Possible factors of colony losses. Their synergism and hierarchy within different biotopes and diverse agricultural/beekeeping practices.

Speaker: Gilles RATIA International Beekeeping Consultant



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Screen 2 / 105

Problems

Lack of shared criteria concerning the observed symptoms, both quantitatively and qualificatively

Lack of reliable databases and beekeeping specialists at regional and national levels

Lack of confidence between groups (different economic interests)

Limited objectivity during heated debates



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C.O.S.T. European Cooperation in the field of Scientific and Technical Research



148 scientists





24 countries: part of EU + China + Egypt + USA + Bosnia & H. + Turkey + Canada, etc.



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History - Examples

During XIX Century Foulbrood in the USA



Beginning XX Century Acarine disease in UK





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During the last 60 years spraying of pesticides!



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1) Weakening of the colonies Different aspects

- Decrease of queen laying
- Increase of cannibalism

Repetitive supersedures with queenless colony risks
 Decrease of queen and bee workers' life span
 Less tolerance to diseases, parasitism and robbing

2) Colony losses Different aspects



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left in the cells



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3) Empty beehive



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CCD: Colony Collapse Disorder represents 50 to 60% of losses in the USA

5 to 10% of losses in the world





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CCD: Colony Collapse Disorder

Nearly all bees leave the hive in 2 to 10 days. Sometimes, the queen and a few newly emerged adults are left behind, Sometimes, brood (eggs, larvae, pupae) remains in the comb and succumbs to lack of feed and incubation





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CCD: Colony Collapse Disorder



Stores remain in the combs: honey & "bee bread" (stored pollens). They are not destroyed by the wax moth and seem to be toxic when immediately re-introduced into another colony



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Colony Collapse Disorder

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Syndrome d'effondrement des colonies d'abeilles - Wikipédia Le Syndrome d'effondrement des colonies d'abeilles ou CCD (pour l'expression anglaise « Colony Collapse Disorder ») est le nom donné à un phénomène d'abord fr.wikipedia.org/wiki/Syndrome_d'effondrement_des_colonies_d'abeilles - 76k - En cache - Pages similaires			
Colony collapse disorder - Wikipedia, the free encyclopedia - [Traduire cette page] Colony collapse disorder (or CCD) is a phenomenon in which worker bees from a beefine or European honey bee colony abruptly disappear en.wikipedia.org/wiki/Colony_Collapse_Disorder - 216k - En cache - Pages similaires	457	,000	
ARS : Questions and Answers: Colony Collapse Disorder - [Traduiro cette page] 29 May 2008, Discusses the importance of the mysterious bee deaths, theories on its causes, and history of the problem. www.ars.usda.gov/is/br/ccd/ - 56k - En cache - Pages similaires	pa	ges	
Colony Collapse Disorder: A Complex Buzz - [Traduire catte page] 2 May 2008 Entomologist injects a healthy bee with viruses extracted from bees in colonies showing colony collapse disorder www.ars.usda gov/s/AR/archive/may08/colony0508.htm - 56k - En cache - Pages similaires Autres résultats, domaine www.ars.usda.gov.s	in 2	2008	
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Colony Collapse Disorder

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Web Afficher Conseil : <u>Recherc</u> Colony collapse a phenomenon in : <u>Background - Sym</u> en wikipedia org/ <u>Syndrome d'eff</u> Le Syndrome d'eff Colony Collapse fr wikipedia org/	les options hez des résultats uniquement en français. Vi se disorder - Wikipedia, the free enc disorder (CCD) or sometimes honey bee dep which worker bees from a beehive or Europea uptoms - Scale of the disorder //Colony_collapse_disorder - En cache - P ondrement des colonies d'abeilles - W ondrement des colonies d'abeilles ou CCD (pr Disorder -) est le nom donné à un phénomé /Syndrome_d'effondrement_des_colonies_d'ab	Résultats 1 à 10 sur sus pouvez indiquer votre langue <u>(clopedia</u> - <u>Tradure cette pa</u> opulation syndrome (HBDS) is i honey bee <u>indes cimilaires</u> <u>ildipédia</u> ur l'expression anglaise « te d'abord eilles -	un total d'enviran 8 620 000 pour " de recherche sur la page <u>Préféren</u> 25]	colony collapse disorder" (8,62	0,46 secondes)		
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BL: Bee Losses

