was achieved to check collected information. Our results showed that various coping strategies such as: reduction or increase of the

number of hives, farming with other bees' species, changing beekeeping techniques, amendment of periods of beekeeping operations, displacement of apiary, prayer or other activities allowing beekeepers to adapt to climate change were adopted by both beekee pers and honey hunters of the three study sites.. The most affected beekeepers by the effects of climate change, as in previous studies in others localities abandon beekeeping for honey hunting, which represented a serious threat to bee' biodiversity, Our studies raise the urgent need of strategies for conservation of bee' diversity.

Symposium: Apiecotourism and Urban Beekeeping

BRO-006

Ecological aternative: Effects of rooftop garden on foraging of honey bee in urban landscape

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Ecological processes and their interactions rely on much larger scales than a single habitat, so that it is necessary to relate spatial patterns to ecological processes at a landscape scale. Urban landscapes support considerable biodiversity and provide ecosystem services, and so are of conservation value, even though they are highly modified ecosystems. What is more interesting, urban landscape is, in general, composed of a variety of land cover types forming a dynamic landscape context. Urban parks and gardens are rich in floral resources that provide pollen which is the food source for pollinators, including bees. In this study, we analyze effects of rooftop garden at Seoul National University where on-campus beekeeping is being practiced on foraging of honey bee (*Apis mellifera*) in an urban landscape. The study site is situated in a unique landscape context, a mixture of highly populated area and mountainous area. We use a newly modified powder dispenser to mark honeybees in order to see their foraging paths, with respect to the following hypothesis: a rooftop garden is an alternative foraging site for honey bees. It is known that honey bees do not normally forage in less than 0.5 km, but this study examines whether the rooftop garden can function as a foraging site when floral resources are not enough in surrounding landscapes.

BRO-071

The canberra urban honey project: Lessons for the role of apiculture in sustainable urban food systems.

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International interest in sustainable, affordable urban food systems is increasing and this, in part, is driving interests in urban beekeeping (1). In 2012, the Australian city of Canberra was facing an emergent pollination crisis. Interaction between apiarists and the community at The Capital Region Farmers Market was the catalyst for development of a community action project to improve pollination in the city. The Canberra Urban Honey Project is a youth led initiative to promote the role of urban apiculture in sustainable food systems and is an

innovative response to the emerging global losses of bee pollinators. The loss of bees is a potential planet wide ecological catastrophe and any education and action based program that can engage the community and provide them with an opportunity to contribute is of great value. Three years later, Canberra Urban Honey is a successful social enterprise that has reintroduced over 2 million bees into the city of Canberra, created innovative community partnerships, spread beekeeping culture and established new apiculture networks. This presentation offers international lessons relating to: - the way farmers markets can contribute to urban innovation, - ways to engage the community in apiculture; - how urban beekeeping can contribute to sustainable, affordable food systems; and - that creation of rural and urban apiculture links can contribute to the success of urban beekeeping ventures. 1 Pearson, D et al. 2014. Building environmentally sustainable food systems on informed citizen choices: Evidence from Australia, Biological Agriculture & Horticulture, 30(3): 183-197.

BRO-057

A Study on developing a non-nomadic bee-keeping model forest to promote apiculture, agroforestry and apiecotourism in Korea

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The objective of this study is to develop a non-nomadic bee-keeping model forest, in which bees are able to be fed with diverse honey plant species from spring through fall. Also the model forest has to provide diverse apiproducts, medical or edible herb species as well as the opportunity of api-ecotourism to promote the local economy of the back regions. In order to achieve the goal, we have chosen study sites and building a development project ecologically-adaptable to the sites. The project includes building a combination of tree-and-herb species as the continuous source of flower nectars for bees. The study sites will be designed to promote the api-ecotourism as well as the apiary by introducing diverse tree-and-herb species adaptable to the scenic and natural environment of the mountain land. In choosing the tree-and-herb species, the species of higher potential for medical or edible use will be preferred. This work was supported by Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry and Fisheries (IPET) through Agri-Bioindustry Technology Development Program, funded by Ministry of Agriculture, Food and Rural Affairs (MAFRA) (No. 314009-3) Corresponding author: Joosang Chung (Email: jschung@snu.ac.kr)

BRO-041

Entrepreneurial development in Brazil by beekeeping

Demian Condé

SEBRAE (Brazilian Micro and Small Business Support Service), Brazil

SEBRAE (The Brazilian Micro and Small Business Support Service) is a private institution that uses public resources to support small business in Brazil. In the agribusiness sector, Sebrae works with small farmers to achieve better conditions through entrepreneurial behavior and management. Brazil has an immense plant diversity, large native forests and huge honeybee friendly crops (eucalyptus, orange, sunflower and others).

Because of these natural wealth, Brazilian beekeeping has an enormous potential, yet it is severely damaged by the lack of formal education, technology, dedication and management skills. As of today, Sebrae supports approximately 5.439 beekeepers in Brazil to improve their life quality and their income. Altogether, we manage 28 projects, investing \$ 3.4 million dollars in beekeeping, each year, all over Brazil. The projects we manage have to be adapted to each region's specifics, but in a larger view most of them focus on Innovation and Technology, Management and Market. Also, we have actions in smaller scale, such as Geographical Indications and good practices. By providing beekeepers with technology and management, Sebrae has been able to improve life quality of many beekeepers, going from extremely low productivity to high productivity in a two or three year period. Such results are showing that with proper guidance, beekeepers in Brazil have the chance to really stand out and make a difference on the local economy and its development.

BRO-018

Crowdsourcing for starting beekeeping businesses

Milan Wiercx van Rhijn

Proup Apiculture, France

With today's worldwide economical difficulty it has become harder to get a loan for starting businesses. As a young Dutch man, starting a life in France, no certification and few financial resources, I was not eligible for a loan to get my beekeeping business started. However, I was dedicated to live my passion for beekeeping. I created a crowdsourcing project, approaching people directly without intervention of a crowdfunding website. Participants became owners of the hive, which I would manage and instead they got 40% of the honey crop. Payment was in honey, not in money. I established a secure investment by offering the opportunity for a refund: 100% for the first year. A limit of 5 hives per person was set to keep equilibrium, to avoid becoming an employee for a big investor. The participants became part of the business: bad harvests and high mortality rates would not put any pressure on me as beekeeper. Nonetheless, it created a sense of compassion from the participants: they were all part of it. After two years there is a business with 40 participants with 50 out of 60 hives. This resulted in a strong network with highly engaged ambassadors and the absence of loan. My goal for 2017 is to have 200 hives and a queen production of 1000 queens a year. I firmly believe this approach could be a tool for many other people wishing to start a beekeeping business, but have few financial resources.

BRO-055

Creation awareness in students of primary schools about importance of honey bee for society and environment

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Honey bee has an important place in human life because of bee products, such as pollen, propolis and royal jelly. More importantly that honey bees are the most effective pollinator insect group as a natural food assurance of the future. However they are growing with sting fear, not realize the importance of bees in terms of nature and natural sustainability. Therefore it was arranged a project within the framework of TUBITAK.

The aim of that was to introduce honeybee, its function for human life and ecological equilibrium to children. Our target groups are students of primary and secondary school in rural and urban areas in Duzce province. This project was conducted with the participation of totally 80 participants at practical and theoretical educations. It was presented bee family, developmental stages of them, alternative bee products and different uses of them and how important the honeybees for human life and the effect of honeybees on pollination. Both before and after the study, it was done pre-test, post test and achievement test applications to each group in order to determine the cognitive and effective skills, ecocentric and anthropocentric perspectives at the beginning and at the end of training course. Feedbacks taken from the participants showed that the awareness was created by the training about honey bee. The students understand that there is a positive correlation between "environmental sustainability and honeybees. The importance of bees and polination was stressed through visual and print media. Acknowledgment: This study was supported by TUBITAK-4004, Project No: 115B096

Symposium: Beekeeping Sector Reviews

BRO-026

Beekeeping in Saudi Arabia: past, present, opportunities and challenges

Ahmad Alkhazim Alghamdi

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Beekeeping is a long-standing and one of the most important agricultural practices in rural area of Saudi Arabia. Approximately 5,000 beekeepers maintain more than one million honey bee colonies and produce approximately 9,000 metric tons of honey annually. More than 70% of the bees are still kept in traditional cylindrical hives made from various locally available materials and the remaining are kept in box hives. Seasonal shortages of bee forage and seasonal and geographic differences in bee forage availability drive many beekeepers to practice migratory beekeeping in search of better nectar and pollen resources. Many bee- keepers reported migrating their bees between 3 and 6 times per annum. The average annual honey productivity of a traditional hive is 3-5 kg/annum, while that of a box hive is 5-10 kg/annum. Attractive honey market is one of the opportunities favoring the development of the beekeeping subsector in the country. Honey is deeply rooted in the Saudi Arabian culture, religion and economy. Generally, consumers pay a much higher price for locally produced honeys of known origin. The prices of locally produced honeys vary from USD 40 to USD 180 per kg. Sider (Ziziphus) honey is in especially high demand in the country. The high price of local honey has encouraged beekeepers to persist in their beekeeping practices. Currently the country imports annually more than 15,000 metric tons of table honey to fill the gaps in demand. Honey Bee Diseases and pests; extensive importation of exotic honey bee races; extended dearth periods and associated shortage

BRO-042

The beekeeping in the Republic of the Union of Myanmar

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Most of the people in Myanmar were used traditional beekeeping methods for honey Production until 1978. At 1979, United Nations Food and Agricultural Organization (FAO) introduced the modern Beekeeping in Myanmar with the program on honeybee in tropical Asia. FAO program imported Honey Bees Species from US and Israel. The commercial honey bee is *Apis mellifera ligustica* sub species has been used in Apiculture in Myanmar imported from abroad 1979. Existing literature demonstrates that this sub species were well adapted in local seasons and local beekeeper. Nowadays the beekeeping in Myanmar has both traditional bee hives and modern standard Langstroth Bee hives. Myanmar Beekeepers have traditional beekeeping from *Apis dorsata* species and *Apis cerana* species. In 2013-2015 FAO (Myanmar) organized TOT training with the Technical Cooperation Program (TCP) Project "Royal Jelly Production in Myanmar". The most beekeeping productions in Myanmar are making by private sectors and some are department of Apiculture, Ministry of livestock Fisheries and Rural Development, Myanmar. Myanmar migratory beekeepers move from one area to another with blooming bee plants 3-4 times in each year. There are about 100,000 colonies in Myanmar and honey production is around 3,000 tons per year.

Apiculture and pollinator industry survey in Thailand

Chama Phankaew

Kasetsart University, Thailand

This study was carried out during August to October, 2014 by using questionnaires to get information from 22 beekeepers, 9 longan orchard owners and 6 lychee orchard owners. In addition, information also comes from indepth interviews with 11 bee experts, 4 bee researchers and reviewing of publications. There are 4 bee species: European honeybee, Indian honeybee, giant honeybee and stingless bees used by beekeepers in Thailand. However, the main species in the bee industry is the European honeybee with 300,000 colonies and the farm value of bee products is about 1,269 million baht. The key nectar crops are longan, lychee and white snakeroot. The key pollen crops are corn, giant mimosa and sensitive plant. These crops are mainly distributed in the northern provinces. The peak activities of honeybees are within 4 months starting in December to March. The 3 major problems faced by bee industry are food sources, Tropilaelaps mite and pesticide misuse. The bee pollination industry is most developed in the northern provinces and there is a potential to develop in off-season longan in Chanthaburi. The future of apiculture industry in Thailand is still on the rise because the demand of honey and other bee products both at national and international levels is increasing and the volumes of bee products are not sufficient at present. On the responsible use of pesticides, apart from the warning statement on the pesticide labels there are no guidelines and activities on bee safety initiated by pesticide industry and regulatory authority.

BRO-014

Reconstruction of the farmland suffered by tsunami damage struk by the Great East Japan Earthquake and revitalization of apicultural industry

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¹ Institute of JRJ Apimedical Science, Japan Royal Jelly Co. Ltd.; Tohoku Fukushi University; Yunnan Agricultural University, Japan ² Tohoku Fukushi University ³ Japan Royal Jelly Co. Ltd.

BACKGROUND: In the afternoon of March 11, 2011, Japan was struck by the most powerful earthquake in recorded history and the tsunami disaster's massive impact. The invaded surface area by sea water was 561km² and the farmland was 21,480ha. The Reconstruction Agency of Japan proposed "New Tohoku" Leading Model Project that supports the acceleration of leading project by organizations and corporations working for reconstruction. OBJECT: The project, reconstructing the disaster farmland with the damage-resisting farm products from salt and revitalizing apicultural industry, was applied for the grant, "New Tohoku" Leading Model Project, in 2014. The aim of the project was to grow salt resistant crops, such as rapeseed, resulting in tourist attraction, production of apicultural products, increased bee colonies as pollinating honeybee, and industrial development in relation to creation of jobs. RESULT: After granting our project, in 2014, we obtained 34ha tsunami disaster farmland at Natori area and planted rapeseed, in order to help farmers, to produce apicultural products, and to enhance bee colonies and beekeepers. THE SECOND YEAR, 2015: We will train more than 10 beekeepers and also to produce honey and royal jelly. Apicultural products, royal jelly products, honey, mead, honey ice cream will be also produced. THE FINAL GOAL: Based on the huge flower land, the reconstruction could be made with hotels, bee museum, college, hospital, worldwide tourist attraction, welfare facilities for the aged, and also apiary industry. This project was supported in part by a Grant from the Reconstruction Agency of Japan.

BRO-029 Beekeeping of *Apis cerana* in Korean peninsula: History, present, and future

Minsuk Oh, Seunghwan Lee

Seoul National University, Republic of Korea

Apis cerana is a honeybee species mainly exists at oriental region. In Korea, first *A. cerana* apiculture starts from China- introduced honeybee at thousand years ago. Scale of *A. cerana* beekeeping industry getting bigger, ca. 300,000 colonies before 2009 in Korea, but 95% of individuals died by sacbrood virus recently and facing severe crisis. We are presenting the history, current, and future prospect of traditional beekeeping of *A. cerana*.

BRO-009

Can beekeeping be sustained in Nigeria?

Yusuf Adeyemo, Oluwasanjo Okunlola

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Beekeeping has benefits that relate to food, medicine, economy, and increased productivity of crops and the wellbeing of the environment. This paper focuses on the constraints that can work against the sustainability of beekeeping in Nigeria. Such constraints include deforestation, bush burning, vandalism, theft and climate change. However, the following are suggested as measures that can mitigate this situation which includes; protection of existing vegetation and planting of trees, educating the Nigerian people through mass media, providing training for the people on beekeeping by incorporating forage tree planting and providing financial assistant, enacting enabling laws to protect the enterprise and establishment of a beekeeping research centre.

Symposium: Regional Beekeeping I

BRO-034

Factors influencing subsistent farmers' decision to practice beekeeping in two Ogbomoso local government areas, south western Nigeria

Samuel Adelani Babarinde¹, Timothy A. Adebayo¹, Adebusola A Adepoju¹, Adetayo D. Adeleye¹, Odunyemi Ayobami¹, Ibukun B. Babatunde¹, Solomon Yisa²

¹ Ladoke Akintola University of Technology, Nigeria ² University of Ilorin, Nigeria

A study was carried out in Ogbomoso North and South Local Government Areas, south western Nigeria between February and May, 2015 to identify the socioeconomic characteristics, types of crops grown and farm management systems practiced by subsistent farmers and analyze the factors influencing the farmers' interest in bee keeping. Multi-stage random sampling technique was employed to select a total number of 80 respondents sample for the study. Descriptive statistics was used to explain the socio-economic characteristics while logit regression analysis was used to analyze the major determinants of farmers' interest to practice bee keeping. The results of study revealed that farming in the area was dominated by male (90% of the respondents). Majority (45%) of the respondents fell were aged 31-40 years. Majority (52.5%) of respondent had post primary education. Land acquisition by the majority (61.25%) was by inheritance, where they took care of permanent crops like mango, cashew, and coconut. Reasons for bee keeping as claimed by the respondents were closeness of farmland to water and ease of land acquisition. The logit regression analysis showed that the coefficients of sex and age were positively significant (P=0.05), which implies that the probability of increasing the number of male farmers and their ages in the study area would lead to the probability of increasing farmers' interest in bee keeping. It is therefore recommended that, government should encourage more experienced aged male farmers to incorporate beekeeping into their agricultural ventures.

BRO-002

Occupational health and safety in beekeeping – Steps in risk assessment

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Beekeeping, which is a significant agricultural activity, could be performed in stationary or mobile manners. Nonmigratory beekeepers utilize from local nectar and pollen sources, while migratory beekeepers follow the blossom to increase production, moving their colonies to different areas within the season. During their operations conducted mostly in a natural environment beekeepers face several dangers that threaten their safety and health. These dangers diversity during the stages of honey harvest and packaging, when the use of tools and equipment increases. Danger is defined as any occurrences that could cause harm and the risk is the possibility of injury or illness faced as a result of danger. Main objective of risk assessment in beekeeping is to protect the health of beekeepers and to provide safety measures. Risk assessment helps minimize possible damages resulted by beekeeping activities that could affect both the beekeepers and the environment. This study aims to scrutinize the steps of collection of the information, assessment of the risks resulted by possible danger, planning the actions that would remove the risks, and finally reporting the risk assessment, and to contribute to the realization of the concept of occupational health and safety in beekeeping.

BRO-032

Top bar honey comb hangers (HCH) for fixing and transporting honey combs on top bars

Abraham Addo-Ansah Allotey

Forestry Commission Allotey Honey Bee Farms, Ghana

The objective of this study was to design and develop Honey Comb Hanger prototypes to fix , hold in place and transport combs on top bars without break-ups. Pieces of Plywood of thickness 4 mm and width 2.5cm were used with pre-drilled holes at all its different parts to develop the following series of prototypes. 1. Two pieces of – shaped plywood of base and arm lengths 20 and10 cm respectively. 2. Two Pieces of plywood (TP) dimension 20 *2.5 cm. 3. Two Double TT- shaped-like (FP) plywood pieces of horizontal and vertical lengths 20 and10 cm respectively. 4. Two- rectangle shaped (RP) plywood dimensions 20*10 cm with a 3cm extension at one of the lengths to form an arm each at its ends. In service, a pair each of the different four types of the plywood was used independently to sandwich the combs, with the TBs being at the top. 2 mm thickness Copper wires were first used to string the plywood pieces, the upper parts of the combs, and tied over the TBs. Likewise the plywood pieces and the lower comb parts were stringed by the copper wires to hold the plywood. – sandwiched-combs together. The Prototypes were used to transport combs on top bars and TBHs with combs without comb break-ups; comb fixing on TBs were less difficult. It could be used to transport beehives for pollination services, migratory beekeeping and log/cylindrical basket hive colony division. HCH reduce challenges of fixing combs whilst wearing plastic gloves

BRO-011 Management practices to avoid stings of honeybees during field work

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¹ Ebonyi State agricultural development program, Nigeria ² Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

Many would-be beekeepers in most rural areas of Africa and other places who wish to improve their livelihood through beekeeping are being kept away from the profession and business due to the single reason that HONEYBEES STING. This a well-known fact that is not agreeable by many people. But have we ever thought of ourselves being the primary cause of any bee attack which is a just a defense response to protect their colony.

Honeybees prefer not to sting because they will die as a result. A honeybee that is away from the hive foraging for nectar or pollen will rarely sting because of their seriousness on the job and the task ahead for them to accomplish. Except when stepped on or roughly handled by anything/anybody. Honeybees will actively seek out and sting when they passive their hive to be threatened. They attack people twenty to forty meters from the hive and this is certainly not good. African honeybees in America is renowned for its high defensiveness (by Eigil Holm, Denmark in Beekeeping and Development Journal, 61, Dec.2001). Considering the above facts and our year of experience working with African honeybees, this paper unveils the ignored management practices to be adopted while working with honeybees to avoid their stings. Bearing in mind that the queen bee, indoor workers, loaded incoming field worker bees, field attendants, and all field equipment MUST be positioned properly not to infuriate the innocent gentle honeybees.

BRO-023

Potential of sunflower and mustard greens *Brassica juncea* L. for bees food related to the development of bee tourism in the village Watu Agung Pasuruan Indonesia

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Background: Research on the optimization of production growth, sunflower and mustard greens, Brassica juncea L. as a producer of nectar for bees food in Indonesia is still not widely pursued. Development of sunflower and mustard Green brasica juncea L as food ingredients that produce nectar bees can help farmers implement the concept of bee grazing permanently. The method implemented by the socialization of participatory planning, a key figure approach, as well as science and technology education and denplot. The technique used (1) socialization group of beekeepers, (2) Establishment of Beekeepers group, (3) Training assistance, (4) Making stup bees, (5). Planting sunflowers and mustard Greens brasica juncea L. Research carried out on an area of 500 square meters. Research during six months from March 2014 through September 2014 in the garden in the village of Watu Agung Pasuruan. Beehive is deployed as well as 50. For each of the honeycomb or stuff consists of 4 strokes full of bees and two empty strokes beehive. The results showed the addition of honey, each 2 strokes frame stuf that had been empty increased to contain honey, so the number of strokes to 6 strokes filled with honey. Conclusion: Sunflower and mustard greens Brassica juncea L help the bees get nectar to produce honey food. Discussion: Planting sunflowers and mustard greens brasica juncea L, helping the bees can produce honey. Develop food for bees for beekeepers to help beekeepers get honey from bees

BRO-036

The Tunisian experience in organic beekeeping

Abbes Saidi

Ministère de l'agriculture de Tunisie, Tunisia

Tunisia has a diverse honey bees potential in forests ready to host organic apiaries that can enhance the quality of honey. In this context the Ministry of Agriculture implemented a pilot program to convert conventional apiaries for the benefit of beekeepers in eligible areas for this mode of production. The experiment started in December 2007 by the formation of a technical committee composed of services directly related to specific components of the project. The first parts of the achievements from 2008 to 2012; 17 apiaries were made about 1000 hives of which 12 were certified. Beekeepers have participated with their apiaries; the BLP has paid certification fees, inputs and provided guidance and technical monitoring and facilitating the marketing of honey. With the exception of difficult years 2009 and 2010, which delayed the conversion period, the average yield per hive and per year was 10 to 15 kg depending on the area and apiaries. The average cost of production per kg of organic honey was 12 EU. The selling price of the kg in 2012 was 22.5 EU. As response to requests for membership, an extension part began 2013 with the creation of 13 new projects 1000 hives until late May 2015, 6 projects have been certified, with conventions being updated to increase the participation and responsibility of beekeepers. In 2016 we plan the intensification of organic beekeeping projects as part of a more organized profession.

Symposium: Regional Beekeeping II

BRO-052

Constraints and opportunities of beekeeping in Werieleke District of Tigray region, Ethiopia

Teweldemedhn Gebretinsae Hailu

Aksum University, Ethiopia

This research was conducted in the highland, midland and lowland agro-ecologies of Wereieleke district of Ethiopia in order to identify and prioritize constraints and synthesis opportunities of beekeeping using interview questionnaire survey. Statistical analyses were carried out using chi-square test in JMP5 statistical package. Beekeeping in Werieleke district was found to be compounded by many constraints including provision of incomplete packed inputs, lack of credit, provision of adulterated wax for the modern production system, application of chemicals, honey adulteration, and knowledge gap. Traditional beekeepers should be trained on beeswax extraction and processing to complement it with modern beekeeping. Training on bee biology can help them to avoid traditional practices such as wing clipping and caging of queen

BRO-053

The path to sustainable beekeeping in the United Arab Emirates

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Abu Dhabi Food Control Authority, United Arab Emirates

Beekeeping with *Apis mellifera* is a highly regarded, but problematic, activity in the UAE. There are 2 main honey-producing periods. These correspond with spring (Oct-Nov) flowering of Ziziphus spina Christi

(commonly called 'sidar') and autumn (Apr-Jun) flowering of Acacia tortilis ('samar'). Small amounts of honey are also produced during these periods and also during winter (Dec-Mar) from Prosopis cineraria (Ghaf tree), citrus, melon and Eucalyptus species. Virtually no honey is produced during summer (Jul-Sept) due to a lack of flowering plants. A number of issues negatively impact on UAE beekeeping and stifle its future development. Most important is the large-scale annual die-offs of honeybee colonies at the end of winter and during summer. Beekeepers deal with these die-offs by restocking with package honeybees imported mostly from Egypt. However, the imported bees are often infested with Varroa destructor and harbor microbial pathogens that may subsequently contribute to colony mortality. Other negative impacting issues include a general scarcity of forage plants and poor hive management, especially during summer when temperatures may exceed 50°C. This paper described studies to determine the cause and prevent the reoccurrence of the annual honeybee die-offs, focusing on the likely culprits; pests and diseases, nutrition and poor hive management. Also described are parallel studies aimed at developing a local line of honeybee, bred in the UAE for UAE conditions. If successful, these combined studies will negate the need to continually import package bees and guide further development of sustainable beekeeping based on firm scientific foundations.

BRO-047

The potential of high income beekeeping projects in acacia forest reserves in Malaysia

Zakbah Mian

Department of Agriculture, Malaysia

Malaysia in needs of high income projects in order to achieve a develop nation status by 2020. Beekeeping can play a major role in achieving this aspiration. It is estimated that the beekeeping industry is capable of creating new wealth generating sales up to millions of ringgit from bee products and by-products. It is an important source of high income activity especially for communities leaving close to the acacia forest reserves. The yield from *Apis mellifera* can reach up to 50kg per colony per year. Since the potential local production from acacia forest reserves is immense, the project is expected to contribute to the government's aspiration of high income agricultural activities. This paper investigates the sustainability issue of enhancing farm production of natural honey in acacia forest reserves. In addition, the research also proposed possible government incentives for achieving high income agriculture projects. The results indicate that the industry is more sustainable if government intervenes with possible incentives. But even with no incentives, the beekeeping project is already able to generate RM5000 monthly income to participants.

BRO-044

Challenges and opportunities for sustainable beekeeping in Miombo Woodlands of Mlele District of Western Tanzania

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Mlele District located in Katavi Region in the western Tanzania is one of the remote areas and is recognize as among the higher potential areas for honey production in miombo woodlands. The study was conducted in Inyonga division of Mlele District, July 2014. The purpose of the study was to assess challenges and opportunities for sustainable beekeeping among the rural community. A total of 101 beekeepers were interviewed from purposively selected three villages. Descriptive statistics and non-parametric test (Kruskal Wallis) were done using SPSS (version 20 of 2014). Results indicate that traditional beekeeping is widely used in the area with bark hives being highly used (63%, n=11,928). Main challenges identified were, lack of beekeeping equipment (20.4%, n=101), prolonged droughts (14%), unreliable market and price fluctuation (8.9%), long distances to bee apiary (8.9%) and lack of enough capital (7.2%). Tree cutting, tree debarking, use of fire during honey harvesting were reported as major cause of loss of both flora and fauna species that also limit beekeeping in the area. Main opportunities included presence of beekeeping groups, 101 beekeepers who responded, 91.4% belonged to beekeeping groups. Other opportunities observed were; Government willingness to support beekeepers, market availability, availability of skilled beekeepers and presence of extensive miombo woodlands. The study thus conclude that, though there are many challenges, however with the existing opportunities, the area can produce more bee products if those opportunities are fully utilized and sustainable beekeeping is promoted.

BRO-051

Honeybee colony marketing and its implications for queen rearing and beekeeping development in Werieleke district, Northern Ethiopia

Teweldemedhn Gebretinsae Hailu

Aksum University, Ethiopia

Development endeavors are trying to use beekeeping as tool for poverty alleviation in Ethiopia. This increased promotion is creating increasing demand for colonies. This research was conducted in Nebelet and Maikinetal colony market centers of Werieleke district of Tigray region to investigate market through interviewing market actors. Descriptive statistics, ANOVA and Pearson correlations were run using JMP5 statistical package. Sellers in Nebelet were males who compose producers and traders. In Maikinetal, they were producers and hunters. Colony sellers in Nebelet were experienced in colony multiplication through swarming and able to transport safely from highland areas of 40km radius. Sellers in Maikinetal were less experienced youngsters who hunt colonies from valleys of Werie. Several youth who bought fewer colonies were found in Nebelet implying their attraction to beekeeping as employment option. There was better involvement of women in purchasing colonies as contrasted to selling, which reflect improving participation in beekeeping. Price of colonies has significantly varied spatially and temporally (P< 0.0001) in association with supply and quality. Several constraints were pointed-out as faced in transporting and marketing colonies. Colonies have been flowing from highlands to lowlands, which can cause genetic mixup, disease transmissions and failure to adapt. Selling virgin queens and deserting worker bees at market were common practices indicating low understanding of beekeepers on bee biology. Therefore, beekeepers should be empowered to rear queens and multiply colonies. Besides, law should be established in order to standardize colonies and queens sold, conserve bee diversity and avoid disease transmissions.

Assessment of the knowledge level on "Apiforestry" among beekeepers in Oyo State, Southwestern, Nigeria

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Integration of apiculture and forestry "Apiforestry" is a new concept which holds a lot of benefits for sustainability. It is not clear how much the people understand about the mechanisms in the study area. This study investigated the awareness of this concept by beekeepers in Oyo State, Nigeria. Questionnaire and interview schedules were employed using stratified and simple random techniques to sample 64 respondents. Data were analysed (SPSS 16.0) using descriptive and inferential statistics. Majority (79.4) of respondents were male and aged 20-50 years. Majority of the respondents (98.4%) took beekeeping as secondary occupation. Majority (88.9%) had formal education. All respondents (100%) produced honey with low yield. About (70%) of the respondents had the knowledge about relevance of plant biodiversity to bee productivity while about 68% reported inadequate access to research/extension services about integration of apiculture with trees. Over 50% of the respondents did not plant trees but depend on wild trees. Highest number of trees per hectare (43) was observed in the Gunea savanna. Chi- square test results showed that education had significant effect on knowledge about the relevance of plant for beekeeping at P=0.05. Source of information and how respondents acquired training on beekeeping had no significant effect on knowledge about importance of plants in beekeeping at P=0.05. Results revealed that beekeepers lack access to research and extension-based information but cultivated self-planting and conservation of trees on apiaries. To bridge the gap between economic and environmental sustainability, there is need for awareness and "apiforestry model farm" for beekeepers.

BRO-039

Bee the source.

Sona Dubna

Privat laboratory Zelenecska, Czech Republic

A short study about new products development from local sources. Natural hand made products inspiration.



Abstracts of Poster Presentation

09:00-18:00, (Wed) 16 - (Fri) 19 September

Daejeon Trade Exhibition Center



2015, 44th APIMONDIA International Apicultural Congress Scientific Program **BEP-001**

Organic beekeeping activities in Turkey

Neslihan Ozsoy, Miray Dayioglu

Republic of Turkey Ministry of Food, Agriculture and Livestock - Aegean Agricultural Research Institute, Turkey

Organic agriculture activities in Turkey started in 1986 and firstly on 18.12.1994 "Regulations on Producing of Vegetable and Animal Products with Ecological Methods" published in the Official Gazette numbered 22145 and entered into enforcement. Currently enforcement is "Regulations on Principles and Applications of Organic Agriculture" which numbered 27676 and dated 18.08.2010. Also after into enforcement of regulations numbered 27676, various changes have been made. In Turkey, organic beekeeping activities are performed in accordance with the provisions of this regulations and according to data in 2013 of Republic of Turkey Ministry of Food, Agriculture and Livestock the number of producers in transition to organic beekeeping is 471 and the hive number is 62.836; the number of producers that activities in organic beekeeping which completing the transition period is 279, the hive number is 32.342 and production is 344,04 tons. Required more studies should be done for consumers to be more conscious and be directed to the manufacturers of this industry about organic beekeeping products which objectives are more healthy and high-quality production. Also, as a result of some wrong practices in beekeeping, residues problem in honey solved with organic beekeeping and in this way export will develop. Organic beekeeping can be expected further development in our country where has a rich flora if the above-mentioned substances are solved.

BEP-002 The investigation of bee keeping and the sugar residues in honey

Kuan-Hua Chen, Yue-Wen Chen

National Ilan University, Taiwan

Honey is a sweet and flavorful natural product consumed for its high nutritive value and its contribution to human health. Honey can be adulterated in various ways. One of the adulteration methods is the addition of different sugar syrups during or after honey production. For example, high fructose corn syrup (HFCS), glucose syrup (GS) and saccharose syrups (SS) can be used for adulterating honey. In generally, honeybees will visit the C3 plant for nectars and won't visit the C4 plant. So, analyzing the difference between the isotope in C3 and C4 plant can be a way to detect the honey is adulteration or not. Result shows the honey adulterate by adding the syrup from C4 plant (HFCS and GS) can be easy detected. But recently, the technology in making fake honey is changing that some adulteration honey adding syrup from C3 plant (beet and cassava) which cannot be detect from the technique we have. Therefore it is necessary to create more detecting skills to aid with the old one.

Taiwan verification honey can significantly increase honey sales value

Chun-Ting Chen, Yi-Cheng Chen, Yue-Wen Chen

National Ilan University, Taiwan

Honey is a natural health product and has a high nutritive value. Honey can be adulterated in various ways. In recent years, food safety has been a hot topic around the world. In 2013 the EU listed the top ten easily adulterated food, honey ranked sixth in that list. Honey verify contents include: 311 pesticide residues, antibiotics (seven kinds of tetracycline, four kinds of chloramphenicol, nitrofuran metabolites) CNS 1305 (water, reducing sugars, sucrose, water insoluble matter, HMF, amylase) C3 syrup, C4 syrup. This year, the use of 12 ton of honey produce about 24,000 cans of honey, it is expected to increase the sales value of \$ 250,000. Honey verification can improve sales value, in addition to ensure the food safety of consumers.

BEP-004

Pinehoney production in Turkey and the current situation of beekeeping enterprises in the pinehoney production area

Murat Polat, Mustafa Bahadr Çevrimli, Engin Sakarya, Ahmet Cumhur Akn, Mehmet Saltuk Arkan

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Pinehoney is an exceptional type of honey that can be produced in Mula, Aydn, Denizli provinces (TR32 Region) in Turkey. 90-95 % of pinehoney in the world is produced in Turkey. That 50 % of Turkey's beekeepers come and operate TR32 Region in autumn which is a pinehoney production area is a fact showing the potential and importance of the region. The amount of honey yield and enterprise scales of beekeeping enterprises in Turkey and Aegean Region and the number of hives in the region are evaluated in this study by making a comparison with the beekeeping enterprises located TR32 Region of Turkey where pinehoney production is carried out intensely. Besides, important points are determined regarding the current situation in the region. Turkey is unrivaled in terms of the production of pinehoney which finds buyers in all international markets and the demand for which increases with each passing day. It is estimated that 30 % of the total honey production in Turkey is the pinehoney but the net amount of pine honey production can't be calculated officially. Permanent measures should be put into practice in respect of determining correctly the production amounts of honey varieties TR32 region, Turkey's pinehoney being in the first place, taking the necessary measures in order to increase the yield per hive and the production of pinehoney, optimization of enterprise scales in terms of the sustainability of production, solving the marketing problems at the producer level and increasing the income of the beekeeping enterprises.

Preliminary studies on the production of honey from the hives, treated with protein supplement during the time of production of honey production

Grupo apícola Serrana Balcarse¹, Martín Eduardo Colombani², Paulo Mielgo³, Pablo Joaquín Moja², Marcelo Luis Del Hoyo³, Patricio VIdondo³

¹ Cambio Rural INTA ² Private consultant ³ Apilab srl

Low levels of essential aminoacids significantly affect longevity of the bees, as it is essential in the preparation phase of the hive (pre-honeydew), reaching up to 50% decrease of the above mentioned hive, preventing large populations are not generated in the colony and what is more worrying, when the bee reaches pecoreadora, it is about to die, reducing the capacity pecoreadora hive "Pajuelo, 2009". What is intended to demonstrate with this experience is the importance of nutrition from the point of view of protein tenor, for the development and sustenance of bee populations during the harvest season. The use of certain protein supplements, as Nutribee Plus, during this critical stage of the cycle would achieve a higher honey production, based on the principle that "A greater number of biologically balanced bees will produce more honey, the same amount of bees divided into smaller colonies "Farrar 1937". In the first season, in the 3 trials, there was an increased production of honey in the hives treated with Nutribeeplus, and the average difference of 2.01 kg of Honey/hive. Meanwhile, in the 13-14 season, the final result for a rather low harvesting in much of Argentina, ended with a difference of 2.3 kg. per hive. Based on the data obtained in both studies, we can say that the Nutribee plus protein supplement is necessary. To achieve an average increase of 2 kg of Honey/hive, it is a positive start to a path based largely on bee nutrition research for a fully productive season.

BEP-006

Determining information and ideas of students about education on beekeeping in veterinary medicine at Ankara University

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Beekeeping sector has an important role in employment of the rural population in Turkey with a low capital and without relying on soil. Thanks to its natural conditions, geographical location and climate, Turkey is convenient for all kinds of beekeeping initiatives. Turkey follows China as the second in the number of hives and amount of honey production. In the sector of beekeeping, Turkey faces various problems such as low-efficiency, marketing problems that manufacturers face, bee illnesses, not being able to manufacture quality product, low capacity of

export. To overcome the said troubles, veterinarians have a great responsibility as one of the most important stakeholders of the sector. It should not be forgotten that veterinarians gain basic sector-specific know-how during their education in veterinary medicine. In the present study, a survey was conducted among 2004th and 5th year students in Veterinary Medicine at Ankara University. The survey aimed to determine how the students evaluate the education that they are having on beekeeping, what kind of education they would like to have on beekeeping, how much knowledge they have about the basics of beekeeping legislation in force in Turkey and to what extent they were interested in the sector as the candidate veterinarians. It is thought that results of the study are to be notably beneficial to student and academicians of veterinary medicines.

BEP-007

Beekeeping Economy

Kodjo Logou Agossou

Organisation pour la Promotion des Arts Apicole et Sylvicole (OPAAS)

This theme raises vis-à-vis the beekeeping business issues profitability itself depends on a lot of parameters, from the source equipment of the various levels of the company until the sale of products. Speaking of equipment, it is necessary to dwell on their origins and their cost: the most effective for the time we come expensive external markets; imitation must have support to provide efficient products or inputs. As for hives accurate determination of ideal size according to eco-botanical characteristics must be of sound research. The efficiency of operations apiary and in various extraction workshops is increasing function of the level of competence of technicians. The operations that increase the chances of capture and retain as long as possible settlements and those that enhance the performance of bees should be preferred. Speaking of marketing the products, the local market, is the most sought; it must offer quality products if you want to have a good customer base and avoiding the most intermediaries. The outdoor market that could be juicier is more binding. The product presentations, the valuation of by-products enhance company's business. A good beekeeping business operating account must be comprehensive inventory of loads so vis-à-vis the revenue potential products to determine one draws a reasonable margin of profit of at least 8% the accumulated charges, the thresholds of digital and financial profitability of the initiative. In terms of the characteristics of high races, we must emphasize the economic importance of improved breeds.

BEP-008

Opportunities and Challenges of Ethiopian Honey Processing and International trade: the need for transformation

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Among many macroeconomic development pillars of Ethiopia, raising agricultural output and productivity, promoting industrialization, huge investment in infrastructure and export promotion and diversification are the major ones. Honey and wax being exportable food items have been contributing to the foreign export earning of the nation since the beginning of honey processing. However, the share of honey and wax exported from the national produce is less than 2%. This study was therefore, implemented to review the opportunities and

challenges of honey processing and export and seeking strategic intervention options to unleash the potential. Data from national and international sources were addressed. Therefore, the study indicated that, due to knowledge gap, failure in meeting international requirements including food safety standards like ISO and HACCP, limited promotion done in marketing and poor linkage among stakeholders, the country is not benefiting from the huge resources. The revival in the private sector participation has not been accompanied either by a significant increase in volume nor in the diversification of export. Therefore, policy support in terms of diverse incentive mechanisms; encouraging more research and development work so as to benefit smallholder farmers and processors and the need for traceability and residue monitoring exercise has to be in place to be competent in the global market. Better business communication with potential buyers and back and forth linkage with stakeholders along the value chain are also very important for the transformation of the sector from the current staggering stage to globally competitive agribusiness.

BEP-009

Evaluation of antioxidant, antibacterial, antifungal and anti-herpes simplex virus of used bee hive extract

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Beekeeping is considered a highly valued industry agroindustrial across the world. Many researches were temped to creating and improving bee products mostly from honey, pollen, propolis, royal jelly and venom but no study about utilizing of waste from beekeeping industry particularly used-beehive. To use, the used-beehive was extracted by simple maceration technique and purified to get a concentrated bee-hive extract (BHE). In our previous study, chemical analysis indicated that BHE had moderate concentration of phenolic and flavonoid derivatives compound, which are reflects the antimicrobial activity. The aim of this study was to evaluation the antibacterial, antifungal and anti-HPV activity of BHE. Experimental results indicated that BHE had antibacterial, antifungal and anti-HPV properties. This is the first report of BHE that could be an alternative cheap source for antioxidant and antimicrobial that can be use as medicinal agent in medical application.

BEP-010

Management of Africanized honey bees in semiarid Northeast Brazil

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Our objective was to test management recommendations we developed in an attempt to reduce absconding and increase productivity of Africanized honey bee apiaries in semiarid Northeast Brazil. This region has had the largest expansion of apiculture in the country, accounting for a large proportion of Brazilian honey exports. Though considerable honey is produced during the rainy season, many colonies abscond during the long dry

season. An experimental apiary was managed with techniques designed to reduce such losses. This included shade for the hives, water available nearby, young queens and maintenance feeding during the drought period. The hives were provided with protein patties consisting of ground soy flour, honey and sucrose. The experiment was initiated in September 2013, during a dearth period, and the 11 colonies were followed until the rainy season began in early 2014, when flowers were again available. The results were compared with those of apiaries of six local beekeepers in the same area, all of whom used traditional let alone management. In the experimental apiary, 27% of the colonies absconded, while in the beekeeper's apiaries, the mean loss was 30%, ranging from 0 to 83%. The mean productivity of the surviving colonies in the experimental apiary was 31 kg, while in the apiaries submitted to conventional management it was only 15 kg, ranging from a mean of 0 to 19 kg/hive. The investment required is more than compensated by increased survival and productivity of the colonies.

BEP-011

Current status of beekeeping industry and pest management in Korea: A questionnaire analysis

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A questionaire study for the current beekeeping status, management problems including honeybee pest and diseases as well as other environmental issues were conducted for the nationwide mostly from the professional beekeepers. Total 278 answers were analysed. The average beekeepers have 19.5 years of career with 219 colonies of *Apis mellifera*. Average wintering Success was 82 % with the primary reason for wintering failure as weak colony and food shortage. No significant increase of winter mortality was noticed. Most beekeepers are concerned on two species of parasitic mites, Varroa and Trapilaelaps followed by predatory vespa hornet and foulbrood. Preventive control of pest and disease are practiced about 6 times a year. For the vespa, southern parts of peninsula are mostly damaged. Significant number of beekeepers experiences honey bee mortality from the environmental noise and vibration from the construction sites, as well as to chemical contamination from the crop growing area.

BBP-001

How environmental factors in al-hassa, Saudi Arabia affect queen honeybee mating

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The objectives of this study were to investigate the effects of environmental factors on mating of queens (*Apis mellifera*) under AL-Hassa conditions. Results showed that the most successful periods for mating the queens were: in March (87.5%), April (100%) and May (100%). In July, the percentage of mated queens had decreased to 20% and then fell to 0% for the remaining months. In March and April a number of colonies repeatedly became queenless and more than one replacement virgin queen had to be introduced in this situation. Merops spp. (Beeeater) was observed in large numbers in and around the bee yard during the mating months and may have been responsible for the demise of the new queens. During the experiment mean daily temperature (r = 0.4073) was observed. In addition, there was a highly positive significant correlation between the percentage of mated queens and the mean no. of combs covered with bees (r = 0.4892). However, a highly negative significant correlation with the mean amount of sealed drone brood in the tested colonies (r = 0.1320). Based on these findings we might suggest that spring (April and May) is the most successful time for rearing and mating virgin queens in queenless colonies.

BBP-002

Simple methods to prepare body parts of honey bees for morphometric analysis, and to establish morphometry maps

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Measuring honey bee morphological characters are very important for systematic purposes and for measuring the degree of hybridization among populations. The traditional method for mounting honey bee body parts requires mounting on glass slides, sometimes with the use of permanent or temporary dyes especially this is particularly tedious and time-consuming in investigations examining large numbers of individuals. A simple method for mass mounting of honey bee body parts using simple materials is described, including heads, wings and legs, to facilitate taking morphological measurements. A new method for presenting and analyzing the morphometric data of honey bees is also presented. Beside the traditional methods for analyzing the morphometric data of honey bees morphometry maps were created using the Geographical Information System (GIS). The steps for creating the morphometry maps enable the comparison between honey bee samples belong to different regions with no limit to the number of the measured characters. Moreover, various statistical analysis methods can be applied to all measured characters at the same time. Such morphometry maps could be considered as an important development for honey bee morphometry.

Characterization and track changes of morphological characters in honey bee, *Apis mellifera*, colonies at El-Behera governorate, Egypt

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Measuring of morphological characters of honey bees, *Apis mellifera*, at different times is important to assess the degree of races purity, to predict colonies productivity, and to understand environmental impacts on honey bees. The study aims to characterize honey bees of El-Behera governorate (a governorate with agricultural and apicultural importance) in Egypt, and to track occurred changes to their morphological characters since 2007. Samples of honey bee workers were collected from four districts at El- Behera governorate. Subsequently, nine body and six wing characters were measured. Morphological characters of honey bees belong to these districts were previously measured during 2007. To track changes, a comparison between new (2014) and previous (2007) measurements of morphological characters was done. The cluster analysis of studied colonies showed presence of two clusters with high overlapping. The first cluster has mostly hybrid colonies of Carniolan X Egyptian honey bees while the second cluster has hybrid colonies of Italian X Egyptian honey bees. The current bees of El-Behera governorate are slightly larger than those of 2007 revealing no reduction in colonies productivity is existed. Environmental factors did not present huge stress on the colonies since 2007.

BBP-004

Biometric study of Algerian bee colonies

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The study of morphometric characters of bees is one of the steps of a conservation program diversity. The objective of this study is to determine the morphometric characteristics of *Apis mellifera intermessa* in the north of Algeria to establish the purity of bee colonies. Samples of a minimum of 60 bees apiary location and are collected in 20 hives in 20 wilayas studied during the years 2011 and 2013. The measures relating to the six morphometric characters of the workers, the cubital index, tongue, tomentum, pilosity and coloring are made with a stereo - microscope. The analysis of cubital index showed that bees outside East which had an average value of 2.30, the bees all other localities had lower 2.30 indices. The results showed that the bees can be classified according to the value of their cubital index, in three rather distinct groups. This study having revealed a significant variation in the characters morphometric of the bee in the North of Algeria, it is important to adopt suitable strategies for the conservation of their diversity.

BBP-005

Morphology and transcriptome differences between the haploid and diploid drones of *Apis cerana*

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In general, drone honey bees are haploid and develop from unfertilized eggs. However, a diploid drone can arise in an inbred colony. In this study, the morphology and transcriptome differences between haploid and diploid drones of *Apis cerana* were analyzed. The newly emerged weight and reproductive organs of diploid drones were significantly lighter than those of haploid drones. However, for other characteristics (the fore wing length, fore wing width and number of wing hooks), the differences were not obvious. For transcriptome analysis, approximately 7.50 million reads from the haploid drones and 4.44 million reads from the diploid drones of *Apis cerana* were obtained by RNA-seq. Additionally, all of the clean reads were assembled into 59,916 unique reads with a mean length of 1357 bp. Among them, 24,625 unigenes were annotated. Using these unigenes as reference sequences, the gene expression differences between the diploid and haploid drones were investigated. A total of 649 genes were differentially expressed between them, with 507 up-regulated and 142 down-regulated in the haploid drones. Of them, cytochrome c oxidase, cytochrome P450, vitellogenin, hexamerin and paramyosin were down-regulated in diploid drones, while several muscle formation genes were up-regulated.

BBP-006

Transcriptome comparison between newly emerged and sexual matured bees *Apis mellifera*

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In order to understand the transcriptome characteristics of queens and drones of honeybee *Apis mellifera*, and enrich the transcriptome data. The transcriptome differences of queen and drones *Apis mellifera ligustica* during sexual maturating were compared using high-throughput RNA-Seq. The results revealed that more than 31 567 186 raw reads per library were obtained and the ratio of clean reads was over 87% which indicated that the quality of sequencing was considerably reliabe. We found that the genes encoding cuticular proteins/ apidermins, CYP and odorant binding proteins were differentially expressed between the sexually matured bees and the newly emerged bees which are related to developments of bones, reproductive system and olfaction system. The results indicated that the expression levels of a large number of genes changed during maturing of *A. mellifera* L bees, which give us an insight into the characteristics of the development in adult queen and drone and a lot of transcript sequences with important function were acquired for future genes expression or regulation research about growth, development and reproduction in *A. mellifera*.

Differential responses of *Apis mellifera* heat shock protein genes to heat shock, flower-thinning formulations, and imidacloprid

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The honey bee, *Apis mellifera*, is a cosmopolitan pollination insect. Recently, global populations of honey bees have rapidly declined owing to colony collapse disorder (CCD), the mechanism of which is still unknown. Here, we used mRNA levels of heat shock protein (HSP) genes as molecular markers of response to three types of external stress: thermal shock, flower-thinning agents, and pesticides. When worker bees were exposed to temperatures of 4, 27, 40, 45 and 50°C for 1 h, decreased survival occurred only at 50°C. Further, increased levels of hsp70, grp78, and hsp90, but not hsp40, were detected, and reached a maximum at 45C, particularly in the hypopharyngeal glands and fat bodies. Artificial ingestion of two flower-thinning agents containing either 0.1% boron and zinc, or 1% sulfur increased hsp70 and grp78 levels at different rates without affecting hsp40 and hsp90 levels, and had no effect on workers' mortality. However, ingestion of imidacloprid solution (0.5–50 ppm) increased mortality in workers and decreased the levels of hsp70, grp78, and hsp90 in a dose-dependent manner. Our results showed that the responses of honey bees to each hsp are differential and highly specific to different stresses. This study suggests that the unique expression profiles of hsps can be used as valuable tools for monitoring the susceptibility of honey bees to various environmental impacts.

