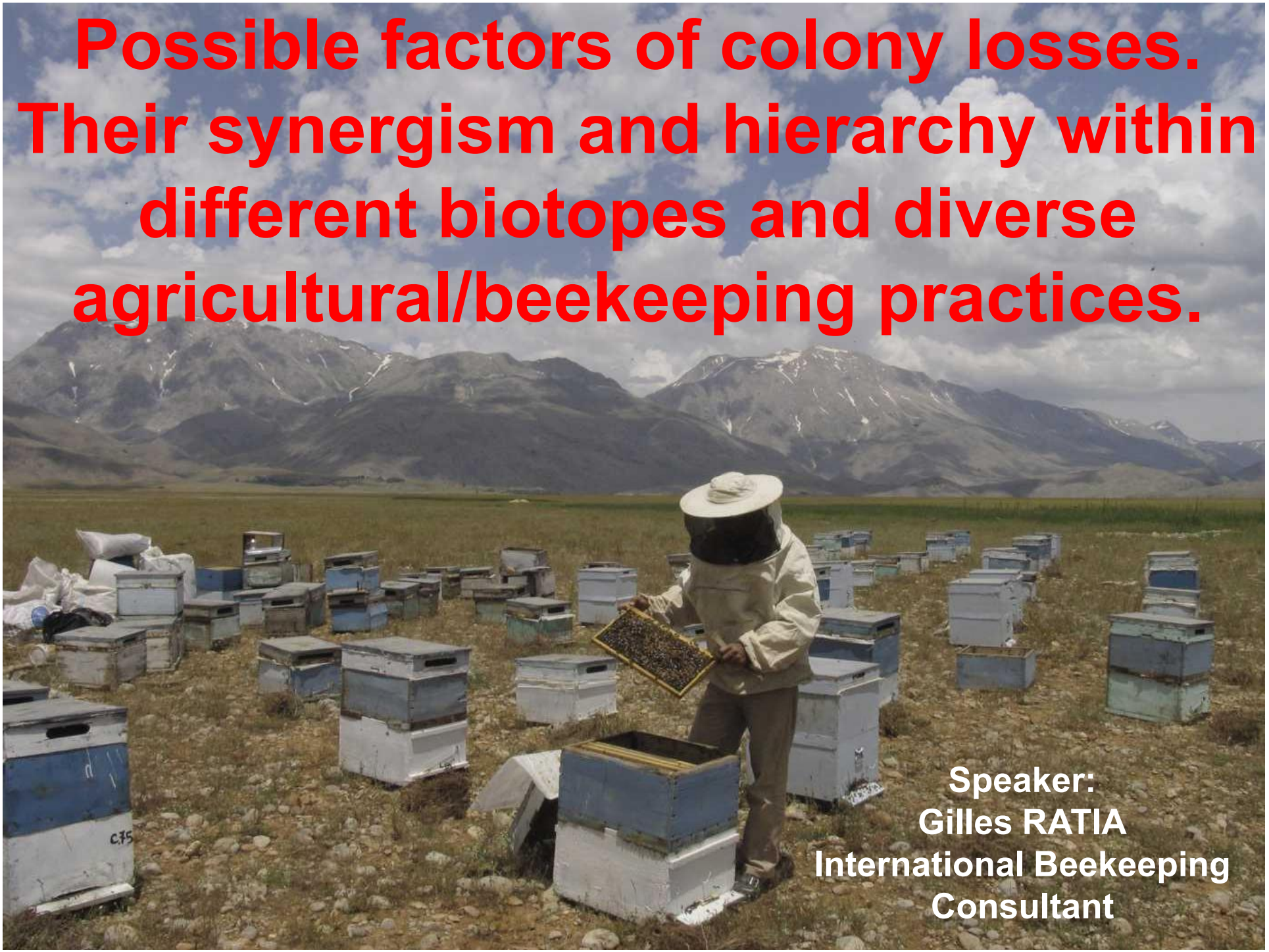
Possible factors of colony losses. Their synergism and hierarchy within different biotopes and diverse agricultural/beekeeping practices.



Speaker:
Gilles RATIA
International Beekeeping Consultant

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**

C.O.S.T.