Annual bee colony mortality up to 1990: 5 to 10% (15 to 18% in the USA)

Current annual bee colony mortality (but not every year and not everywhere): 25 to 40% (32 to 36% in the USA)

Possible peaks: 80 to 100% (including USA)

Bee farm - 40% 1,000 colonies = 600 colonies 4 400 weak colonies
for artificial swarm
production
200 weak colonies
for honey production
today

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For info

Bee colony mortality rates after wintering in the USA

2006/2007 = 35.8% 2007/2008 = 28.6% 2008/2009 = 31.8%

Colony losses + colony weakening = less 50% of honey production in the USA = 100,000 T in 1985 > 50,000 T in 2009



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Other impacts

Human food production (less pollination)



Biodiversity (less pollination)





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Screen 19/105



Screen 20 / 105

Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- 6) Other exogenous pollutions
- 7) Other endogenous pollutions
- 8) Climate changes
- 9) Synergism between factors
- **10)** Single still unknown factor

Possible factors

Screen

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→ 1) Pesticides

- 2) Varroas
- 3) Bee diet
- 4) Colony management
- 5) Diseases, virosis and parasitism
- 6) Other exogenous pollutions
- 7) Other endogenous pollutions
- 8) Climate changes
- 9) Synergism between factors
- 10) Single factor still unknown



TIA Screen 22/105

Different intoxications

- Lethal effect (with bee mortality):
 - acute intoxication (single dose)
 - chronic intoxication (small and repeated doses)
- Sub-lethal effect (without direct bee mortality):
 - Ioss of sense of direction
 - Ioss of olfactory sense





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Screen 23 / 105

1) Pesticides

1.1 New generation of pesticides + their metabolites



Apiservices

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Screen 24 / 105

1) Pesticides

1.1 New generation of pesticides + their metabolites



Imidacloprid
 Commercial name:
 Gaucho[®], Confidor[®],...
 Company: Bayer[™]



Colony losses – Possible factors Aniservices Screen **Gilles RATIA** Conference given in many countries 25/105 nitroso monohydroxy (x 2) **Metabolites** Imidacloprid olefine guanidine a 134 C1 guanidine-olefine urea

. Apiservice

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Screen 26 / 105

1) Pesticides

1.1 New generation of pesticides + their metabolites



Imidacloprid
 Commercial name:
 Gaucho[®], Confidor[®],...
 Company: Bayer™





Fipronil Commercial name: Regent TS[®], Schuss[®], Metis[®], Trident[®],... Company: BASF[™]





Apiservices

Screen

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Apiservices

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1) Pesticides

1.1 New generation of pesticides + their metabolites Other neonicotinoids



▲ Thiamethoxam
 Commercial name:
 Cruiser[®]
 Company: Syngenta[™]



◄ Clothianidine
 Commercial name:
 Poncho[®]
 Company: Bayer™



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1) Pesticides

1.1 New generation of pesticides + their metabolites

Other neonicotinoids



Thiacloprid
 Commercial name:
 Calypso[®]



Acetamiprid Commercial name: Supreme[®]



Dinotefuran
 Commercial name:
 Safari[®]



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Toxicity / Bees (LD50 ng/bee) - Dr. JM Bonmatin (CNRS) France

pesticide	R	utilisation	DL50 ng/ab	Tox/DDT
DDT	Dinocide	insecticide	27 000,0	1
amitraze	Apivar	i/acaricide	12 000,0	2
coumaphos	Perizin	i/acaricide	3 000,0	9
tau-fluvalinate*	Apistan	i/acaricide	2 000,0	13,5
methiocarb	Mesurol	insecticide	230,0	117
carbofuran	Curater	insecticide	160,0	169
λ-cyhalothrine	Karate	insecticide	38,0	711
deltamethrine	Décis	insecticide	10,0	2 700
thiaméthoxam	Cruiser	insecticide	5,0	5 400
fipronil	Regent	insecticide	4,2	6 475
clothianidine	Poncho	insecticide	4,0	6 7 5 0
imidaclopride	Gaucho	insecticide	3,7	7 297