BBP-008

Effects of Trap Nests on the Rate of Trap-Nesting Solitary Bees of the genus *Osmia*

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Trap-Nesting of the genus Osmia Nest traps are one of the most common methods to study Osmia bees. To elucidate the optimal environmental conditions of nesting sites, we investigated the effects of location, direction, altitude, and sites of nest traps on the rate of trap-nesting Osmia spp. During the collection period, the average rate of trap-nesting Osmia spp. collected within 90 days after the installation of traps was $17.0\pm20.0\%$. This percentage was 2.7-fold higher than that of trap- nesting bees in 30 days after the installation of traps. The Jeongseon location exhibited the highest rates of trap-nesting Osmia spp. collected in 30 and 90 days, representing $11.1 \pm 17.6\%$ and $23.2\pm22.5\%$, respectively. The direction of the nest traps did not affect the rate of trap-nesting Osmia spp. The altitude ranges of the traps were 0-199 m, 200-399 m, 400-599 m, 600-799 m and over 800 m.

Interestingly, the altitude range of 600-799 m showed the highest rate of trap-nesting bees, which was $40.4\pm3.9\%$. Higher altitudes seemed to correspond to higher rates of trap-nesting bees. With regards to the sites where the nests were placed, the rate of trap-nesting bees in a mud wall of an old house was $45.1\pm25.2\%$, which was 3-fold higher than that of a nest in an apple orchard. The flowering plants collected at different locations during the trap-nesting activity of Osmia bees belonged to 18 families and 34 species. In conclusion, the rates of trap nests colonized by Osmia spp. were affected by altitude, site, and plant diversity.

BBP-009

The optimal method and solution for collecting sperm of bumblebee male

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Artificial insemination is a technique to transfer instrumentally sperm from the male into the female's reproductive system. A key factor among artificial insemination techniques is gathering sperms. Here, a method for collecting sperm of bumblebee male by pressing was firstly developed. This method has stage of separating reprodutive tract of male, separating accessory testis, separating vas deferens, pressing vas deferens with cover-glass and collecting sperm with syringe. The developed method was 2.8 fold higher in rate of collecting sperm than that of existing method. Among 1M NaCl-, Insect ringer solution-, Phosphate buffered saline (PBS)-collecting sperm solutions, PBS was exhibited the best result as 17.2 sperms/cell, which corresponded to 1.6-1.8 fold increased over the result of other collecting sperm solution. Consequently, we think that this method is very important technique to save time for collecting sperm, to keep activity of sperm and to reduce contamination of sperm.

BBP-010

A combination method of CO2-Narcosis and cold treatment for breaking diapause of *Bombus ignitus* and *Bombus terrestris* bumblebee queens

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Bumblebees are important pollinators of crops and wildflowers. Bumblebees generally produce one generation per year. One of the key stages for year-round rearing of bumblebees is breaking diapause. To evaluate the effects of a combination method of CO2-narcosis and cold treatment to break the diapause of B. ignitus and B. terrestris queens, we determined whether this method affected their ability to establish a colony after the diapause break. The diapause treatment regimes that were utilized were CO2 (CO2–narcosis), CT-1M (cold treatment at 5°C for 1 month), CT-1M-CO2 (CO2–narcosis after cold treatment for 1 month), CT-2M-CO2 (CO2–narcosis after cold treatment for 2 months), CT-2.5M (cold treatment at 5°C for 2.5 months). In view of the effects on the colony

developmental characteristics of B. ignitus queens, the most favorable diapause treatment was CT-1M-CO2. A combination method of CO2–narcosis and cold temperature treatment yielded better results than that of single CO2–narcosis or cold temperature treatment on the colony development of diapause-broken B. ignitus queens. In the case of B. terrestris queens, we concluded that a combination method of CO2 and cold temperature treatment yielded better results than that of a single cold- temperature (up to 2 months) treatment. In conclusion, the findings of the present study indicated that the combined application of CO2 and cold temperature was a favorable method for the colony development of diapause-broken B. ignitus and B. terrestris queens compared with only CO2– narcosis or cold temperature treatments. A combination method of CO2 and cold treatment reduced the side effect of CO2–narcosis and shortened the duration of cold treatment by at least 1 month.

BBP-011

De novo assembly and comparative genomic analysis of *Lactobacillus kunkeei* isolated from the gut of a Chilean honey bee

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The honey bee (*Apis mellifera*) is the most important pollinator in agriculture worldwide, playing a key role in the human food supply by providing pollination services for diverse crops. One of the most common species present in the honey bee gut microbiota is Lactobacillus kunkeei. We previously isolated a L. kunkeei strain (denominated as MP2) from the gut of a Chilean honey bee. The genome of this strain was sequenced using the Illumina MiSeq platform, which resulted in a draft genome of 44 contigs, for a total genome size of 1,581,395 bp, and 826 well-annotated protein coding-genes. The nature of the short-reads used for this assembly, did not allowed to resolve the complete genome without gaps, and complicated the analysis as multiple repetitions, such as the presence of multiple copies of the ribosomal operon, could not be resolved in this draft genome. To overcome this limitations, we performed a resequencing of the L. kunkeei MP2 genome, using single molecule sequencing with the Pacific Biosciences platform. This de novo assembly, resulted in one single contig compromising the complete genome of L. kunkeei MP2 in a single 1,614,522 chromosome. This allowed us to perform comparative genomic analysis of our isolated of Lactobacillus kunkeei against others strains of Lactobacillus, with bioinformatic tools, showing a cluster of unique genes in our isolate.

BBP-012

Honeybee preservatin centers in Western Europe: an innovative strategy using sustainable beekeeping to reduce honeybee decline

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Apis mellifera is subdivided into at least 26 physiologically, behaviourally and morphologically distinct subspecies. As an agronomical species of interest, the natural distribution of honeybee subspecies has been disturbed for many decades by beekeeping activities, particularly because of international trade of honeybees. These movements were particularly amplified this last decade due to livestock rebuilding to counter the effects of colony losses. An interesting assumption is that current honeybee declines observed in European apiaries can be caused by commercial and European trades of honeybees by (i) the introduction (for their apicultural traits) of non- adapted and artificially maintained colonies, and (ii) the spread of allochtone and invasive pathogens carried by allochtones bees. Genetic surveys have demonstrated that some populations of honeybee subspecies are adapted to local climate and flora. Those populations thus constitute particularly interesting populations to study and preserve in a context of sustainable beekeeping. BEEHOPE, our BioDIVERSA ERANET funded project, is to set up, according to a North/South gradient, genetic conservatories of original naturally distributed honeybee populations. These honeybee conservation areas will have as missions: (i) to characterize the genetic and ecoethologic diversity of honeybees from the West-Mediterranean lineage, (ii) to preserve the genetic diversity of those populations, (iii) to constitute a reserve of diversity usable by the honeybee industry and by beekeepers, (iv) to study the impact of the domesticated honeybee in the maintenance of local floristic diversity, and (v) to be able to use the honeybee as a bio-collector and as a biological indicator of environmental quality.

BBP-013

Desmometopa sordida (Fallén), a freeloader fly (Milichiidae, Diptera), found kleptoparasitic on a dead honeybee in Korea

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Freeloader flies (Family Milichiidae) have been occasionally noted as kleptoparasites of various insects including honey bee. *Desmometopa sordida* (Fallén) that has not been reported from Korea was found on a dead honey bee, in Seoul, recently. Kleptoparasitic behaviors of this species have been repeatedly recorded that they possibly ride on predatory arthropds and sarcophagous on the hunted prey. Distribution of the fly has been reported from temperate regions in northern hemisphere, including many European countries, Asia (Mongolia and Japan) and North America (U.S. and Canada).

BBP-014

Comparison of different stimulation methods on the colony initiation of subtropical area bumblebees *Bombus eximius* of Taiwan

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The bumblebee B. eximius has potential as a pollinator for crop pollination programs in subtropical area of Taiwan. In this study, the different of stimulation methods effects on colony initiation of B. eximius queens were compared to increase rearing efficiency and reduce production costs. Total of 62 queens obtained from field in central and north Taiwan. Use four different stimulation methods: only queen alone (q), one queen and one B. eximius pupa (qep), one queen and two honeybee workers (qhw) and one queen with one newly emerged B. eximius worker (qew). The result that four group in egg laying ratio, colony production ratio, progeny queen production ratio as show below: q (50.0, 30.0, 66.6%), qep (77.7, 61.1, 71.4%), qhw (50.0, 35.7, 57.1%) and qew group (85.0, 75.0, 80.0%), respectively. The colony initiation time, total number of queens in four group as show below: q (16.00 \pm 3.24 days, 16.33 \pm 1.53), qep (6.50 \pm 2.24 days, 21.57 \pm 6.63), qhw (17.57 \pm 2.15 days, 18.29 \pm 2.87) and qew group (5.24 \pm 1.99 days, 22.87 \pm 4.98), respectively. The result showed that adding the B. eximius worker and add pupa (qep) is the good methods for simulative the queen staring laying egg in mass production the subtropical area bumblebees colony of Taiwan.

BBP-015

2-Heptanone secreted by honey bees acts as a local anaesthetic

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We demonstrate our discovery, that 2-Heptanone (2-H), secreted from the mandibular glands of honeybees acts as an anaesthetic in small arthropods, such as wax moth larva (WML) and Varroa mites, which are paralysed after a honeybee bite. The effect of 2-heptanone on larval wax moth response is analogous to that of lidocaine, a known local anaesthetic in mammals. A comparative study was made on the inhibitory effects of 2-heptanone and lidocaine on voltage-gated sodium channels of mammalian cells and examination was also made using the isolated rat sciatic nerve. Our results reveal a previously unknown role of 2-heptanone in honeybee defensive behaviour. Further studies have shown 2- heptanone to have analgesic and anaesthetic properties in mammalian systems. Together with its low neurotoxicity, this naturally- occurring molecule shows potential for development in the fields of human and veterinary medicine.

BBP-016

Effect of proline as a nutrient on hypopharyngeal glands during development of *Apis mellifera* (Hymenoptera: Apidae)

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Proline is known to be an energy source for protein synthesis in insects. Insects can detect proline in their food and use it as an energy substrate to start flight and other high energy consumed activities. Honey bee has a feeding preference for nectars with higher concentrations of this amino acid. In this research we present evidence that L-proline can be utilized as a phagostimulant for the honeybee worker (*Apis mellifera*). We reported the L-proline increase hypopharyngeal glands activity and consumption at the experimental cage. Honeybee workers fed on 1000 ppm treatment prolin consumed 77.39 ± 3.18 ul/bee during 18-days old after. It is obvious that the honeybee workers consumed 1000 ppm the more than other treatment. The feeding decreased when concentration of L-proline increased to 10000 ppm. The hypopharyngeal glands development increased gradually from honeybee workers emergence and started to decrease after 9 days old. The maximum development degrees (3.375 and 3.925) were recorded at 9-days old when newly emerged bees were fed on 1000 ppm proline syrup.

BBP-017

Preliminary study of the use of recombinant proteins for controlling *Nosema* spp.

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Fumagillin is the only effective active ingredient against Nosemosis. The aim of the study was to evaluate the effect on the development of Nosema spp. recombinant proteins (PR) with immunomodulatory effect and possible toxicity to bees. The 5g/ml concentrations, 50g/ml, 125g/ml and 250g/ml PR (2 synthetic TLR agonists) were evaluated in sucrose syrup 1: 1; with a positive control (Fumagilina 0.12 g/ml) and negative (syrup only). Approximately 100 adult bees brood obtained were used, naturally infected with Nosema spp. (Average 7000 spores / intestine initial charge). The bees were kept in boxes experimental incubator at 30 ° C and 60-70% humidity with ad libitum protein supplement. Mortality was recorded daily. At the end of the trial, 3 pools (10 intestines each) for each repetition (n=9 per treatment) were obtained to determine the parasitic current (IP). The IP was inversely proportional to the dose of PR, except the dose 250g/ml, where the mortality was 100%. Maximum survival test at 5th day was observed in the Fumagilina (89%) treatment; of 5g/ml to 50g/ml survival increased with dose PR. Fumagilina parasitic intensity treatment showed no significant differences observed in the different doses of PR. The IP negative control was significantly greater than all other treatments. The results indicate that there is a connection between IP-dose longevity in the value range of 5 g/ml to 125g/ml. PR administration with food has potential utility as a preventive treatment of the Nosemosis

Frequency changes of the out-nest activities according to the hive- external temperatures in *Apis cerana*

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The Asiatic honey bee, *Apis cerana*, having received relatively little attention, should need to adapt its whole array of foraging behaviors to climatic changes. In this study we observed how temperature changes affect out-nest activities of the individual workers. Experimentally manipulating air temperatures surrounding the hive we observed workers' behaviors taking-off from and landing on the artificial nest in the custom-designed greenhouse for the experiments. Recording the temperatures every 10 min with a data logger we altered temperature of the shelter surrounding the hive to increase $5\pm1^{\circ}$ C ($33\pm1^{\circ}$ C up to $38\pm1^{\circ}$ C) and to decrease $5\pm1^{\circ}$ C ($33\pm1^{\circ}$ C down to $28\pm1^{\circ}$ C) for an experimental trial of 6 hours. We conducted 4 different trials: 33° C to 38° C, 38° C to 33° C. The results showed, during the morning, the frequency of out-nest activities in 38° C increased more than 33° C. In the afternoon, the frequency in 33° C rather increased more than 38° C. Showed no statistical difference in comparison with that in 33° C both in the morning and in the afternoon. The temperature inside the hive did not change when the hive-external temperature went up to 38° C from 33° C. The colony might suffer to maintain favorable climatic conditions when the ambient temperature goes down or up to certain degree of temperature.

BBP-019

Functional characterization of the inhibitor cysteine knot peptide of the honeybee (Apis cerana) and bumblebee (Bombus ignitus)

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Inhibitor cysteine knot (ICK) peptides exhibit ion channel blocking, insecticidal, and antimicrobial activities, but currently, no functional roles for bee-derived ICK peptides have been identified. Here, we identified the inhibitor cysteine knot peptides (AcICK and BiICK) from the honeybee (*Apis cerana*) and bumblebee (*Bombus ignitus*). Both AcICK and BiICK contain an ICK fold that is expressed in the epidermis, fat body, or venom gland and are present as approximately 6.6-kDa peptides in bee venom. Recombinant bee ICK peptides (expressed in baculovirus-infected insect cells) bound directly to Beauveria bassiana and Fusarium graminearum, but not to Escherichia coli or Bacillus thuringiensis. Consistent with these findings, bee ICK peptides showed antifungal activity, indicating that bee ICK peptides act as an antifungal peptide. Furthermore, AcICK expression is induced in the fat body and epidermis after injection with B. bassiana. These results provide insight into the role of AcICK during the innate immune response following fungal infection. Additionally, we show that AcICK has insecticidal activity. Our results demonstrate a functional role for ICK in bees: bee ICK acts as an antifungal peptide in innate immune reactions in the body and as an insecticidal toxin in venom. The finding that the bee ICK peptide functions

with different mechanisms of action in the body and in venom highlights the two-pronged strategy that is possible with the bee ICK peptide.

Functional characterization of a honeybee (Apis cerana) secapin

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Honeybee venom contains secapin peptides, but currently, no functional roles for bee-derived secapin peptides have been identified. In this study, a bee (*Apis cerana*) secapin peptide that acts as an antimicrobial peptide and as an inhibitor against plasmin or elastase was identified. A. cerana secapin is expressed in the epidermis, fat body, or venom gland and are present as approximately 2.3-kDa peptides in bee venom. Recombinant A. cerana secapin (expressed in baculovirus-infected insect cells) bound directly to *Beauveria bassiana*, *Escherichia coli*, or Bacillus *thuringiensis*. Consistent with these findings, *A. cerana* secapin showed antifungal and antibacterial activities, indicating that A. cerana secapin acts as an antimicrobial peptide. Furthermore, *A. cerana* secapin inhibited both plasmin and elastase, indicating that it acts as antifibrinolytic and antielastolytic roles of *A. cerana* secapin as plasmin and elastase inhibitors. Collectively, our results demonstrate a functional role for secapin in bees: bee secapin acts as an antimicrobial peptide and as an inhibitor against plasmin and elastase.

BBP-021

BBP-020

Molecular distiction, genetic diversity and relationships of honey bee species using RAPD marker

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Molecular genetic fingerprints of Honey bee species were developed using Randomly Amplified Polymorphic DNA (RAPD) marker to elucidate the genetic diversity among the 6 species . DNA was isolated using the CTAB method. The amplification was accomplished by using 5 primers and the specific PCR working program. Three decamer-primers generated 62 RAPD fragments, of which 52 fragments were polymorphic with 96.84% of polymorphism. Some of the RAPD markers were useful for species discrimination and identification. Most of the RAPD markers studied showed different level of genetic polymorphism. Amplified fragment sizes ranged from 300 to 5000 bp. Pairwise Nei and Li's similarity coefficient value ranged from 0.00 to 0.72 for 6 species of Honey bee. A dendrogram was constructed based on the unweighted pair group method using arithmetic averages. Cluster analysis of data using the UPGMA algorithm placed the 6 species of Honey bee into 2 groups that are somewhat congruent with classification based on morphological characters proposed by earlier works. This analysis grouped all species into different clusters and clearly differentiated of Honey bee species into separate groups. This method

of analysis can be helpful in selecting diverse parents and give broadness to the Honey bee breeding programs in the future.

BBP-022

Note on the excellent queen bee

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This study was carried out to the growth method of excellent Queen bee in Korea. Queen bee is very important to high harvest for Royal Jelly (RJ) and honey. The output of honey is effected more 60% by Queen bee's status. To successful production of excellent Queen bee, the surrounding environments, habitat, place, location of other colony and advanced skills etc., are very important and always necessary.

The selection of experimental sites, selection periods and method etc., for production of high quality Queen bee are provided herein.

BBP-023

Nest structure of *Vespa crabro* Linneaus, 1758 (Hymenoptera: Vespidae: Vespinae) in Turkey

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Comprising of six subfamilies, Vespidae is a large family represented by 5000 species, predominantly tropical. Among Vespidae, the Vespinae subfamily is represented by 80 species belonging to the following genera: Vespa, Vespula, Provespa and Dolichovespula. Individuals of the genus Vespa (hornets) shows distribution in Oriental and Palaearctic regions in the world. The European hornet Vespa crabro shows distribution from Europe to Asia and is found in the Eastern Anatolia, Black Sea, Central Anatolia, Mediterranean, Aegean and Marmara regions in Turkey. Vespa crabro individuals execute a eusocial lifestyle and they usually build their nests with rotten tree barks or plant fibers embedded in mud and soil; all these materials are glued together with saliva secreted by female hornets. Their nest can be built under the soil, inside hollow trees, or they can be suspended up to meters 2 meters or above the ground with the aid of a pedicle. Several studies are conducted in order to assess their nest structure, yet little is known. In this study, a Vespa crabro nest was found in an attic in Kocaeli, Turkey on 17/08/2014. The nest consisted of a pedicle attached to the attic ceiling and a comb surrounded by an envelope. All individuals were killed and the nest was carefully taken from the roof. The comb carrying developing pupae and larvae were immediately frozen at -20. The nest dimension was measured and the number of individuals was determined.

The biological interactions in the bee colony

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Bee family is a structured, interrelated and perfect living organism, endowed with a number of properties which, in terms of human experience, seem paradoxical: - Uterus copulates with multiple male-bees; - Male-bee has no father; - Genetic relatedness is higher between the worker bees, who are the sisters by the mother and father, than with the uterus which is their native mother; - Presence of a large number of the male bees in the bee colony during a working period; - Swarming, when the old uterus but not the young flies away from the lived-in territory together with a swarm. The combination of all these properties allows the bee colony quickly accumulate sufficient resources to perform its basic function - pollination of entomophilous crops. Swarming acts as a mechanism for the development of the new spatial areas under the colony with old uterus, and anchorage of the genotype at mastered territory which is adapted to the environmental conditions. The young uterus at the mastered territory with the highest probability is the carrier of the genotype that is evolutionarily adapted to the natural environment in the habitat of the bee colony. The most effective and powerful become the bee colonies, in which done the annual replacement of the uteruses, and systematically selected the uterus that can lay the maximum quantity of eggs without mixing sperm in their sperm receivers.

BBP-025

Genetic diversity and relationship of Honey bee species using RAPD Molecular marker

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Nuclear genetic markers in the form of random amplified polymorphic DNA (RAPD) were sought to distinguish honey bees. In the present investigation primers and analysis of the banding pattern was worked out to investigate the molecular profile of honey bee genotypes collected from different locations having random amplified polymorphic DNA (RAPD) primers. All the five primer screened, amplified the product in between the range of 100 to 1300 bp and 52 scorable markers bands were generated through polymerase chain reaction (PCR), of which 42 (80.55%) were polymorphic and 10 (20.44%) were monomorphic bands identified. Based on the estimated genetic similarity matrix, the highest genetic similarity value (0.861) was noticed between the different region of Karnataka, and lowest genetic similarity value (0.374) was observed between. The major gene cluster consisted of eight honey bee including A. mellifera accessions while the minor gene cluster comprised single species

BBP-026

Tracking of vespidae hornets (Hymenoptera: Vespidae) using radar technology

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Vespid hornets are important predators of insects including honey bees. Recently frequency of vespid hornets attacking managed honey bee colonies is increasing in Korea. One of the best solutions to protect honey bees from their attack is the location of the nest and suppression of the population. However locating the nests is difficult and laborious especially in complex mountain environment. VHF radar tracking technology was adopted to test the feasibility of nest location. Micro-signal transmitter of 0.19 g can only be stably attached to dorsum of hornets using tag-boned. Distance capable was within 200 m with variation depending on the habitat complexity. Even underground nest could be located. Field simulated experiments showed that marked hornets could be located easily in 6.5 - 14 minutes with radar tracking, while impossible without. Capacity of tagging the transmitters varied depending on hornet species with different body weight. Further study area was discussed.

BBP-027

Intron sequence diversity of the Asian cavity-nesting honey bee, *Apis cerana* (Hymenoptera: Apidae)

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The Asian cavity-nesting honey, Apis cerana (Hymenoptera: Apidae), has been extensively studied for biogeography and genetic diversity, but the molecules utilized were mainly a ~90 bp-long mitochondrial noncoding sequence located between tRNALeu and COII. Thus, an addition of molecular markers may enrich our understanding of the biogeography and genetic diversity of this valuable bee species. In this study, we searched for public genome database to find introns of cDNA sequences, with the assumption that introns might have less evolutionary constraint. Six introns selected were subjected to preliminary test and eventually two introns, named White gene and MRJP9 gene introns were selected. The sequencing of 552 clones from 184 individuals of bees have shown a total of 222 and 141 sequence types in the White gene and MRJP9 gene introns, respectively. The sequence divergence ranged from 0.6% and 7.9% and from 0.26% to 17.6% in the White gene and the MRJP9 introns, respectively, indicating higher sequence divergence in both introns. The analysis of population genetic diversity for 16 populations that were originated from Korea, China, Vietnam, and Thailand has shown that nucleotide diversity ranged from 0.003117 to 0.025837 and from 0.016541 to 0.052468 in the White gene and MRJP9 introns, respectively. The highest was found in a Vietnamese population in both intron sequences, whereas the nine Korean populations showed moderate to low sequence divergence. Considering the variability and diversity, these intron sequences might be useful as non-mitochondrial DNA-based molecular marker for the study of population genetics.

BBP-028

Analyses of complete mitochondrial genomes of three honey bee species (Hymenoptera: Apidae) and phylogenetic study using the genome sequences

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We have sequenced complete mitochondrial genomes of three *Apis* species such as *A. cerana*, *A. dorsata* and *A. laboriosa*. These sequences were compared to pre-existing *Apis* mitochondrial genomes to understand the genomic characteristics, gene arrangement of *Apis*, phylogenetic reconstruction of hymenopteran species, relationships of *Apis* in the hymenopteran trees, and utility of individual mitochondrial gene for phylogeny of *Apis*. All available *Apis* mitochondrial genome sequences including three newly sequenced *Apis* have the gene arrangements tRNAAsp and tRNALys between COII and ATP6, instead of tRNALys and tRNAAsp that is found in ancestral insects, indicating that this arrangement is synapomorphy for *Apis*. Phylogenetic reconstruction using 51 hymenopteran species with several partitioning options (ten analyses) has shown five slightly different topologies, but the *Apis* was consistently positioned as ((Apidae + Colletidae) + Crabronidae) in Apoidea. A strong support for *Apis* species falling into three groups was obtained: *A. florea* and *A. andreniform* is as a basal group to the other *A. cerana* and *A. mellifera* group and *A. dorsata* and *A. laborios* group. Phylogenetic analyses using individual mitochondrial genes (13 protein- coding genes and two rRNA genes) provided an identical topology from ND4L, ND6, and srRNA to that from whole genome, with relatively strong support (> 80% of nodal support), indicating that these individual genes can potentially be utilized for within-species and subspecies phylogeny for *Apis*.

BBP-029

Mitochondrial DNA variations in Korean *Apis cera*na (Hymenoptera: Apidae) and development of another potential marker

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The geographic relationships and biogeography of *Apis ceran* have been studied extensively, but Korean populations have not been investigated thoroughly. We sequenced the non-coding region between the tRNALeu and COII mitochondrial (mt) genes (termed NC2) of Korean samples, along with the samples from seven Asian localities (China, Vietnam, and Thailand). Four undiscovered haplotypes were found in Korea and China, respectively. A phylogenetic analysis confirmed that Korean A. cerana belonged to the Mainland Asian group. Dominance of Japan1 haplotype in Mainland Asia including Korea suggests extensive gene flow onto Mainland Asia mediated by Japan1. The newly developed non-coding region between the tRNAMet and tRNAGIn mt genes provided nine haplotypes with twice the number of variable positions compared to those in NC2. An NC1-based phylogenetic analysis revealed the presence of two phylogenetic groups in Korea, suggesting an introduction of A. cerana from two different sources.

Effect of feeding honey bee (*Apis mellifera*) with date palm pollen and some of pollen substitutes on the activity of hypopharyngeal gland

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University of Kerman, Iran

The lack of protein sources has a negative effect on health, production and life cycle of honey bee .Pollen and its substitute play on important biological role as a source of protein, vitamin, fat and minerals on growth of vital activities in gland structures and its secretion .In this study the effect of protein sources on the were investigated development of hypopharyngeal gland of honey bee.The results of this study showed that treatments including natural pollen and Mozafty date palm pollen had the most weigh gain of carcass parts and their protein percentage in the age of 10, 20 and 30 days. The evaluation of disintegration per minute (DPM) in the radio activity of 3, 8 and 14 days old showed that the effect of treatments on hypopharyngeal gland activity and synthesis protein were significant. Development of hypopharyngeal gland was strongly correlated with the age of workers and source of protein and there was no significant difference among groups feed with Mozafty date palm and natural pollen. In this study the highest measured DPM was observed in 8 days old.

BBP-031

The effect of temperature, yellow sand, and acid rain on life span and disease susceptibility of honey bees, *Apis mellifera* L.

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The global climate change such as the temperature shift, increased yellow sand, and acidic rain were concerned to cause serious damage to beekeeping in Korea. We examined the effect of these factors on the life span of adult honey bees, *Apis mellifeara*, and Nosema ceranae infection rate. Adult worker bees incubated in 30 and 35 survived for 34 days, but those in 40 all died in 8 days. Yellow sands of 4.4mg per bee killed all worker bees in a day. The bees dusted with 2.2mg and less sands or sprayed with artificial acid rain of pH 2, 3, 4 did not increase their mortalities; however, their susceptibility to Nosema ceranae was raised. These environmental factors related with climate change should be studied more for sustainable beekeeping industry.

Application of SPME/GC-MS in the analysis of semiochemicals at different *Apis mellifera* larvae instars

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Varroa destructor is an ectoparasitic honeybee mite and causal agent of varroosis which can lead to honey bee colonies death. As parasites, these mites require immature honeybee larvae (brood) on which they deposit their eggs, and adult bees for sustenance. Honeybee larvae produce volatile semiochemicals during a specific time of their life cycle, which stimulate working bees to cap the brood. At the same time these volatiles allure the Varroa mites to infest the brood and hide within the larvae food until the comb is capped. The main objective of this work is to identify the major chemical cues emitted by honeybee larvae before the brood cells are capped for pupation. For that, volatiles emitted by worker bee and drone larvae in different instar were sampled by solid phase microextraction (SPME). The analyses were performed either by cautiously picking and enclosing a specific amount of larvae in a vial or sampling directly in the cell frame, to reduce the larvae stress. The chemical identification was performed by GC-MS. Among the volatiles detected were terpenoids like, -terpinene, -ocimene, 3-carene, limonene, carboxylic acids like hexanoic, octanoic and nonanoic acids, aldehydes like nonanal and decanal, phenylpropanoids like benzoic acid methyl ester and aromatic hydrocarbons like o-cymene. The volatiles identified varied quantitatively depending on the different larvae stages, with -ocimene higher in the early larvae stages. This study was funded by FCT under PTDC/CVT-EPI/2473/2012 and Pest OE/AGR/UI0690/2011

BBP-033

Transcriptomic characterization of Tropilaelaps mercedesae parasitizing honey bees

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Tropilaelaps mercedesae is an ectoparasite of immature honey bees belonging to the genus Tropilaelaps (Acari: Laelapidae). T. mercedesae has become a major threat to the Western honey bee *Apis mellifera* in Asia, including Korea, and is expanding its geographical range to northern regions due to global warming. To establish gene resources of T. mercedesae, the whole transcriptome was analyzed by RNA sequencing. An mRNA-focused library was generated from total RNA extracted from the mixed stages using the TruSeq RNA Library Preparation kit and sequenced using the HiSeq 2000 platform. A total of 6.0 Gb reads were obtained with 85% Q30 value. Trimmed sequence data were de novo assembled using the CLC Assembly Cell v 4.2. A total of 64,868 non-duplicate contigs were finally obtained and annotated by the Blast2GO using the NCBI nr database. The most

abundant species in the resulting 14,336 Blast hits (22.1%) was Metaseiulus occidentalis, a predatory mite, followed by Ixodes scapularis and Tribolium castaneum, suggesting that the T. mercedesae transcriptome matches well with closely related other arthropod species, including mites and ticks. In order to provide basic information for efficient control and monitoring of potential resistance in T. mercedesae, acaricide target genes were annotated and characterized. One voltage-sensitive sodium channel gene encoding the molecular target of fluvalinate, a pyrethroid acaricide most widely used for the control of T. mercedesae, was identified and its molecular properties were investigated. In addition, other acaricide target genes, including acetylcholinesterase and glutamate (or GABA)-gated chloride channel, were identified and characterized.

BBP-034

Primary cell culture method for the honeybee Apis mellifera

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Honeybees are among the most important pollinators in nature, and honeybee-associated products are useful in various areas, including the food industry. However, honeybees may be infected by various types of pathogens. The study of honeybee- associated diseases would greatly benefit from a successful cell culture system, but although some honeybee cell culture techniques have been introduced, these methods have not yet been fully established. Here, we describe a primary cell culture method for the honeybee, *Apis mellifera*. We isolated, sterilized, and seeded egg cells into non-coated cell culture dishes to generate cell aggregates. After approximately 10 days, aggregates were dissociated and seeded to cell culture dishes. Cell passages were continuously performed, with sub-culturing every 3–4 days. The cells expressed non-adherent phenotypes. Their growth increased with the passage number when they were cultured in growth medium based on L-15 insect medium but not Schneider's insect medium. Finally, polymerase chain reaction confirmed that the cells originated from Apis mellifera. Our results suggest that the culturing methods described herein are appropriate for isolating primary cells from honeybee eggs. These methods could thus facilitate the study of honeybee-associated pathogenesis, development, and toxicology.

BBP-035

Fermentation of protein diets can improve their utility for honey bees

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Dearth periods are a critical problem for beekeeping; colonies dwindle and are inadequate for honey production and pollination services. Pollen substitutes can overcome a lack of natural food and reduce weakening and loss of colonies during critical periods. In order for them to be as effective as natural pollen, bee diets need to contain all of the essential nutrients and they need to be palatable for the bees. Since bees normally ferment stored pollen, we investigated whether fermentation affects the value and consumption of pollen substitutes. We compared the diets by feeding recently emerged bees for seven days in small cages with 100 bees. Before and after this period, the protein levels in the bee hemolymph were measured using the Bradford method. The diets tested included beebread and sucrose, considered positive and negative controls. A pollen substitute was prepared, consisting of cane sugar alcohol yeast, soy flour, rice meal and sucrose. This was inoculated with bacteria cultivated from fermented pollen (beebread) found in brood combs of active colonies and fermented at 30°C for two weeks. We also measured vitellogenin levels in the hemolymph to determine whether the bees developed normal levels of this key protein. All of the protein diets resulted in adequate levels of protein in the hemolymph. The fermented diet gave high levels of vitellogenin, similar to what was attained by feeding with beebread, and significantly higher than the same diet without fermentation. We concluded that fermentation can improve the utility of a pollen substitute diet.

BBP-036

Triple-cross hybrid honey bees, *Apis mellifera* L., for improvement of honey collection in South Korea

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To improve the honey productivity in South Korea, the governmental breeding program of honey bee, *Apis mellifera* L., was carried out for ten years. Total eight local queen linages from abroad had been collected and made inbred lines by recurrent crossing. From eight putative pure lines of honeybee, total ten hybrid combinations were produced and evaluated their honey collecting abilities. One triple cross hybrid, showed the highest honey yield when compared with the other cross combinations and common honey bee stocks kept in Korea. The selected hybrid collected 18%~117% more honey than the other hybrids, and 31%~102% more than unselected common bee lines depending on honey-flow seasons. From the test of nest-cleaning activity against frozen-killed pupae in nest, we observed that the hybrid fulfilled superior hygienic behavior by removing more quickly dead pupae compared with controls. We are producing these triple-cross queens through by instrumental insemination and open mating in several islands in cooperation with local beekeepers group to facilitate the distribution in Korea.

BHP-001

Control of Varroa mite in Iran

Reza Shahrouzi

Varroa was first found in Iran in the 1980s and more than three decades Iranian beekeepers have had to deal with this mite. After over three decades my experiences in France and Iran.In the use of different types of treatments:by inhalation, absorption and contact, evaporation against of varroa agree that the efficacy depends on the local condition and that some care is needed. Although we are in the 21st century, Varroa destructor will undoubtedly remain for several years one of the principal agents of the weakening of apiarian livestock. Varroa destructor is a serious disease.It is necessary to learn how to live with it.This can be done: -By preserving only strong colonies in the apiaries. -By systematically changing the queens every two years, by developing queens selected for resistance to the diseases. -The first treatment must be carried out in late march or early april in Iran and Afghanistan by natural or chemical acaricide. -The second treatment must be carried out in the late September or ealy October in Iran and Afghanistan by chemical acaricide. To give over wintering bees the optimum potential for survival, it must be Sufficiently effective to ensure that at the end of the treatment there will be fewer than 50 mites within treated hives. -If colonies were treated only with Apiguard® or Apilifevar® and Formic-acid plates and Hive clean® , they Showed abnormally high winter losses, with clear evidence of mites. (according to.J.P.Faucon and reza Shahrouzi 2003, 2010). , it's necessary to use another acaricide chemical in the autumn.

BHP-002

Resistance of Varroa destructor to wang's flumethin and wang's fluvalinate in Middle East

Reza Shahrouzi

The Varroa mite a parasite well known to beekeepers, is currently the leading cause of death for *Apis mellifera* worldwide. In the Middle East, it appeared in the 70s.Since the advent of varroa, research has evolved significantly regarding the control methods used. This has resulted in the development of several products that have received a market authorization (AMM) in the majority of countries in the Middle East. The Ministries of agriculture of all the countries in the Middle East have undertaken substantial expenditure in the battle against Varroa destructor. They have purchased many anti-varroa products from various companies. This has allowed them to test the effectiveness of different treatments and their mode of action on parasites: inhalation, absorption, or contact and evaporation. Since 2008, products from China have been sold on the black market without veterinary authorization in the Middle Eastrn countries. These products are the Wang's Flumethrin strips and Wang's Fluvalinate strips. Since 1996 to up today difficulty in Middle East as well as in other countries has been the development of resistance in varroa to pyrethroids(Flumethrin and Fluvalinate). This has led to high mortality of colonies worldwide, Wang's Fluwethrin and Wang's Fluvalinate has the same active ingredient of pyrethroids In several counties have serious problem with wang's flumethrin and wang's fluvalinate the beekeepers has led mortality of colonies. Varroa destructor resisitance to Wang's flumethrin and wang's fluvalinate and wang's fluvalinate in Iran and Afghanitan, Pakitan, Tajickitan, Azerbiijan, Irak, Kurdisdan, ect.

Varoasis in Turkey: Alternative approaches

Pinar Ozturk

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Turkey has different and specific climate conditions in every region, therefore has highly rich flora of medicinal and aromatic plants. The botanic fertility of Turkey is a result of its location at the intersection of three phytogeographical regions, its being a bridge between the floras of South Europe and South-west Asia. According to Flora of Turkey, Turkey belongs to 174 genera and families in 1251 to more than 12,000 species and taxa. When the entire European continent thought to have about 12,000 plant taxa shows that Turkey is rich in flora. Turkey has great potential for beekeeping because of vast land, climatic diversity, rich vegetation and the rich colonies that it has. Turkey determined to varroasis in 1977 that enter the Thrace region spread rapidly. Beekeepers in Turkey against V. destructor are trying to combat a variety of plants essential oils and these plants burning in the bee smoker bellows. Many trials carried out in recent years on this subject, the use of walnut leaves smoke, juniper tar smoke and lavandula leaves, peppermint leaves on top of the strips has not been determined that provide activity against *V. destructor*. But tinder fungus smoke is promising hope for activity against varroa mites. Fomes fomentarius (commonly known as the tinder fungus, false tinder fungus, tinder conk, tinder polypore) is a species of fungal plant pathogen found in Europe, Asia, Africa and North America. It is reported that the successful results of tinder fungus against varroa in Anatolian beekeepers in Turkey.

BHP-004

Importance of microscopic testing of honey and pollen samples in the prophylaxis of major bacterial diseases in *Apis mellifera* carpathica bees

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The purpose of the study was to monitor the presence of bacilli in the honey and pollen samples in correlation to the positive diagnosis of these major bacterial diseases in bees. The study took 3 years, and approximately 156 samples of honey and bee bread from reserve honeycombs and 156 live bee samples were processed. To identify the bacilli in honey and bee bread (pollen), we used our own method, and the confirmation of their presence was done through methodology OIE/2008. Of the total tested samples, the bacilli were found present in 63 samples from reserve honeycombs and in 67 samples from live bees' intestine. The bee colonies that did not test bacilli in the samples examined for the duration of the monitoring, did not present a disease episode and did not register mortality of pathologic nature. The mortality registered in the apiaries under study throughout the 3 year- period was 30-100 % for the apiares from which samples testing positive for bacilli had been received. The study confirms that a correlation exists between the presence of bacilli in samples of honey and bee bread from reserve honeycombs, and their presence in adult bees' intestine. The microscopic testing of honey and pollen samples, as well as of bee intestine, may constitute an important prophylactic method in the management of major bacterial

diseases in bees (America n foulbrood and European foulbrood). Acknowledgements: "This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project number PN 108/2012"

BHP-005

Importance of microscopic testing of honey and pollen samples in the prophylaxis of Nosema spp. infestation of *Apis mellifera carpathica* bees

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The purpose of this study was to monitor the load of Nosema spp. spores in honey and pollen samples and to evaluate the pertinence of the method in the prophylaxis of Nosema spp. infestation by eliminating contaminated samples. We investigated 26 apiaries for a period of 3 years at the end of the active bee season, the collected samples consisting in honey (85), pollen (85) and reserve honeycombs (80). The samples were processed and tested for spores of Nosema spp. through the method OIE/2008, adapted for samples of honey, honeycomb and pollen. In the beginning and at the end of each active bee season, the infestation degree and the evolution of the disease amongst monitored bees were investigated. Tests evidenced the presence of Nosema spp spores in 220 samples of honey, pollen and honeycombs of the total of 250 examined samples during the monitoring process. The tests made on bee samples collected at the end of the beekeeping season, by comparison to the ones collected in the beginning of the following season, demonstrated a significant reduction in the infestation degree (72%) in bees by eliminating from consumption the sources of infestation (honey and pollen) in the winter season. Testing before the inactive season for Nosema spp. spores in the reserve honey and pollen represents an important prophylactic method against Nosema spp. infestation in bees. Acknowledgements: "This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI– UEFISCDI, project number PN 108/2012"

BHP-006

Investigating the effect and control of small hive beetle, *Aethina tumida* (Murray) on honeybees and bee products

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The study was conducted to investigate the effects of small hive beetle on honeybees and bee products, and testing the effectiveness of different control methods. A total of 32 honeybee colonies were assigned in to four treatment groups: seasonal colony management, hive entrance modification, trapping of small hive beetle larvae and control

groups. Data on bee population estimate, measurements on brood areas, infested comb and pollen and nectar store areas were recorded using Liebefeld method (frame unit area, $10 \times 10 \text{ cm2}$) at every 21 days. Also, records on small hive beetle infestation rate, average honey yield and absconded tendency of bee colonies were taken under each treatment. The result indicates that there is statistically significant difference (P<0.05) between treated and untreated colonies with mean infestation and absconding rates of the untreated colonies reaching about 80% and 7.33+2.6, respectively. Also, lowest mean honey yield (6.3kg/hive) was recorded in the untreated group. Highest records of bee population, brood, pollen and nectar stores areas were registered in seasonal colony management groups followed by hive entrance modification. Hence, providing bee colonies with proper seasonal management strategy is seen as the best option to minimize and control the effect of small hive beetle on honeybees and bee products.

BHP-007

In vitro testing of the anti-parasitosis pharmacological activity of propolis tincture against *Nosema* spp. spores

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The health state of bee colonies in Romania as well as in Europe is affected by internal parasites among which the most known is Nosema spp. We performed preclinical pharmacology testing of propolis tincture to establish its anti-parasitosis activity on experimental samples in vitro of poly-flower honey naturally infested with Nosema spp. spores (an average of 7 spores/field) at 27 ± 30 C temperature and 55-60% humidity. The infestation degree was established through OIE/2008 methodology adapted for honey. The naturally-infested honey was distributed into two sets, each of 10 samples of 30 g honey each, closed and open, inoculated with propolis tincture in growing amounts of 0.1 ml to 1 ml / sample, as compared to a witness non-inoculated lot. Microscopic determination of Nosema spp. spore infestation degree was performed for 5 days every 24 hours. Results showed a diminution in the spore number from an average 7 spores/field (T0) to 1-2 spores/field (T5), for a minimal concentration of the propolis tincture of 0.3 ml/30 g honey, in both types of closed and open samples, having a 58% effectiveness by comparison to the witness. In vitro testing of the propolis tincture recommends its use as raw material to obtain a product for the prophylaxis and control of the Nosema disease in bees. Acknowledgements: "This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project number PN 108/2012"

BHP-008

Preliminary study on the prophylaxis of nosema disease and of major bacterial diseases in bees by examining the pollen administered as food

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Nosemosis and major bacterial diseases in bees are serious diseases causing important economic damages and increasing mortality. For an effective prophylaxis of these diseases in bees, one must examine beforehand the food resources that constitute their contamination factor. To meet this purpose, we tested by direct microscopy a total number of 50 pollen samples from various flower species in Romania (fruit trees, canola, sun flower, linden) establishing the Nosema spp spore infestation degree and the presence of bacilli as potential ethological agents of major bacterial diseases in bees (America n foulbrood and European foulbrood). The obtained results allowed a classification of the Nosema spp spore charge into 3 categories: weak infestation (1-4 spores/field), average infestation (5-9 spores/field) and massive infestation (10 spores). The lowest degree of Nosema spp charge was registered in the linden and sun flower pollen, while the canola and fruit tree flower pollen showed a high infestation degree. The presence of bacilli was found in all samples of low and average infestation with Nosema spp. spores. Bacterioscopic tests (Gram coloration) permitted evidencing the ethological agents of major bacterial diseases in bees, correlated with higher mortality in the respective bee colonies. The obtained results recommend direct microscopic testing of pollen as prophylaxis of nosemosis and major bacterial diseases in bees. Acknowledgements: "This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project number PN 157/2014"

BHP-009

The dietary tryptophan regulated growth and development of *Apis mellifera*

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The objective of this study is to evaluate the nutritional value of tryptophan for *Apis mellifera*. The 1-day-old worker-bee larvae were transferred from hive to petri-plate in incubator at 34 °C and 90% humidity and fed with diet including 7.84, 8.84, 9.84, 10.84, 11.84, 12.84 and 13.84 mg/g tryptophan to assess the effect of tryptophan on worker-bee larvae. The results showed pupation rate, eclosion rate and protein deposition in larvae were highest when the dietary tryptophan was 10.84 mg/g. In order to evaluate the effect of tryptophan on adult worker-bees, 1800 newly-emerged work-bees were randomly closed in 18 wooden cages (1.2 dm3) kept in incubator at 32 °C and 55-60% humidity and fed with diet including 9, 10, 11, 12, 13 and 14 mg/g tryptophan for 12 days. The survival rate of worker-bee was calculated at 3, 6 and 9-day-old and found 12 mg/g tryptophan improved the survival rate significantly compared with other levels (P<0.05). The development of hypopharyngeal gland of worker-bee was assessed at 9-day-old by measuring the gland acinus size. Data revealed that worker-bees fed with 12 mg/g tryptophan had the biggest gland acinus size (P<0.05). We also found that different levels dietary tryptophan have effects on mRNA expression of 5-HTRs which were deemed to be related with phototaxis behavior, aggressive behavior and so on. Conclusion, dietary tryptophan had regulating roles for growth and development of worker-bee. Thereinto, 10.84 and 12 mg/g tryptophan were the optimum respectively for larvae and adult bee.

BHP-010

Prévalence of Ascosphaera apis on local bee colonies Apis mellifera intermissa in Algeria

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Chalkbrood is a spore-forming fungus (*Ascosphaera apis*, Spiltor & Olive, 1995) that is parasitic on honey bee brood. The etiology of the disease follows this sequence: 3- to 4-day-old larvae consume the fungal spores. The disease does not usually destroy an entire bee colony. However, it can cause significant losses in terms of both bee numbers and colony productivity, with reductions in honey production. In Algeria, no study has been done on the prevalence and distribution of this pathology. The objective of this study is to highlight the changes this disease infestation in apiaries northern and southern Algeria. The laboratory methods of diagnosis of the disease is based on techniques of Bailey (1981), Shimanuki & Knox (1991) and Liu (1995). The infestation levels, in the north averaged 0.5, 3, 4 and 6 % for summer, autumn, winter and spring, respectively. In the south of Algeria, the infestation levels, in the south averaged 0, 1, 2.5 and 3 % for summer, autumn, winter and spring, respectively. The high rate of the disease detected in spring and north of the country is linked falls brutal temperatures and high humidity conditions recorded at this time of year in this area. The rapid development of the colony in the spring, ie the increase in the ratio bee brood adult poses a risk to the cooling of the brood. The migratory nature of commercial beekeeping to the south is probably the most important factor contributing to the rapid spread of chalkbrood disease.

BHP-011

Acute toxicity and survival of *Apis mellifera* L., 1758 after exposure to sublethal doses of clothianidin

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The chemical control is the common tactics used for the control of arthropods-pest. However, bees are also exposed to residues of pesticides and so, this study aimed to assess the acute toxicity (LD50) of clothianidin to *Apis mellifera* L., 1758 and its survival through sublethal exposure. Using dose-response assay and dermal application, the LD50 was estimated as being 6.67 ng/bee (24 hours) and the sublethal doses as equivalent of 1/400 and 1/20 (0.01 and 0.34 ng/bee, respectively), which should be considered as realistic doses. The survival assays were carried out with the intoxication of honey bees by means of the ingestion, dermal and contact with treated surface. Our results showed that the intoxication with clothianidin reduces the lifespan of bees

independently of the exposure route and mainly of the dose administered. Following the dermal and ingestion assays and in comparison with the control treatment, the dose of 0.01 ng/bee reduces the lifespan by 32.7 and 18.2%, respectively. When the effect of the treated surface on the honey bee's survival was assessed, the lowest dose (0.01ng/bee) was the most harmful with lethal time of 155.71 hours. In comparison, the group formed by the control treatments and the doses of 6.67 and 0.34 ng/bee showed a similar behavior and a lethal time of 174.67 hours. Thus, and despite the hazard of clothianidin to honey bees in laboratory, new studies should be encouraged (using approaches that take as reference high tier levels) to estimate the risks of this neonicotinoid to these pollinators.

BHP-012

The impact of bee-eaters (*Merops apiaster*) to the beekeeping endeavors of *Cyprus*

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Large concentrations of bee-eaters (Merops apiaster) are causing major problems to bees in Cyprus during autumn. Initially the flocks encircle the apiary in the vicinity of 200-500 m and prey on every single forager bee returning to its hive. The decreasing number of returning bees gradually results to fewer dancing activities which finally cease. After that, bees remain in their hives and no forage activity is occurring in the whole apiary. The singing of the birds and their appearances are not the reason of this confinement. The restriction of the bees into their hives decreases brood, shrinks adult population and increases the internal temperature of the hive. The colonies are not able to have brood during fall and enter into winter with old and starveling bees. Because of this, 20% of the wintering colonies die every year. The so far proposed solution to repel bee-eaters from apiaries, such as the use of tapes, color balloons, CDs, guns making noises, voices of wild fowls and shot gun shootings was tested and were found ineffective to protect bees. When the alarm voices of merops was recorded and reproduced, birds turned away, shifted to neighboring apiaries and returned after short period of time to continuous their attacks. The present of hawks caused a cry of distress to merops and drive them away but only for a short period of time.

BHP-013

Survey of deformed wing virus, sacbrood virus and black queen cell virus in Thai honey bee species

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Deformed wing virus (DWV), Sacbrood virus (SBV) and Black queen cell virus (BQCV) have been found in honey bees worldwide. The virus infections can cause the bee death and weaken the bee colonies. These three viruses were detected in *Apis mellifera* in northern Thailand by using reverse transcription polymerase chain

reaction (RT-PCR) technique. DWV infection could be detected more frequently than SBV and BQCV. However, in all three Asian honey bee species (*Apis cerana, Apis dorsata and Apis florea*), only BQCV were found. The phylogenetic analyses of the three honey bee viruses in northern Thailand were similar within groups. Thai BQCV strains were closer to BQCV in Asia. It is interesting to note that the genetic variation of the BQCV isolates was more associated with geographic origin than the host bee species from which the isolates were obtained.