European Cooperation in the field of Scientific and Technical Research

148 scientists

Bee Colony Losses
Prevention of Honey

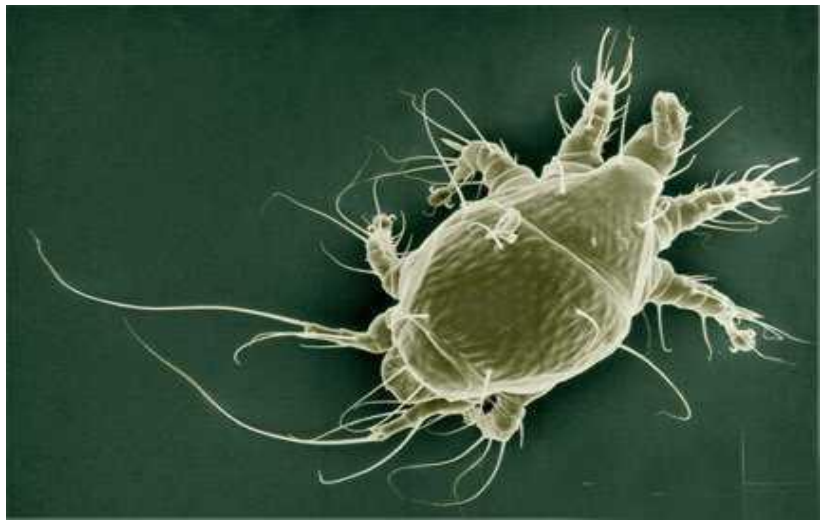
CoLoss

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

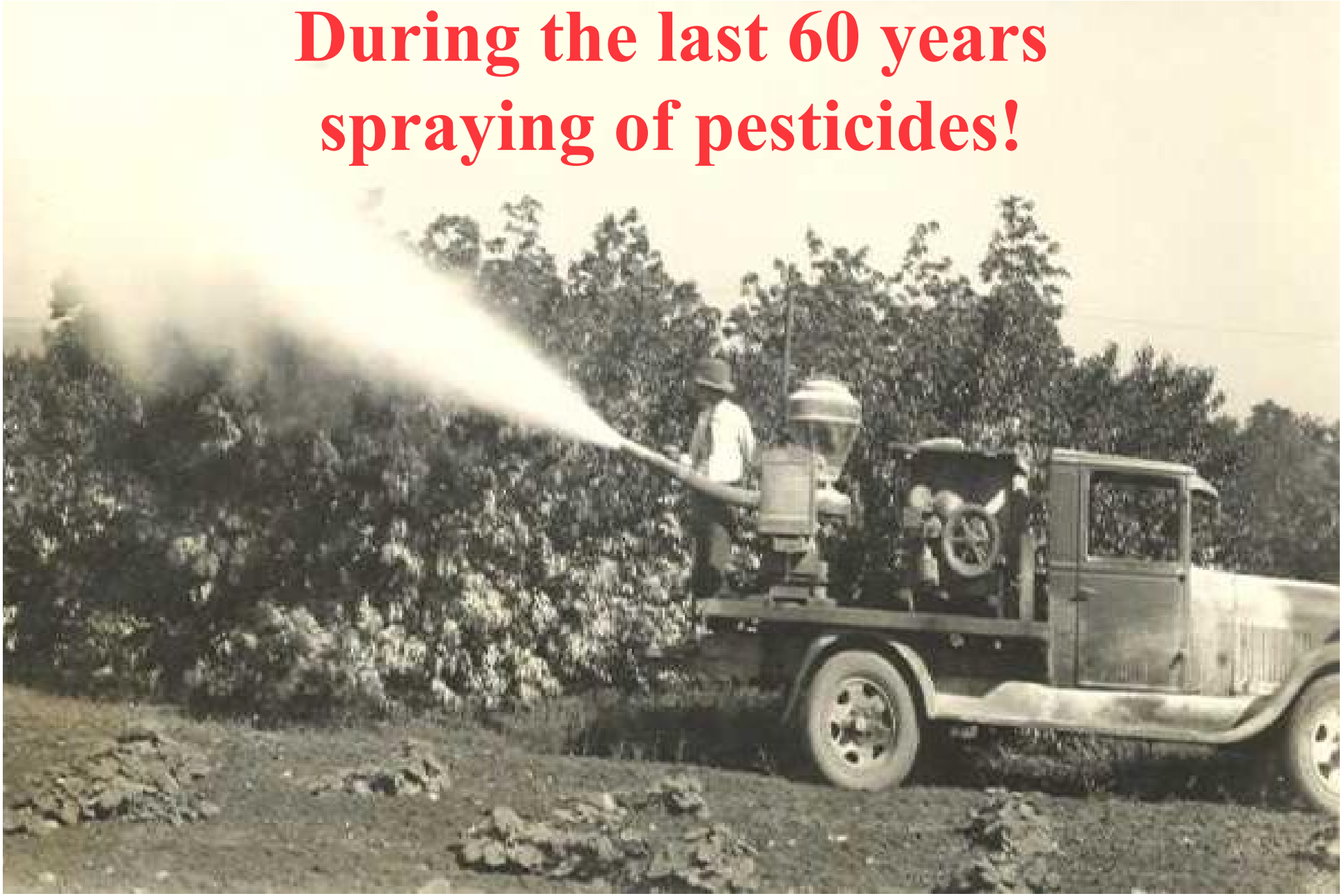
History - Examples

- During XIX Century
  Foulbrood in the USA

- Beginning XX Century
  Acarine disease in UK



During the last 60 years spraying of pesticides!