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1) Pesticides

1.1 New generation of pesticides + their metabolites

1.2 Other conventional pesticides + their metabolites



Pyrethrins / Pyrethroids, Oxadiazines, Phenyl pyrazoles, Oxadiazines, Phenyl pyrazoles / Cyclodienes, Chloronicotinyls Nicotine / Spinosad, Organophosphates / Carbamates, Atropine, Macrolactones, etc.



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1) Pesticides

1.1 New generation of pesticides + their metabolites

1.2 Other conventional pesticides + their metabolites







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Screen 33 / 105

1) Pesticides

- 1.1 New generation of pesticides + their metabolites
- 1.2 Other conventional pesticides + their metabolites
- 1.3 The possible synergism between them





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Screen 34 / 105

1) Pesticides

- 1.1 New generation of pesticides + their metabolites
- 1.2 Other conventional pesticides + their metabolites
- 1.3 The possible synergism between them





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Screen 35 / 105

1) Pesticides

- 1.1 New generation of pesticides + their metabolites
- 1.2 Other conventional pesticides + their metabolites
- 1.3 The possible synergism between them





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Screen 36 / 105

1) Pesticides

- 1.1 New generation of pesticides + their metabolites
- 1.2 Other conventional pesticides + their metabolites
- 1.3 The possible synergism between them
- 1.4 Other sources of intoxication

Sugary exudate at the base of the leaves
Apiservice

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Screen 37/105

1) Pesticides

- 1.1 New generation of pesticides + their metabolites
- 1.2 Other conventional pesticides + their metabolites
- 1.3 The possible synergism between them
- 1.4 Other sources of intoxication





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Screen 38 / 105

<u>id / m</u>

1) Pesticides

100 nă

- 1.1 New generation of pesticides + their metabolites
- 1.2 Other conventional pesticides + their metabolites
- 1.3 The possible synergism between them
- 1.4 Other sources of intoxication

Toxic dust behind seeders!

3 000 colonies in France (Fiprom in 2004) 6 000 colonies in Italy (in 2007) 1 000 colonies in Germany (Clothianidine in 2008)



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1) Pesticides

- 1.1 New generation of pesticides + their metabolites
- 1.2 Other conventional pesticides + their metabolites
- 1.3 The possible synergism between them
- 1.4 Other sources of intoxication



Year 1 Treated crops

> Year 2 Untreated crops but still toxic!



Soil remanence between two crops



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Screen 40 / 105

1) Pesticides

- 1.1 New generation of pesticides + their metabolites
- 1.2 Other conventional pesticides + their metabolites
- 1.3 The possible synergism between them
- 1.4 Other sources of intoxication



Pollution of runoff water

Possible factors

Screen

41/105

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- 1) Pesticides
- ➡ 2) Varroas
 - 3) Bee diet
 - 4) Colony management
 - 5) Diseases, virosis and parasitism
 - 6) Other exogenous pollutions
 - 7) Other endogenous pollutions
 - 8) Climate changes
 - 9) Synergism between factors
 - 10) Single factor still unknown

Possible factors

Screen

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Pesticides
 Varroas





Gilles RATIA Screen 43/105

Possible factors

- 1) Pesticides
- 2) Varroas
- → 3) Bee diet
 - 4) Colony management
 - 5) Diseases, virosis and parasitism
 - 6) Other exogenous pollutions
 - 7) Other endogenous pollutions
 - 8) Climate changes
 - 9) Synergism between factors
 - 10) Single factor still unknown



Screen 44 / 105

Possible factors

- Pesticides
- Varroas
- 3) Bee diet

Monocultures + weedkillers

► 3.1 Biodiversity: decrease of pollen sources





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Screen 45 / 105





Screen 46/105



But, where are the flowers?