BHP-014

The quality of commercial sugar supplements for feeding bees

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Beekeepers use sugar paste or syrup for their colonies as supplementary food. These foods are either hand-made or can be bought by the market. We analyzed sugar pastes and syrups that we bought from the market and also, we tried the different recipes that beekeepers share mainly thru internet in an effort to invert sugar syrup. We found that, in some of the syrups from the market the content was not corresponded to the label. The analysis indicates that they are not totally inverted to fructose and glucose as the label stated. Unsuccessful were also the recipes given by beekeepers to invert the common syrup into inverted-syrup by adding acids, lemons and heating. The splitting of sucrose was incomplete and HMF was produced as byproduct. Sugar pastes were checked for their HMF content which is considers toxic to the bees in concentration more than 20 mg/kg. Some sugar pastes from the market made out of isoglucose (HCFS) and powdered sugar were found having high concentration of HMF. Sugar paste "vanilla" made by sugar syrup after heating, mixing and cooling is found safer regarding the HMF content. We recommend avoiding the long time heating and the addition of acids especially when there are not facilities for immediate cooling. In cases of using HCFS, the control of HMF content is essential. Also we consider very important the establishment of limits for HMF in all bee foods and the application of EC Regulation 767/2009.

BHP-015

Investigation and identification of ABPV, KBV and DWV in diseased apiaries in Iran by RT-PCR.

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Here, we describe the first survey of 3 honey bee viruses (ABPV, KBV, DWV) in unhealthy bee colonies, which has been an unusual loss in adult bee population and significant honey bee mortality during the year. Adult bee samples were collected between July - September 2011 and 2012 and were originated from 23 provinces with different geographic areas of Iran. Following the RT-PCR reaction with the specific primers on the isolated RNA, specific PCR product was detected. We demonstrated the presence of ABPV RNA in 9 (5.8%), DWV RNA in 34

(21.8%), KBV RNA in 7 (4.5%), from 156 samples collected from Iranian apiaries. The investigation revealed that 40 from 156 (25.65%) of the apiaries were infected with at least 1 virus. The most frequent infection was DWV and then followed the ABPV and KBV. The colonies was defined as mono-infection (80%), dual-infection (14%), triple- infection (6%). Our results demonstrated that mixed virus infections in honey bees are quite widespread in 14 provinces (60.8%). The reasons for differences in prevalence of bee viruses worldwide are not fully known and may be related to bee management and propagation practices or possibly the presence of alternative hosts or vectors for these viruses. The spread of V. destructor has been implicated in a dramatic increase in the prevalence of viruses. The role of V. destructor and Nosema in viruses transmission also deserve more intensive investigation. Keywords: Viruses, RT-PCR, honey bees, Iran.

BHP-016

Is greater wax moth (*Galleria mellonella*) effective to transfer *Nosema* species between hives?

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Galleria mellonella is one of economic pest of honey bees and nowadays it spreads almost all over the world. Although it often reports in weak colonies that exposed to pesticides and diseases, it is also a threat for healthy colonies. It is constantly interaction with honey bees, because its essential nutrient is wax. Therefore, it is a fairly high probability to transfer both microflora-specific bacteria and pathogen microorganisms between these live forms. This situation may increase the spread of parasitic Nosema species that causing fatal disease in honey bees. For this reason, it is required to investigate the presence of Nosema species in Galleria mellonella. In this study, Nosema detection method which applied in honey bees was used for Galleria samples. To detect the presence of Nosema spp., Nosema solutions were prepared and examined under the light microscope using a Neubauer slide. At the end of this examination, Nosema spores were found microscopically in Galleria mellonella samples. Real-time PCR amplification studies are still in progress to determine definite Nosema species. According to the first results, it was observed that Nosema species can be found in the honey bee pests and these pests may be responsible for the transmission Nosema species between honeybees. Furthermore, it is considered that Nosema spp. can live a long time without showing any symptoms in Galleria because there is no change in the quality of life of Galleria mellonella.

BHP-017

Determination of infectivity and spore longevity of *Nosema* apis and *Nosema ceranae* according to storage conditions

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Honey bee colonies are often infected with *Nosema apis* and *Nosema ceranae* which causing adult honey bee diseases called Nosemosis. Honey bee colony members consisting of a queen, worker bee and drone can be infected with these species. In addition, it is thought to be the main cause of honey bee winter-losses in many countries. Nosema spores were expected to resistant the environmental conditions and their infectivity continues

for a long time because of long-term durability of fungal spores. In this study, the changes of Nosema spores in terms of storage situations under laboratory conditions were investigated. Honey bee samples that were collected from apiaries in 2011 were divided in two groups. One of these groups was used for preparing Nosema solutions with classical Nosema method and it was found Nosema spore density and identification of species. Nosema solutions were divided and stored at both -20° C and $+4^{\circ}$ C. The spore density was measured every year in the period 2011-2015. Other group of honey bee samples was also stored at -20° C and every year was used for Nosema spore counting. Furthermore, it was examined the infectivity of Nosema spores with solutions which obtained each year. According to results, when we compare the solutions annually, there is no change at Nosema spore density of the solution in -20° C and honeybee samples in -20° C. But reduction was seen at Nosema spore density of the solution in $+4^{\circ}$ C. Nosema spore infectivity tests revealed that infectivity of Nosema spore has not changed between 2011-2015.

BHP-018

Effect of a commercial protein supplement on the development of membrane peritrophic *Apis mellifera*

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Peritrophic status membrane is a reflection of the vitality of the bee. Any situation that generates stress, will impact on this, reducing its thickness. One of these predisposing factors is nutritional deficiency. Protein supplementation is a key management tool to maintain the strength of bee colonies during periods of pollen shortage. The test objective was to evaluate the effect of a commercial protein supplement on the thickness of the membrane peritrophic. Groups of about 50 newly emerged bees were placed in experimental boxes and carried into incubator with controlled humidity and temperature. Two protein diets were fed: bread bee and commercial protein supplement; both with a crude protein content of about 22%. 3 replicates were performed by diet, in all cases the protein food and syrup 50% sucrose *ad libitum*. At 5th day test for extracting intestines bees (n=9 per treatment) were sampled. Histological sections of 5 μ m. thick were performed and stained with eosin / hematoxylin. 3 representative sections of each intestine were selected and each of these three thickness measurements the peritrophic membrane bees fed with beebread (34.82 ± 7.40 microns) and fed commercial supplement (38.51 ± 11.05 μ m). The peritrophic membrane is the first defensive barrier against microorganisms entering via the digestive tract, so its rapid thickening is essential to prevent parasitic infections as *Nosema* spp. Adequate protein supplementation help maintain the health of the colonies.

BHP-019

The "liver" of honeybee colonies, beeswax combs protects honey and avoids brood intoxication

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The beeswax play a major role in the protection against intoxication of honey bee colonies, by decreasing bioavailability of toxic substances into sensitive components of colony. Structure and chemical differences in bee product as beeswax, honey, pollen and propolis and the chemo-physical characteristics of each i.e. lipophilicity, polarity, density, fluidity and solubility, are the key for understanding the detoxifying process and colony defense system. The natural safety mechanism we found can be explained by the honeycomb structure, and the chemophysical characteristics of the beeswax. Distribution and accumulation pattern of toxic substances within the hive was demonstrated by using coumaphos as a toxic marker. We noticed a unique mechanism in hive functioning as the "liver" of honey bee colony, efficiently reduces the exposure of the colony to coumaphos and other toxic substances, such as pesticides and toxic metals. This mechanism enables honeybees to protect colony health and to maintain the bee product safe both for bees and human consumption. Our experiments with coumaphos (CheckMite, Perizin®) clearly show strong correlation between concentrations of coumaphos in beeswax and toxic effects in brood, bees and Queen rearing. The ability of beeswax and honeycomb structure to efficiently absorb a variety of toxic substances, dilute and distribute the contaminants, on the big surface area of the combs, is a unique capability that enable honeybees to forage safely in unknown and risky environments. Cleaning of beeswax during the recycling procedures is very important and enables to eliminate the negative effect and potential risk of foreign toxic substances.

BHP-020

Evaluation of the Fluvalinate, Amitraz, and Formic Acid Efficacy in Control of Varroa destructor

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Varroa mite (Varroa destructor) is considered a major threat to the apiculture industry in Taiwan. Synthetic acaricides and organic acids are widely applied for the control of varroa mite. However, fluvalinate is the only authorized acaricide for apiculture in Taiwan. In order to explore more available alternatives, the effectiveness of fluvalinate strip (5%), amitraz strip (3.33%), and 65% formic acid against varroa mite was investigated in the field from Nov 2014 to Jan 2015. The effects of chemicals against varroa mite were evaluated by mesh bottom board. The result showed the mite mortality of fluvalinate, amitraz, and formic acid was 57, 77, and 75% respectively. However, the effect of formic acid was variability, which might due to the dynamics of atmosphere temperature. The mite mortality between treatment duration (1 week and 3 weeks) of amitraz showed non-significant difference. This study represents that amitraz and formic acid would be potential alternatives for the control of varroa mite in Taiwan.

BHP-021

Pests and diseases of Apis mellifera L. in Bangladesh

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Three locations viz. Gazipur, Tangail and Shatkhira were surveyed to find out different pest and diseases of *Apis mellifera* in Bangladesh. One hundred bee hives from different locations were randomly selected and owners of the apiary were interviewed to know the pests and disease attack in their hives. Results revealed that Tropilaelaps mite, Tracheal mite, Varroa mites are the parasitic mie pest of A. mellifera. Wax moth, Small hive beetle, Ants and Phorid fly are the insect pest of A. mellifera. In terms of diseases Sacbrood, European Foul Brood, Nosema and punctured pupa diseases are present and affect honey bee health. The highest numbers (57) of bee hives were infested by tracheal mite. The second highest numbers (53) of bee hives were infected by nosema disease. Tropilaelaps mite was seen in 31 hives where as punctured pupa disease was observed in 27 boxes. Only 1 box was found to infest by bee parasitic fly, phorid fly. Beside these, bee eating birds and giant hornet were found as pests (predator) of honey bee.

BHP-022

Influence of L carnitine in sugar syrup on brood area, colony population, colony weight in honey bees

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Carnitine is a substance found in almost every cells, it is biosynthesized from the amino acids lysine and methionine. The compound plays a crucial role in energy production, as it is responsible for transporting fatty acids to the mitochondria. So In these investigation effects of different levels of Lcarnitine in sugar syrup on the rate of queen laying, colony population and colony weight in honey bee (*Apis mellifera* L.) were studied. Experimental colonies had the same age queens and the same population and fed with sugar syrup (50 percent sugar) in three levels 5, 10, 15 mg/L syrup–soluble Lcarnitine while the control group fed only with sugar syrup (treatment 1 control, treatment 2, 3 and 4, respectively 5, 10 and 15 mg/L Lcarnitine) were compared. In this experiment feeding colonies for 60 days in April and May (the first 45 days of feeding every second day and the other without feeding-period of 15 days) were done. The highest average brood area was in treatment 3 with 10 mg/L Lcarnitine while the lowest one was in treatment 1 (control).

BHP-023

Effect of sublethal doses of clothianidin on Apis mellifera enzymes

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¹ Federal University of Lavras ² Federal University of Uberlândia, Brazil The goal of this study was evaluate the possible changes in the physiology of honey bee (*Apis mellifera* L., 1758) after the exposure to sublethal doses of clothianidin (CLO). Were assessed key enzymes as biomarkers of exposure: acetylcholinesterase (AChE), three isoforms of carboxylesterase (CaE-1, CaE-2 and CaE-3), alkaline phosphatase (ALP) and glutathione S-transferase (GST). The crude extracts were obtained from adults and larvae (3rd and 4th instars) previously exposed (dermal) to the doses equivalent to 1/400 and 1/20 of LD50 (6.67 ng CLO/bee). Overall, our results show that CLO was able to modify the activity of all enzymes, for both larvae and adults and the all doses tested. For AChE, great changes were observed to 4th instar larvae reaching an increase of 46% on activity of treated groups as comparison with the control. The three isoforms of CaEs were also affected, being than the major modification occurred on adults and mainly with the CaE-1 isoform. For both ALP and GST, its activity, both ALP and GST from all honey bee phases and doses were modified by CLO. As these enzymes are crucial on individual physiology and development, anyone modification on its activities should be assessed in order to check the impact on honey bee health. Additionally, as physiology changes are the first modifications in the intoxication process, complementary studies are necessary to assess the long term impact on honey bee fitness.

BHP-024

Microbial factors in the survival of a Swedish Varroaresistant honeybee population

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Apart from producing honey and other bee products, honey bees play a vital role in pollination and food production. Approximately, 35% global food production depends on the insect pollination and of those crops, 90% is performed by managed honey bees. Honeybee colonies are in decline causing economic and ecological consequences for agricultural crop production and natural plant biodiversity respectively. The parasitic mite Varroa destructor in combination with viruses it transmits is main responsible for honeybee colony losses worldwide, and has been responsible for the nearly complete eradication of wild and feral honeybee populations since its introduction to European honeybees 30 years ago. However, there are a number of feral honeybee populations world-wide that manage to survive long-term without Varroa control. The best studied of these is on Gotland, which was established as an experiment 15 years ago. Central to colony survival, particularly during winter or other long brood-less periods, is the health and longevity of its adult bee population. Recent studies show a major difference between Gotland's Varroa- surviving 'Bond' bees and non-resistant bees in the levels of certain pathogens, which manifests itself increasingly towards autumn. This is when the winter bees are produced whose primary role is to survive winter and re-start the colony the following spring. My project explores the possibility that the longevity of individual (winter) bees may be a key component of the Varroa- survival of colonies, and that this is affected by the honeybee microbial community, including pathogens.

BHP-025

Simultaneous detection of Ascosphaera apis, Nosema ceranae, Nosema apis and Paenibacillus larvae spores in bee products

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Honeybees (*Apis mellifera*) can be afflicted by various pathogens, among them *P. larvae*, *A. apis*, *N. apis* and *N. ceranae*. Honey, pollen and royal jelly are susceptible to contamination by these pathogens because they are stored in honeycombs or transferred by trophallaxis, besides others possibilities. The objective of this study was to propose a method to detect spores of these pathogens in honey, pollen and royal jelly directly by PCR. Samples of these products were sterilized and inoculated with different pathogen concentration, to test the method with different spore concentrations and respectively recovery rates, as well as different centrifugation speeds and times. The greatest detection sensitivity was obtained with centrifugation at 12,500 g for 40 min, of homogeneous aqueous solutions of 10 g of pollen, 5 g of royal jelly and 20 mL of honey, with volume completion of 45 mL for honey or 40 mL for royal jelly or pollen. The sediment from each tube was resuspended in 1 mL of sterile distilled water, with subsequent homogenization and centrifugation at 10,000 g for 20 min, after which the sediment was submitted to DNA extraction. The pollen samples were filtered using a vacuum pump. Monoplex and multiplex PCR confirmed the detection of the pathogens (25 *N. ceranae* or *N. apis*, 150 *A. apis* and 8 *P. larvae* spores). The standardized technique was able to detect the pathogens quickly, besides being inexpensive and practical, and can be used for sanitary control of bee products. Acknowledgments. This work was supported by FAPESP.

BHP-026

Use of Hopguard - a natural Varroa control

Max Watkins

Vita (Europe) Limited, England

HopGuard[®] is a new treatment for Varroa infestations, based on a natural plant extract of hops (*Humulus lupulus*). The product has been in use in The USA for three years and is currently under registration in Europe and in other Regions. HopGuard has shown good control of Varroa infestations and its safety and residue profiles make it an ideal biological treatment, suitable for use even during honeyflow periods. We describe here a number of studies conducted under different climatic and geographic conditions.

BHP-027

Controlling Varroa destructor with Apivar® (Veto-Pharma): results obtained in France, Autumn 2014 in high infestation context and comparison with efficacy results from FNOSAD France from 2007 to 2014

Benoit Siefert, Gael Charpentier, Ludovic de Feraudy

Vetopharma, France

A field trial was conducted in Chaillac 36310, center of France, with Apivar® for 10 weeks between 1st sept – 10 nov 2014 in 8 colonies. Control treatments were applied after treatment removal, then during broodless period. All hives were equipped with sticky board and mesh floor; varroa mites were counted regularly over all the period using the VarEval® device designed by ITSAP. On each colony, the commercial treatment APIVAR®, 3.33% amitraz in a strip form, was evaluated by hanging two strips in the broodnest. At the end of the treatment period, challenge treatments were applied with Ectodex® (amitraz 5%), 1.25 ml dripped onto sticky board positioned over the mesh, twice at 4-day interval after strips removal, then during broodless period with Oxalic acid (5 ml of solution with 42.5g OA dihydrate in sugar syrup 1:1 dripped between frames) on 22 dec 2014. Residual varroa mites were also collected on sticky boards and counted during all the control period. Varroa infestation levels were very high (mean 7,844 mites \pm 4,780). Mean efficacy was 98.4% (all colonies presented an efficacy >95%) and mean residual varroa mites was 123 \pm 134 (half of the 8 colonies presented <50 residual mites after a 10-week treatment). These satisfactory results, despite a huge initial infestation rate, are in line with those of the field efficacy tests performed annually since 2007 in France by FNOSAD, and they do not show any trend for reduced efficacy of Apivar® over now 20 years of use in French colonies.

BHP-028

Decision making between the nectar sites of variable quality in a social wasp, *Vespula koreensis*: comparison with honeybee colonies

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There is a substantial gap in our knowledge of nectar collecting behaviors for social wasps in comparison with honeybees, ants and termites that efficiently select the best of an array of food sources. This study showed behavioral decision-making by nectar foragers of a social wasp, Vespula koreensis between food sites that varied in quality. A colony was installed in an artificial nest on an open field, and individually marked workers trained to forage at a feeder. For the experiment two feeders were placed away from the nest. The fructose concentration at each feeder was alternated between a high and low concentration relative to the other one. Arrivals and departures by foragers to the nest and feeders were synchronously video recorded. Individuals modulated foraging behavior when fructose concentration changed between the two feeding sites. The number of foragers visiting the feeders did not differ, but feeding time and visitation frequency increased at high-quality feeders. Foragers efficiently switched from one feeder to the other when the feeder they visited became less profitable. The low quality food site was not abandoned, but frequently monitored so that feeding resumed when sugar concentration increased. The time spent foraging per visit and the time spent unloading the nectar within the nest also changed with food quality. The food allocation of the yellowjacket colony was different from that of honeybees where the majority of the foragers are allocated to the high-quality source and few foragers visit the low-quality source.

BHP-029

Measurement of deaths in *Apis cerana* according to the climatic condition: A greenhouse experiment

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The Eastern honeybee (or Asiatic honeybee), *Apis cerana* is found throughout the tropical, subtropical and temperate zones of Asia. This wide range should lead to important variations among the bee's geographical races (Abrol 2013). A. cerana in South Korea, having received relatively little attention, should need to adapt its whole array of colony system to the climatic conditions of the temperature region. In this presentation we provide the mortality of A. cerana, measured in the net screened greenhouse (LxWxH : 16.5x6.5x4.5m) experiment, manipulating the climatic conditions: greenhouse air temperature and humidity, luminosity, internal temperature and humidity of the colony, and cloudiness, etc. We observed not much of mortality in this experimental manipulation, however the results showed little fluctuation in the number of death individuals according to the climatic conditions of the greenhouse and inside the nest. The sudden climatic changes should make stresses to A. cerana, although the colony occupies a large range of climatic zones in Asia.

BHP-030

An identification information sheet for the invasive hornet Vespa velutina (Hymenoptera, Vespidae) and possible areas of confusion with other wasp species

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A collaborative work was conducted in 2013-2014 between the NAAS RDA (Jeonju, South Korea) and the MNHN (Paris, France) which focused on the invasion of the yellow-legged hornet Vespa velutina in both France and South Korea from the beginning of the 2000s. Vespa velutina is a bee-hawking hornet which shows an increasing impact on honeybee colonies in South Korea. Although nest destruction is the most efficient method to reduce hornet predation on apiaries, no method is currently available to easily detect the nests which are usually located in the crown of high trees. Citizen participation is thus necessary to help at detecting the invasive species. Such a survey through public warning is already performed since 2004 in France by the MNHN thanks to the INPN website (http://inpn.mnhn.fr). In the framework of the collaborative project and according to the leaflet made by the MNHN for France, a leaflet was produced in collaboration with the Kyungpook National University (Daegu, South Korea) with the aim at helping Korean citizen and beekeepers to recognize the invasive hornet while avoiding confusion with various other hornets and wasp species. Establishing in South Korea a citizen

science program similar to that of France would help at monitoring the spread of Vespa velutina and detect as precociously as possible its potential introduction far from the invasion front, hence to help with planning dedicated control measures.

BHP-031

Analysis of volatile compound profiles involved in *Apis mellifera* hygienic behavior towards *Varroa destructor*

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Varroa destructor constitutes one of the main problems facing the beekeeping. *Apis mellifera* displays a social health mechanism against brood diseases that consists in detect, uncap and remove dead or diseased brood from the hive (hygienic behavior). Previous studies showed that olfactory cues could be involved in the detection of diseased brood by worker bees. The aim of this work was to study the removal behavior of workers towards V. destructor infested-brood at different times, and to explore the volatile compounds associated. Newly-capped bee brood was artificially infested with one mite, and at different post- infestation times (60 h, 5 and 10 days) the number of infested brood removed were recorded. Non-infested brood cells were simultaneously analyzed as a control assay. In parallel, 25 control and infested honeybee larvae/pupae of each treatment were removed from the brood cells and their volatile compounds were analyzed by GC-MS. The percentages of infested brood removed were significantly higher for 5 and 10 days compared to 60h treatment. Differences between the chemical profiles obtained from infested vs control brood were found, particularly for 5 and 10 days treatments. We also detected differences in chemical profiles along infestation time. Our behavioral and eco-chemistry study evidenced that the olfactory cues are stronger as progressing the V. destructor reproductive cycle. These results will contribute with information towards a better understanding of the social mechanism displayed by worker bees against the mite, useful to honeybee breeding programs for the selection of Varroa-tolerant colonies.

BHP-032

Distribution of the mite Varroa destructor, parasite of honey bees, Apis mellifera adansonii in apiaries in Benin

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In Benin, phenomena of weakening of apiaries causing loss of seed yield and considerable reduction of honey yield were observed. The objective of this work was to study the presence and distribution of *Varroa destructor* (Anderson & Trueman, 2000) in apiaries in Benin, and to assess the level of its parasitism on *Apis mellifera* adansonii. Therefor, bees from thirty apiaries located in the eight phytodistricts and three ecological zones of Benin were collected and studied. For the isolation of the parasite, honeybee samples were examined for external parasitic acari using the shaking method. The rate of infestation was then calculated. Variance analysis (ANOVA) was performed on the collected parameters, and, a Student- Newmans-Keuls test (SNK) was used to calculate means. Parameters were analyzed at 5% confidence intervals. The results of the study indicated that the mite is present in all visited apiaries. The parasitism rate on young workers ranged from $0.50\pm0.1\%$ to $9.5\pm1.5\%$, compared to the average of $7.30 \pm 1.89\%$ in the cells of workers. Drone brood were more parasitized, and showed rates ranging from $10.5\pm 1.3\%$ $35.0\pm 2.4\%$. Our study showed the wide distribution and parasitism by V. destructor in Benin, which certainly indicating its presence in other African countries, south of the Sahara. Future studies should focus on its impacts on bees and beekeeping. It's quite urgent to take conservation measures for the protection of the diversity of bees. A call for collaboration with other laboratories is launched for global solutions.

BHP-033

Honey bee *Apis mellifera adansonii* susceptibility to fungicides, herbicides and insecticides commonly used in Benin

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In Benin, producers treated their fields with different pesticides at inappropriate doses. However, the protection and the preservation of bees are a guarantee of sustainable agriculture. Facing poor practices in crop protection, what can be the consequences on the bees? The objective of this study was to assess the toxicity to honey bee *Apis mellifera adansonii* of some commonly used pesticides. To do this, bees were collected in apiaries and transported to the laboratory. Tested active ingredients were glyphosate, pendimethalin, chlorothalonil, carbendazin, and, the association of cypermethrin and dimethoate, at doses of 1.25 ng/bee; 3.3 ng/bee; 5 ng/ab; 10 ng/ bee; 20 ng/bee; 50 ng/bee; 100 ng/bee; 200 ng/bee; 400 ng/bee; 600 ng/bee 1000ng/bee or μ g/bee. Each treatment consisted of three replicates of 25 bees each. Before treatment, bees were anaesthetized with ether. The bees of the control treatment received a microliter of a suspension of water. The observations were made 24 h and 48 h after topical application. The results showed mortality rates ranging from 10.66 \pm 0.8%, 24 hours after the test to 92.00 \pm 2.7% for the lowest dose of the active ingredient glyphosate. Tested pesticides were all very toxic to bees, even at lower doses. Among the used pesticides, insecticide Cypadem was the most toxic. In the light of the importance of bees, it is urgent to establish good plant protection practices. Our next actions will focus on the sensitization of farmers on the impacts of the misuse of chemical pesticides on bees and pollinators.

Recent advances of *Vespa* ecology with focused on invaded *Vespa velutina* (Hymenoptera) in Korea

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There is an increasing threat from Vespa hornets in apicultural and public domains. The species composition and seasonal pattern of Vespa hornets were monitored from diverse environmental habitats in Gyoungbuk area. Overwintered queens emerged and were trapped from early May until mid June followed by the workers from mid July with the peak activities in the late September. Vespa mandarinia, V. crabro and V. analis appeared early even in April, but V. ducalis occurred in mid May. Activity window was larger for those three species than V. ducalis. Population of an invasive alien species of V. velutina has expanded its distribution toward north. Landscape features such as the size of woodland and green area are positively correlated with the number of Vespa caught in the traps. For efficient and independent sampling, sampling range determined by variogram analysis showed 74 m for V. analis, 75 m for V. simillima, 89 m for V. ducalis, and 88 m for V. mandarinia, respectively. The variogram model analyses indicated that the sampling distance of each wasp should be separated at least 70 m. Radar tracking for the vespa nest are in development.

BHP-035 Acaricide efficacy of approved products for the control of *Varroa destructor* in beehives of *Apis mellifera*.

Paulo Damián Mielgo¹, Pablo Joaquín Moja², Marcelo Luis Del Hoyo¹, Patricio VIdondo¹

² private consultant

The Varroosis caused by Varroa destructor affects bees in all stages. It is considered a pandemic causing massive losses, either by reductions in individual performances, or colony mortality. Due to their dynamic population and virulence applying acaricides treatments are necessary. The emergence of resistance to some acaricides synthesis generates global concern about the use of these molecules for the control of parasites. That is why, in this work we decided to evaluate two known synthetic acaricides efficiencies (Flumevar and Amivar500) to ensure the use of the same. Treatments consisted of two plastic strips of slow release for 45 days, inside containing the active ingredients and Amitraz Flumethrin, respectively. The obtained average efficiency was

96.21% Flumevar (\pm 1.72) and the Amivar500 was 99.38% (\pm 0.62). Under the conditions in which the test was carried on, we come to the conclusion that Amivar Flumevar and acaricide treatments demonstrated optimal efficacy against V. destructor. Both products have a strong acaricidal contact action, affecting mites found in phoretic state. Continuous release of active ingredients keeps antiparasitic action for 45 days. Since in this period 3 cycles of operculado met in beekeeping, mites emerge and are exposed to the action of the drug and so are eliminated. With these results the conclusion is that both products can continue to be used as an alternative in the control of this parasitosis, provided they are used in a rational and responsible way.

¹Apilab srl

BHP-036

Sperm viability in honey bee queens (*Apis mellifera*) following exposure to the neonicotinoid insecticide imidacloprid and the organophosphate acaricide coumaphos

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Honey bee population declines are a global concern. Numerous factors appear to cause the decline including parasites, pathogens, malnutrition and pesticides. Residues of the organophosphate acaricide coumaphos and the neonicotinoid insecticide imidacloprid, widely used to combat Varroa mites and for crop protection in agriculture, respectively, have been detected in wax, pollen and comb samples. Here, we assess the effects of these compounds at different doses on the viability of sperm stored in the honey bee queens' spermatheca. Our results demonstrate that sub-lethal doses of imidacloprid (0.02 ppm) decreased sperm viability by 50%, 7 days after treatment. Sperm viability was also reduced about 33% in queens treated with high doses of coumaphos (100 ppm). This research clearly demonstrates that chemical exposure can affect sperm viability in queen honey bees.

BHP-037

Natural plant extract (HO21) with effective antimicrobial activity against *Paenibacillus larvae* is not toxic to *Apis mellifera* and could be used in beehives to control American Foulbrood disease

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American foulbrood (AFB) is a serious worldwide spreading disease of honeybee (*Apis mellifera* L) caused by the spore forming bacterium Paenibacillus larvae. In infected hives, spores are the main vectors for the spreading of the disease, which can be found in brood, honey, wax, pollen and hive walls. The curative treatments with antibiotics is usually used in some countries, unfortunately the extensive use of antibiotics leads to an accumulation of residues in beehive products (especially in honey), and this practice has been shown to lead to bacterial resistance. The natural plant extract HO21 with antimicrobial properties has been shown to have an inhibitory effect on the growth of spores and vegetative cells of P. larvae. The aim of this study was to determine the acute oral toxicity of the extract on adult honeybees and also evaluate the effect of chronic oral administration of HO21 on the survival of larvae and adult bees grown in vitro. Toxicity expressed as LD50 showed lethal effect to bees at very high concentrations, 256 g/bee, showing HO21 it is non-toxic. Survival of larvae and honeybees orally treated with HO21 presented similar results to the group without treatment, causing no toxic effects or death

at the same or superior concentration that exhibits antimicrobial activity (MIC for spores 0,9 g/l), resulting in a survival rate of 85-90% after 5 and 10 days of observation respectively. These results provide initial evidence that HO21 can be administered orally to the colony. HO21 is a potential therapeutic alternative against AFB. BHP-038

Prevalence of tracheal mite at the beginning of the season in apiaries from Melipilla province, Chile

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Universidad Mayor, Chile

Acaropisosis is produced by the endoparasite Acarapis woodi, who affects the respiratory system in honeybees. This parasite invades the trachea, feeding on hemolymph, causing a degeneration of the air conducts. The Chilean reality is unknown but some informal data show a prevalence less than 9%. However it is believed that this mite generated economic losses and sanitary problems especially in wintering season. The aim of this study was to determine the prevalence of Acarapis woodi early in the growing season in the Province of Melipilla and to get some association factors such as professional beekeeper, transhumance and treatments used against Varroa mite. A spatial description of the beehives was done by parasite load on a map of the province. The results indicate that the average prevalence of acaropisosis in Melipilla Province was 14.6% and when it was calculated by commune for the same period move between 25% in María Pinto, 20.8% in Curacaví, 16% in Melipilla, 7.3% in San Pedro and 2.8% in Alhué. It was obtained a positive correlations between the professional level in the beekeeper, a negative correlation between numbers of hives from each beekeeper and no correlations between transhumance and type of treatments used against Varroa mite, on the prevalence of Acarapisosis. We conclude that the prevalence in the province of Melipilla at the beginning of the growing season was higher than expected calculated according to current national records and there is some factors that could affect the prevalence of this disease.

BHP-039

Comparing the level of resistance of varroa mite obteined from apiaries which usually apply synthetic or organic acaricides

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Universidad Mayor, Chile

Globally, the mite Varroa destructor, has become the most serious threat to the honeybee. Because in Chile have a low diversity of products to treat varroa mite has gained strength. The aim of this study was to determine if the mite Varroa destructor has developed resistance to synthetic acaricides flumethrin, amitraz and coumaphos, reducing its effectiveness to values less than 90%, in central Chile. To get this aim, a sample of 48 colonies from beehives in which usually flumethrin, amitraz coumaphos are applied was taken. As a control group, 48 sampling apiary hives from certified organic or in the process of, to compare the efficacies achieved between one group and another was made. In each sample a set of 200 bees with at least 10 Varroa mites were collected. As a result it was found that the average resistance of the mites present in hives treated with flumethrin was 69.9%, as the apiaries treated with coumaphos and 66.5% for the group treated with amitraz. Resistance levels in the control groups were on average 7.1% in flumethrin, from 6.9% resistance to coumaphos and 6.5% when it was exposed to amitraz. When comparing these values with the chi square test, a significant difference between the apiaries with continuous use of synthetic acaricides products relative to those that only were used organics treatments was

obtained. The results confirm the presence of Varroa mite resistance to synthetic acaricides commonly used by beekeepers in Chile.

BHP-040

Association between Antimicrobial Activity of Lactic Acid Bacteria from the Intestinal Tract of *Apis mellifera* and The Floral Species in Chile

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When honeybees (*Apis mellifera*) become foragers, foreign microorganisms are introduced into bees and other nectarivorous through the collection of nectar / pollen and through trophallaxis. The composition of the bee's microbiota may vary according to the floral species, climate, microbes from other pollinating insects, airborne microorganisms, and the nutritional composition of the nectar and pollen of the species of flora. Lactic acid bacteria are part of this microbiota and their diversity and properties may vary in different conditions such as nutritional composition of nectar and pollen, and the presence of different microorganisms between flowers. These conditions may also trigger an array of different responses from lactic acid bacteria of the same species, like the ability to inhibit different pathogens, the ability to survive and thrive under difficult conditions or to stablish themselves in the digestive tract of *Apis mellifera* or other insects. Lactic acid bacteria were isolated from beehives located in north-central, central and south regions of Chile. The honeybee colonies were healthy, without commercial pollination activity and synthetic treatments that could alter the normal microbiota. Digestive tracts were extracted, the content spread on plates with MRS agar medium and incubated under capnophilic conditions. The isolates were identified by PCR amplification and sequencing of the 16S rDNA gene. Our aim was to do a correlation between the antimicrobial properties of the strains isolated and the chilean flora were 45.83% of it is endemic, and demonstrate the differences and correlations between strains from different regions of the country.

BHP-041

Porous ceramics for controlling the release of bioactive compounds in combating bee parasites

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Porous ceramics are studied for natural extracts packaging application to control bee mites. Firstly, the amount of starting precursors such as cellulose (pore former) and PVP (surfactant) are varied to find the suitable preparing condition. The ratio of cellulose and PVP are affected by density and porosity of ceramic. The best ceramic condition is cellulose 10 g and PVP 3 cc with 90.54 % porosity. Second, the effects of lemongrass oil on Varroa jacobsoni and Tropilaelaps mercedesae mites are studied in laboratory scale. The % corrected mortality of V.

jacobsoni mites and T. mercedesae mites were reported 100 %. However, controlled conditions have less that 25 % of corrected mortality. Finally, the effects of lemongrass oil on bees are studied. The lemongrass oil has no effects to bee population. The porous ceramics could be used to release lemongrass oil up to 30 days.

Only Vespa simillima xanthoptera Cameron visits apiaries in Jeju

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Vespid wasps are harmful predators of honeybee. Species inventory and phonological data is the basic information for management of any pest population. We surveyed the vespid wasp occurrence nearby the experimental apiary (Apis mellifera) of Jeju National University from 2013 fall and 2014 season. Conventional traps were located in 3 different locations with altitudes of 255, 356 and 410m. Total 108 Vespa wasps captured were all identified as Vespa simillima xanthoptera Cameron and most Vespa were captured from apiary in the region of altitude 356m. Lowest Vespid wasps were captured in July 2014, cause of heavy rainfall. average precipitation in July, 2014 is more than 255.5mm in July, 2013. Spring population was significantly bigger (25.6 : 6.7 mm) than that of fall (23.7 : 6.4 mm, length : width, respectively), implying spring population would be mostly overwintered queens. Also, late season survey covering Jeju island also confirmed that Vespa simillima xanthoptera only visits apiaries in Jeju. It is known that there are 10 species of Vespa inhabiting in south Korea. But only Vespa simillima xanthoptera Cameron is found in Jeju. Further study on the inventory and altitudinal distribution is demanded to better understand of the vespa community in Jeju island. Sticking pesticide to vespa and repatriating it is one of methods of pest control. Also, study on environmental-friendly control of Vespa mandarina is deviced. Application to Vespa simillima xanthoptera Cameron is needed to control Vespa wasps in Jeju island.

BHP-043

Rearing Apis cerana larvae by In vitro method

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NAAS, Republic of Korea

Honey bees Apis cerana Farbricius 1793 is one of nine species of sting bees in the world. In Korea A. cerana is native bees. Korean A. cerana is a gentle, less absconding and resistant to cold winter. Behavior of A. cerana is much different with Apis mellifera. In This study, we are introduced beekeeping techniques for A. cerana. And then, explain about in vitro larva rearing technique. An in vitro method to rear worker honey bee (A. mellifera) was applied to rear worker honey bee (A. cerana) larvae to the adult stage. Our study results demonstrate that honey bee larvae A. cerana could be reared in vitro. The onset of adult emergence started on day 17 from grafting.
Worker bee emergence peak on day 18 and declined thereafter. The average survival rate from larvae to pre-pupae stage was 74.6%. The average survival rates from pre-pupae to adult stage and from larvae to adult stage were 40.7 % and 30.4 % respectively.

BHP-044

Organic Compounds, Minerals and Vitamin C of Codonopsis (*Codonopsis lanceolata*) Honey Produced in Korea

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In order to use as a new functional food material, we analyzed the chemical components including the organic compounds, minerals and Vitamin C of codonopsis honey which was produced in South Korea. The condensed rate of methanol extraction in honey was 82.5% and main organic compounds that extract by organic solvents in GC-MS analysis were solaestin, acetidin, heminellitene, propyl carbinol, cicloesano, acetoxyethane, cyclopentane and so on. Also, main aromatic compounds that extract by organic solvents in SPME analysis were hydrazine, dimazin, carbamide, isourea, pseudourea, varioform, tropilidene and many more. As proximate composition, crude ash content was higher than manuka honey (0.24%) by 0.57%, and crude protein was higher than manuka honey(0.23%) by 0.36%, but crude fat was lower content than manuka honey(0.34%) by 0.11%. Free sugar that analyze by HPLC consisted of fructose 36.67%, glucose 27.26%, and total sugars was 63.93%. Minerals by ICP analysis were detected total 17 kinds, K 24.63ppm > Na 5.813ppm > Ca 3.708ppm > Mg 1.127ppm etc. Vitamin C was not detected and the antioxidation test result by DPPH free radical scavenge effect of codonopsis honey was lowered than manuka honey.

BHP-045

Organic Compounds, Minerals and Vitamin C of Hedysarum (*Astragalus membranaceus*) Honey Produced in Korea

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In order to use as a new functional food material, we analyzed the chemical components including the organic compounds, minerals and Vitamin C of hedysarum honey which was produced in South Korea. The condensed rate of methanol extraction in honey was 68% and main organic compounds that extract by organic solvents in GC-MS analysis were solaestin, hemellitol, heminellitene, propanoic acid, propyl carbinol, cyclopropanamine and so on. Also, main aromatic compounds that extract by organic solvents in SPME analysis were adilimoll, hydrazine, dimazin, carbamide, isourea, pseudourea, varioform and many more. As proximate composition, crude ash content was higher than manuka honey (0.24%) by 0.65%, and crude protein was higher than manuka honey (0.23%) by 0.28%, but crude fat was lower content than manuka honey (0.34%) by 0.06%. Free sugar that analyze by HPLC consisted of fructose 33.85%, glucose 26.99%, and total sugars was 60.84%. Minerals by ICP analysis were detected total 17 kinds, K 29.315ppm > Na 6.069ppm > Ca 3.702ppm > Mg 1.125ppm etc. Vitamin C was not detected and the antioxidation test result by DPPH free radical scavenge effect of hedysarum honey was lowered than manuka honey.

BHP-046 Resistance of *Varroa destructor* to apistan[®] and bayvarol[®]

Koumad Salima

ENSA, Morocco

Efficacy of Fluvalinate and Flumethrin molecules against Varroa destructor was evaluated in bee colonies in Central Algeria through field tests using Apistan, Bayvarol, we have used Apiguard[®] as an alternative treatment. The average efficacy was found to be in the order of 53% and 41%, respectively, far from the real therapeutic value of 99%, probably due to the resistance of Varroa mite populations to Pyrethroid treatment.

BHP-047

Finding new antibiotics through Actinobacteria and other bacteria isolated from soil samples

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We have selected the most effective15 strains through more than 2,000 colonies, isolated from soil samples at various areas in South Korea. Those can be effective growth inhibitors against Paenibacillus larvae as an agent of American Foulbrood and common microbial human pathogens such as Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Candida albicans and Aspergillus niger. On the basis of 16S rRNA gene sequence analysis, many were involved in genus Streptomyces, and 6 strains were possible new species, which might produce new antibiotic compounds. Through thin layer chromatography (TLC), the compounds included polar and non-polar ones, which will be purified and developed as various drugs for bee pathogens as well as human pathogens.

BHP-048 **Prevalence and infection intensity of Nosema in honey bee** (Apis mellifera L.) Colonies in Mongolia

Khaliunaa Tsevegmid, Selenge Dooshi

Nosema, among the most serious of the bee disease which is believed exist everywhere, however, relatively little is known about the distribution or prevalence of Nosema and its source in bees of Mongolia. To determine the prevalence and potential impact of this pathogen on honey bee colonies in the country, each 10 colonies were sampled from five apiaries. Samples were analyzed microscopically for Nosema spores. Local bees were rarely tested positive by nosema in spring and summer seasons, but most of (56%) just arrived (imported from abroad) bee colonies from more than 2000 km were heavily infected. The prevalence and mean levels of infection will be presented.

BHP-049

A tale of bees, their ectoparasite and vectored viruses

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When a pathogen requires its host to remain mobile to be spread to naïve hosts, selection should act against pathogens that immobilise their hosts too quickly. Thus, over evolutionary time, pathogens are predicted to become less virulent. Classic epidemiological theory predicts that virulence increases when pathogens are transmitted via a vector: pathogens can spread even when their presence debilitates the host. Implicit in these predictions is the presence of a trade-off between virulence and replication rate of pathogens; the faster pathogens replicate, the more severe the host effects. We investigate the effect of mode of transmission on evolution of virulence using RNA viruses of honeybees. Many bee viruses are vectored by the ectoparasitic mite Varroa destructor. Originally found on the Asian hive bee Apis cerana, Varroa jumped species to infect the Western honeybee A. mellifera sometime in the 1980s and is now present on all beekeeping continents apart from Australia. A range of positive-sense single-strand RNA viruses of the Dicistroviridae and Iflaviridae families present covert infections in Varroa-naïve colonies of honeybees, with occasional seasonal outbreaks. The introduction of Varroa sees a marked increase in viral titre, a decrease in viral diversity, and colonies in collapse. We use an experimental evolution approach to tease apart the roles of mode of transmission, the vector itself, and differences in bee responses to viral infections in the evolution of virulence of RNA viruses. We performed serial transmission experiments, determined if viral titres increased and tested the virulence of evolved viruses on adult Varroa-naïve bees.

BHP-050

Development of rapid detection methods of Korean sacbrood virus

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Sacbrood virus (SBV) is one of the most serious honeybee viruses. The virus causes failure to pupate and death in both larvae and adult bees. Recently, Korean Sacbrood virus (KSBV) caused a great loss in Korean honeybee (Apis cerana) colonies. Although KSBV shows high homology with SBV strains, it has unique motifs and causes different symptoms. Therefore, a simple, sensitive and specific method for detecting KSBV is needed urgently. In this study a reverse transcription loop-mediated isothermal amplification (RT-LAMP) and a novel micro PCR-based detection method, termed ultra-rapid real-time PCR (URRT-PCR) were applied for rapid detection for korean sacbrood virus (KSBV) from honeybees (Apis cerana) infected with SBV in Korea. The LAMP could be detect the virus in RT-LAMP reactions containing 102copies of pBX-KSBV within 30 min, which was 10 times more sensitive than a RT-PCR assay. The URRT-PCR showed high sensitivities which were able to detect 10 copies in the standard assays. In the application of URRT-PCR detection to a KSBV-infected honeybee, the shortest detection time was 10 min 12 sec, including reverse transcription. In addition, these methods could be distinguished between KSBV and other closely- related SBV strains. These rapid methods were rapid molecular-based diagnostic tools and useful tool for the rapid and sensitive diagnosis of KSBV infection of honeybees.

BHP-051

Control of Korean Sacbrood Virus using RNA Interference in *Apis cerana*

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Sacbrood virus (SBV), a causative pathogen of larval death in honeybees, is one of the most devastating diseases in bee industry throughout the world. Since 2010, the Korean Sacbrood virus (KSBV) caused great losses in Korean honeybee (Apis cerana) colonies. However, there is no treatment method culture for honeybee viruses including SBV. RNA interference (RNAi) is a gene- silencing technology by which small double-stranded RNAs are used to target the degradation of RNA with complementary sequence. In this study, we report on prevention of SBV infection by feeding with double-stranded RNA. SBV sequences corresponding to a segment of structural protein VP1 gene for dsVP1 and a segment of the structural polyprotein open reading frame for dsSBV1 were used for cloning. dsRNA synthesis was carried out according to the protocol of the mMESSAGE mMACHINE T7 kit, it was treated with food. The feeding activity and mortality of larvae were observed every day. Experiments were carried out to examine whether ingestion of dsRNAs of SBV sequences would protect bees from SBV infection. The result indicated that two SBV-derived dsRNAs (dsSBV1 and dsVP1) protected bee larvae from subsequent SBV infection. dsRNA of SBV will be used as an efficient and feasible way of controlling bee viral disease aw well as SBV.

Expression and purification of SBV antigen for rapid diagnostic method using Immunochromatography assay

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Sacbrood virus (SBV), a causative agent of larval death in honeybees, is one of the most devastating diseases in bee industry throughout the world. Lately the Korean Sacbrood virus (KSBV) induced great losses in Korean honeybee (Apis cerana) colonies. However, the research on Korean Sacbrood virus is practically limited until present. In this study, we investigated the expression and purification of SBV structural protein from Apis cerana for rapid diagnostic method using Immunochromatography assay. The VP1(1,023 bp), VP2 (948 bp), VP3 (1,068 bp) of SBV from Apis cerana was obtained by RT-PCR. Amplified VP1, VP2, VP2 were constructed into expression vector pET21a by BamHI and XhoI site. Recombinant VP1, VP2, VP2 were successfully over-expressed in E.coli system and purified by FPLC. This purified recombinant VP1, VP2, VP2 will be used for the generation of monoclonal antibody to develop a diagnosis tool for SBV infection in honeybee.

BHP-053

Survey on Honeybee Disease in *Apis mellifera* and *Apis cerana* in Korean apiaries, 2014

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The honeybee is a major pollinator of crops. The main species present in Korea are the European honeybee, A. mellifera, and the Asian honeybee. A. cerana. The occurrence and distribution of twelve bee diseases was investigated in A.mellifera and A.cerana in Korea using PCR diagnostic method: american foulbrood (AFB), european foulbrood (EFB), chalkbrood, stonebrood, nosema, sacbrood virus (SBV), acute bee paralysis virus (ABPV), deformed wing virus (DWV), black queen cell virus (BQCV), kashmir bee virus (KBV), chronic bee paralysis virus (CBPV) and Israeli acute paralysis virus (IAPV). Samples were collected from 412 apiaries located in 10 different regions of the country in 2014. BQCV was the most prevalent (identified in 46.32% of samples), follo wed by stonebrood(37.05%), sacbrood(23.99%), Nosema(16.15%), DWV(15.20%), AFB(10.93%), IAPV(8.31%), chalkbrood(4.51%), EFB(4.28%), KBV(2.14%) in honey bee samples(adult bee, larvae and comb), respectively.

BHP-054

Development of a multiplex PCR for rapid diagnosis of viral honey bee disease in Korea

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According to investigated during the last decade, Virus infections of the honeybee(Apis mellifera) have been increased. In general, honeybee viruses are widespread and most of them continue as inapparent infections. We screened honeybee colonies for the existence of several bee viruses, including sacbrood virus(SBV), black queen cell virus(BQCV), Kashmir bee virus(KBV), Deformed wing virus(DWV), Israeli acute paralysis virus(IAPV) and Acute bee paralysis virus(ABPV), using single target RT- PCR. Frequently simultaneous infections with several viruses are diagnosed in seemingly healthy bee colonies. Therefore, we developed a multiplex RT-PCR strategy for the simultaneous detection of six bee viruses. The aim of this study was to establish a multiplex polymerase chain reaction strategy for rapid simultaneous detection of the honeybee viruses commonly infected in Korea. The multiplex RT-PCR strategy would be useful for the observation of honeybee viral diseases in the field. Bee samples used for virus screening were collected from all over the country. Viral RNA was extracted using viral gene-spin viral DNA/RNA extraction kit(Intron). Specific primer for SBV, BQCV, KBV, DWV, IAPV and ABPV were designed based on the published nucleotide sequences. To screening for virus infection in honeybee colonies, brood were tested for the presence of honeybee viruses separately by the uniplex RT-PCR. uniplex PCR assay was performed using Top simple DryMix PCR kit(Enzynomics). Multiplex PCR assay was performed using 2X Master/MultiMAX PCR Kit (Intron). The PCR Products were electrophoresed in 1.5% agarose gel, stained with ethidium bromide, and visualized under UV light. It was cloned in Escherichia coli pGEM-T Easy vector (Promega). The use of broad-range primers enable us to detect a maximum of viral variants ideal to declare honeybee colonies virus. The SBV, BQCV, KBV, DWV, IAPV and ABPV primer sets, when used together in the multiplex reaction, amplified only specific products of the expected sizes of 192, 317, 413, 479,725,900bp, respectively, which could be easily distinguished by agarose gel electrophoresis. And viral clones were used as positive controls in field sample tests. And sequences of each band were confirmed. The main objective of this study was to develop a tool that detects the variants of bee viral species infecting honeybee. We expect to apply of a multiplex RT-PCR assay for offers a significant time and cost-saving advantage, especially when a lot of samples are analyzed.