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

1) Dead bee colony inside the beehive

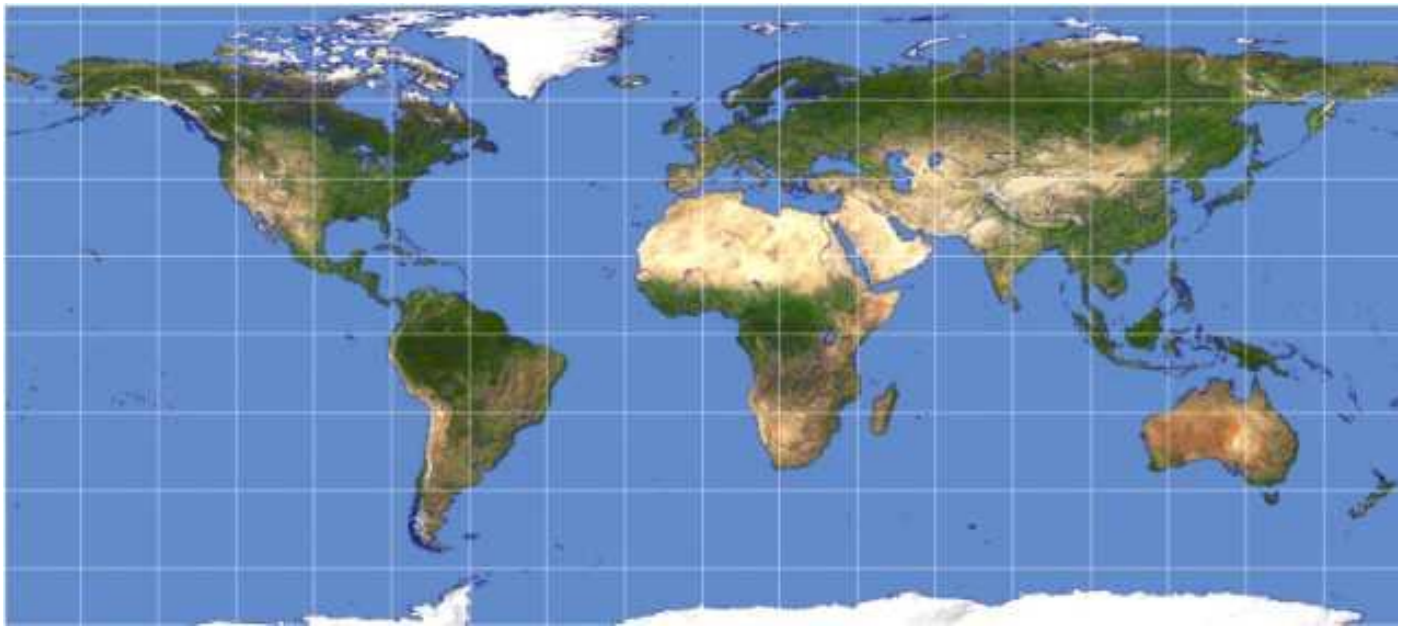
2) A few dead bees left in the cells

3) Empty beehive

CCD: Colony Collapse Disorder represents

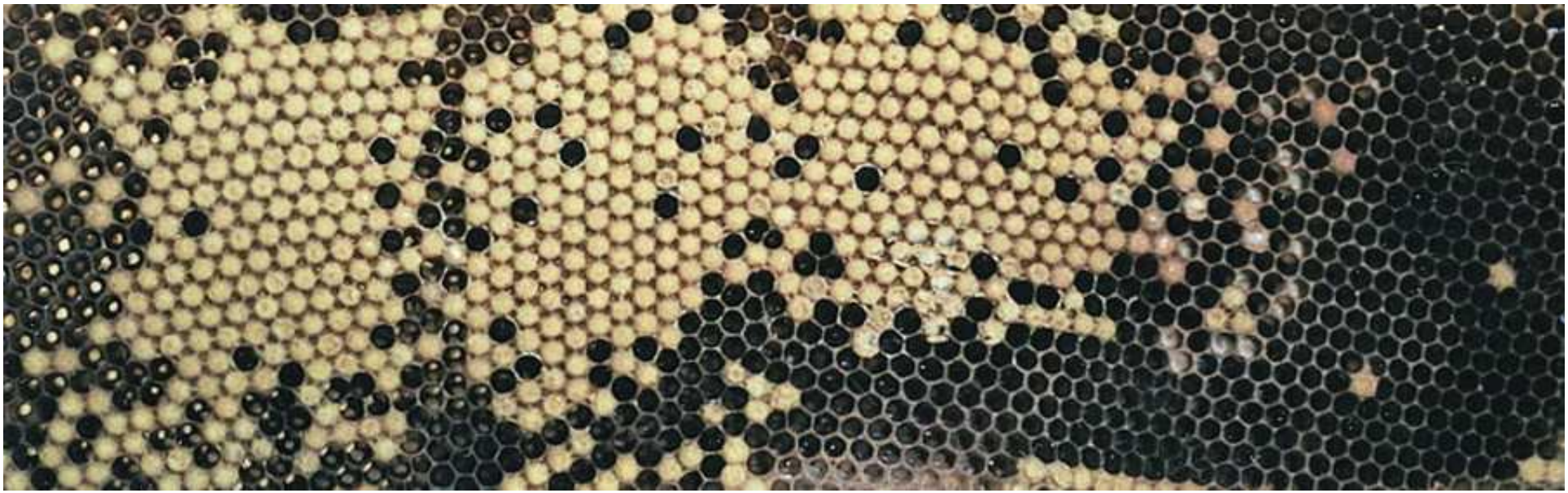
50 to 60% of losses in the USA

5 to 10% of losses in the world

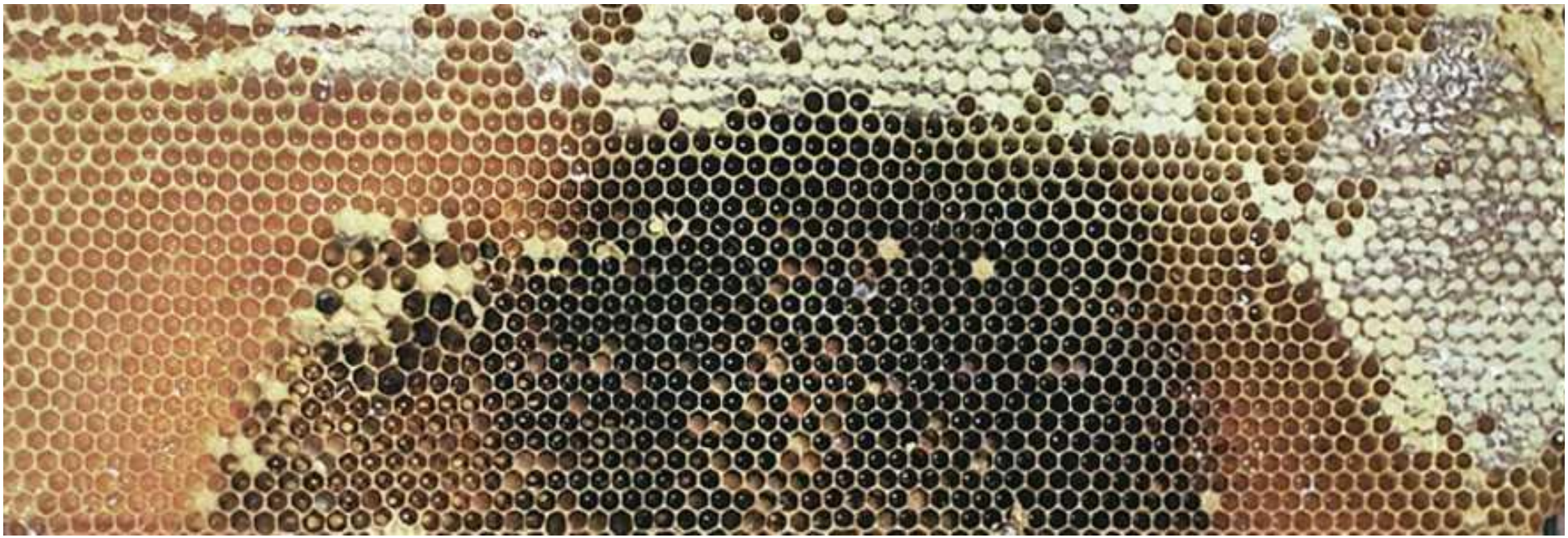


CCD: Colony Collapse Disorder