Possible factors

Screen

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- 1) Pesticides
- 2) Varroas
- 3) Bee diet
 - ► 3.1 Biodiversity: decrease of pollen sources
 - ► 3.2 New generation of bee food, notably from corn



Possible factors

Screen

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- 1) Pesticides
- 2) Varroas
- 3) Bee diet
 - ► 3.1 Biodiversity: decrease of pollen sources
 - ► 3.2 New generation of bee food, notably from corn
 - **3.3 GMO: Genetically Modified Organisms**



A) Artificial production of insecticides!
B) Is pollen modifying bee metabolism?
C) Some GMO are producing less nectar
D) Increased use of weedkillers

Possible factors

Screen

50/105

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- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
 - 5) Diseases, virosis and parasitism
 - 6) Other exogenous pollutions
 - 7) Other endogenous pollutions
 - 8) Climate changes
 - 9) Synergism between factors
 - 10) Single factor still unknown

Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
 - 4.1 Multiplication of migration = stress of the colonies



Possible factors

Screen

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- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
 - 4.1 Multiplication of migrations = stress of the colonies
 - 4.2 Social concentration = overgrazing + unhealthy environment

10 000 beehives on the same spot for *Pinus brutea* honeydew!

Record) And Conservation

West

Turkey



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Screen 55/105

Rounding-up in Japan before migration via ferry-boat

Screen 56 / 105

Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
 - 4.1 Multiplication of migrations = stress of the colonies
 - 4.2 Social concentration, overgrazing and affected environ.
 - 4.3 Queens and package bees international trade





A) BiotopeinadequacyB) Diseasevectors

Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
 - 4.1 Multiplication of migrations = stress of the colonies
 - 4.2 Social concentration, overgrazing and affected environ.
 - 4.3 Queens and package bees international trade
 - 4.4 Repetitive feeding
 - 4.5 Prophylatic use of antibiotics every year!



Screen

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Possible factors

Screen

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- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- ➡ 5) Diseases, virosis and parasitism
 - 6) Other exogenous pollutions
 - 7) Other endogenous pollutions
 - 8) Climate changes
 - 9) Synergism between factors
 - 10) Single factor still unknown

Possible factors



5.1 Nosema ceranae

Opportunistic? / Marker?



Screen 60 / 105

Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- ▶ 5.1 Nosema ceranae
- **5.2 IAPV = Israeli Acute Paralysis Virus**





Opportunistic? / Marker?



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APV	Acute Paralysis Virus	A few other	DWV	Deform Wing Virus
ArkBV	Arkansas Bee Virus	known	EBV	Egypt Bee Virus
BQCV	Black Queen Cell Virus	viruses	FBV	Filamentous Virus
BVX	Bee Virus X		JEBV	Japon strain of Egypt Virus
Β٧Υ	Bee Virus Y	- Martin	KBV	Kashmir Bee Virus
CBPV	Chronic Bee Paralysis Virus	+ how many	SBV	Sacbrood Bee Virus
CWV	Cloudy Wing Virus	more?	SPV	Slow Paralysis Virus

Possible factors

Screen

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- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- ▶ 5.1 Nosema ceranae
- 5.2 IAPV = Israeli Acute Paralysis Virus
- 5.3 Arrival of new parasites and predators



Asian hornet Vespa velutina "Crazy ants" Rasberry Paratrechina longicornis

Small beetle Aethina tumida



Fly Senotainia tricuspis



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Screen 65 / 105



Possible factors

Screen

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- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- 6) Other exogenous pollutions
 - 7) Other endogenous pollutions
 - 8) Climate changes
 - 9) Synergism between factors
 - 10) Single factor still unknown

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Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- 6) Other exogenous pollutions
 - ► 6.1 Industrial



Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- 6) Other exogenous pollutions
 - 6.1 Industrial
 - 6.2 Agricultural (other than on crops)