BHP-055

Artificial infection of Honeybee larvae with Sacbrood virus for virus propagation

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Virus infections of the honeybee (Apis cerana) have been increasingly investigated during the last decade. In general, honeybee viruses are widespread and most of them persist as inapparent infections. Sacbrood disease characterized by brood that fails to pupate and subsequently dies, is an important threat honeybee health. The disease is caused by the sacbrood virus (SBV). We were artificially infected SBV in larvae by feeding SBV suspension. In this study, The honeybee larvae were transferred to 24 well cell culture plate and fed basic diet(6% glucose, 6% fructose, yeast extract, 50% royal jelly) and incubated at 35, high humidity(80%). The larvae were artificially infected with Sacbrood virus by feeding SBV suspension with basic diet. After 8 days, infected larvae were ground with GTNE buffer then, centrifuged for remove debris except virus. And supernatant filtered using 0.45m, 0.22 m filters. In order to purify SBV, we were proceeded Sucrose density gradient centrifugation. virus band was observed at 40%-50% sucrose-TNE gradients and harvested SBV then, scanning Transmission electron microscopy(TEM).a real-time PCR assay was performed using honeybee larvae RNA. In order to obtain the RNA of larvae artificially infected with SBV, infected larvae were Crushed up and RNA extracted using a viral genespine viral DNA/RNA extraction kit(Intron) from The homogenate. real-time PCR quantitative PCR amplification was performed in 20l reaction Mixture using One Step SYBR PrimeScript RT-PCR Kit (TaKaRa) and 10pmol of each specific primer. We confirmed the Sacbrood virus in larvae that were infected SBV by feeding SBV suspension, from scanning TEM image and Real-time PCR results. TEM image of larvae homogenate shows picorna like virus that have 27.8±0.4 nm size. And Real-time PCR result shows as infection period goes by, number of sacbrood virus increased in infected larvae. Feeding method is more safety and give less stress to larvae during experiment. artificial infection method is important In order to discover infection mechanism of SBV in honeybee larva and development therapeutic agent for against sacbrood disease. And Feeding virus method make possible obtain increased sacbrood virus.

BHP-056

Homology between complete Korean Sacbrood viruse genomes in *Apis cerana* and *Apis mellifera*

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Sacbrood virus (SBV) is one of the most destructive honeybee viruses in the world. The virus causes failure to pupate and death in both larvae and adult honeybees. In this study, three complete Korean SBV genome sequences of KSBV1 from A. mellifera, KSBV2 and KSBV3 from A. cerana were isolated from different regions of Korea. These three Korean complete genome sequences were determined and aligned with seven previously reported complete SBV genome sequences from various countries and phylogenetic tree was constructed. The KSBV1 shared 90% similarity with KSBV2 and KSBV3; and KSB2 shared 97% similarity with KSBV3 genotype. These three Korean KSBVs showed 89–97% similarity with different country genotypes. In the phylogenetic tree KSBV1 diverged and formed a separate branch from the KSBV2 and KSBV3 genotypes. Interestingly, KSBV2 and KSBV3 genotypes continuously were missing 51 nucleotides in poly protein region, between 2297 and 2347 (present in KSBV1). The differences in the KSBV2 and KSBV3 strains may be the cause for mutations or virus adapting to a different host.

BHP-057 Complete SBV genome isolation and comparison from A. *cerana* and A. *mellifera* in Vietnam

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Sacbrood virus (SBV) is one of the most severe threats to the health of Apis cerana and A. mellifera. SBV which infects the Vietnam honeybee was named as a Vietnami sacbrood virus (VSBV). From few years, the honey yield had been reduced up to 40-80%, due to cause by VSBV. In the present study, we have isolated six complete genome sequences of SBV from Vietnam and compared the genetic relationships and variations among them. Adult and larva samples of A. cerana and A. mellifera were collected from different provinces of North and South Vietnam. Fifteen sets of primers were used to amplify overlapping PCR products. The amplified products were purified and sequenced then each sequence fragment was compiled and aligned to build a continuous complete genome sequence using BioEdit version 7.0.9.0 based on the Korean SBV sequence as a reference. We have isolated six complete Vietnam SBV genome sequences: AcSBV-Viet1, AcSBV-Viet2, AcSBV-Viet3, AmSBV-Viet4, AcSBV- Viet5 and AmSBV-Viet6. Vietnam SBV genotypes shared 92-99% identity with each other and shared 89-94% similarity with other countries and form a separate clustered with various country genotypes. AmSBV-Viet6 showed geographically separated with other Vietnam genotypes. In the ORF region showed more variations among the genotypes. In the VP1 region AmSBV- Viet6 genotype contains 17 aminoacids more than other Vietnam genotypes and similar with European genotypes. This may cause for geographical variations or virus adapting to a different host.

BHP-058

Nosema Disease in Korea: A. mellifera and, A. cerana

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Nosema disease was found on both Korean native bee *Apis cerana* and exotic honey bee *Apis mellifera*. The samples of both honeybee species were collected from March to May, 2014 at the A. cerana and A. mellifera apiaries of NAAS, Suwon, and republic of Korea. The presence of Nosema spores was checked and the infection rate of colony was calculated. We found out Nosema spores on both A. cerana and A. mellifera colonies in all sampled months. The average number of spores per bee on A. cerana colonies in March (3,598,500 spores) and May (3,071,429 spores) is significantly higher than those of A. mellifera in March (607,800 spores) and May (642,133 spores). The infection rate of colony of A. cerana in March (31.1%), April (12.0%) and May (31.1%) is also higher in compared to of those on A. mellifera in March (4.0%), April (5.6%) and May (5.0%).

Develpment of control method in American foulbrood disease (AFB), stonebrood, and chalkbrood by using actinobacterial Culture

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The most famous microbial honeybee diseases are American foulbrood disease (AFB), chalkbrood and stonebrood caused by *Paenibacillus larvae*, *Aspergillus flavus* and *Ascophaera apis*, respectively. To control these disease, we developed a modified cultivation method to find new antibacterial strains in various soil samples, which may be effective growth inhibitor against bee pathogens. We isolated more than 2,000 actinobacterial strains and screened them to find antibacterial and antifungal activity against P. larvae, A. flavus and A. *apis* by inhibition zone measurement. As a result, we found the most effective 5 actinobacterial strains against P. larvae, 5 strains against A. flavus and 7 strains against A. *apis*. Therefore, this study may play a critical role to control AFB, chalkbrood and stonebrood of honeybee by using the culture of effective strains in the near future.

PBP-001

Detection of *Nosema ceranae* spores in bee pollen of exotic honeybee of Thailand

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Nosema ceranae has caused sharp declining of colony population of honeybees in many countries. We detected spores in 27 samples of commercial products of bee pollens of Apis mellifera from three different regions of Thailand. We found that number of spores per milligram pollen from different regions were significantly different (F2= 6.34, p=0.0028). The highest contamination was found in bee pollen from Northern Thailand which was $15.42\pm 8.48\times106$ spores/g pollen while it was lowest in that of Southern area, 6.6×105 spores/g pollen. Identification of contaminated bee flora using morphological structure revealed *Camellia sinensis* and *Hevea brasiliensis* (A. Juss) Muell. Arg were main bee plants from all studied samples.

PBP-002

Using bee attractants to improve honeybee foraging on Dangshan pear (Pyrus communis L.)

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The fruit set rate and yield of pear are commonly low due to insufficient pollination, as the species is unattractive to honeybees. To improve honeybee foraging behavior for the pollination of Dangshan pear (Pyrus bretschneideri cv. Dangshansuli), nine methods were used to attract bees. A control treatment of colonies was fed with normal sugar syrup, while six other treatments were fed using sugar syrup mixed with Pear syrup, Gallic acid, Arginine (Arg), Lysine (Lys), Methionine (Met), or 8- Br-cGMP; plates containing Juvenile Hormone analog ZR-512, Brood gland pheromone (BP), and Queen Mandibular Gland Pheromone (QMP) were placed inside the hives of another three treatments. Pollination efficacy was compared using the pollen load weight and quantity of foraging bees. The peak time of pear pollen gathering was 10:00–11:00 regardless of treatment. The pear pollen load weight per day was increased by all nine treatments. Pear pollen load weight per day was 49.11 g in the control. The QMP treatment yielded the heaviest pear pollen load weight per day (77.56 g), followed by the 8-Br-cGMP (64.45 g) and BP treatments (64.20 g). The percentages of pear pollen weight and quantity in the total pollen per day were both highest in the BP treatment (80.23%, 87.27%), followed by those in the QMP (79.32%, 86.74%) and Lys treatments (76.25%, 85.81%). In conclusion, BP was the most effective treatment for improving honeybee pollination behavior in the pear orchard, while other treatments, including Arg, Lys, 8-Br-cGMP, ZR-512, and QMP, could also be useful.

Nectar and pollen sources for honey bee colonies in Egypt

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There are various plants with potential feeding importance to honey bee, Apis mellifera, colonies as source of pollen, nectar or both. Selection of suitable regions for apiaries mainly depends on the avilability of honey bee plants in the apiary region. Identifying honey bee plants in specific region is very essential for honey and pollen production from honey bee colonies. Lacking the information about the beneficial plants for honey bees including; plant name, flowering time and potential benefit to honey bee colonies could be considered as a limitation for beekeeping development. So far honey bee plants are not well studied in Egypt. This paper presents potential nectar and pollen sources for honey bee colonies in Egypt using the available publications. This work can be considered as a guide for beekeepers and researchers. Moreover, the presented plants can be used in comparing honey bee plants of Egypt with other countries to get a better understanding of honey bee flora.

PBP-004

Foraging activity of indigenous and exotic honeybees, *Apis mellifera* L., on *Ziziphus nummularia* (Burm. F.) Wight & Arn) under stress of hot-dry environment

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Ziziphus species are very important multipurpose plants in Saudi Arabia as well as in the Arabian Peninsula. Ziziphus honey is one of the most valuable and preferable honeys in this region. In this work two honeybee races, i.e. indigenous Apis mellifera jemenitica and exotic A. m. carnica were subjected for studying their foraging activity in hot-dry environment during summer (June – July) and autumn (August – October) of 2014. Those seasons synchronize minor and major flowering periods of wild jujube, Ziziphus nummularia, respectively. Experiments were conducted at Rawdhat-Khoraim region, an oasis (21.0×1.5 km), 120 km north-east Riyadh, Saudi Arabia (between $25^{\circ}30^{\circ}$ - $25^{"}$ N and $47^{\circ}46^{\circ}$ - $30^{"}$ E at 558 m above sea level). Field observations indicated that workers of A. m. jemenitica and A. m. carnica started foraging in the early morning with a peak in the sunrise period (average 121 ± 9.00 workers /colony /3 minutes). The highest rate of bees collecting nectar was observed in the sunrise (averaged 2.52 ± 0.61 worker /100 flower /3 minutes). Also, workers returning to their hives loaded with pollen peaked in the sunrise (average 44 ± 5.00 workers / colony / 3 minutes). Significant differences (p0.05) were found in the foraging activities between both bee races and also between daytimes (sunrise, forenoon, noon, afternoon and sunset) and during the flowering periods.

PBP-005

Tests of color preference of two Asian honey bee species

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Despite their economic and ecological importance little is known about the color preference of honeybee species. We investiga ted color preferences of two honey bee species, native to Thailand (Apis cerana and A. florea) under natural conditions. We tested seven colonies of each species for preferences for four flower colors of Portulaca grandiflora (yellow, orange, magenta and white). Apis florea foragers exhibited a clear preference for yellow colored flowers (p < 0.0001, n=171), whereas A. cerana foragers showed no color preference for any test color. Moreover, few bees from two colonies visited the color test flowers. Discrimination of different test color showed slightly preference for yellow and orange flowers compared to those of magenta and white flowers (p = 0.74, n=17). This indicates a potential for discrimination of color of this species which has not been proved yet. For further investigation, we will carry on the experiment in European honeybee, A. melifera for more understanding of flower color discrimination in honeybees.

PBP-006

Melissopalynological Studies from Oman

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A melissopalynological study of Omani honeys was undertaken to determine floral sources, and identify pollen types, that would indicate the ecological origins. The study comprised the analysis of 48 honey samples collected from 14 locations in the Muscat and Al Batinah regions of Oman. The beehives and nests examined were either those of Apis florea or Apis mellifera bee colonies. A total of 122 pollen types, representing 50 plant families, were identified. Each taxon was categorized as representing a major or minor source of nectar and pollen. Thirty-two honey samples are unifloral types, and the remaining 16 are multifloral. Honey is harvested twice a year in Oman, once in the summer and again in the winter. The pollen data indicate that Ziziphus spina-christi, Prosopis juliflora, Prosopis cineraria and constitute the chief nectar and pollen sources for honeybees in this area during the winter. By contrast during the summer, Acacia tortilis, Citrus sp., Maerua crassifolia, Phoenix dactylifera, Prosopis cineraria and Prosopis juliflora are the more important nectar sources. This study has identified a wide range of foraging plant sources for honeybees and demonstrates adequate potential for expanding and sustaining beekeeping in Muscat, and in the Al Batinah region. A modern pollen reference collection of 105 local floral species enabled the identification of the pollen types. Seventy-four pollen types were found in the 48 honey samples. The identifications of pollen types are based on both light and scanning electron microscope (SEM) studies of the pollen in the honey and reference samples.

PBP-007

Mineral content in unifloral pollen samples collected from different plant species

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Honey-bee collected pollen is considered as an important source of essential substances such as proteins, vitamins, amino acids, phenolics, lipids and minerals, required for bees' nutrition and human consumption. However, the pollen species differ from each other and no one has the same standard chemical composition. In this study we determined the mineral composition (P, K, Ca, Na, Cu, Mg, Mn, Fe, Zn) of honeybee-collected pollen from various botanical and geographical origins of Greece. Results from 31 pollen species showed a predominance of K (41.6 %) and P (30.7 %), followed by Ca (16.5 %), Mg (6.9 %) and Na (2.1%). The remaining micro-nutrients (Fe, Zn, Mn, Cu) accounted for 2.2 % of the total mineral content. Among the tested elements, the most considerable variation was observed for P, Mg, K and Ca. The pollen of Crocus sativus presented an extremely high concentration of Ca (8724 mg/Kg) and Fe (3253 mg/Kg), Phacelia tanacetifolia the highest concentration of P (9210 mg/Kg), while the pollen of Erica manipuliflora contained the highest concentration of Mg (2278 mg/Kg) and K (11604 mg/Kg). The mineral composition of pollen is dependent also on the growing conditions (soil, environmental conditions) of the respective plant. In order to examine the affect of the geographical origin, the pollen of Sinapis sp. and Cistus sp. was collected from different areas, where a large variation of K and Ca was found in both species. These differences could be attributed to the characteristic geomorphology of Greece.

PBP-008

The effect of pollination on fruit quality in apple

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The study conducted in Ordu ecological conditions . The nut weevil (Curculio nucum L) with the fighting in the region of the inner nut and honey bees period coincided apples blooming period in order to avoid damaging chemicals outside the region. Observations and assessments made previously disqualified dusting apple fruits as related disorder was a significant level of shape. For this purpose, during the 2013 harvest year, and an estimated age of 25 years yield economic Sinap cv apples picked from a tree and a tree full of fruit harvested on the agents . Total Amount of harvested fruit were determined as 82.5 kg, % 6 of this amount (5kg) extra, 24 % (20 kg) class 1 and 70 % (57.5 kg) 2nd class (shape, small size, rotten) as detection agents. The average fruit weight maintenance Weight 101.36 g of apples with extra class, 1st class and 2nd grade apples apples 91.86 g is found to be 46.38 g. In general, there was the formation of core enough apples or 2nd year core rudimentary level, this class is garbled shape apples, fruits enough not growth, there is no market value is determined. Key Words: apple, Snap apple, polinasyon, fruit quality, poor pollination

Determination of adaptation capacity of commercial *Bombus terrestris* l. colonies to native ecosystems

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Colony development of laboratory reared Bombus terrestris colonies which transferred to field in the early stage of the life cycle were observed. Founder queens of these colonies were obtained from commercial colonies. When the colonies reached to about ten workers population, they were placed to field where include some important bee plant such as Onobrychis sativa, Snapis spp., Lamium spp. and Prunus spp. Colonies were not supplied with sugar syrup or pollen and were checked weekly. First male and young queen observing time, competition point and total number of produced individuals were noted during the observation. The times of first male and young queen emerging after the queens put into starting boxes were determined 85.00 ± 3.21 and 62.33 ± 2.67 days, respectively. Switch point was determined 16.00 ± 3.70 days, while competition point was 40.50 ± 1.32 days in social phase. Colonies produced 55.70 ± 9.78 workers, 39.50 ± 14.20 males and 9.67 ± 5.93 young queens at the end of their life. It is also observed that colonies stored pollen near the brood area. Results showed that commercial B. terrestris colonies can survive and produce sexes in the native ecological conditions.

PBP-010

Bee flora for migratory beekeeping and honey production in Bangladesh form *Apis mellifera* L.

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A survey was conducted in three different locations viz. Gazipur, Tangail and Satkhira during the year 2010-2012 to find out major bee flora for migratory beekeeping and honey production from these resources. Twenty three number of plants/trees/crops were recorded as major resources for honey production by Apis mellifera L. Among them 12 number produced food directly for the consumption of people. Eleven numbers were forest tree and one was green manuring crop. All of them produce nectar from their flowers except the rubber tree. This plant is first reported as an extra floral honey source for A. mellifera L. in Bangladesh. The highest (19.74kg/hive) quantity of honey comes from the litchi season utilizing A. mellifera (10 frames/hive). Results also indicated that 13.16kg of honey was produced by a single hive from mustard flower. On the other hand, 10.96kg/hive of honey was harvested from Sundarban flora. In total the highest quantity of honey production (847.06t) was obtained from litchi which was followed by mustard (564.71t) and Sundarban flora (470.30t).

Foraging activity of commercial *Bombus terrestris* L. and *Apis mellifera* L. colonies on some cultivars of *Carthamus tinctorius* L. in caged conditions

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Foraging activities of commercial Bombus terrestris L. and Apis mellifera L. colonies were investigated on four different cultivars of Carthamus tinctorius L. (safflower) which are known as "Balc", "Remzibey", "Dincer" and "Linans". The treatment field was located in Ankara, Turkey (39° 52'05.93" N; 032°43'47.94" E, 1042 mt). Three 100 m² fields were prepared for sowing and in each of them were sown on 22.03.2014. Before the blooming period of the plant starts, the fields were caged with teflon net and ~270 m³ cages were prepared. In the first and second cages, there was only one commercial Bombus terrestris L. and Apis mellifera L. colonies. The blooming period had started on 08.07.2014 and finished on 20.07.2014. Starting from 07:00, 09:00, 11:00, 14:00, 16:00, 18:00, foraging activity of the bees was investigated six times a day between 09.07.2014 and 19.07.2014.

PBP-012 Melissopalynological, physical and chemical analysis of Aardahan honey

Kadrye Sorkun

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According to the statistics done between the years 2010-2011, based on the list of 304 beekeepers, registered in the Ardahan Beekeepers' Association in Ardahan province and its districts, 76 pieces honey samples collected that form the study material. In this study, melitopalynological analyses and physicochemical analyses were used to determine the quality of honey samples collected from Ardahan province and whether they are adulterated or not. In the melitopalynological analyses, the source of pollens and the total number of pollens, the source of the starch in honey and the rate of percentage and the microscopic particles that should not be in honey were examined. In the physicochemical parameters, the percentages of ash content, its electrical conductivity and humidity were determined. In addition, by using High Performance Liquid Chromatography (HPLC) fructose/glucose ratio and invert sugar (fructose + glucose) were analyzed in honey samples. Based on the results of melitopalynological analyses, it was determined that the Total Pollen Number (TPS-10) in ten grams of honey. Total Polen Number varies from 3763 to 594220, and the average number was 21428. As a result of the analysis of pollen in honey samples in all districts Fabaceae and Boraginaceae families were found to be dominant. While all of the honey samples include starch from pollen sources, 25 % of the starch is the alloyed starch from outside.

Melissopalynological and chemical analysis of Azerbaijan Ganja-Gazakh region honeys

Kadrye Sorkun, Duygu Nur Çobanolu

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The aim of the study was to investigate the quality of Azerbaijan honeys using melissopalynological, physicochemical analyses for the first time. For this purpose, 23 honey samples were collected during the harvesting period in 2014 from 8 different rayons in Azerbaijan Ganja-Gazakh Region. Melissopalynological analysis included the total number of pollens in 10 gr honey (TPS-10) and the source of the starch in honey. Physicochemical analysis included the identification of chemical compounds performed by gas chromatography/mass spectroscopy (GC-MS), the quantification of fructose, glucose and sucrose and hdroxymethyl furfural by high performance/liquid chromatography (HPLC) and the determination of conventional quality parameters such as electrical conductivity, ash, humidity. 10 honey samples fall within the "normal" category (20 000-100 000 pollen grains). 12 honey samples had a pollen content less than 20 000 grains and 1 honeys' pollen content exceeded 100 000 grains. Starch granules of 17 honey samples were the alloyed starch granules from the outside and were not seen in 6 honey samples. Moisture, ash content, electrical conductivity and HMF content of the samples had average values of $16.00\pm1.01\%$, $0.13\pm0.1g/100$ gr $0.37\pm0.17\mu$ s/cm and $0.38\pm0,24$ mg/kg respectively. Fructose content gave an average of 40.12 ± 2.96 g/100 g, while glucose content had a mean value of $33.26 \pm 4.42g/100$ g. The sucrose content of the honey samples had a mean value of 1.3 ± 0.98 g/100 g. A total of 268 different chemical substances were determined by GC-MS analysis.

PBP-014

Melissopalynological, physical and chemical analysis of Ardahan honey

Kadrye Sorkun, Fatma Güzel

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According to the statistics done between the years 2010-2011, based on the list of 304 beekeepers, registered in the Ardahan Beekeepers' Association in Ardahan province and its districts, 76 pieces honey samples collected that form the study material. In this study, melitopalynological analyses and physicochemical analyses were used to determine the quality of honey samples collected from Ardahan province and whether they are adulterated or not. In the melitopalynological analyses, the source of pollens and the total number of pollens, the source of the starch in honey and the rate of percentage and the microscopic particles that should not be in honey were examined. In the physicochemical parameters, the percentages of ash content, its electrical conductivity and humidity were determined. In addition, by using High Performance Liquid Chromatography (HPLC) fructose/glucose ratio and invert sugar (fructose + glucose) were analyzed in honey samples. Based on the results of melitopalynological analyses, it was determined that the Total Pollen Number (TPS-10) in ten grams of honey. Total Polen Number varies from 3763 to 594220, and the average number was 21428. As a result of the analysis of pollen in honey samples in all districts Fabaceae and Boraginaceae families were found to be dominant. While all of the honey samples include starch from pollen sources, 25 % of the starch is the alloyed starch from outside.

Schematic analysis of selection category of climate change indicator species of insect including pollinators

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Monitoring communities of climate sensitive species, such as insects, could enable scientists to develop indicators for climate change effects on biodiversity and help devise policies to protect it. Insects are good climate indicators as their development depends on temperature. From the monitoring data, community index such as community temperature index could provide some trend of changes, but not with clear biological correlation. Thus the indicator species are sought. In Korea, several different administration agencies provided the list of climate change indicator species. We analyzed those lists based on the taxonomic group, distribution characteristics, lifehistory traits, overwintering phenology as well as easiness of monitoring, taxonomy and handing, and its flagship values. Further implementations of the finding were discussed.

Miniinventary of some Hymenoptera insects in a northern region of Tunisia

Haifa Boudegga¹, Imen Rejiba², Mohamed Ammar³ ¹ ISA CM- Tunisia ² ISA-CH-tunisia ³ INAT-Tunisia

Natural environment is used as a repere where the diversity and abundance are optimal, to diagnose the farmlands and semi- natural environment. In the order of Hymenioptera, a total of 36 genus were distinguished. in the suborder of Apocrita, we found three superfamilia: Vespoidea (fam:Scoliidae), Ichneumonoidea (fam:Broconidae and Ichneumonidae) and Apoidea. The analysis of the components of the landscape aims to understand the spatial conditions for the installation of flower-feeding insects and to understand which components are responsible of their diversity.

PBP-017

The critical role of bees in eco-farming systems

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Ecofarming or eco-agricultural systems attempt to solve the age-old problem of unsustainable farming that leads to the destruction of the ecosystem and the environment. The ecologically unfriendly farming practices lead in its wake the creation of "weeds" and "pests"; that make agricultural products very expensive and out of the reach of many consumers. The use of expensive agrochemicals for improving productions lead to the destruction of the environment and negatively affect the health of humans. Ecofarming will seek to harness the natural attraction of herbivores to plant and plant defenses to herbivory in a sustained ecosystem management farming practice. Since Ecofarming promote the natural ecological balance, the role of bees as pollinators will be crucial. The study will seek to find out which management practice will better ensure high productivity of Ecofarming: allowing the foraging of wild bees in the natural setting, or a conscious effort to manage bees by beekeepers in the farming landscapes to ensure effective pollination of crops.

PBP-018

Comparison of pollinating effects of *B. terrestris* using 2 kinds of pollen dispenser on kiwi flower in vinyl-house condition

In Gyun Park, Hae Chul Park, Seong Hyun Kim, Mi Ae Kim

To substitute for artificial pollination which is being used for pollination commonly recently in kiwi fruit, and improve the pollinating effect of kiwi fruit which is also being increased as high value added crop recently in Jeju island and south provinces of korea, 2 kinds of pollen dispenser, hand made pollen dispenser and Flying doctor® made by Biobest, designed for bumblebee hive were used in analyzing and surveying of foraging activities on kiwi fruit in Sacheon province. This study was conducted using only 1 species of pollinator, Bombus terrestris in vinyl-house condition. Species of kiwi fruit, red kiwi was used in this experiment. A number of out-going activity of Bombus terrestris released from hand made pollen disperser showed peak in AM, but Flying doctor showed peak from 11 AM to 13. PM. Pollinating ratio of Bombus terrestris was shown 100% in case of hand made pollen dispenser, but showed only 66% in Flying doctor. This results suggest that Flying doctor has so long and dark pathway that many bees can't find the last exit in order to fly out for foraging to the flower of kiwi fruit. The first results of fruit set ratio showed 89% in artificial pollination and 84% in hand made pollen dispenser respectively, but showed 65% in Flying doctor. This result also suggest that dark and long lane of Flying doctor needs to be improved for bees to move easily to the last exit and fly out to the kiwi flower.

PBP-019

Effects of diet and carbon dioxide treatment on oviposition and development of bumblebees, *Bombus ignitus*, *B. ardens* and *B. terrestris*

In Gyun Park, Hae Chul Park, Seong Hyun Kim

The characteristics of oviposition and development of B. ignitus with sugar solution are more effective than with acacia honey and mixed honey in case of oviposition rate and days for first oviposition. Oviposition rate of B. ignitus reared with Actinidia arguta pollen is highest with 35.0% and also higher than another pollen sources. Days required for first emergence of B. ignitus worker with sugar solutionis shortest. In the case of queen, sugar solution and mixed honey are shorter than another sugar sources. 90% of B. ignitus queens reared with 40% concentration of sugar solution laid eggs and 70% of the queens laid eggs within 20 days after mating. Sugar solution is more effective in oviposition ratio and preoviposition periods than Koppert honey(imported from Netherlands) and mixed honey. Survival rate and longevity of B. ignitus just after cold preservation being not treated with CO2 show higher values with 36.7%, 79.2days respectively than the other treatment.

PBP-020

The insect pollinators of *Cypripedium japonicum* Thunb., the endangered orchid in South Korea

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Insect pollinators of the endanger orchid Cypripedium japonicum were surveyed during two years, as a part of a conservation project of the orchid at Jukyeup-san and Hwaak-san (Mt.), South Korea. In total 16 species in 4 families were identified and a dominant family was Halictidae. Among them Lasioglossum exiliceps Vachal was the most frequently visited species during the surveys. The average visiting frequency was 2.5 individuals per hour and the highest 4.3 from 12:00 - 13:00 in a day. After 15:00 insects did not visit the flowers at all. However, all of the visiting insects did not carry a pollinium or pollens of the orchard on their thorax; pollen carryover did not occur at all. The orchid seems to require certain pollinator species in particular body thickness due to its unique pollination mechanism. It was inferred that a pollen carrier should be around 1 cm in body thickness. Therefore, the candidate species as the proper pollen carriers might be Tetralonia nipponensis Perez, Xylocopa appendiculata circumvolans Smith and Bombus consobrinus Dahlbom among the surveyed visitors. To confirm this, we carried out an experiment for pollen carryover using Bombus terrestris, well over 1 cm in body thickness. We confirmed that B. terrestris successfully carried a pollen mass thinly spreaded on the dorsal surface of the thorax upon escaping from the orchid. Thus, we suggest that Bombus species can be used as pollinators suitable for a conservation project of *C. japonicum*.

PBP-021

Biovariety of nectariferous flora and productivity of movable pavilion apiary

Anatoliy Skvorcov¹, Ivan Madebeykin²

During bee-keeper's seasons 2012-2014 research in different terms of collection of honey in Chuvashia was conducted. Pavilion 2 with 20 bee families transported Yadrin district and pavilion 1 with the same it was left the number of families of permanent establishment. To beginning of transportation bee families of both pavilions

were evened on principle of Parapalogov. Counts showed that in the radius of productive flight of bees of pavilion 1 grew 65 types of nectariferous herbs and pavilion 2 -172. As researches showed bee families of pavilion 2 collected commodity honey on 16,7 kg or on 185,6 % more than families of pavilion 1. Productivity of propolis difference of indicators were better – almost thrice. Bees of first pavilion got the infection from tick of Varroa Yacobsoni in 1.6 (or on 62,5 %) more than of bees second. It all goes to show that only at rich specific biovariety of nectariferous flora bee families are healthy and bee families can take the high crop of honey and propolis.

PBP-022

A review of diversity of insect pollinators in Korea

Sei-Woong Choi¹, Chuleui Jung²

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We reviewed insect pollinators visiting fruits and flowers in different orchards across Korea. The literatures published from 1986 to 2013 were checked and summarized. A total of 415 species in 115 families of 7 orders were recorded to serve as pollinators in 43 different fruits and flowers in orchards and wild field. The most diverse insect pollinators was the species of Hymenoptera (373 records), followed by Diptera (219 records), Coleoptera (111 records) and Lepidoptera (97 records). Among the plants, most pollinators were observed as visiting major fruits such as apple (290 records), pear (109 records), peach (81 records) and strawberry (40 records). Meanwhile the insect pollinators on wildflowers were rarely recorded except an exotic herb, Erigeron annuus (31 records). The role of insect pollinators in diverse ecological systems including agriculture is increasing in terms of ecology and economy. Here we have reviewed the diversity of insect pollinators, but we need more detailed research on diversity of pollinators and biological interactions between plants and pollinators in different ecosystems.

PBP-023

New varieties "Yuni" and "Jini" with early and late flowering from black locust (*Robinia pseudoacacia* L.)

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Black locust (*Robinia pseudoacacia*) has about 20 species in the World and introduced to Korea in late 19th century. It has been planted in Korea to produce woods, fiber, honey and forage. In order to select early and late flowering trees of black locust, four cultivars from Hungary and one cultivar from China were introduced and propagated by seeds. For domesticated trees, 63 cultivars from 10 locations in Korea were selected and propagated by root cutting. The trees propagated by root cutting showed higher percentage of flowering individuals than the trees propagated by seeds under two and three years old. The prediction of flowering period by accumulated temperature indicated that back locust flowered to a peak when accumulating daily maximum temperature reached 880 degrees Celsius and when daily mean temperature reached 450 degrees. When it was four years old, however, all trees flowered regardless of propagation method. Among Korean cultivars, all the cultivars from Ganghwa showed abundant flowering with highest nectar production that was 50% more than Hungary cultivar (Debreceni-2). After the eight years of observations, two trees of Hungary cultivars and one tree from China were selected

for early flowering. Meanwhile, one tree of Debreceni-2 and three trees from China cultivar were selected for late flowering. The selected trees flowered two to three days earlier or later than the average. It was thus possible to extend the flowering period of four to six days by planting new cultivars. 'Yuni' and 'Jini'' were designated as early and late flowering varieties.

PBP-024

Characterization of nest structure and foraging behavior of *Xylocopa iris* (Christ, 1791) (Hymenoptera: Apoidea: Apidae)

Burcu Daer^{*I*}, Çidem Özenirler^{*I*}, Kurtulu Özgii², Nezahat Pnar Barkan^{*I*}, Fatih Dikmen $\frac{3}{2}$,

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¹ Hacettepe University ² Eskiehir Osmangazi University ³ Istanbul University, Turkey

The carpenter bees, genus Xylocopa Latreille, of the tribe Xylocopini, include about 450 species in the world. However only nine or ten Xylopoca spp. are found in Turkey. Among them, Xylocopa (Copoxyla) iris (Christ, 1791) is one of the most common and abundant one distributed all around Anatolia. This species is primarily polylectic and displays subsociality. Likewise other carpenter bees, members of X. iris also build their nests in dead, usually decayed wood and structural timbers. In this study, two new X. iris nests were discovered in Eskiehir and Ankara (Turkey). Nest architecture and material were described. Furthermore, to detect the foraging plants of the captured female bees, pollen loaves of the nests and plant vegetation of the surrounding areas were investigated.

PBP-025

Aromatic profile of spontaneous Portuguese Lavender present in unifloral honey

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In Portugal, the production of unifloral honey of Lavandula spp, has been a success across the country. According to its origin, honey displays several characteristics that change with the geographic distribution of the Lavandula species. To understand these changes, a national survey, with the financial support of PAN 2014-2016, was began focusing on the aromatic profile of Lavandula. The plants were collect around the apiaries, and the geographic areas with the three wild species of the genus Lavandula where mapped all over the country (L. stoechas with the

subspecies stoechas and luisieri, L. viridis L'Hér. and L. pedunculata Mill.). All the plant samples were botanically identified and a voucher kept in the Herbarium of Escola Agrária de Bragança (BRESA). The essential oils of these plants were analysed by GC and GC-MS after extraction in a Clevenger apparatus. The composition and oil yields were determined for all samples. The preliminary results show different volatile profiles for the two major species (L. pedunculata and L. stoechas) but also between the two subspecies: stoechas and luisieri. Compounds like trans--necrodol and cis--necrodol are only present in subspecies luisieri, while compounds such as borneol, tricyclene or linalool are present in all the Lavandula pedunculata samples. This type of Lavandula also showed the presence of trans-linalool oxide and -fenchyl acetate but only in the specimens collected on Northern Portugal. The identification of specific compounds in the aromatic profile of Lavandula species can be use in the future to different Lavender honeys.

PBP-026

Anti-tyrosinase activity of acorn pollen and optimization of extraction condition using RSM

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Bee pollen, a complex of flower pollen and nectar collected by honey bees, has been used as a functional products such as dietary supplement due to high content of phenolic compounds including flavonoids. In our present study, the extract of acorn bee pollen inhibited tyrosinase activity, a key enzyme in melanin synthesis. During development as products, extraction conditions greatly affect the biological activity and chemical composition. Therefore, optimization of extraction conditions for maximum tyrosinase inhibition was determined using response surface methodology of Box-Behnken design (BBD) with three-level-three-factor such as extraction solvent (50, 75 and 100% EtOAc in MeOH), extraction time (19, 31 and 43 h) and extraction temperature (10, 30 and 50). Regression analysis showed a good fit of the experimental data with F-value of 52.16 and p-value of 0.001 and showed the importance of extraction solvent for maximum tyrosinase inhibition with p-value of 0.001. The optimal condition was obtained as EtOAC concentration, 66.8 %, extraction time, 19.0 h, and extraction temperature 10.0 oC with 65.6 % tyrosinase inhibition. Further analysis of flavonoid content and tyrosinase activity in the extract prepared from different extraction condition in response surface methodology suggested the positive correlation of flavonoid content and tyrosinase inhibition with R2 of 0.176. Taken together acorn pollen is a promising candidate for decrease in skin hyperpigmentation and food browning. In addition, optimized extraction condition for tyrosinase inhibition will provide useful information for the development of acorn bee pollen as functional products [Supported by RDA through PJ010837032015].

PBP-027

The value of honey plants of *Ligustrum japonicum* Thunb. based on honeybee visit and nectar secretion characteristics

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L. japonicum (Wax-leaf Privet, Japanese Privet) is native of Korea and Japan. It is an evergreen shrub or small tree growing to 2–5 m (rarely 6 m) tall. The flowers are white, with a four-lobed corolla 5–6 mm long and they are borne in clusters 7–15 cm long in early summer. The fruit is used in herbal medicine as a cardiotonic, diuretic, laxative and tonic treatment. Accordingly, this study was conducted to provide a basic data such as honeybee visiting and secreted nectar for possibility of development as a honey plant, L. japonicum in Jeonnam Wando Arboretum. The surveyed tree's flowers bloom and secrete nectar during 7 days in 2014. It is showed that more Apis mellifera visited flowers in priority than other pollinators, so the percentage of A. mellifera which visited flowers was 57%. In addition, number of visited honeybees per flowering lateral bunch can be assumed 173.8 honeybees for a day. Between visited number of A. mellifera and meteorologic traits (temperature, relative humidity) signified correlation, which mean that honeybee activity was influenced by temperature and relative humidity. Secondly, we found that both secreted nectar volume is more secreted in the morning. On average, volume of total and dry nectar secreted by nectary were 1.07 and 0.15 from one flower, respectively. Finally, the surveyed *L. japonicum* is considered as possible sub-honey plant because of its nectar volume and visited honeybee data.

PBP-028

The value of honey plants of *Evodia daniellii* Hemsl. based on nectar secretion characteristics and amino acid content

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E. daniellii Hemsl. is a native of Korea and southwestern China and is called on Korean evodia, bee bee tree or Tetradium daniellii. This species is a deciduous tree belonging to Rutaceae. This study was to analyze secreted nectar volume, nectar sugar content and amino acid in addition to estimating honey quantities that can ultimately reap in male and female flowers of E. daniellii. The peak blooming period of male flowers was on 24th to 26th July. On average, nectar was secreted in 2.73 ± 0.73 from one male flower and nectar concentration showed 17.4%. The peak blooming period of female flowers was on 7th to 9th August. Nectar was secreted in 0.63 ± 0.49 from one female flower and nectar concentration showed 25.7%, averagely. As results of correlation analysis between the meteorological factors and nectar characteristics, we found that both flowers's nectar quantities and concentration were influenced by temperature and relative humidity. Sugar content was calculated at 48.0 ± 5.2 per a male flower and 37.8 ± 8.7 per a female flower, which mean that both values are not as different. At least, a male and female inflorescence could harvest 67.8 mg and 53.5 mg honey by the equivalent ratio. As results of amino acid analysis that Serine, Glycine and Alanine were more detected in male flowers, however Asparatate, Glutamate, Asparagine and Glutamine were more detected in female flowers.

PBP-029

Pollen analysis of honey samples collected from Hakkari-Turkey

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Due to its geographical position, Turkey has a rich natural plant habitat with approximately 10,000 species, many of which not found anywhere in the world. Hakkari which neighbors Iraq and Iran is a province in eastern Anatolian in Turkey and has a rich plant habitat. In this study, it was performed the pollen analyses of two honey samples from Hakkari-Turkey. Samples were obtained from each beehive selected randomly from 2 different apiaries. . Honey samples were analyzed under the light microscope and the source of pollens was examined. According to the results of microscopic analyses, mostly identified pollen belong to the taxa of Apiaceae, Asteraceae, Boraginaceae, Carypohyllacae and Fabaceae families. Pollen of *Astragalus* spp., *Centaurea* spp., *Echium* spp., *Gypsophila* spp., *Lotus* spp., *Pimpinella* spp. and *Trifolium* spp. taxa were identified as secondary and minör in honeys.

PBP-030

Effect of Honeybee (Apis mellifera L.) Pollinator on Strawberry (Fragaria × ananassa Duch.) Production in the Greenhouse

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In order to investigate the efficiency of honeybee pollination on strawberry production, artificially and honeybee pollination were performed in this study. The fruit weight was increased 37.5 upon honeybee pollinator treatment. However, the seed number, misshapen fruit rate, fruit set rate, and the ratio of total soluble solids / titratable acid showed no difference. The peak of colony traffic and foraging activity was located at 10:00-12:00, which was influenced by temperature. The number of flowers visited by honeybee in 5 minute was 12.8 flowers on average. Although the pollination is not the essential factor for strawberry production, honeybee may play a critical role in strawberry productivity in the greenhouse.

PBP-031

Pollen spectrum of commercial honeys from Santarém, Brazil

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We accessed the pollen spectrum of commercial honey samples from Santarém, Pará State, Brazil, in order to provide the botanical characterization of this product. Twelve samples were obtained from different local sellers,

especially in street markets, and submitted to acetolysis procedure. Next, four slides were mounted with the pollen sediment and at least 500 pollen grains were identified and counted per sample. Results showed 31 pollen types related to 16 botanical families: Amaranthaceae, Araliaceae, Arecaceae, Asteraceae, Burseraceae, Commelinaceae, Cucurbitaceae, Euphorbiaceae, Fabaceae, Hypericaceae, Melastomataceae, Myrtaceae, Poaceae, Rubiaceae, Sapindaceae and Solanaceae. Fabaceae stood out from the other families due to the high number of pollen types identified (nine). In general, the samples presented from 5 to 19 pollen types each. Belluccia (Melastomataceae) was the only predominant pollen type (80,26% in the sample S8). According to the seller, this sample (S8) corresponds to a honey produced by a native bee species (Melipona sp., local name: "uruçu-rajada"). The pollen type Myrcia (Myrtaceae) was registered in 11 samples as important (3-15%) or important minor pollen (<3%). Otherwise, the pollen types Acanthospermum (Asteraceae), Protium (Burseraceae), Alchornea 2 (Euphorbiaceae), Senna 2 (Fabaceae), Miconia and Belluccia (Melastomataceae) and Psidium (Myrtaceae) figured out as secondary pollen (16-45%) in the studied honeys. These multifloral honeys reflect the rich Amazonian flora serving native and exotic bee species. The pollen analysis of honey contributes to certify the botanical origin of this product and supports studies on honey adulteration.

PBP-032

Antioxidant activity and total phenolics in pollens of 4 *Quercus* spp. selected from Korea

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In this study, We have analyzed the antioxidant activity and compared species differences in pollens of four Quercus spp. selected from Korea. We used pollens of four species selected Korea, Quercus variabilis, Q. acutissima, Q. mongolica, and Q. serrata. In this study, we evaluated antioxidative capacity and reducing power. The antioxidant activity was measured by the DPPH (1, 1-diphenyl-2-picrylhydrazyl) method and the reducing power was determined according to the potassium ferricyanide method. The contents of total phenol and vitamin C were also investigated. Among 4 species, the pollen of Q. acutissima had the highest antioxida nt activity (EC50 = 166.13ug/ml).

TQP-001

Comparison of the antioxidant contents between *Longan* honey and *Trigona* honey from Thailand

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The Longanhoney and Trigona honey have been valued in traditional medicine. In this study Longan honey samples (n=60) from Chiang Mai province (n=33) and Lamphun province (n=27) in the north of Thailand and Trigona honey (n=9) from Trat province in the east of Thailand were analyzed to determine their antioxidant properties. The Longan honey and Trigona honey had median phenolic content (296.55 \pm 74.80, 1485.05 \pm 20.60 mg/kg), free radical 1,1-diphenyl-2-picrylhydrazyl (95.37 \pm 30.15, 378.27 \pm 151.76 mg Trolox/kg), Ferric reducing antioxidant power (1500.00 \pm 549.01, 6116.67 \pm 1690.59 umole Fe(II)/kg), Trolox equivalent antioxidant activit y (149.16 \pm 47.80 , 512.46 \pm 175.30 mgT rolox/kg), and ascorbic acid value (98.46 \pm 52.30, 255.14 \pm 65.42 mg/kg), respectively. The Longan honey from two provinces were significant only for phenolic content (p<0.01) and ascorbic acid value (p<0.05). Whereas the honey samples from Chiang Mai province were higher value than honey samples from Lamphun province (p<0.05). Antioxidant activity was presented the high values in Trigona honey more than the Longan honey about threefold to fourfold from all methods were significance differences (p<0.001). Thus Trigona honey is a rich source of antioxidants in the human diet.

TQP-002

Bee colony temperature monitoring based on raspebrry Pi

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The Application of Information Technologies in Precision Apiculture (ITApic; www.itapic.eu) project has been funded within the ICT-AGRI 2012 call for transnational research projects. This project proposes implementation of precision agriculture technologies and methods in the beekeeping. Project main goal is to identify different states of the bee colony using various colony monitoring methods, like temperature, sound and video. Constant and real time temperature monitoring of the bee colonies can provide a beekeeper with actual and timely data and information to help recognise various states of bee colonies: death, brood rearing, broodless state etc. Temperature monitoring can be done in various ways. Authors developed multi-node temperature measurement system for bee colonies online monitoring, which is based on Raspberry Pi microcomputer. System consists of two main parts – bee colony measurement node and remote server. Remote measurement node consists of Raspberry Pi and set of Dallas DS18S20 digital temperature sensors, which are connected via 1-Wire network. With software written in Python programming language data from sensors are

obtained and sent directly to server and stored in MySQL data base. For data visualization PHP and Perl web application is used. Data on the server can be viewed real time on http://85.254.247.187/xampp/bites. Such data allows monitoring temperature changes in behives and comparing data between behives.

TQP-003

ITAPIC project – IT tools for implementation of pPrecision beekeeping

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Precision Beekeeping (Precision Apiculture) is an apiary management strategy based on the monitoring of individual bee colonies to minimize resource consumption and maximize the productivity of bees. European project within ERA-net ICT-Agri with topic "Application of Information Technologies in Precision Apiculture (ITAPIC)" joins forces of scientists from Latvia, Denmark, Germany and Turkey to analyse applicability of temperature, sound and video measurements for automated and remote bee colony monitoring. Temperature monitoring system is developed based on Raspberry Pi device, which is used to send data from sensors to remote server. The purpose of video monitoring of a bee hive is to analyse bee activity at the hive entrance. By counting the number of bees entering and leaving the hive during the day, general activity patterns can be observed and analysed. Measuring of the colony sound also can help to understand it behaviour. Both wired and wireless solutions are proposed. Obtained data can be used for automated decision support. Development of decision support system for Precision Beekeeping is a challenging task, which should be done within the mentioned project. Some practical solutions for Precision Beekeeping are developed worldwide, but systems are not widely implemented to the beekeeping practice. A unified method and/or a device for complex bee colony monitoring is not currently available. The advantage of such a system would be the possibility to detect changes or problems in the colonies at an early stage giving the beekeeper the possibility to take counter measures to save bee colonies.

TQP-004

Pollen analysis of Russian bee products

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One of the main methods for establishment and confirmation botanical and geographical origin of be e products (honey, bee pollen, and beebread) is pollen analysis. Identification of any pollen grains is impossible without the collection of reference compounds and/or pollen atlases. The collection of reference compounds of pollen grains for more than 500 plant species of Russian origin was created. Different pollen types were collected from blooming plants in nature and in the Perm State National Research University (PSNRU) Botanic Garden. Determination of the plant species was carried out at PSNRU, the Department of botany and

plant genetics. Some reference compounds were prepared using herbarium plants presented by Moscow State University, the Department of botany and PSNRU, the Department of botany and plant genetics. Pollen grains microphotographs of the reference compounds and of some honey samples from different Russian regions were taken with the light microscope (increasing from 400-fold to 1000-fold). Pollen grains were colored by fuchsine solution. The microphotographs are used to create a pollen atlas. In most cases pollen grains are represented in two projections: polar and equatorial. Pollen grains having a volume shape, some microphotographs were taken at different heights of microscope objective for precise reproduction of the exine sculpture in each projection. The pollen atlas is recommended for palynologists, botanists, explorers of experimental laboratories, students and teachers of biological specialties, beekeepers.

TQP-005

Broad multi-analytical screening of antibiotics in honey with biochip arrays

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Introduction. The use of antibiotic drugs in apiculture is globally restricted. Currently Maximum Residue Limits (MRLs) have not been set for antibiotics in honey. High levels of honey imports and the emergence of antibiotic resistance have led to growing concerns for public health. Biochip array technology (BAT) enables the simultaneous determination of several antibiotics from a single sample, which consolidates testing and increases efficiency. This study reports the application of BAT to the multi-analyte screening of antimicrobials in honey. Methods. Simultaneous competitive chemiluminescent immunoassays, arrayed on a biochip surface, were employed and applied to the analyser Evidence Investigator. Simple sample dilution allowed for simultaneous detection of thirteen sulphonamides, trimethoprim, dapsone, ceftiofur, quinolones, streptomycin, tylosin/tilmicosin, thiamphenicol/florfenicol, and tetracyclines across two arrays. After sample dilution and vortexing aminoglycosides, lincosamides, streptogramins and macrolides were detected with a third biochip array. After simple liquid/liquid extraction, a fourth biochip array enabled the simultaneous determination of chloramphenicol, chloramphenicol glucuronide and nitroimidazoles. Following derivatization and solvent extraction, 4 nitrofuran metabolites, chloramphenicol and chloramphenicol glucuronide were simultaneously detected on a fifth array. Results. The limits of detection ranged from 0.1-0.2 ppb (chloramphenicol, AMOZ) to 20 ppb (sulphamonomethoxine). Generic antibodies on three test sites detected 17 quinolones, 10 tetracyclines (including oxytetracycline and chlortetracycline) and 10 nitroimidazoles. Recovery (%) for all analytes was >70% for three concentration levels. Intra-assay precision (%CV) was 15%. Conclusion. The results show the applicability of BAT to the simultaneous screening of a broad range of antimicrobials in honey samples on one platform.

TQP-006

Determination of minerals in honey from native *Melipona beecheii* bee from the Yucatan peninsula

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This work was carried out in order to determine the mineral content of honey from Melipona beecheii bee of 13 samples from different areas in the Yucatan Peninsula, Mexico. The content and number of minerals could serve as a predictive indicator of certain qualitative features related to nutrition and to identify those minerals that could reflect potential pollution issues. Each sample was evaluated with respect to the concentration of 12 minerals: molybdenum, cadmium, lead, iron, phosphorus, manganese, chromium, magnesium, copper, calcium, sodium and potassium. A method of extraction by acid digestion was utilized and the determination of mineral content was carried out by means of Plasma Emission Spectrometry (ICP). The average concentrations of the following elements studied were obtained (ppm): Mb 0.78, Cd 0.08, Pb 1.24, Fe 4.015, P 77.27, Mn 1.50, Cr 0.061, 19.77 Mg, Cu 0.09, Ca 72.62, Na 42.78, K 467.71. In general and coincidentally, the identified concentrations were remarkably similar to those reported for tzitzilche honey (Gimnopodium floribundum) from Apis mellifera bees produced in the Yucatan. Minerals which predominated were: K 467.71 ppm, P 77.27 ppm, Ca 72.62 and Na 42.78 ppm

TQP-007

One honey sample, one biochip array and simultaneous screening of multiple nitroimidazoles and chloramphenicol

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Introduction. Antimicrobial drugs like nitroimidazoles and chloramphenicol are not authorised for the treatment of honey bees in the EU. However they are authorised in other countries, which could raise problems with honey imports. For consumer protection and to ensure compliance with EU regulations, it is imperative the use of sensitive and reliable residue testing methods. Biochip array technology represents a multi-analytical screening approach; this study evaluates its application to the simultaneous detection of a broad range of nitroimidazoles, chloramphenicol and chloramphenicol glucuronide from a single sample. Methods. Simultaneous competitive chemiluminescent immunoassays on a biochip surface were applied to the semiautomated analyser Evidence Investigator. Before application to the biochip honey samples were extracted by a simple solvent extraction method. Results. The nitroimidazole assay was standardised to metronidazole and showed broad specificity profile with the detection of other nitroimidazoles including dimetridazole, and ronidazole [cross-reactivity(%):90 % and 310% respectively]. The chloramphenico l assay was standardised to chloramphenico l and also detected chloramphenico l glucuronide [cross- reactivity(%):75%]. The limits of detection (LODs) were 0.9ppb (nitroimidazole), 0.1ppb (chloramphenicol). Recovery (%) was 70-90% (nitroimidazole), 108-130% (chloramphenicol). When blind samples were assessed five reported positive on the nitroimidazole biochip assay, which was confirmed by LC-MS/MS. Conclusion. The results indicate applicability of biochip array technology to the multiplex screening of a broad range of nitroimidazoles (including metronidazole, dimetridazole and ronidazole), chloramphenicol and chloramphenicol glucuronide from a single sample. LOD for nitroimidazole falls below the guidelines set by Community Reference Laboratories (<3ppb recommended) and for chloramphenicol is below the minimum required performance limit (0.3ppb).