► 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

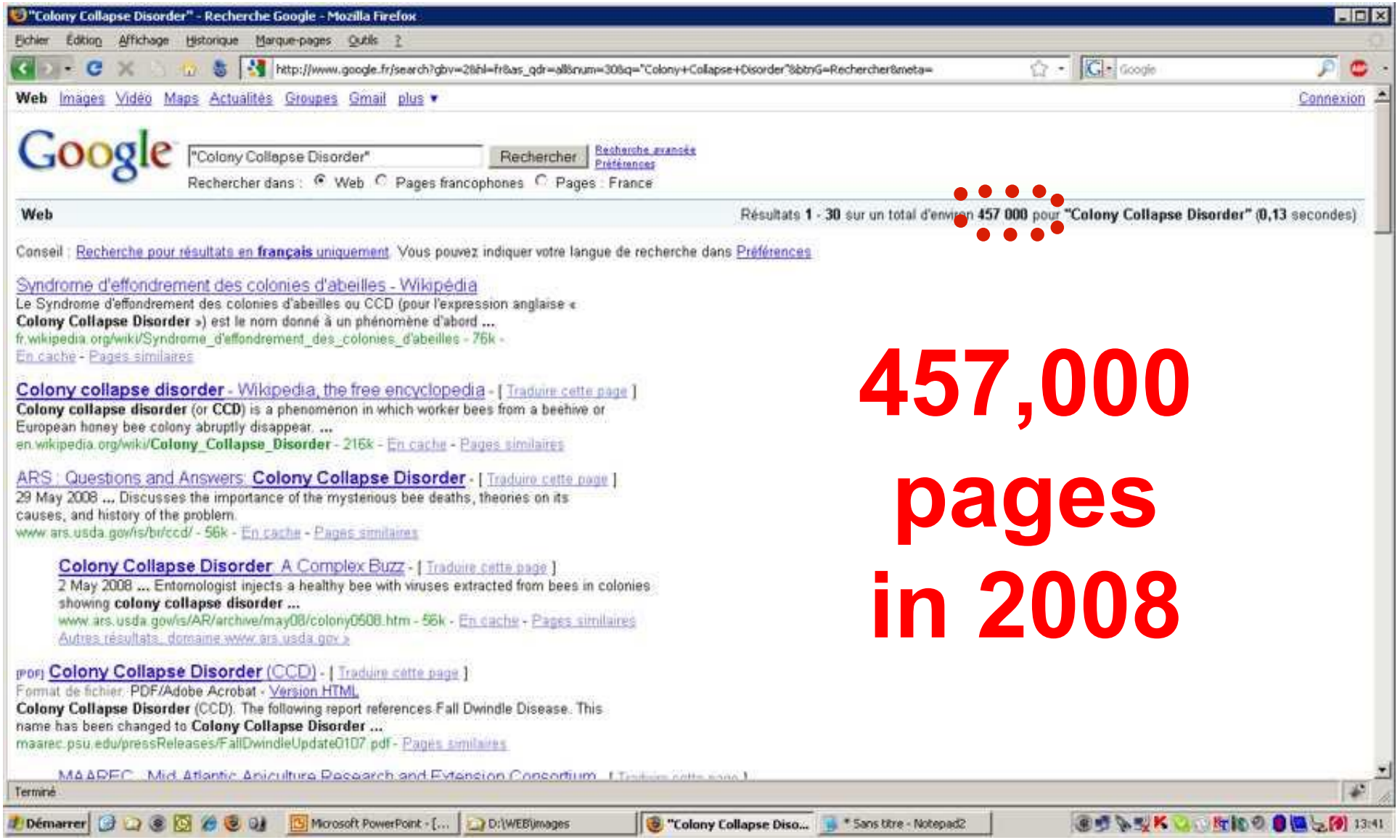


CCD: Colony Collapse Disorder



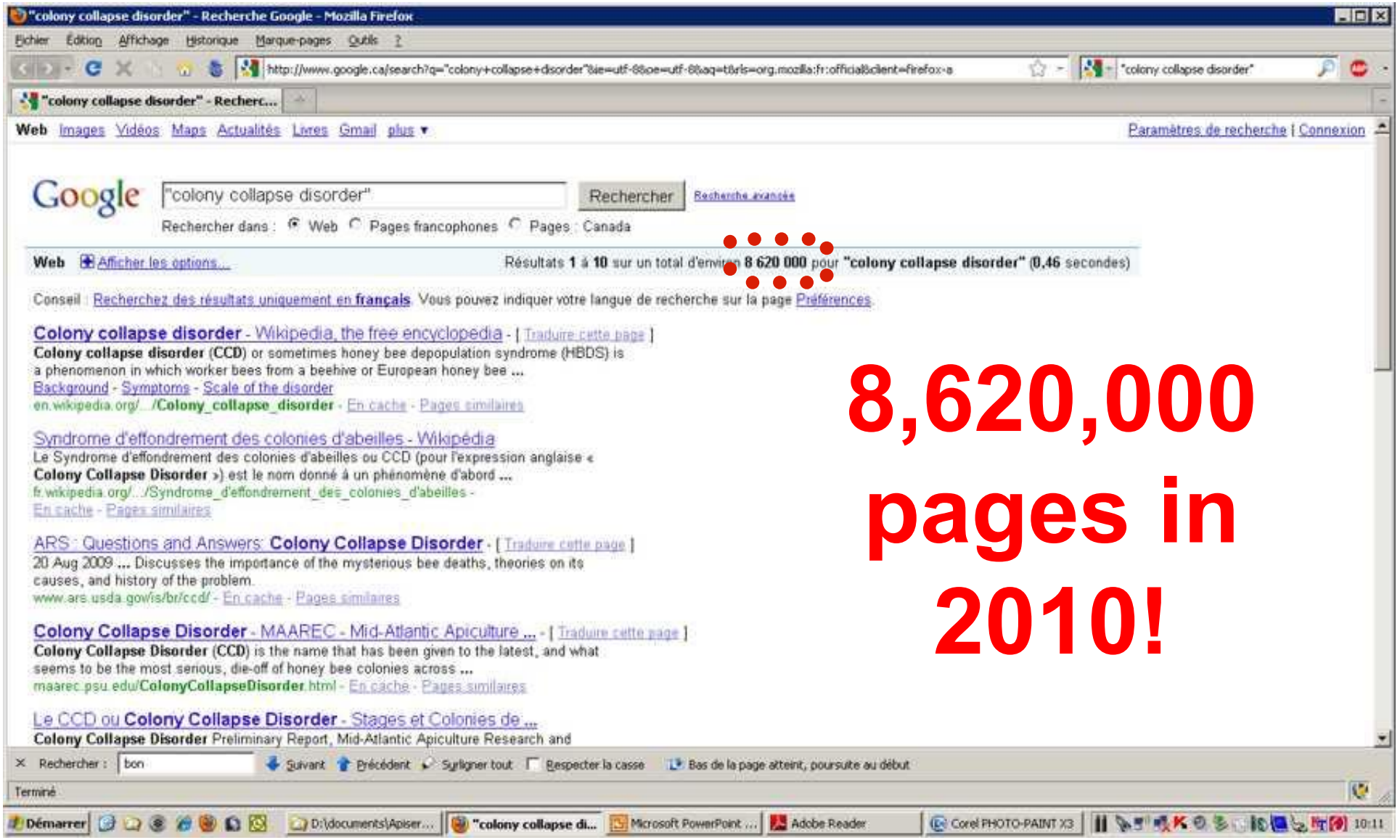
► **Stores remain in the combs: honey & "bee bread" (stored pollens). They are not destroyed by the wax moth and seem to be toxic when immediately re-introduced into another colony**

Colony Collapse Disorder