Screen

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Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- 6) Other exogenous pollutions
 - 6.1 Industrial
 - 6.2 Agricultural (other than on crops)
 - 6.3 Hertzian pollution



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Screen 71 / 105

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Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- 5) Diseases, virosis and parasitism
- 6) Other exogenous pollutions
- 7) Other endogenous pollutions
 - 8) Climate changes
 - 9) Synergism between factors
 - 10) Single factor still unknown

Screen 72 / 105

Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- 6) Other exogenous pollutions
- 7) Other endogenous pollutions
- ► 7.1 Accumulation varroa treatments in wax + metabolites


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Screen 74 / 105





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Screen 75 / 105





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The accumulation of two miticides (taufluvalinate + coumaphos) in wax could block the detoxification action of bee enzymes against pesticides





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Screen 78 / 105



Screen 79 / 105

Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- 6) Other exogenous pollutions
- 7) Other endogenous pollutions
 - 7.1 Accumulation varroa treatments in wax + metabolites
 - 7.2 Do-it-yourself treatments against bee diseases/parasites



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Possible factors

Screen

81/105



7.3 Products to protect wood

Colony losses – Possible factors **A**MISONVICOS Gilles RATIA Screen Conference given in many countries 82/105 **Possible factors** H н **Climate changes** 8) 9) Synergism between factors

10) Single factor still unknown



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8.1 More frequent droughts and fires



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Screen 84 / 105



8.1 More frequent droughts and fires



Screen 85 / 105



8.2 More frequent floods



Screen

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Screen 87/105



▶ 8.3 Decrease in aphid population

Screen 88 / 105

Possible factors

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony management
- **5)** Diseases, virosis and parasitism
- 6) Other exogenous pollutions
- 7) Other endogenous pollutions
- 8) Climate changes
- 9) Synergism between factors
 10) Single factor still unknown



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Screen 95/105





Screen 96/105







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Plants pulled up by the shepherds

Thyme (Thymus sp.) and Oregano (Origanum vulgare)

Possible factors

Screen

99/105

- 1) Pesticides
- 2) Varroas
- 3) Bee diet
- 4) Colony manager int
- 5) Diseases, viros s and parasitism
- 6) Other exogenous pollutions
- 7) Other endoger us pollutions
- 8) Climate changes
- 9) Synergism between factors
 - **10)** Single factor still unknown



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SON UNITS

Screen 100 / 105

- 11) Eccentric factorsA) Ozone depletion
 - **B)** Plane trails
 - **C)** Solar eruptions
 - D) Even apocalypse described by few religious fanatics!







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Keywords Google	French	Final Street Free Street Freet
0	pages	pages
bee mortality diseases	852 000	123.000
bee mortality pesticides	65 100	113.000
bee mortality varroa	42 500	51.500
bee mortality "climate change"	36 900	43.700
bee mortality biodiversity	287 000	38.500
bee mortality (GMO OR OGM)	10 300	25.000
bee mortality "Nosema ceranae"	2 930	16.300
bee mortality stress colonies migration	415	13.700
bee mortality ("Israeli Acute Paralysis Virus" OR IAPV)	1 710	5.900
bee mortality ("queen rearing" OR "queen breeding")	25 000	1.880
bee mortality "water pollution"	1 990	616
bee mortality ("hertzian pollution" OR electrosmog)	505	491
bee mortality sugar feeding	13 600	430



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Provisional conclusion

The weakening of bee colonies and the abnormal mortality rate could be due to the result of multiple factors, combined differently according to the biotopes and bee management.

These factors are much more prevalent in environments where agricultural AND beekeeping practices are intensive.

The bee's immune system is thereby diminished and beekeepers no longer have room for error!



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The international beekeeping sector is in trouble! We cannot simply count on the resilience of our bees... We have to work together to save

them and all other pollinators to help preserve biodiversity.

Solutions exist for each of these factors. This will be the subject of another conference.



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To be(e) or not to be(e)!

Thank you

gilles@apiservices.com