TQP-008

Cooperation between Thailand and Argentina for improving and breeding queens

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Department of Agricultural Extension (DOAE) and International Development Cooperation Agency (TICA) from Thailand and National Agricultural Technology Institute (INTA) and Argentine Cooperation through the Argentine Fund for South-South and triangular Cooperation (FO.AR) from Argentina join a Cooperation Project in Beekeeping. Bee products and Marketing. Selection queen rearing and multiplication were the priorized topics. In Chiang Mai and Kanchanaburi, Thailand is being tested with good results. When single and double grafting and use of cells of different size(9 vs 11 mm) were compared it was concluded that single grafting with smaller plastic cells had the best results in relation to acceptance. Baby nucs (4,94 dm3) are feasible for mating queens investing 6 times less bees than traditional mating nuclei used in Thailand though are more sensitive to robbing and absconding. After training 6 strains have been selected according to the following criteria: brood production, hygienic behavior, gentleness, disease resistance and varroa mites tolerance. These strains are being used as mother colonies and are the bases of the genetic program in Thailand. Instrumental insemination technique will be used the following year to maintain the strains. As first time in Thailand DOEA technicians have used the technique of making package bees as a way of colony reproduction keeping healthy colonies. The cooperation has improved the tools for obtaining good queens to be available to beekeepers in Thailand and the region one of the main important topics to develop a sustainable beekeeping.

TQP-009

Seasonal pattern of protectives compounds in honey from Apis mellifera L., 1758 in Brazil

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In beekeeping activity, honey is the main product exploited being well appreciated as food due its flavor and sweetness as well as for its therapeutic use, in special as protective compounds on reactive oxygen species. However, as its characteristic are closely related with floral origin, this study intended to assess the seasonality of phenolic compounds of honey harvested from October/2012 to September/2013 in Lavras, South of Minas Gerais State, Brazil. Our study took as parameters to be assessed: i) the content of phenolic compounds (via Folin-Ciocalteau); ii) the antioxidant activity (via DPPH) and iii) the chromatographic pattern of phenolic compounds (via HPLC). The content of phenolic compounds showed a clear hyperbolic pattern in relation to the season, with highest content being obtained in May (45.56 mg GAE.100 g-1) and the lowest amounts in October (11.76 mg GAE.100 g-1). Similarly, the antioxidant activity measured by using the DPPH method showed the same pattern, the highest value of activity being observed in May (80.54%) and the lowest in September (35.69%). The main phenolic compounds found were: gallic acid, catechin, chlorogenic acid, caffeic acid and p-coumaric acid, however, only gallic acid was present in all samples and the other compounds were present only in 83% of the

samples. Therefore, we could hypothesize that both, the high content of phenolic compound and high antioxidant activity, are related with unfavorable weather (lo w temperature and dry season) and poor availability/quality of food in environment becoming a protective mechanism on honey bees.

TQP-010

Antioxidant, antimicrobial, and anti-inflammatory activities of Taiwan honey

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This study was aimed at evaluating the antioxidant and antibacterial activities of the honeys from different floral sources including the medicinal herb Bidens pilosa, the fruit trees Dimocarpus longan, Litchi chinensis and Citrus maxima, the Taiwanese endemic plant Aglaia formosana, and a multifloral forest. The total phenolic and flavonoid contents of the honey from Bidens pilosa were significantly higher than those of the other honeys. The honey from Bidens pilosa also displayed significantly greater scavenging activities of 1,1-diphenyl-2-picrylhydrazyl (DPPH) and hydroxyl radicals and more substantial reducing power. In addition, the honey from Bidens pilosa showed higher antibacterial activities against Gram-positive bacteria including Staphylococcus intermedius and Streptococcus alactolyticus and Gram-negative bacteria including Citrobacter koseri and hemolytic Escherichia coli than was the case for the other honeys. These findings suggested that the levels of antioxidant and antibacterial activities of the honey studied herein seem to attribute to the total phenolic.

TQP-011

Multi-residue method for the determination of nitroimidazoles, sulfonamides and trimethoprim in honey by liquid chromatography-tandem mass spectrometry

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Residues of nitroimidazoles, sulfonamides and trimethoprim can be found in honey largely because they are illegally used in apiculture to prevent and control bacterial and protozoan diseases such as American foulbrood, European foulbrood and nosemosis. As other antimicrobials, nitroimidazoles, sulfonamides and trimethoprim are not authorised for the treatment of honey bees in the European Union because there are no Maximum Residue Limits (MRLs) for these drugs in honey. For this reason, to carry out official control, a multi-residue method for the determination of 12 nitroimidazoles, 16 sulfonamides and trimethoprim in honey was developed. Honey samples were extracted with 2% acetic acid and clean-up on strong cation-exchange solid phase extraction (SPE) cartridges. The obtained extracts were evaporated to dryness, reconstituted in 0.1% acetic acid and analysed by an ultra-fast tandem mass spectrometry (LC-UFMS/MS) method operated in MRM mode with positive electrospray ionization. The separation of analytes was performed on a pentafluorophenyl (PFP) analytical column using acetonitrile and 0.01% acetic acid as mobile phases with gradient elution. The proposed multi-residue

method was successfully validated according to EU Commission Decision 2002/657/EC requirements and all validation criteria were in the required ranges.

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TQP-012

How do we deal with some limitations of the melissopalynological analysis for the determination of honey botanical origin?

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ce

The determination of the botanical origin of honey is very important for the marketing of the product. For the botanical evaluation, several methods including sensory, pollen and physicochemical analysis are been used. However, melissopalyological analysis is so far the main method used to define the botanical origin of blossom honeys. One of the main problems faced during pollen analysis of honeys is the presence of over- or underrepresented pollen in the sediment. As these species are considered a significant source of variation for the results of pollen analysis (especially in cases where both over- and under-represented pollen grains coexist in honeys), the International Honey Commission Geographical and Botanical Origin Working Group collected data about the most often present and under-represented pollen types in European honeys, as well as data about the way that the analysts are handling these honeys regarding their botanical evaluation. The results derived from 24 laboratories of Europe showed a great variation mainly in the final interpretation of the botanical origin among the analysts. Ways about the harmonisation of the results given among the melissopalynological laboratories are discussed.

TQP-013

Impact on enzymatic content of crystallized cotton and citrus honey during their liquefaction

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Citrus (Citrus sp.) and cotton (Cossypium hirsutum) honeys are two of the major unfloral honeys of Greece that crystallized very fast. Crystallized honey predisposes negatively some consumers and beekeepers utilized heating for their liquefaction. Heating results to the loss of thermo labile compounds, enzymes, volatile compounds, vitamins. We search the combination of heat and time that is needed for liquefying of citrus and cotton honey in order to minimize the harmful effect of treatment. The combination of heating and time of treatment that we applied was 45, 55, 65 and 75 C for 1, 6, 24 and 48h and the parameters that we examined were the enzymes activity (diastase, invertase), HMF and changes of color. To monitor the crystallization level of the treated honeys, we use a light microscope with incorporated polarizer and analyzer and an appropriate software (image Pro plus).

The honeys qualification was achieved after heating at 55 C for more than 6 h. Diastase was affected significant after heating at 6 h mainly at the high temperatures, while invertase proved more sensitive. Citrus honey was more resistance in heating than cotton. Heating at low temperature is most suitable for melting the crystals and keeping honey's parameters within the legislation limits but some bioactive compounds like invertase is affected even if cotton and citrus honeys are processed at 45 C.

TQP-014

Determination of residual paraffin in honeycomb constructed on adulterated foundations

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Paraffin is the most commonly used beeswax adulterant due to its specific physico-chemical properties, low price, availability and lack of internationally standardized analytical methods and/or regulations controlling beeswax authenticity. Consequently, the accumulation and circulation of paraffin in comb foundation production process is inevitably. A causal effects of paraffin adulteration on the quality and chemical composition of the comb constructed on foundations contaminated with paraffin, as a material that further enters comb foundation production process, have not yet been investigated. Also, there are no data on the amount of paraffin that remains in the honeycomb after it was built on adulterated foundations. Therefore, the aim of this study was to determine the residual paraffin share in the honeycomb constructed on paraffin-based foundations. Comb foundations containing 90% of paraffin were placed in 5 Apis mellifera colonies (3 frames / LR hive) situated at experimental apiaries in Croatia at the beginning of May 2014, and left until the honey bees finished comb construction. In order to determine the exact proportion of residual paraffin in constructed combs, samples of adulterated foundations and combs built on them were recorded separately (n=30) by FTIR-ATR spectroscopy. Combs constructed on experimental paraffin foundations were melted separately prior to spectroscopic analysis. PLSR model was used for determination of paraffin share in analyzed samples. The results have revealed that 47-67% of paraffin remains in the newly built comb indicating that honey bees can annul at best only 50 % of paraffin by their work (addition of virgin beeswax).

TQP-015

Observation - forecasting service of honey bee pastures in the Slovenia

Jure Justinek

Slovenian Beekeepers Association, Slovenia

Observation and forecasting service of nectar and honeydew pastures in the Slovenia has the basis for the functioning of the law on livestock, where is defined as the professional task in animal husbandry. It is financed by the Ministry of Agriculture Forestry and Food and implemented by the Slovenian Beekeepers' Association. In Slovenia for honey bees the most important is forest bee pasture. Forests in Slovenia cower 59% of the total area. Although the Slovenia is a small country measure only 20,251 square kilometres, it has an extremely diverse

climate and vegetation. Already in 1901 the beekeepers realized our natural resources. Under the guidance of the inventor AŽ hive Anton Žnidarši starts monitoring and forecasting service, which is still active today. The network of monitoring stations which are monitored daily returns is placed in the whole country at various altitudes. At the each station is one hive of bees on an electronic Libra. In addition to the weight of the hive, station records also the air temperature and relative humidity. Informing beekeepers on honey contribution takes place daily through the telephone answering machine and web pages and also through the mobile applications. Beekeepers get daily data in Slovenia and are informed about upcoming pastures. Also, beekeepers are advised regarding technological instructions on care of bees.

TQP-016

Interaction of some parameters physicochemical parameters of Chaco honey. Argentina

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Honey is the only sweetener material which can be stored and used as it is produced in nature. The objective of this work is to elucidate the interactions between different physicochemical parameters analyzed. Humidit y test, acidity, color and hydroxymethylfurfural .It analyzed 30 samples were carried 2013/2014 harvest in the province of Chaco. Results: Samples Zone 6 are dark, below the limit moisture, acidity below 40 mequivalente of NaOH / kg of honey and less than 40 mg HMF / kg of honey hydroxymethylfurfural; Bee honey of zone 5, with values of humidity below commercial limit, they are light amber, varying acidity between 21- 50 meq NaOH and values below 20 mg HMF HMF / kg honey; samples zone 7, have a variety of color between amber and light amber, less than 5 meq NaOH / kg acidity, humidity less than 18%, traces of HMF; Samples of beekeeping area 3 had low acidity, amber to light amber, hmf low humidity and lower limit. With respect to an increase in acidity honeys zone 5, with respect to other areas with values within the allowed standards it is observed. As to HMF, all areas have allowed values. All areas analyzed are light amber except zone 6. The parameters analyzed do not denote a physicochemical interaction, for the samples analyzed.

TQP-017

The use of analytical techniques as tool to detect paraffin on bee wax

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The intentional addition of paraffin on bee wax, which should be taking as fraud, has aroused a great concern of beekeepers, consumers and also of regulatory agencies. For this reason, the development and improvement of new techniques is encouraged, being these important tools to be used on programs that have as goal the monitoring of

the wax quality. Thus, from the wax of Apis mellifera L., 1758, were prepared samples containing paraffin at 1.5, 3, 6, 12, 24 and 48% (w/w) and then assessed by combining the techniques of Gas Chromatography + Mass Spectroscopy (GC -MS) and the Fourier Transform Infrared Spectroscopy (FTIR). The data obtained were subjected to the principal component analysis + hierarchical component analysis, allowed us to identify (by GC-MS) more than 21 compounds on pure bee wax and also on samples containing paraffin. However, from the FTIR technique was possible to detect the paraffin only on sample containing more than 6%, leading us to search for new features to improve this technique and thus become it more sensible. Overall and even by the current limitation of FTIR to detect samples with quantities of paraffin below 6%, the combination of both GC-MS and FTIR should be proposed to assess the bee wax quality due its precision and accuracy. Key-words: Honey bee, GC-MS, FTIR, bee wax

TQP-018

Development of a simple and rapid enzymatic assay kit for reliable determination of d- glucose/d-fructose in honey

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Introduction. Honey is a natural sweet substance, composed primarily of the sugars D-glucose, D-fructose and water. The measurement of glucose and fructose content is important in quality control. Honey quality criteria are specified in many regulations including the Codex Alimentarius Standard 12-1981 and European Directive 2001/110/EC which is now being implemented worldwide. The development of analytical methods which monitor the compliance to quality specification, facilitates fraud prevention and the protection of authentic honeys. This study reports the development of an assay kit for the determination of D-Glucose and D-Fructose in honey samples. Methods: The method is based on enzymatic reactions and the concentration of sugars is directly proportional to the increase in absorbance measured spectrophotometrically at 340 nm. The assay kit was applied to the semi-automated analyser RX monza and included ready-to-use reagents and standard solution. With this system honey samples can be analysed within 15 minutes. Liquid honey samples (1g) were dissolved in deionised water (100 mL) and 5µL was used for sample analysis. Results. Initial analytical evaluation of this assay kit measured D-glucose, D-fructose and total sugars. The sensitivity and linearity limits for all the analytes were 0.21g/L and 7.5g/L, respectively. When two honey samples with certified concentration values were assessed, the concentration values achieved for all analytes fell within +/-6% of target concentration. Conclusion. This assay kit is applicable to the measurement of glucose/fructose in honey. This represents a convenient analytical tool to facilitate the quality control of honey in respect of compliance to legislative requirements.

TQP-019

A investigation of production efficiency of mating queen bees based on weather conditions of island and inland

areas

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The ideal mating season of queen bees and the production efficiency of mating queen bees in island and inland areas were explored on an island called Wido which is 15 km away from an inland region. This research was conducted so as to preserve honeybee lineages. In order to compare a mating season of queen bees on an island with that in an inland area, 10 drone colonies, 10 organized queenless colonies, and 60 queen bees were raised. The rates of grafting queen cells, the rates of oviposition, and the priod needed for the first oviposition was examined from March 26th to May 20th. In addition, with a view to find out an ideal mating season of queen bees in an island, 10 drone colonies, 10 organized queenless colonies, and 480 queen bees were raised. The rates of grafting queen cells, the rates of oviposition and the number of days needed for the first oviposition were examined on the basis of daily and monthly weather environments. Because of weather differences between island and inland areas, research on the mating season of queen bees resulted in different rates of grafting queen cells as follows; 93% on the island, and 100% in the inland area. This finding resulted from a lower temperature and stronger winds in an island. The rate of oviposition on the island was 50% and that of the inland area was 86.7%. The priod needed for the first oviposition was 21 days on the island and 10 days in an inland area, respectively, which shows a huge discrepancy between them. The first oviposition dates on the island were all on May 1st, but those in the inland area varied depending on time and seasons. As for the perfect mating season of queen bees, the rates of grafting queen cells were 91% in the first experiment, 96% in the second, and 98% in the third. Meanwhile, the rates of oviposition were 37% in the first, 63% in the second, and 71% in the third, which indicates large differences, depending on maximum temperature and wind speed. The numbers of days needed for the first oviposition were 27 days in the first, 21 days in the second, and 16 days in the third. The later dates of grafting queen cells was getting, the shorter the priod needed for the first oviposition weas. The oviposition dates were all on May 1st, as mentioned above. In conclusion, even though the rate of oviposition on the island was 36% lower than that of the inland area, islands would be better for isolated mating spaces for the purpose of preserving honeybee lineages. According to the findings of these experiments, when islands are used as isolated mating spaces, it is advisable that mating should be done under the following conditions; wind speed less than 1.5 m/s, maximum temperature above 20°C and moving hives should be done after April 25th.

TQP-020

Ultrasound technology for processing honey

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A new processing technology utilizing shorter processing time and less energy for distrupting crystalline structure to liquidize honey prior to packaging is researched. The main objective of this project was to determine the effects of ultrasound application on the quality of cotton, citrus, sunflower and polyflora honeys compared to water bath thermal processing. Effects of 14 mm and 22 mm probe thickness and three different amplitude (50%, 75% and 100%) is determined. UIP 400S hielscher ultrasound was used for experiments. Optimum probe was found to be 22 mm and 100% amplitude in terms of diastase, HMF, invertase, viscosity, humidity. 65000 J to 70000 J for maximum 500 s was enough to completely liquidize honeys. Furthermore, utrasound bath at 24 kHz for 50°C and 55° C and normal water bath at 50°C and 55° C to liquidize honey was used. Afterwards, pasteurization at 65° C, 70° C and 75° C was done to accomplish the usual industry processing conditions. The results are compared for
HMF, diastase, invertase and physical properties of honeys. In conclusion, a new processing technology with significantly reduced energy in a short time was developed which resulted in a better quality of product.

Differentiation of Manuka and Kanuka Honey by NMR Spectroscopy

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Nuclear Magnetic Resonance (NMR) spectroscopy, which allows detection of quantitative molecular finger prints of mixtures, has already been successfully applied to test authenticity of fruit juices and wines in the respective industries. Verification of authenticity is performed by comparison of an unknown sample with a data base of authentic samples. We demonstrate the application of NMR spectroscopy for the differentiation of Manuka and Kanuka honey as well as the differentiation of Manuka honey from New Zealand and Australia. Specifically, we show that Kanuka honey contains a characteristic marker substance, which is also found in the nectar of Kanuka flowers, but not in Manuka flowers.

TQP-022

Chemical and biological standardization of propolis extracts of Santiago del Estero, Argentina

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The Argentina apiculture is one of the major players in the international market. The present work was developed under the Argentine apícola cluster NOA-Center, with the aim of standardized chemical and biological propolis extracts of Santiago del Estero, Argentina. Material and methods: aqueous (APE) and ethanol (EPE) extracts from seven samples of propolis (SE1-SE7) collected Santiago del Estero, Argentina were prepared. The content of functional compounds (phenolic, flavonoids, non flavonoids phenolic) and nutritional interest compounds (sugars, protein and minerals) were analyzed. Their biological properties antioxidant, antimicrobial (antibacterial and

antifungal), ability to inhibit bacterial virulence factors and antigenotoxicity activity were evaluated. Results: The EPE had high content of total phenolic and flavonoids compounds. All extracts were biologically active, the APE showed greater ability to scavenge free radicals (ABTS• + and DPPH•), reactive oxygen species (HO•, 0• -) and to protect against oxidative damage to lipids. EPE showed higher inhibition of multirresistant human pathogenic Gram-positive bacteria. All samples were not genotoxic and didn $\hat{\tau}$ affect the viability of A. salina at the bio-active doses. Three compounds were isolated and identified as: naringenin, chrysin and pinocembrina, can be used as chemical markers. Conclusions: The biological properties of Santiago de Estero propolis extracts would promote their inclusion in the pharmaceutical industry, such as herbal medicine and in the food industry as functional foods or preservatives

TQP-023

Development and validation of a multiclass method for the quantification of veterinary drug residues in honey and royal jelly by liquid chromatography-tandem mass spectrometry

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The aim of this study was to develop an analytical method for the analysis of a wide range of veterinary drugs in honey and royal jelly. A modified sample preparation procedure based on the quick, easy, cheap, effective, rugged and safe (QuEChERS) method was developed, followed by liquid chromatography tandem mass spectrometry determination. Use of the same sample preparation method for analysis of 42 veterinary drugs becomes more valuable because honey and royal jelly belong to completely different complex matrices. Another main advantage of the proposed method is its ability to identify and quantify 42 veterinary drugs with higher sensitivity than reference methods of China. This work has shown that the reported method was demonstrated to be convenient and reliable for the quick monitoring of veterinary drugs in honey and royal jelly samples.

TQP-024

Determination of total phenolic and flavonoids pollen composition by FTIR-ATR Spectroscopy

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Bee pollen has a variable composition in proteins, lipids, sugars, fibers, minerals, amino acids, phenolic compounds and vitamins. The ability of FTIR-ATR spectroscopy for predicting total phenolic and flavonoids

content was studied in bee pollen samples. The total phenolic content of the extracts was determined using the Folin–Ciocalteu method and results were expressed as mg of gallic acid per g of bee pollen (GAE). For flavonoids contents the aluminium chloride method was used and results were expressed as mg of quercetin equivalents per g of bee pollen (CAEs). FTIR-ATR spectra were acquired with a Bruker FTIR spectrometer (Alpha) using a diamond single reflection attenuated total reflectance (ATR) at a spectral resolution of 4 cm-1 in the wave-length range from 4000 to 400 cm-1. Partial least squares regression (PLSR) model was developed for the total phenolic and flavonoids prediction using 100 different bee pollen samples with a variation range of 35.5- 17.6 mg GAE/g of pollen, 5.9-2.2 mg quercetin/g of pollen extract, respectively. Good correlation models of calibration were found for the analysed parameters with the next characteristics: 1) For total phenolic content: pre-processed spectra wave-length (2826-2490 + 2158+1823 cm-1) used second derivative pre-processing, root-mean- square error of estimation of 1.17 mg GAE/g of pollen, r2 of 92.2 % and a RPD of 3.6; 2) For flavonoids: pre-processed spectra wave-length (2858-1470 + 777-430 cm-1) used vector normalization pre-processing; root-mean-square error of estimation of 0.418 mg quercetin/g of pollen, r2 of 81.8 % and a RPD of 2.3.

TQP-025

Analysis on the individual foraging decision-makings in *Apis cerana* using a digital system recording automatically the individual identities provided by the p-Chips®

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An important aspect of foraging behaviors in honeybee colonies is the ability to exploit food sites of good quality and recruit nestmates to the nectar sources. Most of such behaviors are considered as a swarm intelligence consisting of the numerous individual decision-makings interacting locally with one another and with their environment. In this study, we develop a computer system automatically recording individual identities in Apis cerana, in order to investigate individual behaviors and to analyze efficiently. In order to construct the system we used the p-Chip® which is an ultra-small micro-transponder tag (500x500x100 microns) carrying a unique serial number (ID), and the PharmaSeq wand which is a small device capable of reading the IDs of individual p-Chips®, one at a time (products by PharmaSeq Inc., 2015). The wand is connected to our computer system (hardware and so ft ware). Our experimenta l design was equipped with A. cerana nest (3 70x150x625 mm) containing 4 co mbs (395x30x275mm) with removable transparent walls to observe inside of the hive occasionally. The individual recognition system was installed to the nest entrance which is custom-designed for the system and experiments. The artificial nectar source was placed 15m away from the hive where we installed the individual recognition system. We present here individual foraging behaviors of A. cerana recorded by the system including the individual recognition rate of the system, individual frequency of the out-nest activities, etc. The system might contribute to filling some substantial gaps in our knowledge with respect to individual decision-makings involved in the feeding ecology of honeybees.

How do we deal with some limitations of the melissopalynological analysis for the determination of honey botanical origin

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The determination of the botanical origin of honey is very important for the marketing of the product. For the botanical evaluation, several methods including sensory, pollen and physicochemical analysis are been used. However, melissopalyological analysis is so far the main method used to define the botanical origin of blossom honeys. One of the main problems faced during pollen analysis of honeys is the presence of over- or underrepresented pollen in the sediment. As these species are considered a significant source of variation for the results of pollen analysis (especially in cases where both over- and under-represented pollen grains coexist in honeys), the International Honey Commission Geographical and Botanical Origin Working Group collected data about the most often present and under-represented pollen types in European honeys, as well as data about the way that the analysts are handling these honeys regarding their botanical evaluation. The results derived from 24 laboratories of Europe showed a great variation mainly in the final interpretation of the botanical origin among the analysts. Ways about the harmonisation of the results given among the melissopalynological laboratories are discussed.

TQP-027

The impact of geographical origin in 10-HDA in Greek royal jelly

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Royal Jelly (RJ) is a secretion from the mandibular and hypopharyngeal glands of nurse bees. It has the properties to change a female worker honeybee into a queen. The compound 10-hydroxy-2-decenoic acid (10-HDA) is found only in RJ as natural form and it is the major fatty acid of this product. The aim of this study was to determine the concentration of 10-HDA in ninety nine samples collected from RJ producers from several Greek regions and to define the impact that the geographical origin may have on. For its determination the HPLC - DAD method was developed and validated. The Limit of Detection (LOD) was determined at 0.086 g mL-1 and the limit of quantification (LOQ) at 0.260 g mL-1. A five point calibration curve was created in the rang 0.002 - 0.5 mg mL-1, while methyl-4-hydroxybenzoate was used as internal standard. The method showed good accuracy and precision. According to the suggested from the IHC limits (C10-HDA >1.4%), the 15.2% of the samples were off limits. The results showed that the RJ samples from the four origins had no significant differences in the concentrations of 10-HDA. The maximum concentration was observed at 6.41% and the minimum at 0.85%.

Proton-NMR-profiling to detect adulteration of honey

Cord Lüllmann, Gudrun Beckh, Arne Dübecke *Quality Services International GmbH*, *Germany*

In the past, NMR-technology usually has been used e.g. for structure elucidation of chemical compounds. Recently, NMR- profiling of complex mixtures made it possible to build up reference databases consisting of several thousand sample profiles for juice and wine in order to detect a range of quality parameters in those matrices. As part of a cooperation between Quality Services International and Bruker BioSpin this approach is now being applied to the matrix honey to detect adulteration. More than 3.000 NMR-profiles have been measured so far and added to a reference database. In order to get a broad overview, the samples were taken from more than 45 geographical origins. A range of monofloral botanical origins was included to be able to trace back NMR-signals to certain honey specialities. This knowledge is needed to prevent false positives due to such signals deriving from monofloral honey rather than adulteration. Furthermore, comprehensive statistical evaluation of reference data was performed and statistical models developed to detect deviations in the NMR-profile to detect adulteration. The authenticity was ensured by performing classical methods, e.g. determination of ¹³C-isotopic ratio and HPLC-analysis of oligosaccharides. Additional analyses of deliberately adulterated samples were carried out to test the statistical model. The method allows for the detection of different types of adulteration of honey. Additional information on geographical and botanical origin is obtained as well.

TQP-029

Pyrrolizidine alkaloids in honey – A current overview

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For several years the presence of pyrrolizidine alkaloids (PAs) in different foodstuffs is known. Though, honey is probably the most intensively investigated foodstuff in terms of concentration of PAs. In August 2011 the German Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung) published a maximum recommended daily intake of 0.007 μ g PA per kg bodyweight. Thus, a person of 60 kg bodyweight should not take more than 0.42 μ g of PAs per day, which corresponds to a PA-concentration of 21 μ g/kg and a consumption of 20 g of honey. Though no official limit, this recommendation poses pressure on honey trade. Due to reports in a range of journals as well as on television, PAs are in the focus of authorities and consumers alike. In 2014, a popular consumer journal in Germany tested a number of honeys bought in different supermarkets. For the first time PAs were within the scope of a test by a consumer journal. Tested honeys exceeding a PA-content of 20 μ g/kg were downgraded by two marks, thus strongly influencing the acceptance by the consumers. This study shows an updated global overview of PA-concentrations and PA-patterns in honey.

TQP-030

Apalbumins as dominant proteinous components of European and Asian honeys

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Honey, the primary food of honeybee worker, is product made by honey bees from nectar in process of regurgitation and evaporation, and store in wax honeycombs inside the beehive. The variety composition of honeys depends on the floral origin of the nectar, and chemical composition can vary also depending on the seasonal, regional and climatic conditions and on the honeybee colony. In presented work we show the similarities and differences of the protein composition of some typical monofloral European and Asian honeys. The immunochemical analysis of tested honey samples by using specific polyclonal anti- apalbumins antibodies confirmed, that the major royal jelly proteins, are dominant proteinous part of honey. These proteins are not only the source of aminoacids for honeybee, but some of them possess different physiological activity including antibiotic properties. Moreover, we demonstrate, that besides honeybee enzymes (e.g. invertase, diastase, glucoso-oxydase, catalase) apalbumins play important role as the key factor in processing nectar to honey. While the proteins of floral origin can vary in honey depending on the nectar source, the apalbumins are always presented. The similar electrophoretic profile of apalbumins in honeys produced by European honeybee Apis mellifera and Asian honeybee *Apis cerana* confirmed, that these proteins are specific for genus apis.

TQP-031

Sugar out - dispersive solid phase extraction for the determination of four neonicotinoid residues in honey by HPLC-UV

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In this paper, a novel sample preparation method called sugar out-dispersive solid phase extraction was used for the determination of four neonicotinoid insecticides (Thiamethoxam, Imidacloprid, Thiacloprid and Acetamiprid) in honey. Acetonitrile was introduced into the aqueous honey solution to form aqueous two-phase system for the extraction of target compounds. The resultant mixtures were centrifugated to separate acetonitrile phase in which neonicotinoid insecticides were concentrated. After phase separation, extract was purified by using dispersive solid phase extraction, in which different absorption materials C18, PSA, and MgSO4 were studied. Then the obtained purified extract was analyse by HPLC-UV. Linearity was obtained with the coefficient higher than 0.999 from 0.07 to 11.2 ug/mL. Recoveries at three levels were between 84.3% and 97.8%. Limits of quantification were found to range from 25 to 100 ug/Kg.

TQP-032

The artificial swarm attractant for Apis cerana japonica

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The flower of *Cymbidium floribundum* Lindl. (kinryohen) attracts swarming bees of *Apis cerana japonica* Rad (the Japanese honeybee) and the flower is used to capture swarms. In our former study 3-hydroxyoctanoic acid and 10-hydroxyl-(E)-2-decenoic acid were identified as the active components of the flower. Because the blooming of the flower changes often and does not coincide sometimes with the swarming, capture of swarms using raw flower is unstable. In order to test an artificial swarm- attractant, we prepared a lure which contains a mixture of the synthesized active components. To clarify the effectiveness of our lure on capturing swarms, we conducted the two tests. One test was comparing the attractiveness to swarms between the lure treatments and controls (attractive test). Another test was comparing the capturing success in the field of five methods between 2011-2012 and 2013: in 2011-2012 we did not include the lure method, in 2013 we added the lure method (capturing success test). In the attractive test, 27 swarms out of 28 were captured by the lure treatments and one swarm was captured by the controls. In the capturing success test, 91 swarms out of 173 were captured by the conventional kinryohen methods in 2011-2012, but 21 swarms out of 196 were captured by the kinryohen methods in 2013. As results of the tests, our lure was thought to be effective on capturing swarms.

TQP-033

Non-invasive monitoring of the Honey bee brood cycle.

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The use of modern sensor technology to monitor honey bees is growing in popularity and it is of great interest to develop new methods which can more accurately and less invasively assess honey bee colony status. Our approach is to use accelerometers inserted in the central frame of the hives to measure vibrations in order to provide information on the colony bee population activity and development. The accelerometers provide both amplitude and frequency information which has been averaged and stored every three minutes and analysed for night time only. To complement vibrational data, visual inspection data of the colonies, particularly the brood development, are recorded for correlation. In this work we show that suitable vibrational data processing allows highly sensitive monitoring of the brood cycle in the vicinity of the sensor using only the vibrational amplitude distribution. We then explore the minimum data that is required, when frequency information is also included, to accurately determine the current point in the brood cycle.

TQP-034

Swarming prediction using vibration monitoring

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Swarming is the natural reproduction mechanism for honeybee colonies however the majority of beekeepers actively work at controlling it or at least managing it. Swarming is particularly undesirable for commercial bee

keepers for whom the ability to predict swarming would allow them to actively intervene more efficiently. In this work we show that the vibrations from a honey bee hive can be used to predict, several days in advance, when a hive is going to swarm. Vibrations have been measured, using accelerometers installed in the central frames of honey bee hives, for over a year and the colonies have been allowed to swarm. Principal component analysis has been applied to the averaged vibrational spectra to red uce the data to a smaller number of relevant variables. The principal components have then been further used, along with observation of the dates that colonies have swarmed, in discriminant function analysis to discriminate the non-swarming from the pre- swarming events in discriminant function space. The results provide the basis for a hive monitoring tool that could alert the bee keeper well in advance of swarming, and reduce the need to visually inspect those colonies that do not intend to swarm.

TQP-035

A non-invasive technique for signalling a failing honey bee colony during the winter months.

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In this work we describe a non-invasive technique for signalling a failing honey bee colony during the winter months. Vibrations have been measured from twenty different hives using accelerometers embedded within the wax of the central comb. The accelerometers provide frequency resolved amplitude information which has been averaged and recorded every three minutes and analysed for night time only. The data shows that for colonies that did not survive the winter a clear drop in vibrational amplitude can be observed in the run up to failure. This is what would be expected as the number of bees falls, but alone does not provide a robust technique as the central location of the bees may also move away from the accelerometer. However, we show that colony failure is also systematically accompanied, up to 2 weeks before failure, by an increase in a characteristic frequency, normally observed in any healthy colony from accelerometers embedded in the wax of the comb, at around 125 Hz. Taken together, the fall in amplitude and the increase in the 125 Hz frequency feature give advanced warning that a colony is due to fail and offer the chance for remedial action to be taken.

TQP-036

Overview of typical pesticide residues in honey and hive products (bee pollen, royal jelly, beeswax and propolis)

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Pesticide residues in honey and hive products are a sensitive topic as honey and bee products (bee pollen, royal jelly, beeswax and propolis) are considered as pure and natural food. Maximum residue levels (MRLs) for pesticide residues in honey, royal jelly and bee pollen are given in Regulation (EC) No. 396/2005. According to article 18 of this regulation, a default MRL of 0.01 mg/kg was set for those products for which no specific MRL is set out in Annexes II or III, or for active substances not listed in Annex IV. MRLs for bee treatment agents are stated in Regulation (EC) No. 470/2009. The analysis of hundreds of honey and bee product samples in 2014,

determined the most typical pesticide residues. Additionally, an overview of more or less affected origins and the situation of organic products were given. Moreover, difficulties in legal interpretation are highlighted for some real life cases. On top, the tendency of the residue situation in honey over the past 5 years will be shown. The Multi-residue method used covers about 300 pesticides including bee treatment agents. For the sample preparation of honey, bee pollen, royal jelly and beeswax the QuEChERS-technique was used. Propolis samples were prepared with a modified version of the "DFG S-19" and a new inhouse method.

TQP-037

A rapid, inexpensive and field-deployable cavity ringdown spectroscopy based system to detect C4 sugar adulteration of honey

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Picarro, Inc.

Honey is one of a number of natural products that are regularly tested for adulteration with lower cost sweeteners such as High Fructose Corn Syrup (HFCS) and cane sugar, know as C4 sugars. Such frequent adulteration poses a problem for scrupulous honey producers and importers who end up operating at a cost disadvantage. The problem is significant enough that U.S. Customs and Border Protection agents regularly test for adulteration in honey shipments. Carbon isotope ratio analysis is a well-known tool used to detect food adulteration by comparing botanical isotopic signatures. The stable carbon isotope value, 13C, of plant material or plant-derived products is the metric identifying botanical origin. Scientists have not used this value to its full extent to detect food adulteration of honey by measuring both the 13C/12C isotope ratio of the honey sample itself and that of the protein content isolated from honey. The faster and less costly Combustion Module-Cavity Ring-Down Spectroscopy system (CM-CRDS) provides 13C values equivalent or better than values obtained using Isotope Ratio Mass Spectroscopy (IRMS) for honey samples. The study we present here covers the published AOAC ISCIRA method. The data shows excellent precision. The results further validate the use of the Picarro CM- CRDS as a screening tool for food products in general and specifically for honey samples analysis.

TQP-038

Melissopalynology of the Portuguese lavender honey (*Lavandula* spp.)

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³ Mountain Research Centre (CIMO), Instituto Politécnico de Bragança, Campus de Sta. Apolónia, 5300-2 53 Bragança, Portugal, mvboas@ipb.pt Given the growing consumer interest on unifloral honeys, it is crucial to establish standards values to guarantee the authenticity, underlying its higher price. In Portugal, the unifloral honey with higher production comes from three wild species of the genus Lavandula, growing spontaneously: L. pedunculata (Mill.) Cav., the most abundant; L. stoechas L., with the subspecies stoechas and luisieri; and L. viridis L 'Her., with smaller growth geographic area. The almost total absence of studies at national level associated with the observed differences towards the standards of European honeys of the same genus, are generating some resistance in their international recognition. This work, with a national scope and funding by the National Beekeeping Program (PAN 2014-2016), focus on the characterization of unifloral honey from Lavandula spp, where the melissopalynological analysis is a strategical information used to access the botanical and geographical classification. The qualitative and quantitative melissopalynological analysis of 75 honey samples, collected in areas with previous survey of floristic potential, revealed that more than 60% of samples can be classified as unifloral Lavender honey, with Lavandula pollen percentages (known as under- representative) that goes from a minimum of 15% to as much as 61%. This information, coupled with the physicochemical and sensory characteristics of the same samples, will allow to establish the limits to define the Portuguese Lavender honey.

TQP-039

Requirements of Queen Bee Production and Points to Take Into Consideration

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Türkiye has the presence of 6 million hive and 94 thousand tons of honey annual production, which has a large field flora, diversity and long nectar flow period, ranks second in the world. In this peerless natural wealth, the performans of colonies in the production of honey, pollen and other bee products depends on strongly entering the honey production period. The most basic elements to determining the the performance, production and behavioural characteristics of honey bee colonies, is quality properties and age of queen bee. The colonies strongly entering the honey production period due to depends on directly queen bee quality and age, beekeepers have to produce the queen bee when they needs to renew the queen bee. For the produce a quality queen bee has to known quenn bee breeding values as well as there are many important factors. Colonies properties which will use to produce the queenbee, the method of queen bee upbringing, the quality and population os starter and finisher colonies, the quality and population of drone, season, the flora situation, the number of larvae that is transferred a colony, larval age and nutrition of larvae are major factors to be considered. In this review, issues to be considered to improve the quenn bee produce effiency and quality and the importance, requirement of queen bee produce and to make the practice-oriented literature research, to propoud the practice-oriented points and the requirements are aimed.

TQP-040

Study of heavy metals in the Iranian propolis

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Propolis or honeybee glue is prepared by honeybee through combination resin or gum with wax. Due to its numerous pharmaceutical characteristic, this material is increasing considered such that it global trade has provided tremendous in co mes for the countries enjoying beekeeping industry like China, Brazil, Australia and Ukraine. Each honey bee colony produces between 50 to 300 g propolis/year. Its precise amount depends on the honey bee race, available plants and trees, climate and collection produce. World annual production is estimated to be about 300 – 400 tons. Heavy metals like lead, mercury, and arsenic that at certain level cause toxicity of the body are amongst standard factors for most countries. Permissible level of all three elements has been determined to be less than 2 ppm. Most of the Iranian propolis is produced in the northern strip of the country in the where plant sources producing propolis are abundant and from the race viewpoint as well sees are close to the Caucasian race. In order to study the level of heavy metals in the Iranian propolis, 50 samples were collected from various regions and were tested from the viewpoint of heavy metal level the amounts of which were at and even less than the standard level.

TQP-041

Late split colonies *Apis mellfera* using queens cells in the north of Argentina

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The Argentine beekeeper's often split the hive after ended the honey flow. However the results are variable and winter survival they have been low. The objective of this assay was to assess the productive efficiency of the split of hives of end of season with the use of queen cells, in subtropical climate with AHB in the Chaco province. In an apiary of 44 Langsthoth hives, n: 10 were control and others 34 seek queen and placed it in a split hive (SHQR) with 5 frames with brood,1 of honey and 1 of beeswax. Keep in the original hive (OHQL) 2 frames with capped brood one of beeswax and one with honey. The OHQL rotate the entrance in the opposite direction (180 degrees). A double mesh floor was placed between both hive bodies. 24 hours later SHQL put it down and relocated within the same apiary, put the queen cell. All the hives were 1 liters of sucrose syrup every 7 days. 18 days check 31of 34 SH had mated queen (91, 17%). 45 days: measured the amount of frames covered by bees OH 7, 59 NH 5, 77. The production of honey in kilograms during 2014 was OH 25.30 NH 22.5. Control: 23, 50. Winter losses OH 5,88% NH 2,94 % Control 10%. We can conclude in the conditions of this assay it is possible to perform the multiplication of hives with actual cells with high levels of efficiency and harvest honey in the following season. Support PRODEAR.

TQP-042

New controlled release delivery system for propolis

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Propolis is a resinous material produced by honey bees. It exhibits antimicrobial and antioxidant properties and is used in the preparation of foodstuffs and cosmetics. Its composition varies depending on the plant origin, the geographical location and the collection season, thus its standardized formulation is difficult. The active components of propolis are polyphenols, terpenes, steroids, as well as sugars and aminoacids. Due to the complexity of propolis structure, the extraction of propolis usually has several issues such as the low yield in polar solvents and the poor stability and bioavailability. In this study a new delivery system for the green extraction and simultaneous encapsulation of propolis' polyphenols in natural carriers was developed. The new system is standardized in polyphenol content and exhibits in vitro controlled release properties. Its toxicity and bioactivity profile (antioxidant, anti-mutagenic and anti-ageing potential) was assessed against normal human epidermal keratinocytes under normal and UV exposure conditions. The new system is currently further evaluated for its biological properties on a reconstituted skin model.

TQP-043

The effect of different feedbee's concentration level on the bee colonies' development during the spring season

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To estimate the effect of use of different Feedbee's concentration level in the development of bee colonies during Spring Season, an experimental trial was carried out in an apiary in Tirana. For this trial, 21 bee colonies, similar towards strength and Queen's age, divided into three groups, were selected. The First Group (G1), during the whole trial's period, was fed with 4% Feedbee, the Second Group (G2) was fed with 10%, while the Third Group (G3) with 35%. The trial was organized into two phases, starting on January 20th through April 30th, each of them 45 days long. The feed consumption per each colony/phases was 2 kg. During both phases, the number of brooding frames and size of caped brood area in each group was measured. At the end of this trial, it was concluded that the application of different Feedbee's concentration level has not demonstrated any effect on the number of brooding frames. The application of the 10–35% concentration level of the Feedbee during the First Phase has stimulated a higher brooding rate up to 52% more, while during the Second Phase this effect is not evident, since the differences among the groups are not significant (p < 0.05). Using the 10% Feedbee during the Phase 1, since the differences among the G2 vs G3 were not significant, 2. 42 Euro/bee-colony will be saved. During the Second Phase the least concentration can be effectively applied, saving 3.4 Euro/bee-colony.

TQP-044

Application of GIS in potential beekeeping assessment: Case study of Montesinho Natural Park (Portugal)

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Planners require solutions that address routine work needs and seems essential to improving efficiency and productivity. There are a great number of different factors related to beekeeper activity as well the quality and productivity of different bee products. The spatial analysis is a powerful tool for overlap and relates various levels of information on a map, and consequently a very useful for beekeeping activity planning. This work proposes and applies a methodology to potential beekeeping assessment in Montesinho Natural Park, a region in the northwest of Portugal. The beekeeping potential maps were developed with the following data sources: legal standards, vegetation, land use, topography, water resources, roads, electromagnetic fields, and some honey physico-chemical analysis. The design and implementation of spatial analysis model based on Geographic Information System (GIS) to beekeeping planning activities has already been described by Anjos et al (2014). Spatial analysis techniques allows to define the potential beekeeper map supporting the beekeeper management in this region. Anjos O, Silva G, Roque N, Fernandez P, 2014. GIS based analysis to support the beekeeping planning. Book of abstracts of the International Symposium on Bee Products 3rd edition – Annual meeting of the International Honey Commission (IHC), Faculty of medicine, University of Rijeka, p:61.

TQP-045

Discovery of phytochemical biomarkers in propolis using 15t fourier transform ion cyclotron resonance mass spectrometry

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Propolis is a resin that bees collect from different plant sources and use for the defence of bee community. The intricate composition of propolis varies depending on plant sources from different geographical region and growing environment. Propolis is being widely used as dietary supplements, cosmetics, and toothpaste based on its anti-microbial and antioxidant activities but the activities have a wide fluctuation depending on the

compositions and quantities. To produce the constant efficacy, propolis needs to be thoroughly analysed to find its markers and index compounds and then be standardized by chemical compositions of the raw material. We investigated 11 different geographical samples collected from China, Korea, Argentina, Brazil (green and brown), Malaysia, Chile, India, Kyrgyzstan, and Uruguay. Constituent chemicals were extracted from the samples with 70% aqueous ethanol and then investigated by LC-MS and direct infusion MS on an electrospray ionization Fourier transform ion cyclotron resonance mass spectrometer (ESI FT-ICR MS) and a quadrupole time-of-flight mass spectrometer (Q-ToF MS). Chemical fingerprints were analysed by principal component analysis (PCA) and hierarchical cluster analysis (HCA) according to their growing environments. Despite their similar appearance such as colour and smell, the propolis samples were classified into different groups due to their characteristic chemical compositions. The result has shown that the high resolution mass profile can be a very specific method to distinguish the propolis samples by their growing areas and identify the characteristic marker compounds for their medicinal activities.

TQP-046

Using tics in the evaluation of prototypes of hives for *Apis mellifera* adapted to high temperatures in Latin America and Caribbean

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One of the consequences of climate change (CC) in Latin America and Caribbean (LAC) is the increase in the occurrence of extreme events. In recent years, extremely high temperatures have caused absconding of colonies and melting of thousands hives in this region, where Langstroth's hives, developed for temperate climates in 1852, is mostly used. With the aim of improving the conditions of comfort for the colonies of Apis mellifera without altering the size of the standart material used, a trial was carried out in an apiary located in province of Santa Fe (29 ° 54 '52.17 "lat. S, 61 ° 54 '40.81 " long). Eight prototypes were evaluated, all of them designed according the contributions of technicians and beekeepers of affected regions, using two treatments: with and without bees in its interior. Two dataloggers designed in the Electronics laboratory of the IIR (INTA Castelar) were used with 8 analog temperature (TMP36) and 5 digital sensors of temperature and humidity (SHT11) each. SD memory card reader, they have to store the recorded data, at 10 minute intervals, in ".csv" formatted files. The dataloggers are powered sealed battery 12V 7Ah connected to a solar panel. In this exploratory stage, the designs of best perfomance were the prototypes which reduce the external input of air and have any insulation on the top. These prototypes will be evaluated in apiaries with a higher number of repetitions in a second stage. Support: FONTAGRO FTG/FR 1331/RG- PNAPI 1112053

Apitherapy

ATP-001

Therapeutic effect of propolis on alpha amanitine toxicity

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Intoxications caused by -AMA containing mushrooms represent an unresolved problem in clinical toxicology since no specific and fully efficient antidote is available. Therefore, mushroom intoxication and its treatment are major research subjects. In the present study, it was aimed to determine therapeutic effects of propolis extracts in different solvents such as DMSO, water, ethanol, L-lysine against to the -AMA toxicity on C3A cell line. MTT assay were performed to evaluate the cell viability of hepatocyte C3A cells following propolis treatment and compared with cells treated silibinin which commonly used as an antidote of -AMA. In cultures treated with four different extracts of propolis without -AMA, cell viability significantly increased with only ethanolic extract of propolis in a dose-dependent manner. The C3A cell lines including -AMA (5 g/ml) treated with propolis (0.5, 1, 5 and 10 g/ml), and silibinin (0.1, 1, 10 and 100 m) each of 48h to investigate conventional method to new and natural remedy. After cell culture infused with -AMA and treated various propolis (AEP). The efficacy of aquatic extract of propolis (AEP) at 10 g/ml and the efficacy of silibinin (10 µm) indicated the same rate therapeutic effect against the toxicity of -AMA in cell culture. Additionaly, aquatic propolis (10 g/ml) extraction has revealed higher antitoxic effect against to -AMA in vitro as compared to alcohol extraction (10 g/ml). Acknowledgment:This study was supported by TUBITAK, ARDEB-3001, Project No:114S024

ATP-002

Antibacterial activity of royal jelly (Apis mellifera) proteins

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Royal jelly is a natural and biodegradable product and several reports have validated the relationship between continuous consumption of royal jelly and health. Several studies have demonstrated the potential of this natural product as an antioxidant, neur otrop hic, hyp o glycemic, hyp o cho lester olemic, hep atopro tective, hyp otensive, anti-tumor, anti-inflammatory, inmunomodulatory and anti-allergic. The aim of this study was to determine the properties of proteins of royal jelly and evaluate its antibacterial activity. Royal jelly samples were collected directly from hives in the state of Yucatan, Mexico. Strains used were E. faecalis ATCC 29212, E. coli ATCC 25922, S. aureus ATCC 25923 and V. cholerae. Protein extract was purified by size- exclusion chromatography (Sepharose-G200). The antibacterial effect of purified proteins was tested by disk diffusion method. Proteins were analyzed by SDS-PAGE (Bizan i et al., 2005). Proteolytic activity was determined using substrate-gel electrophoresis (Abreu-Payrol et al., 2005). A total of 46 fractions were obtained by size-exclusion chromatography from the royal jelly protein extract. The SDS-PAGE gel of the group of fractions called RJP2 showed four bands with molecular weights of 32, 45, 55, and 62 kDa. RJP2 showed proteolytic activity and antimicrobial activity against the strains tested, with inhibition diameters of 1.10 cm (E. coli), 2.20 (E. aureus),

1.24 cm (V. cholerae), and 1.66 cm (E. faecalis). The protein extract of ro yal jelly and RJP2 fraction showed proteolytic activity and wide spectrum of antibacterial activity against gram positive and gram negative microorganism. The results indicate that proteases could contribute significantly in the antibacterial activity of royal jell y.