457,000 pages in 2008

Colony Collapse Disorder



8,620,000 pages in 2010!

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
  - **400 weak colonies for artificial swarm production**
  - **200 weak colonies for honey production today**

BL: Bee Losses

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

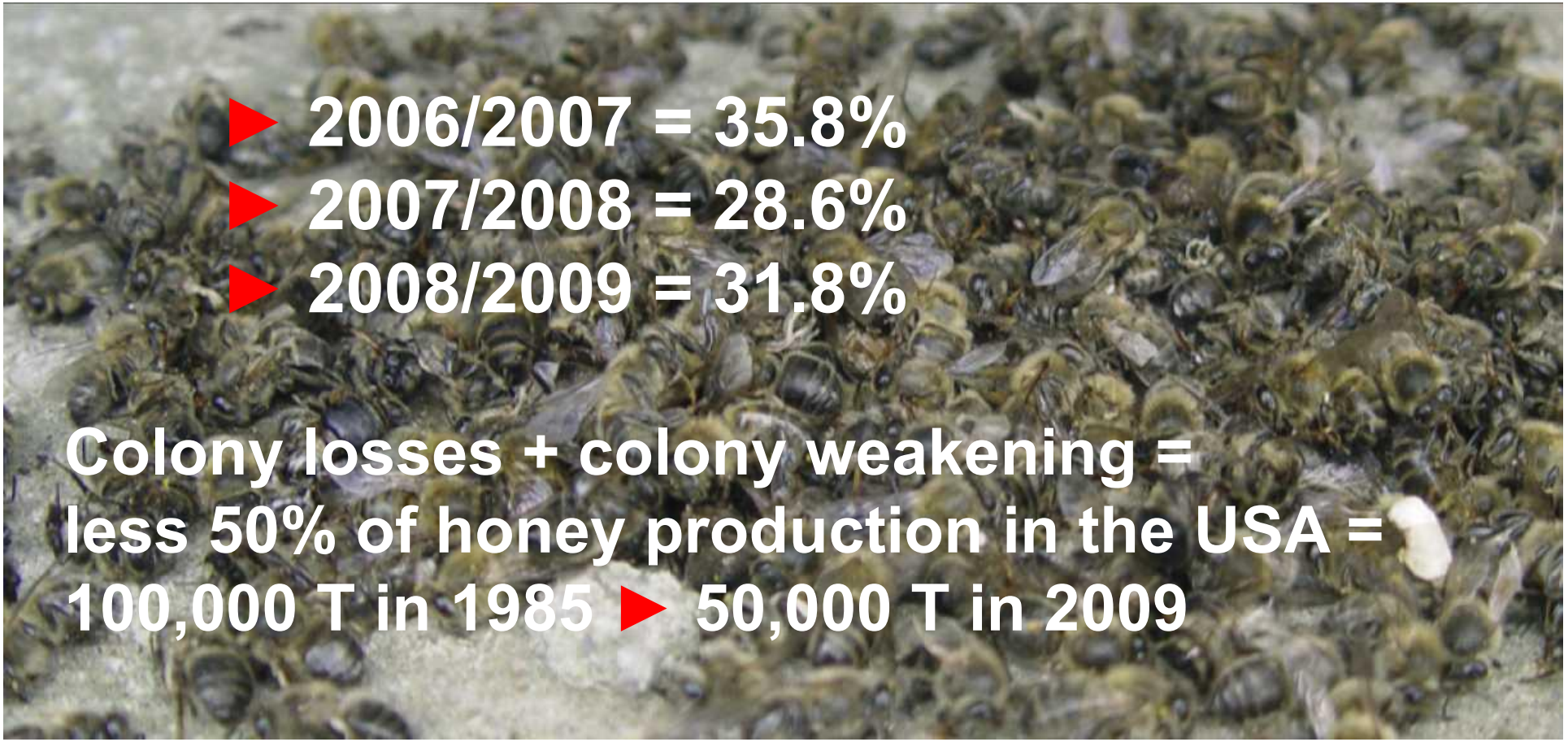
Huge economic impact for professional bee farms!

950 strong colonies 20 years ago!

200 weak colonies for honey production today

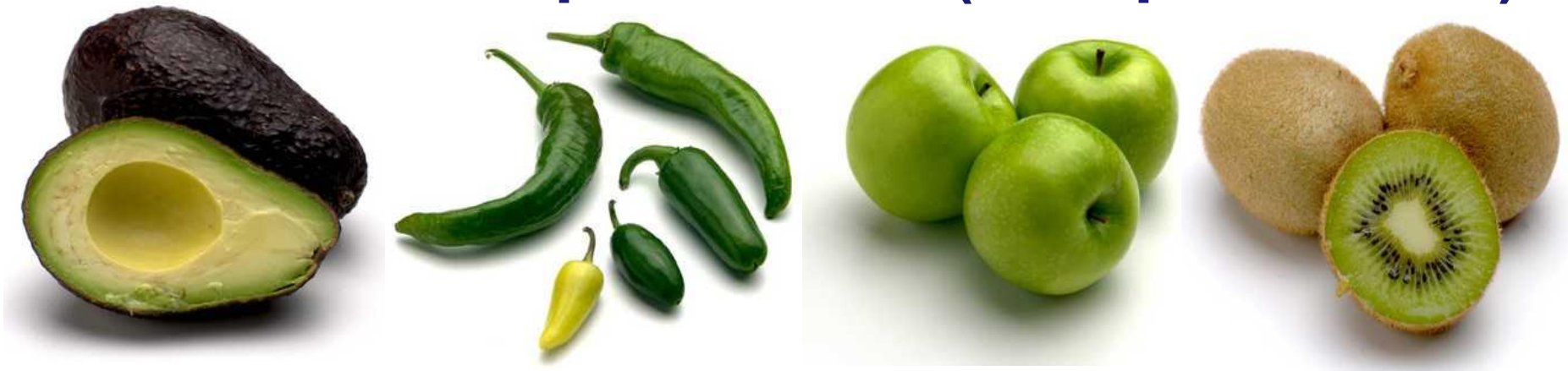
For info

- **Bee colony mortality rates after wintering in the USA**



Other impacts

- **Human food production (less pollination)**



- **Biodiversity (less pollination)**


WHY?

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

➡ 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

Different intoxications

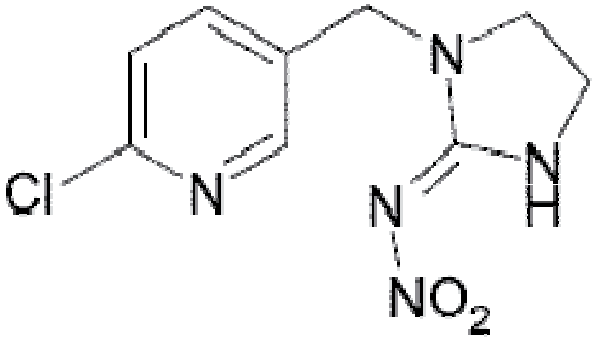
- **Lethal effect (with bee mortality):**
  - **acute intoxication (single dose)**
  - **chronic intoxication (small and repeated doses)**
- **Sub-lethal effect (without direct bee mortality):**
  - **loss of sense of direction**
  - **loss of olfactory sense**
  - **etc…**