ATP-003

Comparing the antioxidant potentials of honey, propolis and locust and developing their healthy mixture

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Among bee products, honey and, especially, propolis exhibit greater antioxidant capacity, providing the favourable effects on human health. The carob pod's high polyphenolic content and its strong antioxidant activity make this nutrient to be a potential candidate for developing a healthy food. The aim of this study was to assess the total phenolic and flavonoid contents of honey, propolis, locust samples and to develop a healthy new food product. Total contents of phenolics (TCP) and flavonoids (TFC) as well as total antioxidant capacities were measured by Folin-Ciocalteu and AlCl3 coloration methods, and by CUPRAC (cupric reducing antioxidant capacity) methods, respectively. The results indicated that honey (0.5 gGAE/g) gave the lowest responses for TPC, while the responses of propolis (199.1 gGAE/g) were highest. Also, the highest values were obtained in ethanolic extract of propolis (354.0 gTEAC/g) > locust (19.8 gTEAC/g) > honey (1.1 gTEAC/g). The mixture developed by the proper addition of each ingredient was evaluated by conducting a sensory panel focusing on consumer likings. A total of 144 untrained panelists assessed their preference of liking for one sample pair using 2-Alternative Forced-Choice test. Friedman test of rank sums of each batch revealed that the samples containing the Carob pod were liked over other treatments (p0,05).

ATP-004

Inhibition of *Candida albicans* biofilm through *Bifidobacteria* isolated from the digestive tract of Saudi Arabian honeybee race, *Apis mellifera jemenitica*

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We investigated the effect of probiotic Bifodobacterium (ksuBF4), isolated from the gut of *A. m. jemenitica*, on biofilm formation of *C. albicans*. The ability of *C. albicans* to adhere and grow on a polystyrene plates, reflecting

biofilm formation, was studied in the presence of Bifidobacterium. The effect of Biofidobacterium culture supernatant on the viability of *C. albicans* was studied as well

ATP-005

Bioactive qualifications and characteristics of cherry honey, bee pollen and bee bread

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In this research, physicochemical properties and active biological components of cherry honey, bee pollen and bee bread have been researched for moisture, conductivity, hunter color, optic rotation, total protein, prolin, phenolic content, flavonoids, antioxidant capacity, DPPH radical scavenging activity, anti-hyaluronidase activity. According to results, prolin has found 633 mg/kg in cherry honey. Total phenolic was 1371 mg/100g in bee pollen and 1428 mg/100g in bee bread whereas total antioxidant capacity (FRAP) was 5908 mgFeSO4/100 gand 4634 mgFeSO4/100 g, respectively. Cherry honey has characteristics with light color (L:80)in whitish-yellow. Anti-hyaluronidase activity of cherry honey (0.55 IC50 (g/mL)wa s found higher than bee pollen (0.02 IC50 (g/mL)and bee bread (0.01 IC50 (g/mL). Cherry pollen and bee bread have high antioxidant and anti-inflammatuar capacity due to their excessively having phenolic components. As a result, cherry honey, pollen and bee bread have high theraperutic specifications and more intensive research should be done for usage of them in Apitherapy. *Key Words: Cherry honey, pollen, bee bread, apitherapy*

ATP-006

The inhibitory effects of bee venom on atopic dermatitis in an animal model

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Atopic dermatitis (AD) is a multifactorial skin disease, with complex interactions of innate and adaptive immune responses based on a genetic, pharmacological and psychological predisposition. Purified Bee venom (BV) is a natural toxin produced by honeybees. BV has been widely used as a traditional medicine for various diseases. However, the precise mechanism of BV in ameliorating the AD is not fully understood. We investigated the pharmacological effects of BV on 1-Chloro-2,4-dinitrobenzene (DNCB)-induced AD in mice. BALB/c mice were sensitized with 200 μ l of 1% DNCB in acetone-olive oil (3:1) applied to the dorsal skin twice per week for

2 weeks. And then, the treatment of 0.2% DNCB was repeated twice a week alternatively for 4 weeks. BV (100, 200 µg in mixed with Placebo) was applied to the dorsal skin. Treatment with BV inhibited the eosinophil and mast cell infiltration into AD skin tissue. In addition, BV attenuated the production of histamine and proinflammatory cytokines in AD mice. The finding of this study demonstrated that BV reduced DNCB-induced AD in mice. Collectively, this study provides us with novel insights into the pharmacological actions of BV as a potential molecule for use in the treatment of allergic inflammation diseases.

ATP-007

Determination of flavonoid classes in *Trigona* sp. propolis from Luwu Regency, South Sulawesi Province, Indonesia

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Propolis is a resinous hive product, collected by bees. Recently, propolis has been used clinically by dentist to treat various oral diseases such as to support aid for the healing of post-extraction wounds, as an antimicrobial agent in the treatment of dental caries and pulpal infections, and to promote dentinal bridge formation in direct pulp-capping treatment. Propolis contains waxes, ferulic acid, cinnamic acid, phenol acids, aromatic aldehydes, and a large number of flavonoids. The application of propolis preparations in dentistry leads to increase interest in its chemical composition.

The aim of this research was to determine flavonoid classes in Trigona sp propolis which was collected from honeycombs in Luwu regency, South Sulawesi Province, Indonesia. Propolis was subjected to exhaustive maseration, filtered using aqueous ethanol solution and concentrated using a rotary evaporator. The residue was separated using toluene solution to yield polar flavonoid fraction and semi-polar flavonoid fraction which was analyzed using Thin Layer Chromatography (TLC) method (silica gel GF254 precoated plates with n-butanol: acetic acid: water (3: 1: 1 v/v) as mobile phase). The purification of flavonoid swas carried-out by UV-radiation at 253 nm and 366 nm and treatment with ammonia. The idenfication flavonoid classes based on color reactions according Mabry et al.

The result of this research showed that the flavonoid classes in the Trigona sp propolis from Luwu regency, South Sulawesi province, Indonesia were flavones, flavonoe, flavonol, and chalcone classes.

ATP-008

Beneficial properties of argentine stingless bees propolis: Anitnociceptive, anti- inflammatory and anti-pathogenic activities

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Propolis from stingless bees is well known for its biologic properties; however, few studies have demonstrated these effects. Therefore, this study aimed to investigate the antinociceptive, anti-inflamatory and anti-biofilm activities of alcoholic extracts propolis from the stingless bees Tetragonisca fiebrigi y Scaptotrigona jujuyensis, produced in Estación Experimental Agropecuaria Famaillá del INTA, Tucumán, Argentina. Anti-inflammatory activity was evaluated using carrageenan induced paw oedema. Analgesic activity of the extracts was estimated against acetic acid induced writhing, tail immersion method, formalin test. The anti-biofilm activity of these propolis was tested on Pseudomonas aeruginosa and Staphylococcus aureus bacterias. Both propolis extracts induced a significant anti-inflammatory effect, reaching maximum inhibition (55% T. fiebrigi and S. jujuyensis 62% respectively) at 1 hour with the highest dose, similar to ibuprofen (100%). It showed that alcoholic extracts of propolis studied species possess antinociceptive activity at both central and peripheral levels demonstrated by the three test algesia used. Scaptotrigona jujuyensis propolis tested at doses of 200 and 100 ug/ml against Pseudomonas aeruginosa presented a selective inhibition of biofilm unrelated to inhibition of bacterial growth, thus achieving reduce pathogenicity. It has started the isolation and identification of compounds responsible for the pharmacological activities displayed by propolis.

ATP-009

Bee bread: Origin, Composition, Properties and Uses against aluminium chloride-induced anemia in wistar rats

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Aluminum (Al) toxicity was associated with hypochromic microcytic anemia through observations of patients undergoing renal dialysis and Al-containing phosphate binder treatment. Bee bread is a mixture of pollen loads, honey milk enzymes and various lactobacilli that serves basic food for bees. Due to its more complex composition and to its easier digestibility/bioavailability, bee bread is valuable in the treatment of severe diseases like cardiovascular pathologies, diabetes. The present studies were undertaken to assess the effect of chronic administration of aluminum (AlCl 3,6H2O (DL10 = 662.2 mg/kg BW) on the perturbation of the haematological parameters and the production of a hypochromic microcystic anemia in Wistar rats, and to study the protective effect of co-administration of the extract of bread bee and aluminum. The measured parameters are : hematocrit % ; red blood cells (RBC); platelets ; hemoglobin (Hb); lymphocytes ; monocytes; mean corpuscular volume (MCV) ; mean corpuscular hemoglobin concentration (MCHC); Red blood cell distribution width (RDW) ; mean platelet volume (MPV) ; leucocytes (wbc); sodium ; potassium ; urea ; renal clearance. The results of this study shows the protective effect of bee bread extract on anemia induced by aluminum in rats. The major finding of this study is that aluminum enhanced oxidative stress. Bee bread showed a significant improvement in reduction of this oxidative stress by enhancement of superoxide dismutase and catalase levels. This effect may be attributed mainly to the active components present in bee bread.

ATP-010

In vitro screening for Anti-inflammatory activity of Moroccan propolis

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Propolis is a natural substance, produced by honeybees from the gum of various plants. Propolis chemical composition has been correlated with plant diversity around the beehive, It contains several chemical compounds, including various phenolic compounds like flavonoids (galangin, quercetin), cinnamic acid and its derivatives (chlorogenic acid, ferrulic acid, caffeic acid phenethyl ester), various steroids, amino acids and volatile aldehydes and ketones[1].

The Capacity to inhibit 5-lipoxygenase and hyaluronidase of 24 propolis samples collected from various regions of Morocco were evaluated in this work.

A lipoxygenase assay was used as an indicator of anti-inflammatory and antioxidant activities. aqueous ethanol extracts of propolis were revealed to have different inhibition activities with IC50 values ranging from from 0.02 to 0.65mg/ml. Sample S1 showed the lowest IC50 values (0.02 mg/ml), this sample was more effective than nordihydroguaiaretic acid (IC50=0.02 mg/ml). The highest hyaluronidase inhibition was recorded in the sample S1 with 92.3 + 0.7%, Folowed by sample S10 with 87.86 + 0.6% and Sample S22 with 87.04 + 0.1%, while le sample S6, showed le lowest inhibition wit 7.6 + 0.1%. Keywords: lipoxygenase, Propolis, Hyaluronidase. [1] W. Greenaway, T. Scaysbrook, F.R. Whatley (1988) Composition of propolis in Oxfordshire, U. K. and its relation to poplar bud exudates. Z Naturforsch, 43, p. 301

ATP-011

Tyrosinase and xanthine oxidase inhibitory activities of Moroccan propolis

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Propolis is a colored and aromatic colloidal substance collected by honeybees through adding their saliva secreted to the resinous plant exudates, which is used to build honeycomb and to fight against the invasion of pathogenic microorganisms. It has been applied in popular folk medicine since 3000 BC due to possessing a broad spectrum of biological activities such as antioxidant, antimicrobial, anti-inflammatory, antiviral, anticancer, and antihepatotoxic. Tyrosinase and xanthine oxidase inhibitory activities of 24 propolis samples collected from various regions of Morocco were evaluated in this work. The effectiveness of enzymatic inhibition of the various extracts was determined by calculating IC50. The lower the value showed, the higher the enzymatic inhibition. Xanthine oxidase inhibitory activity is used for the treatment of gout, hepatitis and brain tumor. Tyrosinase inhibitory activity is used for the treatment of hyperpigmentation and other related disorders. IC50 values of propolis extracts ranged from 0.037 to 4.28mg/ml against mushroomTyrosinase and from 0.007 to 3.12mg/mL against xanthine oxidase.

Antiurolithiatic Effects of hydro-alcoholic extract of propolis on Ethylene-Glycol-Induced Nephrolithiasis in Rats

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Propolis is a natural honeybee product known to be beneficial for human health, with a complex chemical composition, highly dependent on the collection site. The aim of our study is to evaluate the preventive effect of hydro-alcoholic extract of propolis in ethylene-glycol induced urolithiasis in the male Wistar rats. Materials and methods: Wistar albino rats were given 0.75% v/v ethylene glycol in drinking water to induce chronic hyperoxaluria and simultaneously hydro-alcoholic extract was given to nephrolithiasic treated rats at the dose of 100 and 250 mg/kg b.w. orally for 30 days, Cystone (500 mg/kg, p.o.) served as a standard. The weight difference, pH, Urinary volume, urinary crystals and the levels of calcium, magnesium, phosphorus, sodium, potassium, chloride, proteins, creatinine and uric acid in 24h-urine were measured. The biochemical parameters and the transaminase (alanine aminotransferase, ALT; aspartate aminotransferase, AST), phosphatase alkaline activity (PAL) were also evaluated in both serum. Results: The results show that the EG treatment lead to increased pH, urine volume and the levels of calcium, phosphorus, uric acid and protein in urine compared to healthy rats. The decrease in the magnesium, creatinine, sodium, potassium and chloride. Levels were normalized by hydroalcoholic extract of propolis and Cystone treatments. Moreover, the biochemical parameters were also largely normalized by the extract, which could contribute to the antiurolithiatic property of the extract. Conclusions: The results of this study indicate very promising antiurolithiatic effect of the hydro-alcoholic extract of propolis with preventive treatments in this experimental condition

ATP-013

Protective effect of Moroccan Carob honey against carbon tetrachloride (CCl4) induced liver injury in rat

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Honey contains various biological active substances including proteins, free amino acids, enzymes, vitamins, organic acids, flavonoids, phenolic acids and other phytochemicals. Honey has antioxidant, antiviral, antimicrobial, antiparasitic, and antimutagenic properties. This might explain its wide range of the therapeutic and biological activities. The present study was aimed to investigate the hepatoprotective effect of carob honey on carbon tetrachloride (CCl4) induced liver injury. The Wistar rats were used for the study and the hepatotoxicity was induced by intraperitoneal injection of CCl₄ (1ml/kh b.w.) after four days of pretreatment with carob honey

(2g/kg b.w. : orally). The hepatoprotective effect of carob honey was determined by assessing the biochemical parameters in serum and the markers of oxidative stress in liver. Pretreatment with honey prior the administration of CCl₄ significantly prevented the release of transaminases, alkaline phosphatase, lactate dehydrogenase, significantly inhibited lipid peroxidation (MDA), protein carbonyl (PCO) formation and Advanced protein oxidation products (AOPP) in liver and markedly enhanced catalase, glutathione peroxidase and ascorbic acid in liver. This findings confirmed the hepatoprotective effect of carob honey against CCl4 toxicity.

ATP-014

Determination of flavonoid classes in *Trigona* sp. propolis from Luwu regency, South Sulawesi province, Indonesia

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Propolis is a resinous hive product, collected by bees. Recently, propolis has been used clinically by dentist to treat various oral diseases such as to support aid for the healing of post-extraction wounds, as an antimicrobial agent in the treatment of dental caries and pulpal infections, and to promote dentinal bridge formation in direct pulp-capping treatment. Propolis contains waxes, ferulic acid, cinnamic acid, phenol acids, aromatic aldehydes, and a large number of flavonoids. The application of propolis preparations in dentistry leads to increase interest in its chemical composition.

The aim of this research was to determine flavonoid classes in Trigona sp propolis which was collected from honeycombs in Luwu regency, South Sulawesi Province, Indonesia. Propolis was subjected to exhaustive maseration, filtered using aqueous ethanol solution and concentrated using a rotary evaporator. The residue was separated using toluene solution to yield polar flavonoid fraction and semi-polar flavonoid fraction which was analyzed using Thin Layer Chromatography (TLC) method (silica gel GF254 precoated plates with n-butanol: acetic acid: water (3: 1: 1 v/v) as mobile phase). The purification of flavonoids was carried-out by UV-radiation at 253 nm and 366 nm and treatment with ammonia. The idenfication flavonoid classes based on color reactions according Mabry et al.

The result of this research showed that the flavonoid classes in the Trigona sp propolis from Luwu regency, South Sulawesi province, Indonesia were flavones, flavanone, flavonol, and chalcone classes.

ATP-015

Apimanaxx - honey from uncaria tomentosa (willd.) Dc: A new organic functional product that protects natural immunity and prevents premature radiation aging. Results of clinical studies

Viacheslav Tsuprykov

Environmental NGO

New honey with brandname APIMANAXX, containing active substances from Uncaria tomentosa (Willd.) DC. or Uña de Gato or Cat's Claw - legendary wild liana from Amazon rain forest or selva del Peru, a herb which has historical usage for the treatment of several human disorders including cancer, inflammatory and infectious diseases, was first obtained in apiary "Gogolmed" in Orzhitsky district, Poltava region, Ukraine.

APIMANAXX was tested on efficacy and safety in National Research Centre for Radiation Medicine of NAMS. In clinical study were attended 42 volunteers from number of clean-up workers of Chernobyl disaster. Every day they have ate 20 grams of honey for 28 days. As a placebo (control group was formed from 20 subjects) was taken an acacia honey that was the source-honey for APIMANAXX production. Before taking honey and after its completion, each participant of clinical study was a subject of laboratory examination (clinical, biochemical, immunological blood tests, general urinalysis, ECG, encephalogram), psychological tests (verbal, cognitive, intellectual). It was found that APIMANAXX is completely safe and has positive impact on human body. Laboratory investigations showed stimulation of leuko-and erythropoiesis, an increase of hemoglobin levels and platelet count, increasing numbers of cytotoxic T- lymphocytes, decreased titers of antiviral antibodies. Studies of radiation parameters of cellular aging demonstrated the stabilizing effect of honey on a relative telomere length and entry of cells into apoptosis.We have examined APIMANAXX for the presence of Carboxy alkyl esters and have found that this compounds are responsable for it immune-enhancing properties.

ATP-016

Antibacterial activity of bee venom

Ahmed Hegazi

National Research Center

Bee venom is very complex mixture of active peptides, enzymes, and amines. The composition of the venom produced by the glands of *Apis mellifera* has been well documented. The therapeutic application of bee venom, has been used in traditional medicine to treat diseases. It has biological activity as inhibit mammary carcinoma cell proliferation), cytotoxic to maligna nt cells both in vitro, arthritis, rheumatism, pain, cancerous tumors, and skin diseases, rheumatoid arthritis and osteoarthritis. Honey bee (*Apis mellifera*) venom therapy (apitherapy) has been elucidated therapeutic value for bacterial diseases and reported to be as effective as antibacterial drugs. Antimicrobial activity on some Gram-negative bacteria as Escherichia coli and Salmonella spp., Enterobacter cloacae, Escherichia coli and Citrobacter freundii and Staphylococcus aureus, Coagulase-negative Staphylococcus and E. coli. The aim of this review was, therefore, to evaluate the data from antimicrobial activity of bee venom.

ATP-017

Multiple Sclerosis patients treated with Apitherapy: Immunological pattern

Ahmed Hegazi

National Research Center

Objective: Determination of immunological pattern of patients suffering from multiple sclerosis treated with apitherapy in particular using bee sting therapy. Methods: Fifty patients with MS, their ages ranged between 26-71 years, were subjected to complete clinical and neurological history and examination to confirm the

diagnosis. All cases were under their regular treatment they were divided into two main groups, Group I received honey, pollen, royal jelly and propolis and were treated with apiacupuncture 3 times weekly, for 12 months, in addition to their medical treatment, while group II remains on their ordinary medical treatment only. IFN-, interleukin (IL) 1, IL-4, IL-6, IL-10, tumor necrosis factor alpha (TNF) were detected. Apiacupuncture was done by bee stings for regulating the immune system. Results: Results revealed that 4 patients showed some improvement regarding their defects in gait, bowel control, constipation and urination, while 12 cases, showed some mild improvement in their movement in bed, and better improvement in bed sores, sensation, and better motor power, only two cases of them were able to stand for few minutes with support. The level of IFN-, (IL) 1, IL-4, IL-10, TNF- was significantly elevated in patients in Group II, and no significant differences were found for IL-6 between the 2 groups of treatment. The mean values of IgE level in both groups of M.S. patients were low but with no statistical significance, while by the end of the study there were an elevation in the levels of IgE for both groups which was statistically significant.

ATP-018

Influence of royal jelly, ubiquinone and their composition on balance of pro-and antioxidant systems in the blood of rats with heat injury

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Experiments were carried out on 50 white rats Wistar male rats m=250-300g in 5 groups: intact; verification (thermal burn, 7sec); and 3 advanced-animals with the burn, which daily orally injected Royal Jelly (RJ) in a dose of 100 mg/kg; Ubiquinone-10 (Q-10) at a dose of 15 mg/kg; and RJ and Q-10 together. In the 10 days after the burn in plasma and erythrocytes studied the level of the lipid peroxidation (LP) and the overall antioxidant activity (AOA). Compared with healthy rats, for burns in plasma increased level of LP and number of Malonic Dialdehide (MDA) at 5% and 45%, respectively. Plasma AOA decreased on 13% and activity of Superoxyddismutase (SOD) decreased in 31%. Application of postburn RJ reduces the intensity of LP, the increase of SOD activity at 91%. Number of MDA has decreased in comparison with control and healthy animals at 50% and 28%, respectively. Introduction of Q-10 has increased the plasma AOA and activity of SOD in 31% and 29%, respectively, and the content of MDA in plasma by 58%, compared to the animals with the burn. Introduction of "RJ + Q1-10" reduced the rate LP and MDA in plasma by 11% and 44, respectively, increased the activity of SOD at 87%, compared to the controls. In erythrocytes membrane resistance increased, free radical oxidation they decreased by 16%. The most positive effect found when Ubiquinone-10 and Royal Jelly.

ATP-019

Application of the mixture for inhalation based on propolis and royal jelly "Apingalin" in the treatment of broncho-pulmonary diseases of various origins

Vasily Krylov, Svetlana Kopylova, Olga Cherkunova, Marina Rodavskaya

Lobachevsky State University of Nizhny Novgorod, Russia

Experiments were performed on 100 male rats weighing 200-250 g. There were two experimental series: pulmonary edema with modeling and experimental model tracheitis. In each of the experiments, the animals were divided into groups: intact, control (swelling of the lungs or trachea), experienced (treatment of a mixture for inhalation "Apingalin"). Experiments have shown that inhalation of "Apingalin" in a simulation tracheitis increases the total number of erythrocytes, increases the hemoglobin content, contributed to the restoration of the functional usefulness of erythrocyte membranes. Course inhalation means "Apingalin" when modeling adrenal pulmonary edema in rats helped reduce the intensity of the formation of endogenous intoxication: a decrease in endogenous release of toxins into the bloodstream from the lung tissue, reduced lipid peroxidation, Recovery biotransporta endogenous toxins, albumin concentration, very low density lipoproteins and low density lipoprotein; increasing the concentration of the total protein and fibrinogen and the normalization ratio protein fractions. Thus, for the treatment of broncho-pulmonary diseases can be recommended to use a mixture based on inhalation of propolis and royal jelly "Apingalin".

ATP-020

Efficiency of apitherapy by treatment of patients with chronic cerebral ischemia and seringomieliey

Vasily Krylov, Anna Deriugina, Elena Antipenko

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The aim of the research was to study the efficiency of apitherapy in combination with standard therapy in patients with chronic cerebral ischemia (CCI) stage II and seringomieliey (M). 50 patients with a CCI stage II, and 25 patients with a M were obser ved. Patients each disease were divided into two groups (main and control). The treatment course in the main group contained the ba sic therapy and apipuncture. Sterile solution of bee venom were injected intramuscular about 0.2 ml (single dose - 0.1 mg). The control group reseived standard therapy only. Blood counts (electrophoretic erythrocytes mobility, the concentration them in malondialdehyde and catalase activity) are examined patients of both pathologies. The dynamics of the neurological syndrome was evaluated in patients CCI and pain syndrom was evaluated in patients M. It is shown that the inclusion of apitherapy in a complex of basic therapy, more significantly improves the number of neurological indicators, pain and indicators of red blood compared with standard therapy. Apitherapy causes reduction of blood parameters to the physiological norm for about pathologies. Patients with CCI identified significant improvements dynamics cephalgic (p = 0.04), cochlear (p = 0.01) and vestibular-atactic (p = 0.04) syndromes from the control group. If CM noted positive dynamics in relation to the intensity of pain on a visual analog scale (p = 0.03). Possibly, the positive influence of apipuncture in patients with CCI stage II and CM were associated with activating effect of bee venom on the adaptive mechanisms of an organism.

ATP-021

Influence of bee venom and hyperthermia on the energy metabolism of tumor-animals

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Experiments are executed on white nonlinear rats females weighing 200±50g in 5 groups with 5 rats in every group: intact group; control (tumor-animals) at introduction of 1ml physiological solution; skilled 1- tumor-animals subjected to a hyperthermia 42,5C against effect of bee venom; skilled 2 - tumor-animals subjected to a hyperthermia 43,5C against effect of bee venom; skilled 3 – the tumor-animals subjected to a hyperthermia 44,5 C against effect of bee venom; skilled 3 – the tumor-animals subjected to a hyperthermia 44,5 C against effect of bee venom. Blood was taken from a hypoglossal vein. Blood plasma was exposed to research. Dynamics of change of the ATP, ADP, AMP, glucose content in blood of experimental animals was carried out by means of a blood plasma IK-spectroscopy method. It was registered ranges in the range of 1170-1025cm-1. The received results have showed a decrease in concentration of AMP, ADP, glucose and increase of the ATP level at experimental animals in relation to control at a hyperthermia (42,5C; 43,5C) against effect of bee venom 1 days later after therapy (0.05). The hyperthermia at 42,5C causes decrease in ADP and glucose concentration since the 7th days after therapy, however the hyperthermia of 43,5C doesn't cause their change. At 44,5C all contents increases authentically (0.05). For the 28th days there is an increase in the AMP, ADP level, and decrease in ATP and glucose level in all skilled groups (0.05).

ATP-022 Pharmaceutical Activities of Darae (Actinidia arguta) pollen

In Pyo Hong, Soon Ok Woo, Sang Mi Han

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Bee pollen is male reproductive cells of plants, which are made up of natural flower pollen by worker honeybees into granules with added honey or nectar. The incredible nutritional and medicinal value of bee pollen has known for thousands of years. It contains most of the known nutrients such as sugars, proteins, lipids, vitamins and flavonoids. Pollens have been extensively used in functional food, folk medicine, and beverage industry to improve human health. Recently, Bee pollen is receiving special attention to the potential therapeutic benefits field; bee pollen can plays a positive role in promoting the growth of endocrine glands and enhancing their secretionary functions. However stiff pollen wall hinder dissolution of polysaccharides and lower extraction efficiency. This study was conducted to establish the optimized protocol for cytoplasm isolation of bee pollen. We measured the antioxidant activities as DPPH radical scavenging, the total polyphenol content and NO production of the pulverized and lyophilized darae pollen to confirm the husk removal effect.

ATP-023

Improvement storability of the fresh-cut vegetables with propolis

Soon Ok Woo, Sang Mi Han, In Pyo Hong National Academy of Agriculture and Science, Republic of Korea Propolis is a health food, known that high antioxidant and antimicrobial effects, fresh cut vegetables that rapidly increasing consumption has recently faced the problem storability fall down after washing. To improve storability of fresh cut vegetables are being carried out various studies. In this study, using the characteristics of propolis we were performed to improve the storability of fresh cut vegetables. There was prepared in 18% solution of propolis extracts, by using this solution, propolis solution prepared diluting 0.001 to 1%, were dipped in fresh vegetables(cabbage lettuce, perilla leaf, and lettuce). Vegetables were measured the sensory evaluation and hardness after each treatment by placing in a certain period of time at room temperature and refrigerator. The results showed that the storage stability is excellent compared to non-treated as if diluted to 0.1-0.01% propolis solution is to improve the shelf life of fresh cut vegetables.

ATP-024

Antimicrobial efficacy of mastoparans against multidrugresistant Acinetobacter baumannii and Escherichia coli clinical isolates

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Emergence of multidrug-resistant pathogenic bacteria, e.g., Acinetobacter baumannii and Escherichia coli, has become serious problems worldwide and it limited therapeutic options to combat bacterial infection. Therefore, it is an urgent need to seek new antimicrobial agents from natural resources, e.g., mastoparans (MPs) isolated from hornet venoms or to develop alternative therapy, e.g., antimicrobial combination. MPs, cationic tetradecapeptides, exhibited potent antimicrobial activity against both Gram-positive and -negative bacteria, especially Acinetobacter baumannii and Escherichia coli. In this study, it found that mastoparan-AF (MP-AF), isolated from the venom of Vespa affinis, showed superior activity against multidrugresistant Acinetobacter baumannii (MDRAB) as compared with ampicillin, cephalothin, ciprofloxacin, gentamicin, neomycin, trimethoprim/sulfamethoxazole (SXT) and tetracycline. In addition, it also revealed that MP-AF exhibited synergistic activity against MDRAB when combined with ciprofloxacin or SXT. Meanwhile, mastoparan-B (MP-B), isolated from the venom of Vespa basalis, was modified to improve its antimicrobial activity by substituting amino acid content. After appropriate amino acid substitution, it found that [Leu3]-MP-B had better antimicrobial activity against multidrug-resistant E. coli and caused membrane permeabilization in a concentration- dependent manner. When [Leu3]-MP-B combined with specific antibiotic such as ampicillin, gentamicin or tetracycline, they also acted synergistically against multidrug-resistant E. coli. In conclusion, it revealed that MP- AF alone or combining with specific antibiotic could display potent antimicrobial activity against MDRAB. In addition, antimicrobial activity of MP-B could be improved by appropriate amino acid substitution. Vespid venom peptides, such as MP- AF or MP-B, could be promising candidates to be developed as antimicrobial therapeutics against MDR bacterial infection.

Occurrence of radio resistance at rats at intragastric bee venom introduction in structure nanopartical gold

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The work purpose – to investigate radio protective action nanostructured a biological bee venom at preventive introduction white rats-males. To skilled group entered been venom (0,5mg/kg) in structure nanoparticals gold (0,5mg/kg) and chitosan (100mg/kg), control group - a solution nanoparticals gold and chitosan. Indicators were accepted to relative norm of intact animals. All preparations were entered of 1ml intragastric of 1 times a day. Upon termination of feeding rats, control and skilled groups were exposed to the general gamma irradiation in a dose of 5Gr. The Blood sampling carried out for 1 and 28 days after an irradiation and defined total of leukocytes (Le) and quantity lymphocytes in formula of leukocytes (Lymph). During experiment it has been shown that for 1 days after irradiation Le and Lymph in group «the control on an irradiation on blood system) and maintenance of Le in skilled group above (<0,05) indicators of animals of group «the control on an irradiation». By 28 days total of Le group reached level of intact animals and it was above (<0,05) indicators of group «the control on an irradiation». The quantity Limph skilled group reached level of intact animals. From the received results follows that course per os introduction to rats of bee venom in structure nanopartical led to increase of stability of animals to action of the damaging factor and radio resistance occurrence.

ATP-026

The role of propolis as a natural product in conservative dentistry and endodontic treatment

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Propolis, or bee glue, is a natural wax-like resinous produced by honey bee from substances collected from parts of plants, buds, and exudates. Chemically, it contains waxes, ferulic acid, cinnamic acid, phenol acids, amino acids, aromatic aldehydes, and a large number of flavonoids. Propolis well known has antibacterial, anti fungal, anti-inflammatory, immunostimulator, and anti oxidant properties. Nowadays, propolis was found in many health stores in different forms like capsules, mouthwash solution, creams, toothpaste, and powder. Propolis has been used clinically by dentist to treat various oral diseases such as to support aid for the healing of post-extraction wounds, as an antimicrobial agent in the treatment of dental caries and pulpal infections, as a storage media following teeth avulsion, as a mouth rinse, and to promote dentinal bridge formation in direct pulp-capping treatment. This article is an attempt to review various applications of propolis in Conservative Dentistry and Endodontic treatment to stimulate the interest of clinicians to make further research about this natural compound. *Keywords: Propolis, Conservative Dentistry, Endodontic, Oral Health.*

Determination of flavonoid classes in *Trigona* sp propolis from Luwu regency, south Sulawesi province, Indonesia

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Propolis is a resinous hive product, collected by bees. Recently, propolis has been used clinically by dentist to treat various oral diseases such as to support aid for the healing of post-extraction wounds, as an antimicrobial agent in the treatment of dental caries and pulpal infections, and to promote dentinal bridge formation in direct pulp-capping treatment. Propolis contains waxes, ferulic acid, cinnamic acid, phenol acids, aromatic aldehydes, and a large number of flavonoids. The application of propolis preparations in dentistry leads to increase interest in its chemical composition. The aim of this research was to determine flavonoid classes in Trigona sp propolis which was collected from honeycombs in Luwu regency, South Sulawesi Province, Indonesia. Propolis was subjected to exhaustive maseration, filtered using aqueous ethanol solution and concentrated using a rotary evaporator. The residue was separated using Thin Layer Chromatography (TLC) method (silica gel GF254 precoated plates with n-butanol: acetic acid: water (3: 1: 1 v/v) as mobile phase). The purification of flavonoid classes based on color reactions according Mabry et al. The result of this research showed that the flavonoid classes in the Trigona sp propolis from Luwu regency, South Sulawesi province, Indonesia were flavonoid classes on color reactions according Mabry et al. The result of this research showed that the flavonoid classes in the Trigona sp propolis from Luwu regency, South Sulawesi province, Indonesia were flavone, flavonol, and chalcone classes.

ATP-028

Cardol, isolated from *Trigona incisa* stingless bee propolis enhances apoptotic cell death by stimulating caspase pathway in human colorectal cancer cell lines

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Attention in the field of drug discovery has been focused on the cancer prevention of natural compounds from traditional medicinal herbs. We had demonstrated that cardol, isolated and characterized from Indonesian stingless bee propolis, induced apoptosis in human colon cancer rapidly. The apoptosis might have been through a mitochondrial and caspase-dependent pathway. Cardol, isolated from Trigona incisa propolis inhibited human colon cancer cell lines (SW620) with IC50 4.5 μ g/ml and cytotoxicity in a time dependent

manner. According to the previous result of cell apoptotic activity rapidly after treated with cardol, we evaluated anticancer mechanism of that compound and characterized the promising targets. Human colorectal cancer cell line SW620 and cell viability was determined using MTT assay. Intracellular reactive oxygen species (ROS) were assessed by DHE assay. The expression of apoptosis-associated proteins was determined by Western blotting analysis and caspase luminace analysis. Cardol in high concentration (14 μ g/ml) induced apoptosis of SW620 cells, increased the expression of PARP, caspase 3 and caspase 9 and subsequent activation of caspase-3. Cardol produced intracellular ROS in a time dependent, however, N- acetylcysteine (NAC) pretreatment resulted in the inhibition of this effect and the recovery of cell viability. The activation of caspase-9, caspase-3, and concomitant poly ADP-ribosyl polymerase (PARP) cleavage, which are the indicators of caspase- dependent apoptosis. This study showed that cardol exhibited a potential antitumor effect in SW620 colon cancer cells through induction of apoptosis which mediated by superoxide generation. Keywords: cardol; stingless bee propolis; human colon cancer; apoptosis; caspase-3; ROS

ATP-029

The therapeutic efficacy and necessity of apifito composition "vitalar" for athletes and children of Ukraine

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We have developed a high-tech apifito dietary supplement composition "Vitalar" (homogenate of bee queen larvae on the base of honey), which proved itself as a safe and high effective supplement, that should be included in the training practice of highly skilled athletes. "Vitalar" has an indirect positive effect on the performance of structural and functional state of erythrocyte membranes, primarily by increasing the degree of antioxidant protection, indicating on the compensatory growth of the athletes organism.

There are a wide range of positive effects from dietary apifito compositions supplements. It's easy to use and has several advantages over medical prevention means of chemical synthesis because it does not have undesirable effects even after prolonged use.

"Vitalar" is a product of high biological value, which is made of substances which are identical in structure to the natural and can act as endogenous regulators of energy processes metabolism in the body. It has such active ingredients as natural honey and royal homogenate that activate immune defenses, accelerate adaptive changes in the body and stimulate physical and mental performance.

Considering our previous positive experience with apifito compositions in the treatment of children affected by the Chernobyl accident, our objective was to investigate the therapeutic efficacy of "Vitalar" and receive a positive impact on the health of children with diseases of the gastrointestinal tract, nervous and cardiovascular systems.

So "Vitalar" is an effective cure in the treatment of children's nervous, cardiovascular and the digestive system disorders.

ATP-030

Antimicrobial activity of korean propolis extracts against skin pathogen

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Propolis extracts from Korea and Brazil were investigated for their antibacterial and antifungal activities against skin pathogen. For this, we used 80% ethanol extracts of propolis from Korea (KPEE) and Brazil (BPEE). Minimal inhibitory concentration (MIC) for the strains tested was determined using the method of broth dilution with the KPEE and BPEE in serial concentration, respectively. The antibacterial activity of KPEE showed MIC of 0.25 g/ml for Bacillus subtilise and Escherichia coli ; 0.5 g/ ml for Staphylococcus aureus; 1.0 g/ml for Propionibacterium acnes. However, the MIC of BPEE for B. subtilise, S. aureus, P. acnes, and E.coli was 1.0, 0.5, 4.0, and 0.5 g/ml. The antifungal activity of KPEE using agar diffusion test was 24.34 \pm 0.5, 19.19 \pm 1.0 and 26.64 \pm 1.0 of the inhibitory zone for Trichophyton tonsurans, T. mentagrophytes and T. rubrum. The inhibitory zone of BPEE was 11.48 \pm 0.3, 11.0 \pm 0.5 and 13.11 \pm 0.5 for T. tonsurans, T. mentagrophytes and T. rubrum. All tested skin pathogens were more susceptible to the KPEE than BPEE. It seems that the Korean propolis has antimicrobial activity more than Brazilian propolis.

ATP-031

Angiogenesis suppression of korean propolis by inhibiting tube- formation and inducing apoptosis of endothelial cells

Da Hye Jeong, Mok-Ryeon Ahn

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Propolis, a folk medicine employed in treating various ailments, is a resinous substance collected by honeybees from the bud and bark of certain trees and plants, and stored inside their hives. We have reported that the ethanol extracts of Korean propolis (EEKP) possesses antiangiogenic activity both in vitro and in vivo. However, the mechanism of angiogenesis inhibition by Korean propolis has not been well-clarified. In this study, we investigated the effects of EEKP on tube-forming human umbilical vein endothelial cells (HUVECs). We found that inhibition of tube formation by EEKP was accompanied by partial fragmentation of endothelial cells, indicating that it induced cell death. Western blotting revealed that EEKP induced the reduction of vascular endothelial cadherin and platelet endothelial cell adhesion molecule-1. EEKP also induced chromatin condensation and cell nuclear fragmentation, morphological markers of apoptosis, in tube-forming HUVECs. Furthermore, EEKP suppressed phosphorylation of extracellular signal-regulated kinase 1/2, but upregulated phosphorylation of p38. It was also shown that EEKP induced apoptosis via activation of proapototic signaling, activation of caspase-3 and cleavage of poly ADP-ribose polymerase and lamin A/C. In conclusion, EEKP exerts its antiangiogenic effects through induction of endothelial apoptosis.

ATP-032

Antiangiogenic activity of various components identified from korean propolis

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Propolis is a resinous substance collected by honeybees from the bud and bark of certain trees and plants, and stored inside their hives. It has been reported to possess various biological activities. We have reported that the ethanol extracts of Korean propolis possesses antiangiogenic activity both in vitro and in vivo. In this study, we investigated the antiangiogenic activity of various components identified from Korean propolis: apigenin, benzyl caffeate, caffeic acid, chrysin, cinnamylidenacetic acid, p -coumaric acid, 3,4-dimethoxycinnamic acid, ferulic acid, galangin, kaempferol, phenethyl caffeate, pinobanksin, pinocembrin, pinostrobin, and tectochrysin. The effects of these components were tested on in vitro model of angiogenesis, the tube formation model of human umbilical vein endothelial cells (HUVECs) cultured in a 2-D systems (3.1350 g/mL). Apigenin, benzyl caffeate, galangin, kaempferol, and phenethyl caffeate possessed strong inhibitory effects on tube formation. In contrast, cinnamylidenacetic acid, 3,4-dimethoxycinnamic acid, ferulic acid, and tectochrysin had very little to no inhibitory activities. From these results, we propose that components from Korean propolis such as apigenin, benzyl caffeate, galangin, kaempferol, and phenethyl caffeate might represent a new class of dietary-derived antiangiogenic compounds. These propolis components may have the potential to be developed into pharmaceutical drugs for the treatment of angiogenesis-dependent human diseases such as tumors.

ATP-033

The role of propolis as a natural product in conservative dentistry and endodontic treatment

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Propolis, or bee glue, is a natural wax-like resinous produced by honey bee from substances collected from parts of plants, buds, and exudates. Chemically, it contains waxes, ferulic acid, cinnamic acid, phenol acids, amino acids, aromatic aldehydes, and a large number of flavonoids. Propolis well known has antibacterial, anti fungal, anti-inflammatory, immunostimulator, and anti oxidant properties. Nowadays, propolis was found in many health stores in different forms like c a p s u l e s, mouthwash solution, creams, toothpaste, and powder. Propolis has been used clinically by dentist to treat various oral diseases such as to support aid for the healing of post-extraction wounds, as an antimicrobial agent in the treatment of dental caries and pulpal infections, as a storage media following teeth avulsion, as a mouth rinse, and to promote dentinal bridge formation in direct pulp-capping treatment. This article is an attempt to review various applications of propolis in Conservative Dentistry and Endodontic treatment to stimulate the interest of clinicians to make further research about this natural compound.

ATP-034

The effect of propolis on cytokines during dental pulp inflammation

: A review

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Propolis has been used empirically for centuries because of its several biological and pharmacological properties. It was always mentioned as an anti-inflammatory agent. When dental pulp has inflammation, several mediators will be produced by innate immune cells. Cytokines are proteins released from cells in inflammatory process. In recent years, in vitro and in vivo assays provided information concerning about propolis and cytokines, thus a review dealing with the effect of propolis on cytokines during dental pulp inflammation became imperative. This review complies data from our study as well as from other researchers, focusing on its chemical composition on inflammatory process. Its anti-inflammatory property, considering its effect on interleukin, tumour necrosis factor, transforming growth factor as well as other cytokines during dental pulp inflammation are discussed. In vitro and in vivo assays demonstrated that propolis could inhibit inflammation process in dental pulp. Since humans have used propolis for many inflammation diseases and propolis-containing products have been marketed, the knowledge of its properties with scientific basis is not only of academic interest but also of those who use propolis as well. This review opens a new prespective on the investigation of propolis, mainly with respect to the immune system.

ATP-035

Extraction characteristics of propolis by ethanol

Soon Ok Woo, In Pyo Hong, Sang Mi Han

National Academy of Agriculture and Science, Republic of Korea

Propolis is a sticky material made from plant growth point protection secretion and resin which are collected by bees, then mixed with bee saliva enzyme, it is used to keep bee colony safe by applying inside of bee hive, and it is consisted of about 50% of resin and aromatic, 25% of beeswax, 10% of essential oil, pollen and mineral. In this study, it was necessary to extract the active ingredient in crude to use of propolis, since the use of a health food and extracted with ethanol. We reported a summary of the main results of the extraction of propolis by ethanol. Propolis extract yield and total flavonoid content tends to increase the higher the ethanol concentration. Total phenolic content exhibited the highest value in the 50-60% EtOH, the EtOH concentration showed a tendency to decrease further enhanced.

ATP-036

The extraction yield and DPPH free radical scavenging effects of liquor ratio from Korean propolis

Soon Ok Woo, In Pyo Hong, Sang Mi Han

National Academy of Agriculture and Science, Republic of Korea

Propolis is a sticky material made from bee collected growth point protection materials or resin of plants mixed with bee saliva enzyme. It is used to keep bee colony safety by applying inside of bee hive with various color including dark brown and yellowish brown. Propolis is extracted with ethanol, so as to take advantage of edible material, this experiment was carried out in order to investigate the relationship between liquor ratio and extraction yield and antioxidant effects. Although differences in the extraction yield according to the collected area, when one solution ratio 1:10 showed the highest extraction yield. The results confirm the DPPH free radical scavenge ratio (%) as antioxidant effects, the greater the amount of extraction solution showed higher antioxidant

Antibiotic resistnce

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Antibiotic Resistance occurs when antibiotic treatment is no longer effective at limiting and/or killing the growth of bacteria. This can occur either through previous exposure to a similar antibiotic treatment or through contact with another organism that is already resistant to the bacteria (transfer of resistance). Resistance may also occur naturally through genetic mutation or innate ability.

Bacteria can resist the effects of antibiotics by

- Neutralizing the antibiotic before it can cause harm
- Modifying the antibiotic attack site so it will not affect the function of the bacteria
- Removal of antibiotics from the cell
- Preventing the antibiotic from entering the cell

Once bacteria become resistant, the infections they cause may not be cured or controlled by antibiotic treatment. Ultimately, antibiotic resistance may lead to disability or even death over time. With the presence of many pathogens and contaminants in hospitals, patients have become more susceptible to the superbug. This presentation will examine the effects bee products have on patients suffering with the superbug. Farvardin Referral Laboratory Complex has played a major role in the research and development of new methods of treatment involving a combination of bee products. Cultures of the following resistant microbes have been analyzed and tested by Merhan Mohamadi, a microbiologist at Caspian Apiaries, and Dr. Mehrdad Vanaki and his team at Farvardin Referral Laboratory Complex. Coli

o Streptococcus pyogenes o Streptococcus agalactiae o Acinetobacter baumannii o Pseudomonas

ATP-038

New quinolinone alkaloids from chestnut (*Castanea crenata* Sieb) honey

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Two new quinolinone alkaloids and 13 known compounds were isolated from chestnut (Castanea crenata Sieb) honey. Two new compounds were determined to be 3-dihydro-spiro[2(1H),3(1H)-diquinoline]-3,4,4-trione (spirodiquinolinone) and 3-(2-piperidine)-kynurenic acid. In addition, 2,3-dihydropyrrolo[1,2-a]quinazolin-5(1H)-one was identified for the first time from nature. In addition, 2,3-dihydropyrrolo[1,2-a]quinazolin-5(1H)-one was newly identified from chestnut honey, although this compound has been synthesized before. The structures were determined by the NMR and electrospray ionization mass spectroscopy (ESIMS). Three compounds were qualified and quantitated in chestnut honey by selective multiple reaction monitoring (MRM) detection of LCESIMS using the isolated compounds as external standards.

Phenolic profile, antioxidant and antinociceptive activities of stingless bee honey from Argentine

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The honey of stingless bees in Argentina is popularly used as food and for the treatment of various human diseases. There is growing interest in this product, yet there is little information about the characteristics that give these properties. Currently it is not included in the Argentine Food Code. In this study honey samples produced by Scaptotrigona jujuyensis and Tetragonisca fiebrigi, collected in Estación Experimental Agropecuaria Famaillá of INTA, Tucumán, Argentina were evaluated. The phenolic profiles were determined by HPLC-DAD and the total phenolic content in both stingless bee honey by spectrophotometric method. The antioxidant power of the honeys has been determined in-vitro by using ABTS radical reaction system. Analgesic activity was estimated in-vivo against acetic acid induced writhing, tail immersion method, formalin test. The results obtained with the formalin test showed that honey of S. jujuyensis (1000 mg/kg) has an activity of 42%, lower to morphine (1 mg/kg) 66.22%, in nociceptive phase. During the inflammatory phase, both honeys presented analgesic effects. At central level, by the test of induction of pain by heat, observed that the honeys evaluated show the greatest antinociceptive activity at 90 min. The honeys analized at 1000 mg/kg inhibited pain between 49-51%, lower than morphine (90%) and ibuprofen (95%), in the test of induction of pain by acetic acid. All honey presented antioxidant activity. Coumaric, ferulic and ellagic acid, quercetin and kaempferol were determined. The study provides fundamental information to establish standards that promote the regulation, encourage the consumption and exploitation of stingless bee honey.

ATP-040

Chromatographic analysis of five different honeys collected from Korea

Segun Kim1, Inpyo Hong¹, Soonok Woo¹, Hyeri Jang¹, Sangmi Han¹ ¹ National Academy of Agricultural Science

This study was taken to evaluate chromatographic patterns and chemical characteristics of acacia, chestnut, linden, citrus and styrax honey collected from Korea. Chromatographic analysis was performed using reverse-phase UPLC with the mobile phase of

0.1% H3PO4 and MeCN and 12 min run time. Constituents in the honey samples were detected at 210, 250, 300 and 350 nm. Altogether, 9 common peaks were detected among the chromatograms of the honey samples at 210nm. Peak 5 especially showed the highest UV absorption. Also, peaks detected in 4.63 and 4.83 min at 300 nm were major constituents in linden and chestnut honey, respectively. The characteristic peak in styrax honey was detected in 0.67 min at 350 nm. The chromatographic analysis showed similarity and specificity among the different honeys and can be useful for distinguishing honeys on the basis of their floral sources.

N chromosome royal jelly, bee pollen, and honey as alternative treatment for autoimmune disease

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Autoimmune disorders occur when a person's immune system is unable to distinguish the difference between foreign cells and healthy body cells. As a result, the immune system attacks healthy body cells, which may cause abnormal organ growth and changes in organ function. Autoimmune disease can affect one or many different types of body tissue, which can have a debilitating effect on the health of many organs in the body. Diagnosis of this disease is quite challenging because it is possible to have more than one at any given time. It isn't uncommon to find similar symptoms amongst the many different types of Autoimmune Disorders. These symptoms usually fluctuate between periods of remission (little/no symptoms) and flare-ups (worsening symptoms), which inhibits effective treatment. Currently, there are no official cures for autoimmune diseases, so treatment focuses on minimizing the symptoms a patient may encounter.

This presentation will examine the use of N chromosome royal jelly, bee pollen, and honey as alternative treatment for Autoimmune disorders such as asthma, arthritis, eczema, rheumatism, diabetes, and fatty liver.