1) Pesticides

► 1.1 New generation of pesticides + their metabolites

1) Pesticides

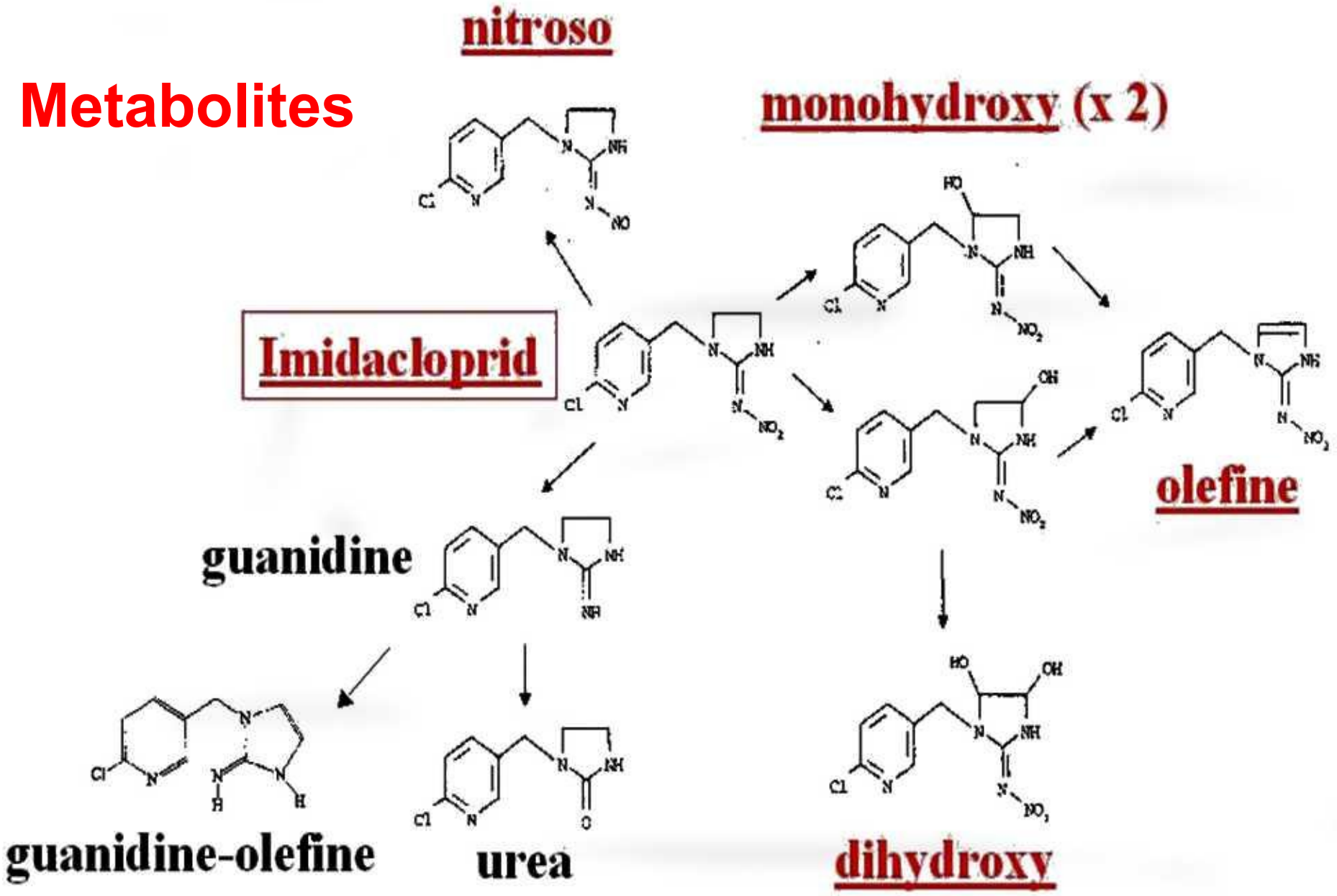
► 1.1 New generation of pesticides + their metabolites



◄ **Imidacloprid**

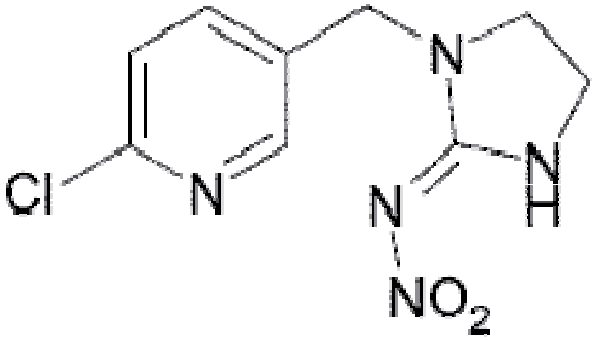
Commercial name:
Gaucho®, Confidor®,…
Company: Bayer™