The following results indicate the percentage of patients who were able to recover completely after 7 - 30 days of treatment:

Eczema -100% Fatty Liver – 84% Diabetes – over 90% Rheumatism - 95 %

ATP-042

Bee venom therapy in Sinusitis - clinical experience

Cristina Pavel

Romanian Apitherapy Society

The paper presents six cases of acute or chronic sinusitis treated with small doses of bee venom injected directly into sinusal points or painful points from face area. The patients needed only few sessions of bee venom because immediately after the treatment, they started to breathe almost normally (nose was previously obstructed). The only exception was a lady with chronic sinusitis who had surgery previously for cleaning sinuses and she was having severe headache. She needed several months bee venom treatment, associated with leech therapy, and clinical results were very good.
ATP-043

New case report of multiple sclerosis treated successfully with api-phytotherapy

Cristina Pavel

Romanian Apitherapy Society

The paper presents the case of a 43 years old lady, diagnosed with Relapsing-Remitting Multiple Sclerosis ten years before first consultation. At the beginning she had fine urinary and sensitivity problems, but nine years later, after surgery for uterine fibroids, she was not able anymore to stand and to feel any sensation of urination. At the first consultation she was in the wheelchair, using urinary probe all the time, because she didn't have any sensation of urination. She had also dyslipidemia and had treatment previously with Glatiramer acetat. She started to take mixture of herbs and bee products and later injectable solution of bee venom (3 times per week). After two months from the beginning of bee venom therapy, she started to feel sensation of urination and muscular force in the legs increased. Five months later, she didn't need urinary probe, urination was normal and she was able to lift her legs and stand for a while. She is now very happy continuing the treatment with herbs and all bee products, mainly bee venom, to recover completely.

ATP-044

Bee products against liver diseases. review and clinical cases

Stefan Stangaciu

Romanian Apitherapy Society

There are hundreds of substances, physical factors and emotional factors that can disturb the normal functioning of the liver and thus, indirectly, of the whole organism. The bee products, having thousands of different useful nutrients and pharmacologically active compounds, can counteract most of the above mentioned factors, when used properly, respecting the golden rule of Natural/Integrative Medicine: "Treat the patient as a whole and not just the localized symptoms/diseases". We made a review of the relevant articles that makes the connection between the bee products and their substances and the functioning of the liver. Besides the review, to prove in practice our treatment concepts based on integrative medicine, we have treated with bee products and medicinal bee plants over 30 patients with liver diseases. In the presentation it will be shown also a comparative table between the advantages and disadvantages of both classical (allopathic medicine) and the natural/integrative medicine/apitherapy.

ATP-045

Nanoemulsion formulation of anti oral biofilm based propolis and curcumin extract

Muhamad Sahlan, Anissa Permatadietha A, Risqa Rina D

Universitas Indonesia

Propolis and curcumin have been reported to have antibacterial activity. Both of those herbs can be developed as anti oral biofilm mouthwash. In order to deliver the biological activity, mouthwash is produced as nanoemulsion that promotes wide distribution throughout oral biofilm and effectively penetrates to target cell. This study aims to create the best mouthwash formulation with great physical characteristics and stability, and also proved as antibiofilm agent. Each propolis A.mellifera and curcumin Curcuma domestica Val. was formulated into a mouthwash using the combined method of homogenization, mixing and ultrasonication. There was a variation amount of tween 80 and glycerin in each formulation to investigate its effect on stability. The proven formula with greatest stability was continued to undergo antibiofilm assay. Result of this study showed that formula with ratio of tween 80 and glycerin 2:1 (v/v) was found to be the best. Tween 80 and glycerin was investigated can't work as a single surfactant to produce stable nanoemulsion. Propolis and curcumin mouthwash showed in vitro antibiofilm activities against Streptococcus mutans, the primer colony in biofilm. Propolis mouthwash reported has a better effectiveness with the MIC of biofilm formation was 5% v/v and % inhibition of 48,54%, respectively.

ATP-046

Collagen type I density on dental pulp inflammation of sprague-dawley rats following the application of *Trigona* sp propolis from south sulawesi province, Indonesia

Ardo Sabir¹, Latief Mooduto², Cahyono Kaelan³, Sherly Horax¹

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² Faculty of Dentistry, Airlangga University, Indonesia
³ Faculty of Medicine, Hasanuddin University, Indonesia

The aim was to analyse the collagen type I density as the result of Trigona sp propolis application in the dental pulp inflammation of Sprague-Dawley rats.

Propolis was obtained from Luwu Regency, South Sulawesi Province, Indonesia. Flavonoid and non-flavonoid extracts were purified from propolis using the thin layer chromatography. Eighty male Sprague Dawley rats were used in this research. The rats were divided randomly and equally into 5 groups. At Group I (negative control) was not conducted any treatment. Group II, III, IV and V. A Class I cavity (Black Classification) were prepared on the occlusal surface of right maxillary first molar. The dental pulp was perforated using dental explorer and allowed to open in the oral cavity for 60 minutes, after that the ethanolic extract of propolis (EEP) (Group II), the extract of flavonoid-propolis (EFP) (Group III), the extract of non-flavonoid propolis (ENFP) (Group IV), or Calcium Hydroxide (Ca(OH)2) (Group V) were applied. All cavities were then filled with Glass Ionomer Cement. The rats being sacrificed in 6 hours, 2 days, 4 days and 7 days. Sample biopsy were obtained, staining using Mallory method and observation under light microscope. Data was analysed statistically with significance level of p<0.05.

The result show that there is no significant difference of the collagen fibers density among 4 time periods of each group and among 5 groups of each time period. Although, numerically, there is the slight increase of the collagen fibers density along with the increase of the observation time period duration.

BRP-001

Beekeeping for rural development

Hana Tadesse

Ethiopian Meat and Dairy Industry Development Institute

Farmers use beekeeping mostly for honey production for medicinal value and for home consumption. But the method of beekeeping not modified in most rural community because of lack of money, basic skill for beekeeping and skilled manpower. Honey has high cash value relative to its weight and bulk properly stored it is essentially anon-perishable product. Beekeeping activity can also solves economical problem of the rural people since it doesn't require large capital and land. If government and community members are working together in the filed of rural development beekeeping has to be given due attention for great change. Bee keeping is a family business it can easily done by women, the men work directly with the bees and women are often involved in preparing the honey for market and in actual marketing. Bee keeping is an activity is that everyone can do it only needs commitment and passion. Beekeeping can solve many problems that the rural community faces like shortage of cultivated land and shortage of income for starters 2 traditional or modern hive is enough with good management system it is profitable it can be source of income in farm off seasons. Beekeeping is an activity that fits well with the concept of small-scale agricultural development. It is labor intensive under taking which can be easily integrated into larger agricultural or forestry projects. Bee not only aid in the pollination of some crops used in such projects' but they make use of other wise unused resources nectar and pollen.

BRP-002

Revolving fund as a development tool

Emilio Figini³, Pablo Chipulina¹, Mauricio Mateo²

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One of the major drawbacks for the development of apiculture in North of Argentina is the lack of resources for the purchase of supplies to the micro and small producers, which are not subject to credit for traditional banks. With the aim of covering this segment was implemented a financial services with a social approach that allows strengthening the productive and financial aspects of the beekeeping business. The Government of the province of Chaco implemented in the "BEEKEEPING PLAN" a revolving fund of supplies destined for members of beekeeping associations and cooperatives support by PRODEAR. It is currently being implemented in 15 organizations. The initial fund was u\$s 155,000. The beekeepers purchase the supplies and pay them once marketed its production, at wholesale prices. Then is the replenishment of funds to the institution. In the case of inert material is financed to a period of five years, beekeeper pay one fee fixed in kilograms of honey, which is discounted at the moment of commercialize production. The funds recovered from the first three payments are used to increase the revolving fund of supplies and the latest two to new loans. Beekeepers receive technical assistance that allows them to adjust the details of PROAPI technological path way. Since 2011 with the implementation of this system the number of users increased by 20%, while the number of total hives grew 25%.

You are managed to reduce the mortality rates to less than 15%, and increase by 50% the number of productive hives.

BRP-004

Apicultura de presicion/ miel organica y Abejas reinas agroecologicas

Sergio Iglesias

Ecolabbee

ECOLABBEE ES LABORATORIO SUSTENTABLE DE CRIANZA INTENSIVA DE ABEJAS REINAS , SUB PRODUCTOS APICOLAS, ELABORADOR DE MIEL NATURAL ORGANICA

Nuestra Especialidad La Cria de Abejas Reinas en Eco Region de bosque nativo bajo inver nadero y Sub Productos apicolas agroecologicos.

Utilizamos Ecotipos locales de abejas melíferas. libres de consanguineidad

Sistema posicionamiento satelital y trazabilidad en todo su estadio Y asi poder acceder a toda info mediante codigo Qr.

Cuidamos al Ecosistema Natural mediante practicas amigables al ambiente. Desarrollamos una actividad sustentable.

Proveemos de material genetico de alta calidad biotipica para desarrollo de nuevas unidades productivas que benefician la produccion de aliementos mediante la polinizacion de cultivos.

Producimos alimentos saludables.

Agregamos inovacion tecnologica en ingenieria de procesos.

LA APICULTURA DE PRESICION ES UNA ALTERNATIVA VALIDA EN CONSTANTE CRECIMIENTO, ATENTO A LA PRODUCCION EN AUMENTO DE ALIMENTOS SALUDABLES.

LA DEMANDA INTERNA Y EXTERNA NO SE CUMPLIMENTA, QUEDANDO SALDOS ANUALES DE IMPORTANCIA SIN CUBRIR.

LA PRODUCCION DE NUESTRAS ABEJAS AGROECOLOGICAS, LA UTILIZACION DE PRACTICAS AMIGABLES AL AMBIENTE, ELABORACION Y PROCESOS SUSTENTABLES Y LA ASISTENCIA TECNICA A PRODUCTORES SOBRE CONSERVACION DE ECOTIPOS Y BIOTIPOS LOCALES NOS DAN UNA VENTAJA COMPETITIVA EN EL IMPACTO AMBIENTAL, CALIFICANDO EN VALOR AGREGADO NUESTRAS PRODUCCIONES.

BRP-005

Invitation to diverse learning - what honeybees can bring to classroom –

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Keeping small animals in educational scenes has been encouraged over a century in Japan. Through the rearing experiences, kindergarten and primary school children are expected to learn the value of life and feel respect to it, to grow tender loving feeling, and to find ecology and diversity of living things. Insects are one of the most familiar animals, which can be excellent teaching material through rearing, imparting child's scientific way of thinking, and the social view point as well. Unfortunately, several factors, including the confusion and misunderstanding of wasps with bees by teachers and the general public, limit children's happy encounter with honeybees in Japanese classrooms or apiaries. Nowadays honeybees play vital roles in domestic food production. Honey, royal jelly and other bee products are a part of our daily life. If appropriate bee program is offered, not only children but also teachers and parents will recognize the integrated bee- related facts that supports their everyday life, such as pollination, food chain, beeswax, honeycomb structure, communication, diligence, division of labor and united efforts. We aim to develop hands-on bee programs for school teachers and students of the teacher training course. As the bases, the activity of a beekeeping family and a small primary school in Kunneppu, near the Northeast end of Japan will be introduced. The program should be designed to take in various sides of bee-people interacts that has a long and rich history, to bring out deep, unique and personal reactions even from those not familiar with honeybees.

BRP-006

Beekeeping for rural development in India

Prashant Sawant

Sahyog Pariwar (NGO)

'Sahyog Pariwar' is a nonprofit organization working from year 1990 for the rural development & Tribes Development. Organization work in various areas for rural developments. From these various projects or activities Employment for tribe's very important activity of the organization. In this activity focus on the forest & forest food. Scientific Beekeeping & Honey collection is main component run by this Organization. Dorsata Honey Bees (Rock Bee) Conservation activity run by 'Sahyog Pariwar' from last 25 years. Dorasta bees very much neglected. Theses bees found only in the Asia. People think that Dorsata Honey Bees are very dangers in the world so this Honey is not good for health. Through the 'Scientific technical Beekeeping & Honey collection training programs without killing honeybees we collected honey from these Dorsata bees. Since 2000 trend tribes said to organization that "We collected honey as per your training programs. We learn how save our environment, bees & forest. After the training we can collect honey on repeatedly basis from same honey comb. Quantity is too large so please help us for selling." Before the training program tribes collect honey only one time from one comb by traditional method. They kill honeybees, through fire and squeezed the honey comb and collect Honey. In traditionally process, unknowingly tribe's used to harm the honey bees, bee's reproductivity and environment. After all conversation program organization took that honey selling activity on experimental They took the activity with new structure, new mission & vision, new social change & solidarity.

BRP-007

Posters work for rural beekeeping training in Uganda

Biryomumaisho Dickson

The Uganda national apiculture development organization, Uganda

Beekeeping training is based on written training manuals. Meaning, only literate trainers selected to train. In LDCs, those with formal education read and write (academicians, theorists, and not practical). Few experienced trainers (expensive) with strong practical skills willing and able to provide hands-on. Adults learn well through seeing and doing. Where written training materials are given to beekeepers, are kept well in bookshelves (rarely retrieved). There is growing concern on how to reduce cost of training, reach more beekeepers and make materials retrievable relevant. In 2010 while implementing UHTP, beekeeper to beekeeper extension model developed. Prominent beekeepers (managers) trained and given capacity motivation to train 10 beekeepers. The 10 train three additional each (multiplier effect). This model worked well. However, a significant challenge emerged. The managers given written manuals, expected to use these to train others. This was hard because trained beekeepers (illiterate) couldn't consult materials provided. GoU (2012) produced first Beekeepers' Training Manual, 2000 copies distributed to beekeepers. Soon discovered that manuals were poorly used rarely shared Compared to posters (pollination and 10 benefits of beekeeping) distributed by BfD in 2008 - 2010, and ones TUNADO distributed in 2012, are still available accessible among the beekeepers. Beekeepers hang these posters in their sitting rooms, offices and in public places making it reference point. In Uganda, non-educated beekeepers continue to demand the picture training cards developed by BfD than written training manual. This prompted me develop 10 training posters (BfD, Trias ZOA supported) and wish to make poster presentation.

Apiculture and pollinator industry survey in thailand

Chama Phankaew

Kasetsart University

This study was carried out during August to October, 2014 by using questionnaires to get information from 22 beekeepers, 9 longan orchard owners and 6 lychee orchard owners. In addition, information also comes from indepth interviews with 11 bee experts, 4 bee researchers and reviewing of publications. There are 4 bee species: European honeybee, Indian honeybee, giant honeybee and stingless bees used by beekeepers in Thailand. However, the main species in the bee industry is the European honeybee with 300,000 colonies and the farm value of bee products is about 37.7 million USD and honey export value of 17.1 million USD in 2012. The key nectar crops are longan, lychee and white snakeroot. The key pollen crops are corn, giant mimosa and sensitive plant. The peak activities of honeybees are within 4 months starting in December to March which coincide with the availability of the 3 main nectar crops. The biggest challenges, according to beekeepers surveyed, are food sources (25.6%) and the Tropilaelaps mite (25.6%). Respondents also improper (off-label) use of pesticides (12%), resulting from the lack of pesticides that are registered for specialty or minor crops. The bee pollination industry is most developed in the northern provinces and there is a potential to develop in other parts of Thailand. The future of apiculture industry in Thailand is still on the rise because the demand of honey and other bee products both at national and international levels is increasing and the volumes of bee products are not sufficient at present.

BRP-009

Linking women beekeepers to market

Chipangile Musongole

Envirodevelope Zambia Limited

Key Success Factors for Linking Beekeepers to the Market

1.Approach

-Market Driven approach

-Business and Producers = Committed and Risk takers

-Heavy social capital investment - over time

2. Types of useful interventions

a)Technical support – Field Extension service remains no.1 in working with farmers b)Strengthened the capacities of all existing groups and facilitate long term linkages between them

c)Private sector innovation was needed most and encouraged participation through exchange visits, market access mechanisms, best practices, technology transfer

3. Outgrowers Programmes:

Crucial Linkages between the Beekeepers (producers) and the Market

-Infrastructure - Technology development - Communications - Market Access - Training (production group mobilisation)

4.Results

-2,680 women trained

-60 tons honey exported to South Africa every year

- 52 tons sold locally

-Rural economic growth ZMW 760,000 pumped into the local economy in direct payments to beekeepers in the year (2014)

-Income generating activities are simple, cheap and likely to have high adoption. Simplicity and low cost materials were critical factors for sustainability and extension to other local communities (from Central province to North Western Province).

5.Impact of EDZ Programme

-EDZ had played a major role, working with farmers and market intermediaries in order to establish and scale-up sustainable market relations

-EDZ has integrated in its training programme total ecosystem management of forests so that communities are able to appreciate their environment from a wider perspective since forests meet both economic and non-economic needs.

BRP-010

Assessment of beekeeping in sustainable rural livelihood

Duke Alexander Nettey

Gab Seven of Enterprise

Beekeeping or apiculture is the preservation of honey bee colonies to get pure honey and help in pollination beekeeping is a useful mean of the study was to assess the impact of beekeeping training give by Federation of Ghana Beekeeping Association(FGBA)to females Tolon-Kumbungu district of Northern region, and Nkwata district capacity building of the rural women in beekeeping was the focus and ten twelve trainees " beekeeping were selected randomly from each district for survey to assess the impact of beekeeping in their livelihood.

Analysis suggest that there are the management practices of beekeeping.

For future selection criteria of participants have to be focused and without the involvement of male member they can't manage this whole activity in a better way.

For female it was very difficult to handle bees, proper colonies management, their supplement feeding honey extraction movement of hives etc.

Economically, beekeeping increased keepers incomes but this ration was very low in the targeted area.

Training had to be gender based for sustaining livelihood. There are some problems identified by the beekeeping. Finally the auther have drawn some recommendations for future beekeeping training.

In not shall there was no positive impact of beekeeping training of rural women.

However, it has not been a route out of poverty; despite support, the majority of beekeepers subsist on \$2 a day. An energetic, revitalizing the apiculture sector.

The combination of participatory action research, a value chain approach, monitoring, and learning from traditional knowledge has lead to positive societal and ecological benefits that extend from Cameroon to an international level.

BRP-011

Beekeeping for rural development

Kapalay Kabemba Lumina Mabwe Jean Pierre

AVEC-PVS / The Consortium of the Tanganyika Beekeepers

A well trained beekeeper of the DR Congo and Projects Coordinator of AVEC-PVS/The Consortium of the Tanganyika Beekeepers, we are interested in developing beekeeping for Rural Development, in growing specific flowers crops which will allow bees to make a honey of superior quality. Furthermore, we are determined to fight against diseases especially those related to lack of proteins and minerals; to protect and to spare the environment, as well as to promote the economical development of our members. For these reasons above mentioned, among other ones, we wish to participate to the APIMONDIA Congress 2015 for presenting our beekeeping products, for experiences exchanges and for developing our beekeeping activities in our area.

BRP-012

Beekeeping rural development in Uganda

Jude Ssettaba

Native Products ltd (Uganda)

Beekeeping is emerging as Avery successful agricultural practice for local people in rural areas of less developed countries. Not only does the practice of beekeeping have intrinsic health benefits through providing food source of great nutritional value which is lacking in rural areas, but beekeeping requires few inputs and capitalizes on a ready supply of pollen.

Beekeeping as a Commercial Enterprise may not be easily done by an individual but can easily be achieved by a couple of individuals who can produce collectively for the market which currently outstrips supply locally. Beekeeping practice in developing countries is majorly done in local hives using traditional methods which comprises approximately 85% and the other

15% use top bar & frame hives. Despite the types of technologies, majority of the beekeepers still use old beekeeping practices based on their forefather's know how techniques and this could also explain why the yields are low coupled with poor quality of the honey.

Bees are the most effective pollination agents second to none. Bees pollinate about 80% of the various plants (more than half of food crops) & vegetation to yield fruit. Pollination is the biggest benefit mankind gets from bees like Dr. Albert Einstein was quoted "if bees disappeared from the surface of the earth, man would have

no more than 4 years to live. No more bees, no more pollination, no more food....no more man." This is how important bees can be as regards pollination. Bee pollination can increase yields by 45% and above.

BRP-013 Beekeeping development in Maharashtra through training in rural area

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¹ Vidya Pratishthan's School of Biotechnology, Baramati, Dist. Pune, MH, India ² Vidya Pratishthan's School of Biotechnology, Baramati, Dist. Pune, Maharashtra, India

Based on the survey conducted in 84 villages in Baramati, Dist. Pune, Maharashtra, it was found that nectar and pollen sources in flowers from agri horticultural plantations are useful to honey bees. Farmers need honeybee colonies for pollination to increase the crop yields especially, sunflower, pomegranate, maize etc. In view of this, awareness and training programme in beekeeping conducted at different locations. Over 5000 farmers, women and students trained in beekeeping. Simultaneous demonstrations in honeybee pollination of different crops were conducted.

The increase in yield, improvement in quality paid good prize to the farmers. Now farmers are demanding honeybee colonies for beekeeping for pollination of crops. This needs rapid breeding and multiplication of bee colonies as well as new queen rearing techniques for mass production. The increasing demand for beekeeping can be fulfilled by modern technologies and training as plan for the future programme.

BRP-014

Rural areas bee realing and development of local community

Borah Lemmy

Masesa Group

Masesa group is a group of three woman which has been registered under Tanzania Registrer of Companies (BRELA) with registration number 289629. The Group has started its corncerning with beek keeping activies and its product long way back before registration around 2005. Due to growth of high level of unemployment and large number of women emerge as a group of house keeper, this group see it is wise to employ women to participate in bee realing activities in order to make the income of women to rise up.

Since it has been started its function the group has emerge as an opportunity for women to exchange ideas, rise up their capital and make them to sustain the daily life.

Masesa group has its own farm for bee realing though it has not been registered within internation GPS cordinates. It has local tools for extracting honey, clearing and packing it within bottless. The group has an opportunity to participate within international Trade Market festival) which localy had been organized in Tanzania each year and mark its climax on 7 July each year. During the particular festival the group has opportunity to show bee product and its harvest, and to educate member of the public on the area of which are suitable for bee realing.

Every struggle has its outcome, this activities make the group to obtain number of certificate on various seminars, conference and certificate of recognitions as well as it has provide number of employment toward number of women.

BRP-015 The Impact of contracts on Ethiopian organic honey producers' incomes

Jony Girma¹, Cornelis Gardebroek²

¹ Apis Agribusiness ² Wageningen University

In southwest Ethiopia honey is a non-timber forest product that provides income for many smallholders. Some of these beekeepers supply their honey under contract to a company that markets their organic honey internationally allowing them to access premi um markets. Since both production and marketing depend crucially on the forest, both smallholders and the company have an interest in preserving the forest. An important question is whether smallholders also benefit economically from supplying under contract. This study examines the impact of contract supply on household income of organic honey producers in southwest Ethiopia using econometric methods. Results show that participation in contract farming causally improves honey prices and beekeepers' annual incomes. These results underline the importance of participation in contractual organic honey production as a sustainable rural development strategy.

BRP-016

Honey comb rest (HCR) for resting top bar combs in a workable state

Abraham Addo-Ansah Allotey

Forestry commission Ghana/ allotey honey bee farms, Ghana

This innovation sought to design and develop an adjustable honey comb rest to reduce comb break-up and to provide a wide, stable and workable comb-view HCR is a two stainless steel plate (thickness 2 mm) of dimension 50cm *30 cm (comb rest) and base stand 50*25cm joined by hinges at their length- wise edges to form a some-what open –book-like system with one of the plates being a base or stand whilst the top one acts as the comb rest . A wedge (a metal plate,dimension 45*20) at the back of the comb rest creates various angles between the comb rest and the base at the beekeepers' convenience The developed HCR allowed the viewing of the combs at a desirable angle without break-up of the combs for efficient working activities. The comb rest unit has holders at its top and bottom sections to hold and secure in place the top bar and comb respectively. In that way the combs attached to the Top Bars rest and are worked on without break –up. The HCR could be used during top bar honey comb decapping, queen cell grafting, pest and disease inspections etc., to reduce or prevent comb break up. It will provide convenient viewing of combs at various working angles by beekeepers as

working with top bar honey combs are delicate operations which must be done carefully so as not to break the combs especially when on Top Bars (TB) as against those on the frames.

BRP-017

Knock-down wood and metal combined 'hybrid' hive of Langstroth and Top Bar Hive designs (HBLTBH).

Abraham Allotey

Forestry commission Ghana / alloteyhoney bee farms, Ghana

The objective of the study is to design and develop a combined wood and metal 'hybrid' of Langstroth and Top Bar Hive which combines the advantages of both hives with additional benefits in its construction and operations. The HBLTBH has heavily perforated metal, covering one –quarter or the whole hive surface and internal wood covering of thickness 1cm. It is a knockdown of 6 parts with the following internal and external dimensions. This dimension is for a 18 Top Bar 'Hybrid' Hive.

Deemves	
Parts	Dimensions(cm) InternalExternal
Front 62 X 31	70 X 35
And Back	
Sides48 X 35	58 X 35
Base 62 X 50	70x58
Roof 70 X 58	90x70x3

The 4cm extended extra plate forming the external dimension has 3 equally drilled holes for fixing the hive's parts by bolts and nuts. The top bars are internally placed on a Top Bar rest with a metal screen placed over them to hold them in place by bolt and nuts. It has twelve -2cm diameter aeration pipes, 6 each , front and back of the hives respectively. The pipes are fixed just below the Top Bar rest, screened internally to prevent bee escape and covered with plastics lid externally to control air entry.

The HBLTBH could be stacked with 'supers' for the same colony and for different colonies in different hives, stacked on each other to reduce land usage.

Honey production and land utilization will be improved. Hive construction will be uniform, less costly and more durable

BRP-018

Low- cost knock down top bar beehive stand (KDBHS)

Abraham Addo-Ansah Allotey

Forestry commission Ghana/ allotey honey bee farms, Ghana

The objective of this innovation was to design and fabricate a durable low cost knock- down stands for the Top Bar Hive (TBH) KDBHS was made up of four- 1/2 inch iron rod of length 18 inches whilst the 8- pieces of the cross- bars were either made of bamboo (full or half Culm), raffia palm branches and wood of thickness 2*2 inches and length 14 inches with pre-drilled holes. Each leg had 8- L- shaped iron rods of length and width 4 inches with four each of the L-shaped iron rods wielded perpendicular to the legs at 8 and 4 inches respectively from below the base of the legs and from the top of the legs. The cross - bars pre- drilled holes were passed over

the L- shaped wielded iron rods to fix the table in a stable state. The adoption of KDBHS reduced the time and cost of its fabrication. Additionally the cost and packing spaces were reduced both in storage and their transportation to sites .In service, a one inch PVC pipe of length 7.8 inches was placed over the iron rod legs as 'shoes' to prevent rusting of the rods whilst in the termite/ ant- barrier water bath. Also the 'shoes' prevented climbing by lizards, ants etc to the hives. The lengths of the stand could be varied depending on the lengths of the cross- bars. Also two or more tables could be fixed in series to carry more behives horizontally at a lesser cost

BRP-019 Enzymatic browning reduction in white cabbage (*Brassica* oleracea) using honey: Does honey color matter?

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¹ Zambia Forestry College ² Copperbelt University

Thirteen honey groups consisting of 66 samples from different geographic locations in Zambia were screened for total phenolics, total flavonoids and antioxidant activity, and their color parameters (L*, a* and b*) were measured by transmittance. Total phenolic and flavonoid contents ranged from 479.2 ± 1.1 to 1383.9 ± 3.7 mg Gallic Acid Equivalents per kilogram of honey (mg GAE/kg) and from 85.5 ± 1.8 to 609.2 ± 3.7 mg Catechin Equivalents per kilogram of honey (mg CE/kg) respectively while total anti- oxidant activity ranged from 3.9 ± 0.5 to 7.8 ± 0.9 mmol (Fe2b)/kg. Enzymatic browning reductions increased with decreasing honey lightness (L* value) and honey redness (a* value) but were not found to be significantly affected by honey yellowness (b* value) (p > 0.05), implying that darker honeys possess stronger ability to reduce enzymatic browning in white cabbage than lighter honeys. Furthermore, the effect of honey color on aroma and taste characteristics was not significant (p >0.05). However, geographic location had an effect on flowery (b 14 #0.21, t 14 #2.48, p < 0.05) and acidic (b 14 #0.52, t 14 #3.47, p < 0.01) characteristics of honey, suggesting that honey aroma or taste is likely to be influ- enced by the location where honey is harvested rather than by its color.

BRP-020

Top bar hive internal bee feeder (TBHIF) for providing water/sugar solutions in top bar hives

Abraham Addo-Ansah Allotey

Forestry commission Ghana/ allotey honey bee farms, Ghana

The objective of this study was to design and develop a bee feeder/fountain prototype where bees draw water outside the water cistern whilst the feeder is in the Hive.

TBHIF is a triangular box-like unit, thickness 2.5 or 5 cm to replace a (two) top bar comb(s) and height of 20 cm to fit into the standard TBH. The width at the base is 15 cm and 35cm at the top. It has a top holder of Top Bar (TB) dimensions of 3.2 and 6.4 widths respectively for single and double TBs and length of 48cm

respectively. Water inlet orifice $(2 \text{ cm } \emptyset)$ with lid is positioned at 2.5 cm above the TBHIF base at its posterior side. Similarly two orifices $(3 \text{ mm } \emptyset)$, each at 1.0 and 1.5 cm respectively above the TBHIF base are positioned at the posterior and anterior sides of the TBHIF. The feeding tray of width 3cm and 5.7 respectively for single and double TB and depth 1.4 cm but with variable lengths to fit into various TBHs are held by a locker to the water container's base.

The developed TBHIF enabled bees to draw water from the TBHIF's feeding tray outside the water cistern when the TBHIF is placed in the TBH to prevent/ reduce bee drowning .It could be used during queen rearing and colony multiplication activities as well as transportation of behives for pollination services and migratory beekeeping

BRP-021

Bee-keeping in the hives out of concrete, a reality

Hodabalo Kpemoua

AEDD (Action Environnementale pour le Développement Durable)

The AE2D, an Association of the place in Togo developed bee-keeping in the concrete hives in the Community forests installed around the reserve of fauna of Abdoulaye. The purpose of association is to promote sustainable development by the taking into account of the environmental and social concerns of the populations in the actions in favour of environmental protection. It managed to set up a network of four Community forests around the Classified Forest of Abdoulaye whose governance is made by the State. The installation of these Community Forests made it possible to organize various actors in generating activities of income of which bee-keeping. Concerned of the pressures made on the resource wood, which is strongly related to the request, Association to contribute in this direction by using other materials to produce honey. A mussel was designed for this purpose and makes it possible to leave the concrete hives Kenyan which have a production capacity of almost honey 40kg by harvest. These hives have one minimum lifetime of 30 and resist fires and various bad weather contrary to the hives out of known wooden of the common run of people. These types of hives do not have any influence on the quality of honey and deserves to be to popularize near the practitioners for a perfect rhimage of the bee-keeping to the conservation.

BRP-022

Initiative for stingless bee keeping in Esmeraldas province, by Altropico in Ecuador

Marlenis Valencia¹, Esnelda Quintero¹, Santiago Montaño¹, Marcos Jimenez¹, Patricia Vit²

¹ Altropico ² Universidad de Los Andes

The ancestral knowledge of pot-honey in Esmeraldas province of Ecuador was based on honey hunting until year 2000. The honey is used as a sweetener and for traditional medicine. Altropico is an NGO that promotes stingless bee keeping in Ecuador, also known as meliponiculture in tropical countries. This activity gathers 51 families in the association with four ethnic groups: Afro, Awá, Chachi and Epera. The species most abundant, and therefore kept in the community, is Melipona indecisa. This bee has diverse ethnic names: "abeja real" and "beja nativa" in

Spanish, and "wimal" in Awá. A second species is Tetragonisca angustula known as "angelita". A total of 150 stingless bee colonies are kept, 1 to 24 per family. Altropicos organizes updating trainings on management of Melipona, divisions, feeding, pot-making. Honey is sold in San Lorenzo, Esmeraldas province at 7 USD/200 g Melipona and 10 USD/200 g Tetragonisca, planning expansion to Guayaquil. The abundance of floral resources in Esmeraldas, and the social impact of this Project has attracted private initiatives to optimize the hives,

currently under observation. Advantages of stingless bee keeping are easier management than Apis mellifera by women, children and elderly. Ecological implications are protective actions for the multiplications of Melipona and Tetragonisca nests. The biodiversity of Ecuadorian stingless bees demands a Norm on Pot-Honey with standards adapted from the Apis mellifera honey regulations.

BRP-023

Study on the increasing methods for royal jelly in Korea

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¹ Beekeeper

² Department of Conservation Ecology, National Institute of Ecology, Korea ³ Department of Applied Biology, Kyungpook National University, Korea

This work was carried out to know the increasing production methods of royal jelly (RJ) based on the excellent Queen bee.

This methods were used by skills of traditional and new technology at Ulreongdo Is., in the far eastern clean part of Korea. As the results, the total RJ outputs by this methods was strongly increased as 9,000 bottle (x100 colony) than 600 bottle (x 100 colony) of general one and the total selling price was also higher as 315,0000 Korean Won than 21,000,000 Korean Won of general methods. The methods for high production of RJ are provided herein.

BRP-024

Beekeeping management practices by communities located in Eastern ASALs of Kenya

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A survey of beekeeping management practices was carried out in 2013 amongst beekeepers in the eastern ASAL region of Kenya covering Mwingi, Makueni, Ijara, Garissa and Meru Zones. These are occupied by three distinct cultural groups - the Akamba, the Ameru and Somali communities.126 beekeepers associated with formal self-help beekeeping groups were interviewed based on standard questionnaires and their practices documented. Data was managed using Excel spreadsheets and analyzed using SPSS software. Results showed that traditional log, Kenya Top Bar and Langstroth hives are all in use but the dominant type is the Kenya Top Bar Hive of which all groups owned from 1 to 20 in number. When examined in detail, the practices followed by beekeepers are such that visits to apiaries take place at any frequency between daily, twice weekly, once a week and monthly for apiaries located near homes. The most common visits are twice weekly for apiaries located in forests/woodland and once weekly when located on farms or other distant locations further than 5 km from home. Routine visits cover pest management during which attention is especially paid to clearing the apiary of bushes, checking hive occupation rate and cleaning hives which are empty. Time is also spent inspecting

occupied hives of pest invasion and in fencing around the apiaries. Pests are managed following cultural practices with occasional use of non-toxic chemicals. Beekeepers also help to improve hive occupation by supplying bees with water during drought periods and by planting forage plants in vicinity of apiaries.

BRP-025

Top bar hive propolis collector for commercial propolis harvesting in top bar hives

Abraham Addo-Ansah Allotey

Forestry commission Ghana/ allotey honey bee farms, Ghana

This innovation sought to design and develop Top Bar Hive (TBH) Propolis Collector (PC) For pure propolis to be harvested commercially in the TBHs two innovations were designed and developed as follows. PC-1; A space of 40 x 2.5 x 2cm was cut out from the central axis of a Top Bar (TB) piece of wood/plastic of dimensions 48 x 3.2 x2 cm. A 3mm thick plastic sheet with 2 mm perforated diameter holes was fixed over the created TB space. PC-2; To increase the surface area for collection of more propolis, the propolis collector width dimensions were increased downwards by two installments of 40* 10*2.5 cm with a base cover similar to PC-1 in dimensions In service the cover of the TBH is slightly lifted with a piece of wood wedge for air and light entry to stimulate bees to collect propolis to fill holes which cut out light and air from hives. The developed PCs were used to replace a TB. By the use of PC-1&2 commercial grade propolis collection from the TBH were made possible as against the current situation of scrapping propolis from the TBs by pre arranging the TBs to create space for air and light entry. The PCs could be adopted to collect propolis from the log and grass hives. Export of propolis from Africa which was virtually not in existence could be promoted as well as research into African grade propolis medicinal usage.



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AMMAR AMMENDOLA AMORIM AMULEN AN AN AN AN ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANNE ANSARI ANSARI ANSARI ANTCZAK	M. A. N. D. R. J. D. H. J. D. S. C. O. S. Y. M. J. M. J. E.	PBP-016 BHO-025 ATO-043 BRO-058 BBO-010 ATP-006 ATO-008 BRO-053 TQO-050 TQO-050 TQO-050 TQO-050 TQP-024 TQP-044 BRO-061 BRO-061 BRO-064 ATP-004 TQO-002 TQO-030 TQP-011 ATP-020	420 201 291 326 165 456 305 350 272 272 441 451 328 327 455 263 255 434 464	BAATARTSOGT BABAEI BABARINDE BABARINDE BABATUNDE BACHERT BAE BAE BAE	U. H. S. D.R.A. I. B. W. W. R. B. F. T. M.	ATO-031 BHO-090 BRO-040 BRO-034 BRO-034 TQO-033 BHO-082 BHP-050 BHP-050 BHP-051 BHP-052 BHP-053 BHP-055 BHO-061 BHP-056 BHP-057 BHO-042 BEO-026 BHO-068 ATP-009	304 193 353 347 250 183 406 407 408 409 213 410 411 206 119 175 458
AMMAR AMMENDOLA AMORIM AMULEN AN AN AN AN ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANJOS ANKUNDA ANJOS ANKUNDA ANNIE ANSARI ANSARI ANTCZAK	M. A. N. D. R. J. D. H. J. D. S. C. O. S. Y. M. J. M. J. M. E. C.	PBP-016 BHO-025 ATO-043 BRO-058 BBO-010 ATP-006 ATO-008 BRO-053 TQO-050 TQO-050 TQO-050 TQP-024 TQO-044 BRO-061 BRO-061 BRO-064 ATP-004 TQO-002 TQO-030 TQO-030 TQP-011 ATP-020 ATO-012	420 201 291 326 165 456 305 350 272 272 441 451 328 327 455 263 255 434 464 312	BAATARTSOGT BABAEI BABARINDE BABARINDE BABATUNDE BACHERT BAE BAE BAK BAKI BAKONYI BAKOUR	U. H. S. D.R.A. I. B. W. W. R. W. R. B. F. T. M.	ATO-031 BHO-090 BRO-040 BRO-034 BRO-034 TQO-033 BHO-082 BHP-050 BHP-051 BHP-055 BHP-053 BHP-055 BHO-061 BHP-056 BHP-057 BHO-042 BEO-026 BHO-068 ATP-009 ATP-012	304 193 353 347 250 183 406 407 408 409 213 410 411 206 119 175 458 460
AMMAR AMMENDOLA AMORIM AMULEN AN AN AN AN ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANJOS ANKUNDA ANJOS ANKUNDA ANSARI ANSARI ANSARI ANTCZAK ANTIPENKO AOSAN ARAI	M. A. N. D. R. J. D. H. J. D. S. C. O. S. Y. M. J. M. J. M. E. C. Y.	PBP-016 BHO-025 ATO-043 BRO-058 BBO-010 ATP-006 ATO-008 BRO-053 TQO-050 TQO-050 TQO-050 TQP-024 TQP-044 BRO-061 BRO-061 BRO-064 ATP-004 TQO-002 TQO-030 TQP-011 ATP-020 ATO-012 TQO-007	420 201 291 326 165 456 305 350 272 272 441 451 328 327 455 263 255 434 464 312 260	BAATARTSOGT BABAEI BABARINDE BABARINDE BABATUNDE BACHERT BAE BAE BAE BAK BAKI BAKONYI BAKOUR	U. H. S. D.R.A. I. B. W. W. R. W. R. B. F. T. M. K. G.	ATO-031 BHO-090 BRO-040 BRO-034 BRO-034 TQO-033 BHO-082 BHP-050 BHP-051 BHP-052 BHP-053 BHP-055 BHO-061 BHP-055 BHO-061 BHP-057 BHO-042 BEO-026 BHO-068 ATP-009 ATP-012 BBO-059	304 193 353 347 250 183 406 407 408 408 409 213 410 411 206 119 175 458 460 166
AMMAR AMMENDOLA AMORIM AMULEN AN AN AN AN AN ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANDERSON ANTOR ANTOR ANTOR ANSARI ANSARI ANTOZAK ANTIPENKO AOSAN ARAI ARAKI	M. A. N. D. R. J. D. H. J. D. S. C. O. S. Y. M. J. M. J. M. E. C. Y. Y.	PBP-016 BHO-025 ATO-043 BRO-058 BBO-010 ATP-006 ATO-008 BRO-053 TQO-050 TQO-050 TQO-050 TQO-050 TQP-024 BRO-061 BRO-061 BRO-064 ATP-004 TQO-002 TQO-002 TQO-030 TQP-011 ATP-020 ATO-012 TQO-007 ATO-037	420 201 291 326 165 456 305 350 272 272 441 451 328 327 455 263 255 434 464 312 260 311	BAATARTSOGT BABAEI BABARINDE BABARINDE BABATUNDE BACHERT BAE BAE BAK BAKI BAKI BAKONYI BAKOUR	U. H. S. D.R.A. I. B. W. W. R. W. R. B. F. T. M. K. G. G.A.S.	ATO-031 BHO-090 BRO-034 BRO-034 BRO-034 TQO-033 BHO-082 BHP-050 BHP-050 BHP-051 BHP-052 BHP-053 BHP-055 BHO-061 BHP-056 BHO-061 BHP-057 BHO-042 BEO-026 BHO-042 BEO-026 BHO-068 ATP-009 ATP-012 BBO-059 BEP-005	304 193 353 347 250 183 406 407 408 409 213 410 411 206 119 175 458 460 166 358

BALOTIS	G.	TQO-036	274	BILIKOVA	K.	BHO-024	219
BANKOVA	V.	ATO-060	278			BHO-026	181
BARANOVIĆ	G.	TQP-014	436			TQP-030	444
BAREL	S.	BHO-033	179	BILIM	C.	PBO-035	228
		BHP-019	390	BINYUY	W. E.	BRO-017	338
BARINOVA	О.	ATO-034	302	BIRON	D. G.	BBP-012	367
BARKAN	N. P.	BBP-023	373	BISHOP	N.	BRO-069	319
		PBP-024	424	BIYIK	S.	BBO-018	142
BARRAGAN	S.	BBP-017	370	BLAIR	S.	ATO-059	278
		BHP-018	390	BOCQUET	M.	BEO-021	131
BARREL	S.	BRO-067	326			BHO-024	219
BASTOS	J.	ATO-033	289	BOIDO	E.	TQO-031	258
		TQO-012	274	BOLIVAR MORENO	D.	TQP-006	431
BATAINH	А.	BBO-038	159	BONINI	A.	TQO-031	258
BAUM	К.	BBO-055	159	BONMATIN	J. M.	BHO-028	209
BAYDAN	E.	BHO-067	190	BORODACHEV	A.	BBO-032	145
BAYETA	A. G.	BHP-006	383			BBO-044	150
BAYRAKTAR	М.	TQO-016	251	BORODACHEV	V.	BBO-044	150
		TQP-020	439	BOSSELMANN	A. S.	BEO-018	128
		ATP-003	455	BOUDEGGA	H.	PBP-016	420
BAYRAM	R	ATP-001	454	BOURGEOIS	L.	BBO-038	159
BDOUR	А.	TQO-014	253	BOYACIOĞLU	D.	ATO-010	283
BEA	W. R.	BHP-054	409			TQP-020	439
BECKH G	G.	TQP-028	444			ATP-003	455
		TQP-029	444	BOZIDIS	Р.	TQP-042	450
BEEKMAN	М.	BHP-049	406	BRAGA	K.	PBO-027	226
BEHL	G.	BHO-068	175	BRAGGINS	Т.	TQO-018	256
BELAY	А.	TQO-009	269	BRAKE	M.	BBO-038	159
BENAZIZA	D.	BHP-010	386	BRANNER	S.	BEO-019	115
BENBOW	E.	BHO-006	216	BRAUER	F.	TQO-033	250
BENCSIK	М.	TQP-033	446			TQP-021	440
		TQP-034	446	BRITTAIN	C.	PBO-042	234
		TQP-035	447	BRODKIEWICZ	I.	ATP-008	457
BENDINI	J.D.N.	BEP-010	360	BRODSCHNEIDER	R.	BBO-029	140
BEREZIN	А.	BBO-030	161	BRUNEAU	E.	BHO-027	217
BERNIER	М.	BHO-080	202			BHO-041	208
		BHO-081	199			TQO-040	273
BERRETA	А.	ATO-027	296			TQO-041	250
		ATO-033	289	BRUNO	S.	TQO-042	262
		ATO-043	291	BRYANT	V.	PBP-006	415
BEZABEH	А.	BHP-006	383	BUAWANGPONG	N.	BHO-030	175
BHANDARI	P. S.	ATO-062	303	BUBALO	D.	TQP-014	436
BIENEFELD	К.	BRO-013	332	BÜ CHLER	R.	BEO-019	115
		BBO-017	139	BUCHORI	D.	PBO-021	230
BIENKOWSKA	M.	BHO-042	206	CHIKKASWAMY	B. K. D	BBP-025	374
BILANDŽIĆ	N.	TQO-015	257				

CHIKKASWAMY	B. K. D	BBO-043	168	CERVANCIA	C. R.	BHO-087	219
		BBP-021	372			PBO-048	246
BUDNIKOVA	N.	TQO-035	265	Ç ETIN	A.	ATP-003	455
		TQO-037	275	ÇEVRIMLI	M. B.	BEP-004	357
BUKOVAC	I.	BRO-012	324			BEP-006	358
BULET	Р.	BHO-024	219	CHA	B. G.	ATO-045	300
BURGUT	А	BBO-013	149	CHA	D. J.	BBP-033	378
BURMISTROVA	L.	TQO-037	275	CHAAND	D.	BHO-052	196
BYEON	K. H.	BBO-051	160	CHAIMANEE	V.	BHP-036	400
		BHP-043	403			BHO-049	197
		BHP-058	411	CHAKRABARTY	PK	BRO-007	322
BYEON	G. H.	BBP-031	377	CHAMPIN	L.	BBP-012	367
				CHANCHAO	C.	ATP-028	468
С				CHANG	Y. C.	ATO-032	304
CAKICI	N.	ATO-015	287	CHANG CHANG	C.	BHP-020	391
CALUVA	E.	TQP-046	453	CHANTAWANNAK	P.	BHO-037	211
CAMPBELL	P.	BHO-088	205			BHP-013	387
CANDRA	M.	BEO-022	121			BHO-030	175
CANLI	D.	PBO-019	237			BEP-009	360
		PBO-020	237			BBO-062	157
		PBO-025	231	CHAPHALKAR	S.	BBO-006	163
		PBP-029	426			BEO-034	120
CANVERDI	N. P.	PBP-008	416			BRP-013	484
CAPANOGLU	E.	ATO-041	285	CHAPLYGINA	A.	ATP-018	463
ÇAPANOĞLU	E.	TQP-020	439	CHARPENTIER	G.	BHP-027	394
CAPORGNO	J.	TQP-046	453	CHAUDHARY	OP	BHO-039	209
CARMENZA	L.	BRO-037	331			BHO-050	176
CARRÃ O	D.	ATO-027	296	CHAUHAN	A.	PBO-022	230
		ATO-043	291	CHEMUROT	M.	BHO-036	214
CARRECK	N.	BEO-019	115	CHEN	С. Т.	BEP-003	357
CARVALHO	C.	BHP-011	386	CHEN	K. H.	BEP-002	356
		BHP-023	392	CHEN	L. H.	BEO-025	129
		TQP-009	433			BEO-032	128
		TQP-017	437			ATO-017	313
CARVALHO	E.	TQP-009	433			TQO-021	270
CARVALHO	S.	BHP-011	386			BBO-057	152
		BHP-023	392			BEO-038	122
		TOP-009	433			PBO-017	227
		TQP-017	437	CHEN	W. B.	BBO-023	141
CASTILHOS	D.	BHO-014	218	CHEN	W. Y.	BBO-027	162
CASTRO	M.	PBO-027	226	CHEN	X. X.	BHO-020	208
CASTRO CRUZ	E.	TQO-023	265			BHO-021	184
CECOTTI	E.	TOP-046	453	CHEN	Y.C.	TOP-010	434
CELEBIER	I.	BHP-016	389	CHEN	Y. C.	BEP-003	357
,		BHP-017	389	CHEN	Y. W.	BEO-013	116
CERVANCIA	C.	ATO-028	296			BHO-060	193

CHEN	Y. W.	BEP-002	356	CHOI	Y. S.	BHP-030	396
		BEP-003	357	CHOI		BBO-024	153
		BBO-027	162	CHOI		BBP-028	375
		BHO-089	205	CHOI		BBP-029	376
				CHOI		BBO-050	150
CHENG	X. Y.	ATO-049	290	CHOI		BBO-051	160
CHERKUNOVA	О.	ATP-019	463	CHOI		BHP-043	403
CHIANG	С. Н.	BBP-014	369	CHOI		BHP-058	411
CHIDIEBERE EMMANUEL	A.	BRO-011	348	CHOI		ATP-038	473
CHIEGELE CHRISTIAN	A.	BRO-011	348	CHOI		BHP-044	404
CHIPULINA	Р.	TQP-041	450	CHOI		BHP-045	404
CHIPULINA	Р.	BRP-002	478	CHOI		BBP-031	377
		TQO-047	261	CHOI		BBP-036	380
CHISHA- KASUMU	E.	BRP-019	487	CHOUKALAS	A. J.	TQP-042	450
CHIU HSUN	L.	BHP-020	391	CHOVE	P. B.	BRO-067	326
СНО	Y. H.	BBP-009	366	CHU	Y. N.	BHO-069	213
СНО	Y. R.	BRO-006	341	CHUN	S. N.	ATO-044	302
СНО	E. R.	BEO-024	131	CHUN CHING	Υ.	BHP-020	391
СНО	C. R.	TQP-025	442	CHUNG	H.	ATP-006	456
СНО	J. M.	BHP-042	403			ATO-008	305
СНО	J. Y.	ATP-038	473	CHUNG	J.	BRO-057	342
СНО	S. G.	BRO-073	319	CHUNGU	D.	BRP-019	487
СНО	Y. S.	BHO-082	183	CICEK	H.	PBP-009	417
		BHP-050	406	CIMPEAN	C. D.	TQO-034	268
		BHP-051	407			TQO-022	259
		BHP-052	408	CINBIRTOGLU	S.	PBO-018	236
		BHP-053	408			PBO-035	228
		BHP-054	409	CLADERA	J. L.	BHP-031	397
		BHP-055	409	CLEMENT	H.	BEO-012	116
		BHO-061	213			BHO-012	217
		BHP-056	410			BHO-013	211
		BHP-057	411	COBANOĞLU	D. N.	PBP-013	419
CHOE	H. J.	BBP-013	368	,		PBO-019	237
CHOI	B. J.	TOP-025	442			PBO-020	237
CHOI	B. W.	ATO-063	287	COELHO	E.	ATO-033	289
CHOI	E.Y.	BBP-022	373	COLOMBANI	M.E.	BEP-005	358
СНОГ	НҮ	BBP-036	380	CONDÉ	D	BRO-041	342
СНОГ	I Y	BRO-003	335	CONGET	D. P	BHP-037	400
СНОГ	у. т. М. В	BHP-030	396	COSTA	r. C	BHO-042	206
СНОГ	M.D.	BHD 020	306	COSTA SOUZA	с. D	BED 010	360
CHOI	IVI. D .	TOD 025	110	COLLSON	D. P	BBO 055	150
		1QF-023	++∠ 271	COULSUN	K. I		200
	C W		271		1. V		308
CHOI	5. W.	PBP-015	3/1	CKAILSHEIM	К.	BBO-029	140
CHUI		PBP-022	423			RRO-001	138

CRAUSER	D.	TQP-033	446	DENG	Y.	BBP-019	371
CRISTINA	M.	BHP-004	382	DEOWANISH	S.	BBO-057	152
CROSS	P.	BRO-058	326	DERIUGINA	A.	ATO-034	302
CUEVAS-GLORY	L.	TQP-006	431			ATP-020	464
CUKUR	Т.	BEO-001	122	DESMAISON ELESPURU	C.	BRO-020	332
		BEO-003	133	DEVECI	M.	PBO-018	236
CUKUR	F.	BEO-003	133	DI GIROLAMO	F.	BBP-017	370
CURRIE	R.	BBO-025	156	DIAO	Q.	BHO-069	213
				DIAZ	F.	BHO-064	174
D				DICKSON	B.	BRP-007	480
DA SILVA	Т.	ATO-043	291	DIETEMANN	V.	BBO-016	143
DAHLE	B.	BEO-019	115			BHO-022	204
DAINAT	B.	BHO-018	185			BHO-030	175
DALL'OLIO	R.	BHO-042	206			BHO-037	211
DAMARLI	E.	TQO-011	268	DIKMEN	F.	PBP-024	424
DANERS	G.	TQO-031	258	DIMOU	M.	ATO-021	310
DANERT	F. C.	TQP-022	440			TQP-012	435
DAOUD	E.	ATO-029	301			TQP-026	443
DARVISHZADEH	A.	BBP-016	370	DINI	C.	TQP-046	453
DAŞER		BBP-023	373	DISAYATHANOOW AT	Т.	BHP-013	387
		PBP-024	424	DJOSSA	B. A.	PBO-032	242
DAŞTAN	Т.	TQO-011	268	DOGAROGLU	M.	BEO-027	124
DAVYDOVA	H.	ATP-029	469			ATO-005	297
DAYIOGLU	M.	BEP-001	356			ATP-005	456
		TQP-039	449	DOKUKIN	Y.	PBO-026	233
DE FERAUDY	L.	BHP-027	394	DOLLIN	K.	TQP-018	438
DE GRAAF	D.	BHO-036	214	DOOSHIN	S.	BHP-048	406
		BHO-077	182	DORJAY	N.	PBO-008	225
DE GUZMAN	L.	BBO-038	159	DOUARRE	V.	BBP-012	367
DE JONG	D.	BHO-023	215	DRAGANI	Р.	TQP-042	450
		BBP-035	379	DRAPER	Р.	BRO-068	322
DE LA RUA	Р.	TQO-042	262	DRAZIC	М.	BHO-042	206
DE SMET	L.	BHO-036	214	DUANGPHAKDEE	О.	BBO-057	152
		BHO-077	182	DÜ BECKE	A.	TQP-028	444
DEÁ KNÉ PAULUS	Р.	BHO-068	175			TQP-029	444
DEARMAS	M.	BHP-037	400			BRO-039	353
DEL HOYO	M.	BHP-018	390	DUDDENHOEFER	B.	TQO-033	250
		BEP-005	358	DUKART	J.	TQP-046	453
		BHP-035	399	DUKE	C.	TQO-004	258
		BBP-017	370	DUR HAN	K.	ATO-058	288
DELA VIÑ A	C.	BBO-031	170	DURÁ N	N.	BHP-038	401
DELBAC	F.	BBP-012	367	DURMUS	E.	ATO-041	285
DELLACASSA	E.	TQO-031	258	DUWAL	R. K.	BRO-027	321
DEMPSEY	R.	TQP-018	438				

DYKES	M.	BHO-079	187	F			
DZIB-LEON	R.	ATO-019	285	FAGUNDEZ	G.	TQO-031	258
DZULFAQOR		BBO-007	164	FAJARDO	A.	ATO-028	296
				FAJARDO JR.	A.	BBO-059	166
Ε				FALCÃ O	S.	BBP-032	378
ECCLES	L.	BHO-080	202	FARIÑ A	L.	TQO-031	258
ECEM BAYRAM	N.	PBP-029	426	FAROOQ	S.	PBO-010	226
EFRAT	H.	BHP-019	390			PBP-006	415
EITSSAYEAM	S.	BHP-041	402	FAROOQI	S.	ATO-022	284
EKA PUTRA	R.	ATO-024	293	FATEEVA	E.	ATO-035	315
EKINCI	D.	BBO-018	142	FEARNLEY	J.	ATO-014	313
EL MENYIY	N.	ATP-009	458	FEDERICO	G.	BHO-025	201
		ATP-012	460	FÉLIX	M.	BRO-064	327
EL-FEEL	M.	BBO-002	170	FERNANDEZ	PC	BHP-031	397
		BBO-003	170	FERNANDEZ	Р.	TQP-044	451
ELFLEIN	L.	TQP-036	447	FERREIRA	M. G.	PBO-029	247
EL-GUENDOUZ	S.	ATP-010	459	FIGINI	E.	TQP-008	433
		ATP-011	459	FIGINI	EE	BHP-031	397
EL-HASKOURY	R.	ATP-013	460			TQP-041	450
ELIASH	N.	BHO-044	180	FIGINI	E.	ATP-008	457
EL-NIWEIRI	M.	BBO-034	154			BRP-002	478
ELOVIKOVA	E.	TQP-004	430			ATP-039	474
ELTAYEB	E.	PBO-010	226			TQP-022	440
		PBP-006	415			TQP-046	453
EMERHI	E.	BHO-055	200			TQO-047	261
EMIR	M.	BEO-004	129	FIGUEIREDO	A. C.	BHO-044	180
EMMANUEL	B.	BRO-045	329	FIGUEIREDO	М. Т.	TQP-038	448
ENKHTAIVAN	G.	ATO-058	288	FISHER	J.	BEO-019	115
ENOMOTO	H.	BRP-005	479	FITZGERALD	S.P.	TQP-005	431
ERDEM Sönmezer	О.	TQO-011	268			TQP-007	432
ERKAN	C.	PBP-009	417			TOP-018	438
		BRO-002	347	FLURIN	C.	TQO-003	275
ERTURK	0.	ATO-015	287	FOKIALAKIS	N.	BBP-015	369
ESCLANDA	E.	PBO-023	231	FORFERT	N.	BHO-038	210
ESEN	0.	ATP-003	455	FORGÁ CH	P.	BHO-068	175
ESMAEILNIA	K.	BHO-090	193	FORGHANI	M.	BBP-030	377
ESMAIL	A.	TQO-017	252	FORSGREN	E.	BHO-004	192
ESTEVINHO	L.	TQP-024	441	FORSI	M.	BHO-078	180
ESTONBA	A.	BBP-012	367	FOSTER	L.	BBO-025	156
EVANS	Н. А.	TQO-029	271	FOUAT-Ö ZGÖ R	E.	BHP-016	389
EVANS	H.	TQO-051	270			BHP-017	389
		BHO-040	215	FOULADIAN	S.	BHP-022	392
EVANS	J.	BHP-036	400	FOURNIER	V.	BHO-080	202
EYER	M.	BBO-016	143			BHO-081	199
				FRANCIS	F.	BHO-005	177

FRANGEN	D.	BRO-012	324	GENÇ AY	О.	BHO-051	189
FRANKLIN	G.	BRO-059	318	ÇELEMLI		BHO-015	190
FREITAS	N.H.A.	BHO-023	215			PBO-019	237
FROES DIAS JUNIOR	A.	PBP-031	427			PBO-020	237
FROGHY	L.	BHO-090	193	GENG	S.	PBO-051	232
FUJII	A.	ATO-048	307	GENGLER	N.	BHO-005	177
FUJIWARA	A.	PBO-012	222	GENNARI	G.	ATP-008	457
FURSOV	V.	TQO-006	253			ATP-039	474
		TQO-026	263	GERULA	D.	BHO-042	206
		BBO-036	167	GETACHEW	A.	TQO-002	263
FURUSAWA	Τ.	TQO-007	260			BBO-014	162
				GHALEM BERKANI	Z.	BEO-039	135
G				GHAZI	R.	PBO-006	227
GAIFULLINA	L.	BHO-002	216	GHIL	S.	BBP-034	379
GAL	L.	TQP-030	444	GHOGOOGHI	R.	BHO-078	180
GALATIUK	0.	ATP-029	469	GHOSH	S.	BEO-031	130
GAN	H.	BBP-005	364	GIBBS	J.	PBO-042	234
GANBOLD	S.	ATO-031	304	GICHORA	М.	BRP-024	489
GAO	Υ.	BEO-006	127	GILLARD	Τ.	BHP-049	406
GAO	L.	ATO-036	311	GILYAZITDINO	I.	BHO-056	207
GAO	P.	ATO-036	311	GIM	S. Y.	BBP-022	373
GAO	L.	ATO-064	312	GIOVENAZZO	P.	BHO-080	202
GAO	Р.	ATO-064	312			BHO-081	199
GARÇ Ã O	H.	TQP-044	451			PBO-044	236
GARCIA	R.	PBO-023	231	GIRISGIN	A. O.	BHO-033	179
GARCIA	C.	BHO-042	206			BHP-019	390
GARCIA	R.	PBO-028	245			BHO-034	218
GARCIA FLORES	A.	BRO-024	336	GIRMA	J.	BRP-015	485
GARCÍA RAMOS	C.	BRO-024	336	GIUDICI	V.	TQO-031	258
GARDEBROEK	C.	BRP-015	485	GLELE KAKAÏ	R.	BBO-028	165
GARDIKIS	K.	TQO-036	274	GLUSCHENKO NIKODIM	V.	TQO-026	263
GARDIKIS	К.	TQP-042	450	GOÇ RASGELE	Р	ATP-001	454
GARIPOGLU	A.V.	BBO-018	142			BRO-054	320
GARNERY	L.	BBP-012	367			BBO-013	149
GASCON	C.	PBO-023	231			BRO-055	343
GASCON	C.	PBO-028	245			ATO-040	281
GAŠIĆ	U.	TQO-039	266	GÖ KALP	F. D.	ATO-040	281
GATAULLIN	A.	BHO-002	216	GOLDMAN		ATO-027	296
GAUTHIER	L.	BHO-024	219	GOMEZ	А	TQO-047	261
GAUTHIER	L.	BHO-038	210			TQP-041	450
GAYFILLINA	L.	BHO-056	207	GONCALVES	L.S.	BHO-014	218
GEISLER	E.	BRO-015	323	GONÇ ALVES	M.	TQP-044	451

GONG	H. R.	BHO-020	208	HAMILTON	J.	BEO-005	124
GONG		BHO-021	184	HAMMADI	M.	BRO-053	350
GORAS	G.	BEO-009	115	HAN	S. M.	ATO-044	302
		BHP-012	387			ATP-030	469
		BHP-014	388	HAN	T.M.	BBO-040	167
GÖ RGICS	I.	BHO-068	175	HAN	S.M.	ATP-022	465
GOSTERIT	A.	PBP-009	417	HAN	S.H.	BBO-042	144
		BRO-002	347	HAN	S.M	ATP-023	465
GOTSIOU	Р.	TQP-012	435			PBP-026	425
		TQP-026	443			ATP-040	474
GOUSSIA	А.	TQP-042	450			ATP-035	472
GOWE	J.	PBO-040	244			ATP-036	472
GRANDINETTI	G.	BHO-025	201	HAN	S. U.	PBP-032	428
GRENIER	C.	BBP-012	367	HANSTED	L.	BEO-018	128
GREY	A.	BHO-042	206	HARDIYANTO		BRO-023	349
GROSU	R.	ATO-011	308	HARPER	S.	BHO-048	203
GUARNA	M. M.	BBO-025	156	HASSAN	N. B.	PBO-006	227
GUARNA	М.	BHO-047	202	HASSAN	А.	TQO-025	264
GUERREIRO	М.	TQP-017	437	HATA	Τ.	ATO-037	311
GULER	A.	BBO-018	142	HATJINA	F.	BHO-010	198
GÜ LER	D.	BEO-026	119	HATJINA	F.	BHO-042	206
GÜ LER	A.	PBO-035	228	HAUBRUGE	E.	BHO-005	177
GUNATHILAKA	G.L.B.E.	ATO-001	298	HAUTIER	L.	BHO-027	217
GUNEY	F.	PBO-018	236	HAU-YAMA	N.	ATO-019	285
		ATO-015	287	HEGAZI	А.	ATP-017	462
GUPTA	Р.	BBO-017	139			ATP-016	462
GUPTA	S.	BRO-007	322			ATO-026	300
GÜ RDAL	В.	PBO-014	235			BBO-002	170
GUYOT	S.	BBP-012	367			BBO-003	170
GÜ ZEL	F.	PBP-014	419			ATO-002	284
		PBO-019	237			ATO-029	301
		PBO-020	237	HENRIQUEZ	M.	BHP-037	400
				HENRÍQUEZ	Р.	BHP-040	402
Н				COLORADO	H.	BRO-024	336
HADDAD	N.	BHP-010	386	HERREN	B.	PBO-021	230
		BBO-038	157	HESSEFORT	M.	TQO-033	250
HAE CHUL	Р.	PBP-018	421	HIDAYAT	Р.	PBO-021	230
		PBP-019	421	HILALHOTAMAN	O. Y.	ATP-005	456
HAEFEKER	W.	TQO-010	256	HO JAE	L.	BHP-059	412
		BHO-011	197	HODA	A.	TQP-043	451
HAE-RAN	Р.	ATO-057	295	HOFFMAN	E.	BHO-032	204
HAGGAG	S.	BBO-002	170	HOFFMAN	C.	BHO-032	204
		BBO-003	170	HONDA	Υ.	ATO-037	311
HAILU	Τ.	BRO-051	352	HONDA	S.	ATO-037	311
		BRO-052	350	HONG	I. P.	ATP-030	469
HALIMA	H.	BBP-004	363			ATP-022	465
HAMAJO	S.	TQP-032	445			BBO-042	144

HONG	I. P.	ATP-023	465	I			
		PBP-026	425	ICHIHARA	K.	TQO-007	260
		ATP-040	474			ATO-037	311
		ATP-035	472			ATO-038	309
		ATP-036	472	IGEL	C.	TQO-033	250
HOOVEN	L.	BHO-048	203	IGLESIAS	S.	BRP-004	479
HOOVER	S.	BBO-025	156	ILIENKO	E.	TQO-006	253
		BHO-047	202			BBO-036	167
HORAX	S.	BHO-001	198	IMAI	T.	ATO-069	299
		ATP-014	461	IMPERATRIZFONSECA	V. L.	BBO-035	161
		ATP-046	477	IMTARA	H.	ATP-009	458
		ATP-027	468	IN GYUN	P.	PBP-018	421
		ATP-007	457			PBP-019	421
HORI	J.	ATO-027	296	INTATHA	U.	BHP-041	402
HOSHIBA	H.	BRP-005	479	IOANA	M.	BHP-005	383
HOSSAIN	M.S.	BHP-021	391	ION	R.	BHP-004	382
		PBP-010	417			BHP-005	383
HOSSEININAVEH	V.	BBP-016	370	IP	S.	ATO-032	304
HOTIU	C.	TQO-022	259	ISAACS	R.	PBO-042	234
HOTSKA	S.	ATP-029	469	ISKANDAR	M.	BEO-022	121
HOTTA	S.	ATO-038	309	ISLA	M.I.	TQP-022	440
HOU	C.	BHO-069	213	ISLAM	R.	PBO-002	224
HOUTE	S.	BBP-012	367	ISMAIL	M.M.	BEO-002	132
HRABAK	J.	BRO-021	339	İVGİN TUNCA	R.	BBO-052	149
HU	P.P.	ATO-017	313				
HU	F.L.	BHO-020	208	J			
		BHO-021	184	JAAPAR	M.F.	PBO-006	227
HU	L.	ATO-003	289	JACOB	M.	TQP-009	433
HU	F.L.	ATO-003	289	JAE HYEUNG	S.	ATO-058	288
HU	Р	PBO-017	227	JAMIN	E.	TQO-045	257
HU	P.P.	BEO-032	128	JAMORA	R.	ATO-028	296
HU	Р.	BEO-038	122	JAMSHIDI	M.	ATO-054	280
HU	F.L.	ATO-049	290	JANG	H.	ATP-030	469
		BBO-019	146			ATP-040	474
HUANG	J.	BBO-010	465	JAWO	M.T.O.	BHO-054	196
HUANG	S.	BBO-023	141	JAYAKODI	M.	BBO-053	157
HUANG	W.F.	BBO-060	147	JAYARAM	G.N.	BRO-066	334
RADHAKRISHNA	B. H.	ATO-030	305	JAZANI	S.	BHO-075	188
HUR	Y.K.	ATO-001	298			BHO-076	191
HUTAGALUNG	J.	ATO-051	294			TQO-048	262
		BRO-023	349	JAZANI- DORCHE	S.	TQO-046	271
		BEO-022	121			ATO-061	306
		ATO-024	293			ATP-037	473
		ATO-067	292	JEAN PIERRE	K.K.	BRP-011	483
HUTTLEY	G.	BBO-062	157	JEONG	S.M.	BEO-023	114
HWANGBO		PBO-013	229	JEONG	W.J.	BRO-057	342
				JEONG	S.M.	BHO-043	207

JEONG	S. M.	BEP-011	361	JUNG	H. N.	BHO-082	183
JEONG	D. H.	ATP-031	470			BHP-050	406
JEONG	S. Y.	BBP-027	375			BHP-051	407
JIANG	Y.	PBP-002	413			BHP-052	408
JIANG	J. A.	BHO-089	205			BHP-053	408
JIANGTAO	D.	TQO-019	260			BHP-054	409
JIMENEZ	M.	BRP-022	488			BHP-055	409
JIMOH	S.	BRO-040	353			BHO-061	213
JIN	B. R.	BBO-022	168			BHP-056	410
JIN	X. L.	ATO-003	289			BHP-057	411
JIN	B. R.	BBP-008	365	JUNG	C.	BBO-063	166
		BBP-019	371	JUNUS	M.	BRO-072	339
		BBP-020	372	JUSTINEK	J.	TQP-015	436
		BBO-050	150				
		ATP-038	473	K			
JING	M.	ATO-052	308	KAEHLER	B.	BBO-062	436
		BBO-021	144	KAELAN	C.	BHO-001	198
JO	S. K.	ATO-056	295			ATP-014	461
JOHNSON	О.	BRO-050	325			ATP-046	477
JOHNSTON	S.	BBO-055	159			ATP-027	468
JOMA	I.	BRO-053	350			ATP-007	457
JONES	H.	BRO-013	332	KAEMPF	B.	TOO-033	250
JONG	D. D.	BEP-010	360	KAFTANOGLU	О.	BBO-020	140
JØ RGENSEN	A. S.	BEO-019	115	KAGIAVA	A.	BBP-015	369
JOSELOW	К.	BHO-049	197	KAGUTHI	P.	PBO-001	243
JOSEPH	Т.	BRO-064	327	KAJOBE	R.	BRO-031	336
JU	Н. Н.	BBP-034	379	KAMBUR	M.	ATP-001	454
JUNG	С.	BEO-023	114			BBO-013	149
		BEO-017	125			BRO-055	343
		BEO-024	131			ATO-040	281
		BHO-043	207	KAMILOGLU	S.	ATO-041	285
		BHP-034	399	KAMOUN	Z.	ATP-013	460
JUNG	J. W.	BHP-034	399	KAMPF	B.	TOP-021	440
JUNG	C.	BEP-011	361	BOROVŠAK	<u>–</u> . А. К.	TOO-038	255
		PBP-015	420	KANELIS	D.	ATO-021	310
JUNG	J. W.	PBP-015	420			BHP-012	387
JUNG	C	BEO-033	123			TOP-027	443
	0.	BEO-031	130			BHP-014	388
		PBP-022	423	KANG	S. W.	BHP-051	407
		BHO-058	177	KANG	K.S.	PBP-023	423
		BBP-026	374		11.51	BHO-082	183
IUNG	Y S	BHP-042	403			BHP-050	406
JUNG	C.	BHP-042	403			BHP-053	408
	с.	PBO-051	232			BHP-055	409
JUNG	ΙW	BBO-053	157			BHP-056	410
	3. 11.	BBO-054	152			BHP-057	411
JUNG	U	ATO-056	295			BHP-052	408
	0.	BEP-011	361			BHP-054	409
			201				107

KANG	K. S.	BHO-061	213	KIM	S. H.	PBO-038	241
KANG	S. W.	BHP-050	406	KIM	I. S	BBP-028	375
KANGAVE	A.	BRO-004	337			BBP-029	376
KANNO	Т.	BRP-005	479	KIM	M. Y.	ATO-023	299
KARADENIZ	Т.	PBP-008	416	KIM	N. R.	ATO-023	299
		PBO-011	234	KIM	Y.	BRO-057	342
KARAPETSAS	A.	TQP-042	450	KIM	H. W.	TQO-013	251
KARIMOVA	A.	BHO-002	216	KIM	S.	ATP-030	469
KASHYAP	L.	PBO-022	230	KIM	J. Y.	ATP-006	456
KATIKU	P.	PBO-001	243	KIM	W. H.	ATP-006	456
KATO	K.	TQO-007	260	KIM	D. H.	PBO-015	235
KATSENIOS	I.	TQO-036	274	KIM	S. H.	PBO-015	235
KATSURA	Y.	TQP-032	445	KIM	J. H.	ATO-008	305
KAUSHIK	H. D.	BHO-050	176	KIM	S. Y.	BBP-007	365
		BHO-039	209	KIM	K. W.	BHP-028	395
KAYA	Е	ATP-001	454	KIM	B. S.	BHP-029	396
KAYA	S. T.	ATO-040	281	KIM	K. W.	BHP-029	396
KAYA	U.	BEP-006	358	KIM	S. Y.	BBP-008	365
KEKEÇOĞLU	M.	BRO-054	320	KIM	N. J.	BBP-008	365
		BRO-055	343	KIM	J. H.	BRO-006	341
		ATO-040	281	KIM	H. J.	ATP-032	470
		BBO-013	149	KIM	D. W.	BHP-034	399
		ATP-001	454	KIM	B. S.	TQP-025	442
KENCE	M.	BBO-052	149	KIM	K. W.	TQP-025	442
KENCE	A.	BBO-052	149	KIM	H. C.	PBO-031	238
KENMOGNEFOISO	R.	BRO-064	327	KIM	B. S.	BBP-018	371
KESKIN	N.	BHP-016	389	KIM	K. W.	BBP-018	371
		BHP-017	389	KIM	H. S.	PBP-023	423
		BHO-051	189	KIM	D. W.	BHO-058	177
		BHO-015	190	KIM	K. M.	ATO-071	303
303KEUM	E.	PBP-015	420	KIM	K. G.	ATO-071	303
KEZIC	D.	BHO-042	206	KIM	B. Y.	BBP-020	372
KEZIC	N.	BHO-042	206	KIM	Y. H.	BBO-041	141
KHALOKAR	V.	BEO-034	120	KIM	J. H.	BBO-041	141
		BRP-013	484	KIM	K. G.	BBO-041	141
KHAN	K.	ATP-004	455	KIM	D. S.	BHP-042	403
KHARITONOV	N.	BBO-030	161	KIM	S. B.	PBP-026	425
		BBO-045	142	KIM	I. S.	BBP-027	375
KHATRI	N.	BRO-043	330	KIM	M. J.	BBP-028	375
KHISMATULLIN	R.	TQP-004	430	KIM	H. S.	PBO-036	238
KHONGKHUNTIAN	T.	PBP-005	415	KIM	M. S.	PBO-036	238
KHONGPHINITBUNIONG	K.	BHO-037	211	KIM	S. H.	PBO-036	238
KIEMI	P.	BRO-067	326	KIM	M. S.	PBP-027	425
KIEVITS	J.	BHO-041	208	KIM	H. S.	PBP-027	425
KILPINEN	0.	BEO-019	115	KIM	S. H.	PBP-027	425
KIM	S. H.	PBP-028	426	KIM	M. S.	PBP-028	426
				KIM	H. S.	PBP-028	426

KIM	M. S.	PBO-038	241	КО	C.	BHO-089	205
KIM	H. S.	PBO-038	241	KOCAOKUTGEN	H.	BBO-018	142
KIM	H. K.	BBO-050	150	KOCYIGIT	M.	PBO-014	235
KIM	I. S.	BBO-050	150	KOEBERLE	L.	TQO-033	250
KIM	H. K.	BBO-051	160	KOECH	C.	PBO-030	241
		BHP-043	403	КОН	Y.H.	ATO-071	303
		BHP-058	411	КОН	I.S.	PBO-042	234
		ATP-038	473			BEO-035	117
KIM	S. T.	BHO-086	186	КОНІ	E.	BRO-049	329
KIM	D. E.	ATO-066	298	KOLAYLI	S.	ATP-005	456
KIM	H. B.	ATO-066	298	KONGSOMBUN	N.	TQP-008	433
KIM	H. K.	BHP-044	404	KÖ NIG	H.	TQP-036	447
KIM	M. S.	BHP-045	405	КОО	J.	BBP-007	365
KIM	H. K.	BHP-045	405	KOPYLOVA	S.	ATP-019	463
		BBP-031	377	KORDIC	S.	TQO-029	271
KIM	J. H.	BBP-033	378			TQO-051	270
KIM	K. M.	BBP-033	378			BHO-040	215
KIM	J. S.	BHO-070	182	KORIR	B.	PBO-001	243
		BHP-047	405	KÖ RMENDY- RÁ CZ DR. CSC	J.	ATO-065	294
KIM	S. G.	ATP-040	474	KOROL	J.	ATO-035	315
KIM	N. R.	TQP-045	452	KORU	О.	ATO-016	282
KIM	M. R.	TQP-045	452	KORYAGIN	A.	ATP-025	467
KIM	H. S.	TQP-045	452	KOSANOVIĆ	М.	TQO-015	257
KIM	N. R.	ATO-056	295	KOVETZKAYA	A.	ATO-046	310
KIM	Y. M.	BBO-063	166	KOZMUS	Р.	BBO-037	148
KIM	C. W.	PBP-032	428	KPEMOUA	H.	BRP-021	488
KIM	S. H.	PBP-032	428	KRISHNAMURTHY	V.	BBO-038	159
KIM	M. J.	PBP-032	428	KRISTIANSEN	L.F.	BEO-019	115
KIM	C. W.	PBO-049	240	KRISTIANSEN	Р.	BEO-019	115
KIM	S. H.	PBO-049	240	KRITOF KRAKOVA	Т.	TQP-030	444
KIM	M. J.	PBO-049	240	KRIVOPALOV	A.	ATO-035	315
KIM	H. K.	BBP-036	380	KRIVOPALOV	D.	ATO-035	315
KIM	I. S.	BBP-036	380	KRIVOPALOV MOSKVIN	I.	ATO-035	315
KIM	M. S.	PBO-037	239	KRYGER	Р.	BEO-019	115
KIM	H. S.	PBO-037	239	KRYLOV	V.	ATP-025	467
KIM	S. H.	PBO-037	239	KRYLOV	V.	ATP-018	463.
KIM	H. S.	PBO-039	239			ATP-019	463
KIM	M. S.	PBO-039	239			ATP-020	464
KIM	S. H.	PBO-039	239			ATO-034	302
KIMIAEI	M.	BEO-028	134	KRYLOVA	E.	ATP-018	463
KIMITEI	R.	PBO-001	243			ATO-046	310
KIMURA	К.	BHP-013	387	KUGEYKO	V.	BHO-056	207
KING	D. I.	TQO-004	258	KUGEYKO	К.	BHO-056	207
KIRILMAZ	L.	ATO-005	297	KULAKOV	V.	PBO-005	224
KIVATINITZ	S.	TQP-016	437				

KUMAR	G. N.	BHO-050	176	LEE	S. W.	PBO-015	235
		BHO-039	209	LEE	J. H.	PBO-015	235
KUMAR	R.	PBO-041	245	LEE	W. R.	ATO-008	305
KUNARTI	S.	ATO-051	294	LEE	K. Y.	BBP-007	365
KUPELWIESER	V.	BBO-029	140	LEE	K. J.	ATO-001	298
KUSTIAWAN	P. M.	ATP-028	468	LEE	K. Y.	BBP-008	365
KUVANCI	А.	PBO-035	228	LEE	K. B.	BBP-008	365
KUZYAEV	R.	TQP-004	430	LEE	K. Y.	BBP-009	366
KVIESIS	A.	TQP-002	429	LEE	Y. B.	BBP-009	366
KWAK	A. K.	BHP-044	404	LEE	K. Y.	BBP-010	366
		BHP-045	404	LEE	Y. B.	BBP-010	366
KWEON	С. Н.	BHO-082	183	LEE	S. W.	BRO-003	335
KWON	H. W.	BBP-029	376	LEE	M. J.	BRO-006	341
		BBO-024	153	LEE	D. W.	BRO-006	341
KWON	S. S.	ATO-001	298	LEE	S. H.	BEO-024	131
KWON	O. W.	BHP-034	399	LEE	С. Ү.	BHO-043	207
KWON	S. H.	PBP-023	423			BEP-011	361
KWON	O. K.	BBP-026	374	LEE	H. S.	BBP-013	368
KWON	H. W.	BBO-053	157	LEE	W. Y.	PBO-031	238
		BBO-054	152	LEE	J. C.	PBO-031	238
KWON	M. S.	TQP-045	452	LEE	S. H.	BRO-027	321
KWON	H. J.	ATO-056	295	LEE	K. J.	PBP-023	423
KWON	M. S.	ATO-056	295	LEE	S. H.	BRO-029	346
				LEE	S. H.	ATO-071	303
L				LEE	K. S.	BBP-019	371
LABAT	J.	BBP-012	367			BBP-020	372
LAKORTE	E.	TQP-013	435	LEE	S. H.	BBO-041	141
LANZAVECCHIA	S. B.	BHP-031	397	LEE	M. C.	ATP-024	466
LARASATI	A.	PBO-021	230	LEE	M. K.	PBP-026	425
LAUDE	R.	BBO-031	170	LEE	J. Y.	BBP-029	376
LE CONTE	Y.	TQP-035	447	LEE	M. L.	BBO-050	150
		TQP-034	446			BBO-051	160
		TQP-033	446	LEE	M. Y.	BBO-051	160
LE CONTE	Y.	BHO-024	219	LEE		BHP-043	403
LEAL-KENAL	G.	BHP-037	400			BHP-058	411
LEBEDEV	V.	BBO-033	146	LEE	M. L.	BHP-043	403
LECLERCQ	G.	BHO-005	177	LEE		BHP-058	411
LEE	C.	BEO-023	114	LEE		ATP-038	473
LEE	Y.	ATO-023	299	LEE	H. J.	ATP-038	473
LEE	J. H.	ATO-023	299	LEE	S. H.	BRO-073	319
LEE	D. C.	TQO-013	251	LEE	Y. S.	BHO-086	186
LEE	K. Y.	BBO-022	168	LEE	M. L.	BHP-044	404
LEE	K. S.	BBO-022	168			BHP-045	404
LEE	K. Y.	PBO-013	229			BBP-031	377
LEE	Y. B.	PBO-013	229	LEE	S. H.	BBP-033	378
LEE	M. L.	BBO-024	153	LEE	J. S.	BHO-071	183
						BHO-072	194

LEE	τc	DUO 072	105	T TN / A	1 0	DUO 044	100
LEE	J. S.	BHO-073	195		A. S.	BHO-044	180
	ъц	BHO-074	184		L.	TQP-017	437
LEE	B. H.	ATO-063	287		A. S.	BBP-032	3/8
LEE	S. W.	AIO-056	295	LIN	Z. G.	BHO-021	184
LEE	Н. S.	BHO-082	183		a u	BHO-022	204
		BHP-050	406	LIN	С. Н.	ATP-024	466
		BHP-051	407	LIN	C. F.	ATP-024	466
		BHP-052	408	LING	L.	BBO-023	141
		BHP-053	408	LIOLIOS	V.	ATO-021	310
LEE	C. W.	BHO-083	184			BHP-012	387
LEE	S. B.	BHO-083	184			PBP-007	416
LEE	H. S.	BHP-054	409	LIRA	J.	TQP-006	431
		BHP-055	409	LIRDPRAPAMO NGKOL	K.	ATP-028	468
		BHO-061	213				
		BHP-056	410	LIU	Z.	BHO-008	220
		BHP-057	411	LIU	F.	BBO-015	145
LEE	M. L.	BBP-036	380	LIU	Z.	BBO-015	145
LEE	M. Y.	BBP-036	380	LIU	Х.	BBO-026	
LEFFLER	V.	TQO-031	258			BBO-056	155
LEGOTKINA	G.	TQP-004	430	LIU	Y.	BBO-060	147
LEGOUT	H.	BBP-012	367	LIU	Х.	BBO-060	147
LEHNEKE	М.	TQP-036	447	LJUNG	М.	BEO-019	115
LEHRACH	H.	BHO-026	181	LLAZAN	М.	TQP-043	451
LEMMY	В.	BRP-014	484	LONSDORF	E.	PBO-042	234
LEO	R.	BRO-028	336			BEO-035	117
LI	Х.	BBO-048	156	LOPEZ-BAÑ OS	E.	ATP-002	454
		BBO-047	158	LORENZO	A.	TQP-041	450
LI	Y.	BHO-059	214	LORENZO	A.	TQO-047	261
LI	F.	BHO-059	214	LÜ LLMANN	C.	TQP-029	444
LI	J. C.	TQP-010	434			TQP-028	444
LI	Y.	TQP-023	441	LUONG THI HUONG	G.	BHO-072	194
LI	B.	BHO-069	213	LYOUSSI	B.	ATO-018	280
LI	Z.	BBO-056	155			ATP-009	458
LI	W.	BBO-056	155			ATP-010	459
LI	Z.	BBO-060	147			ATP-011	459
LIA	E.	ATO-033	289			ATP-012	460
LIAO	H. C	TQP-010	434			ATP-013	460
LIBOR	A.	BBO-029	140				
LIENDO	M. C.	BHP-031	397	М			
LILEK	N.	TQO-038	255	МА	W.	PBP-002	413
		TOO-020	269	МА	0.	ATO-003	289
LIM	Y.	BHO-062	195	MADEBEYKIN	I.	PBP-021	422
		BHP-042	403	MADOHONAN	D.	PBO-032	242
				MAGAÑ A-ORTIZ	D.	ATO-019	285
				MAITIP	J.	BEP-009	360
						BBO-062	157
				MAKNI	M.	ATP-013	460
				1#	-·-•		100

MAKSONG	S.	BHO-006	216	MIAN	Z.	BRO-047	351
MALDONADO	L.	ATP-008	457	MIELGO	P. D.	BHP-018	390
		ATP-039	474			BEP-005	358
MALDONADO	L.	TQP-022	440			BHP-035	399
MALLET	N.	BBP-012	367			BBP-017	370
MANALO	F. K.	BBO-059	166	MIGDADI	О.	BBO-038	159
MANCHIGANTI	R.	BBO-038	159	MIGUEL	I.	BBP-012	367
MANH NGUYEN	T.	BHP-047	405	MIGUEL	M.D.G.	ATP-011	459
MANUEL	M. C.	BBO-031	170			ATP-010	459
MAPOLU	M.	BRO-049	329	MIKHAIL	S.	ATP-021	464
MARGAOAN	R.	ATO-011	308	MILEA	F.	BHP-007	384
MARIN LOAIZA	J.	TQO-023	265	MILOJKOVIĆ- OPSENICA	D.	TQO-039	266
MÁ RKUS MD	A.	ATO-065	294	MIN	S. H.	BHO-074	184
MARONI PONTI	A.	BHO-025	201			BHO-071	183
MARQUELE- OLIVEIRA	F.	ATO-043	291			BHO-072	194
MARTIN	G.	PBO-044	236			BHO-073	195
MARTÍNEZ	J.	BHP-037	400			BHO-083	184
MARTINS	M. F.	BHP-025	393	MINOO	H.	BRO-042	344
MARTINS	A.	TQP-038	448	MITROFANOV	D.	TQO-037	275
MASSAUX	C.	TQO-041	250			TQO-035	265
MATEESCU	C.	ATO-068	279	MITROWSKA	К.	TQO-030	255
MATEO	М.	BRP-002	478			TQP-011	434
MATHER	N.	BHP-049	406	MLADENOVIC	M.	BHO-042	206
MAUS	C.	BHO-017	212	MOAREFI	М.	ATP-041	475
MAYER	М.	BBO-017	139			ATO-061	306
MBAHIN	N.	BEO-007	134			BHO-084	187
MCBRIDE	A.	TQP-007	432		_	ATP-037	473
MCCONNELL	R. I.	TQP-005	431	MOCHORWA	J.	PBO-030	241
		TQP-007	432	MODIRROUSTA	Н.	BHP-015	388
		TQP-018	438	MOHAMED	В.	BBP-004	363
MEDEIROS	S. V.	BEP-010	360	MOHAMMED	S. E.	ATO-042	281
MEDRZYCKI	P.	BHO-042	206	MOHARRAMI	M.	BHP-015	388
MEHMANN	M.	BHO-018	185	MOHD RODI	M. M.	BRO-030	340
MEI CHUN	L.	PBP-030	427	MOHD YUSOFF	K.	ATO-050	286
	-	BHP-020	391	MOJA	P. J.	BHP-018	390
MEITALOVS	J.	TQP-002	429			BEP-005	358
MENEZES	С.	PBO-027	226			BHP-035	399
MENG	J.	PBP-002	413			BBP-017	370
MENG	F.	BBO-019	146	MOLTONI	A.	TQP-046	453
MENG	W.	BBO-056	155	MOMANYI	D.	PBO-030	241
MENG JIN	L.	PBP-030	427	MONTAN O	S.	BRP-022	488
MESHREF	A.	BHO-031	178	MONTENEGRO	S.B.	TQP-016	437
MESSAGE	D.	вно-023	215	MONTES	I.	BBP-012	367
		BHP-025	393	MOODUTO	L.	BHO-001	198
MIAE	К.	PRD-018	421			ATP-014	461
						AIP-046	477

MOODUTO	L.	ATP-027	468			BHO-038	210
		ATP-007	457			BHO-046	176
MOO-HUCHIN	V.	TQP-006	431			BBO-049	138
MOOKHPLOY	W.	BHP-013	387	NEUPANE	K. R.	BRO-063	334
MOON	J. H.	ATP-038	473			BHO-009	201
MOONGA	M.	BRO-056	325	NG'ANDWE	Р.	BRP-019	487
MORAIS	M. M.	BBP-035	379	NGO	H.	PBO-021	230
MORAIS	M. M.	BEP-010	360	NGUYEN	B. K.	BHO-005	177
MORITZ	R.	BHO-038	210	NGUYEN	Р.	ATO-071	303
MOSHARAF	S.	BEO-028	134	NICHOLLOS	Y. M.	ATO-044	302
MOURA	S. G.	BEP-010	360	NIKOLENKO	A.	BHO-002	216
MSEMO	S.	BEO-015	126			BHO-056	207
MUCHIUTTI	N.	TQO-031	258	NINDI	S.	BRO-049	329
MUGISHA	B.	BRO-005	335	NOUALA	S.	BEO-007	134
MUNSHI	A.F.M.F.	PBP-010	417	NOZARI	J.	BBP-016	370
MUNTAABSKI	Ι	BHP-031	397	NTAHONDI	V.	BRO-065	327
MURATA	K.	ATO-048	307	NTALWILA	J.	BRO-044	351
MUSONGOLE	C.	BRP-009	481			BRO-049	329
MUSTAFA KOSOGLU	Е. Т.	ATP-005	456	NUNES	L.	TQP-038	448
MUTINELLI	F.	BHO-025	201			PBP-025	424
MWAKATOBE	А.	BRO-049	329	NURELDEEN	K.	ATO-042	281
MYUNG-SANG	К.	ATO-057	295	NURU	A.	ATP-004	455
				NYAWALI	B.	BRP-019	487
Ν				NYUN KI	C.	ATO-055	292
NAGARAJA	N.	BBO-004	164	NZANO	Р.	PBO-030	241
		BRO-035	338				
NAI	Y. S.	BHO-060	193	0			
		BBO-027	162	О.	D.	BEO-042	120
		BHO-089	205	ODOUX	J. F.	BBP-012	367
NAKANISHI	Т.	ATO-038	309	OH	D. H.	ATO-001	298
NAM	J. W.	PBP-020	422	OH	D. G.	BHP-029	396
NARAE	KIM	ATO-057	295			TQP-025	442
		ATO-058	288			BBP-018	371
NDYABAREMA	R.	BRO-005	335	OH	M. S.	BRO-029	346
		BRO-025		OH	S. J.	BHP-044	404
NEGA	T. E.	BEP-008	359	OHATA	М.	TQP-032	445
NEHZATI	G.	BBP-016	370	OKAY	Y.	PBO-035	228
NEJLOVEANU	C.	BHP-008	384	OKECHA	Т.	PBO-030	241
NESTERENKO	R.	BRO-001	333	OKETCH	J.	PBO-030	241
		BEO-040	126	OKINYI	В.	PBO-030	241
		BRO-020	332	OKUNLOLA	О.	BRO-009	346
NETTEY	D. A.	BRP-010	482	OLAYINKA	Y.	BRO-045	329
NEUMANN	Р.	BBO-016	143	OLGA	K.	ATP-021	464
		BHO-018	185	OMAR	E. A.	ATO-009	286
		BHO-022	204	ONDER	H.	BBO-018	142
		BHO-030	175	ORTIZ-VAZQUEZ	E.	ATP-002	454
		BHO-037	211			ATO-019	285

OSAWA	T.	BRP-005	479	PARK	K. K.	ATO-044	302
OSKAY	D.	TQO-024	252	PARK	I. G.	BBO-040	167
		BBO-052	149	PARK	H. C.	BBO-040	167
OWAYSS	A.	PBP-004	414	PARK	K. K.	ATO-007	279
		TQO-025	264			ATP-006	456
Ö ZENIRLER	C.	PBP-011	418	PARK	Y. K.	PBO-015	235
		BBP-023	373	PARK	K. K.	ATO-008	305
		PBP-024	424	PARK	J. Y.	BBP-022	373
ÖZGIŞI	K.	PBP-024	424	PARK	J. K.	BBP-022	373
OZKIRIM	А.	BHO-065	192	PARK	J. M.	PBP-023	423
		BHO-066	194	PARK	Y. H.	ATO-071	303
		BHO-051	189	PARK	H. G.	BBP-019	371
		BHO-015	190	PARK	D. R.	BBO-053	157
		BHO-067	190	PARK	H. R.	ATO-056	295
OZKOK	А.	ATO-016	282	PARK	S. J.	ATO-056	295
OZSOY	N.	BEP-001	356	PARK	J. Y.	BRP-023	489
		TQP-039	449	PARK	J. K.	BRP-023	489
OZTURK	P.	BHP-003	382	PARK	Y. K.	PBP-032	428
OZTURK	C.	BBO-020	140			PBO-049	240
				PATZELT	A.	PBP-006	415
Р				PAULA	V.	TQP-024	441
Р.	R. I.	BEO-042	120	PAVEL	C.	ATO-006	301
PAGE	P.	BHO-022	204			BRO-008	320
		BHO-030	175			TQO-034	268
PAIK	W. K.	BHP-044	404			TQO-022	259
		BHP-045	404			ATP-043	476
PAK	S.	ATO-044	302			ATP-042	475
PALACIO	M. C.	BHP-031	397	PAYKARI	H.	BHO-090	193
PALACIO	A.	TQP-008	433	PEARCE	М.	BRO-071	341
PALLA	D.	PBO-030	241	PEARCE-BROWN	C.	BRO-071	341
PALLIWAL	N.	BRO-007	322	PEDRO	L.	PBP-025	424
PANASIUK	B.	BHO-042	206	PEIYING	S.	ATO-052	308
PANAYIOTIDIS	M.	TQP-042	450	PENG	C. C.	TQP-010	434
PANPUM	P.	TQP-008	433			TQP-030	444
PAPACHRISTOFOROU	А.	BBP-015	369	PENNISI	C.	BEO-014	132
PAPAEFTHIMIO	C.	BBP-015	369	PEREIRA	A. P.	TQP-024	441
PAPAIOANNOU	А.	PBP-007	416	PERES	F.	TQP-044	451
PAPITSA	C.	TQP-042	450	PERETYAGIN	Р.	ATO-046	310
PAPPA	A.	TQP-042	450	PEREYRA	J. M.	TQP-016	437
PARAISO	A.	BHO-019	210	PERMATADIETHAA	A.	ATP-045	476
PARAISO	G.	BRO-016	340	PERNAL	S.	BBO-025	156
PARAISO	A.	BRO-016	340			BHO-047	202
		BBO-028	165	PETERSON	М.	BHO-042	206
		BHP-032	397	PETTIS	J.	BHP-036	400
		BHP-033	398			BHO-049	197
PARK	S. Y.	BRO-057	342	PHANKAEW	C.	BRO-046	345

ROGERS	K.	TQP-021	440	SALEH NEZHAD	S.	ATO-054	280
ROHMATIN	E.	ATO-020	288	SALEHNEZHAD	A.	ATO-054	280
ROME	Q.	BHO-035	174	SALES	P.	TQP-017	437
		BHP-030	396	SALESI	М.	BEO-028	134
ROQUE	N.	TQP-044	451	SALIMA	K.	BHP-046	405
ROSCH	Р.	TQP-021	440	SALOMON	V.	ATP-039	474
ROSSI	A.	PBO-027	226	SALTYKOVA	E.	BHO-002	216
ROTH	K.	BHO-038	210			BHO-056	207
ROTH	P.D.H.M.	BHO-054	196	SAMANCI	Т.	TQO-016	251
RUIZ-RUIZ	J.	ATP-002	454			ATP-003	455
RUSSO	R	BHP-031	397	SAN MARTIN	G.	BHO-027	217
RUSSO- ALMEIDA	Р.	TQP-038	448	SANCHEZ	N.	ATO-028	296
		TQO-032	267	SÁ NCHEZ	P. A.	BEO-019	115
		PBP-025	424	SANER	G.	BEO-027	124
RUSVAI	M.	BHO-068	175			BEO-026	119
				SANNI	А.	BBO-028	134
S						BHP-033	398
S.	N.	PBO-007	225	SANTOS	L. G.	BHP-025	393
SAAD	N.	TQP-037	448	SANTOS	K.	TQP-017	437
SABER	М.	ATO-029	301	SANTOS	A. J. A.	TQP-024	441
SABINO	N.	ATO-028	296	SANTOS DE NOVAIS	J.	PBP-031	427
SABIR	ARDO	BHO-001	198	SANTOSA	В.	BEO-022	121
		ATP-014	461	SANTRAC	V.	BHO-053	189
		ATP-026	467	SAPCALIU	A.	BHP-007	384
		ATP-046	477			BHP-008	384
		ATP-027	468	SARI	A. N.	ATO-024	293
		ATP-007	457	SASWADE	S.	BRO-019	328
		ATP-033	471	SAURI-DUCH	E.	TQP-006	431
		ATO-070	291	SAVIN	A.	PBO-024	232
		ATP-034	471	SAVU	V.	BHP-007	384
SADEGH- ETEGHAD	S.	BHO-090	193			BHP-008	384
SAGILI	R.	BHO-048	203	SAVUSHKINA	L.	BBO-044	150
ŞAHIN	F	BRO-055	343			BBO-032	145
SAHLAN	М.	ATO-020	288	SAWANNAPON	G.	PBP-005	415
		ATP-045	476	SAWANT	Р.	BRP-006	480
SAIDI	A.	BRO-036	349	SAYEDI	S. M.	BEO-028	134
SAINI	D.	BBO-038	159			TQP-040	449
SAJWANI	A.	PBO-010	226	SCANNAPIECO	A. C.	BHP-031	397
		PBP-006	415	SCHAAB	G	TQP-041	450
SAKAMOTO	F.	TQP-032	445	SCHAAB	G.	TQO-047	261
SAKARYA	E.	BEP-004	357	SCHERKL	D.R.L.	BHO-045	179
SAKSANGAWONG	C.	TQP-001	429	SCHIESSER	A.	BHO-051	189
SALAKO	V.	BBO-028	165			BHO-015	190
SALEH NEZHAD	S.	ATO-050	286			BHO-065	192

SCHIESSER	А.	BHO-066	194	SHIN	J. M.	ATO-023	299
		BHO-067	190	SHIN	K. Y.	ATO-063	287
SCHLOTHAUER	R.	TQO-018	256	SHUANG	Z.	ATO-004	307
SCHLUETER	B.	BEO-014	132	SHUTLER	D.	BHO-038	210
SCHMIDT	K.	TQP-036	447	SIEFERT	B.	BHP-027	394
SCHNEEBERGER	A.	BHO-037	211	SILICI	S.	ATO-039	306
SCHWARZINGER	S.	TQO-033	250	SILVA	I.	BHO-023	215
		TQP-021	440	SIME-NGANDO	Т.	BBP-012	367
SEDAK	M.	TQO-015	257	SIMON DELSO	N.	TQP-035	447
SEKEROGLU	N.	PBO-043	240			TQP-034	446
SEMENIUK	V.	TQO-005	254			TQP-033	446
SEMENIUK	N.	TQO-005	254			BHO-027	217
		BBP-024	374			BHO-041	208
SEMENIUK	V.	BBP-024	374	SIMUTH	J.	BHO-026	181
SENA	S.	TQP-043	451	SIN	C. Y.	BBP-022	373
SENA	L.	TQP-043	451			BRP-023	373
SEO	D. J.	PBO-031	238	SINGH	А.	BRO-010	321
SEO	J. B.	ATO-071	303	SINGH	N.	BHO-044	180
SEO	H. Y.	ATO-071	303	SINSIN	B. A.	PBO-032	242
SEO	H. J.	BHO-082	183	SIUDA	M.	BHO-042	206
		BHP-050	406	SKALTSOUNIS	A. L.	BBP-015	369
		BHP-051	407	SKRINER	K.	BHO-026	181
		BHP-052	408	SKVORCOV	A.	PBP-021	422
		BHP-053	408	SLAA	K.	BBO-005	154
		BHP-054	409	SMAGGHE	G.	BRO-058	326
		BHP-055	409	SOKENOU	F.	BHO-019	210
		BHO-061	213			BHP-033	398
		BHP-056	410	SOLOVIEVA	A.	ATP-018	463
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