Metabolites

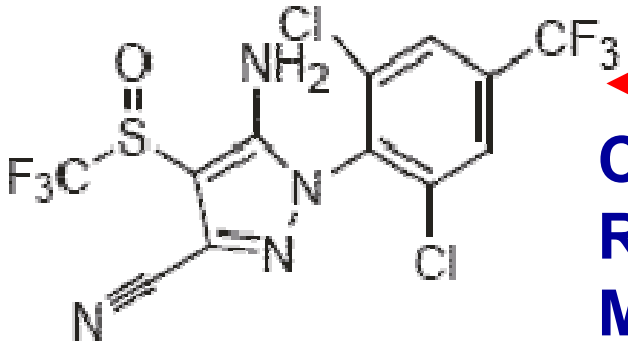


1) Pesticides

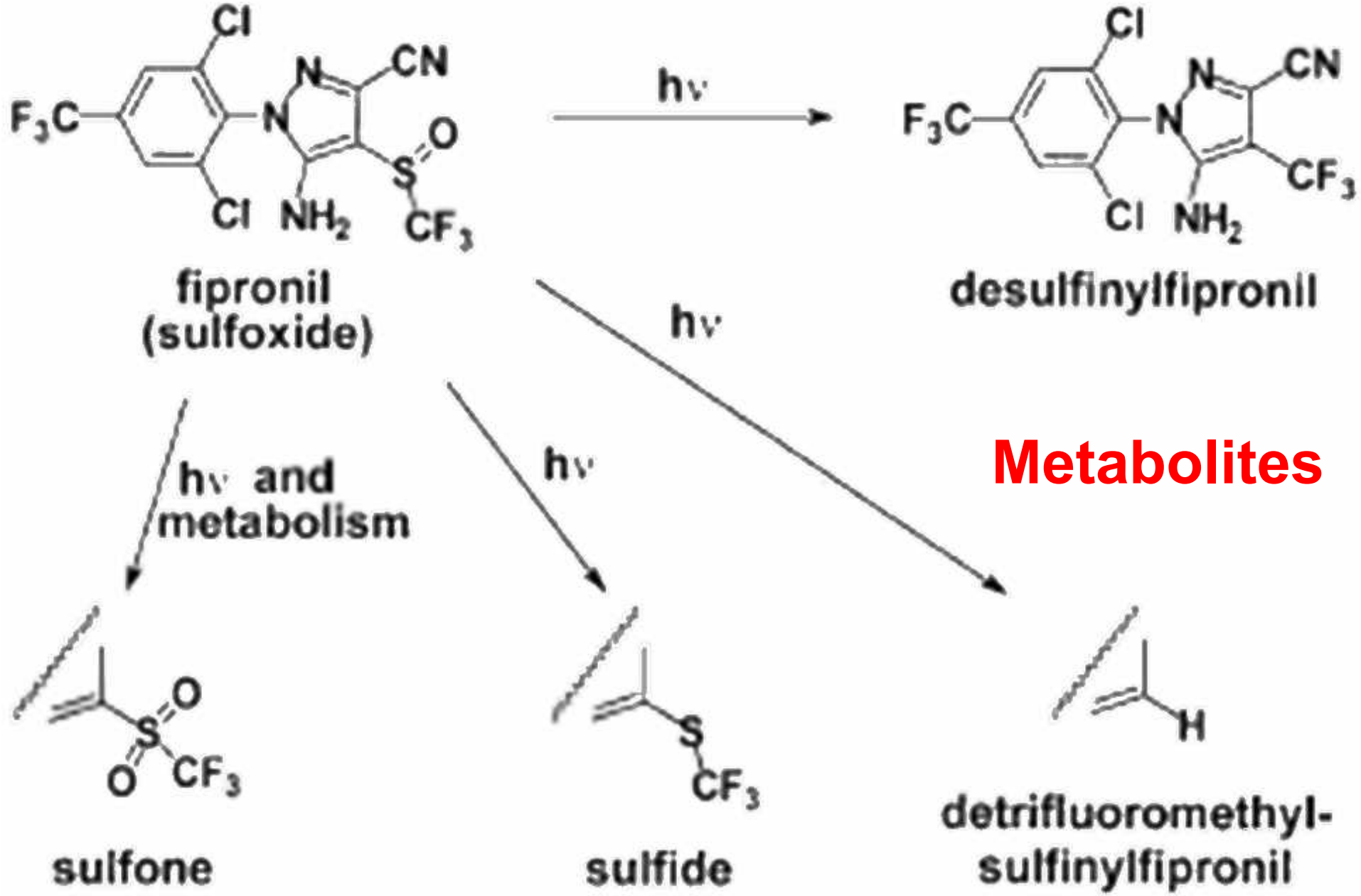
► 1.1 New generation of pesticides + their metabolites



◄ **Imidacloprid**
Commercial name:
Gaucho®, Confidor®,…
Company: Bayer™



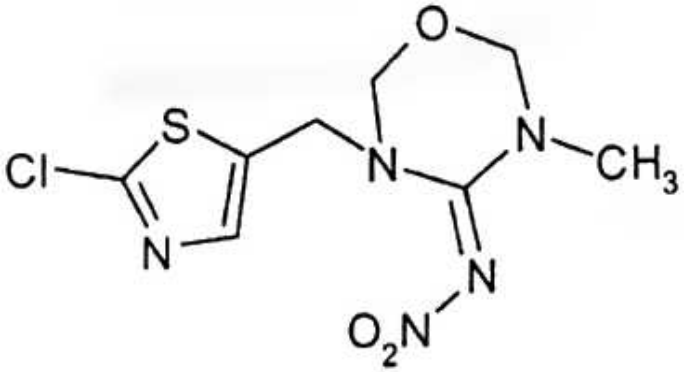
◄ **Fipronil**
Commercial name:
Regent TS®, Schuss®,
Metis®, Trident®,…
Company: BASF™


Cl
F3C
N
CN
O
S
Cl
NH2
CF3
fipronil
(sulfoxide)
hν
desulfinylfipronil
hν and
metabolism
hν
hν
Metabolites
sulfone
sulfide
detrifluoromethyl-
sulfinylfipronil

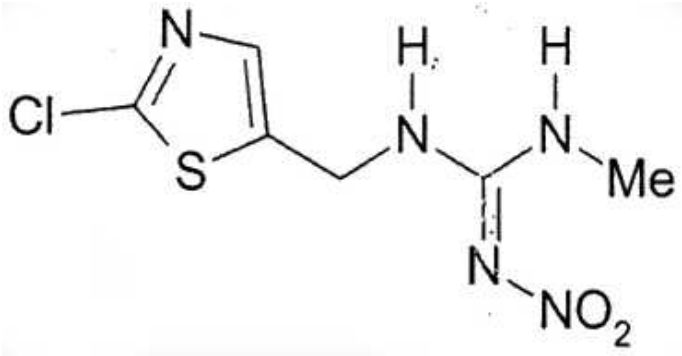
1) Pesticides

► 1.1 New generation of pesticides + their metabolites

Other neonicotinoids



◄ **Thiamethoxam**
Commercial name:
Cruiser®
Company: Syngenta™

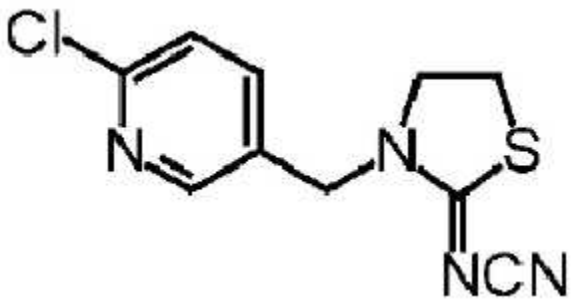


◄ **Clothianidine**
Commercial name:
Poncho®
Company: Bayer™

1) Pesticides

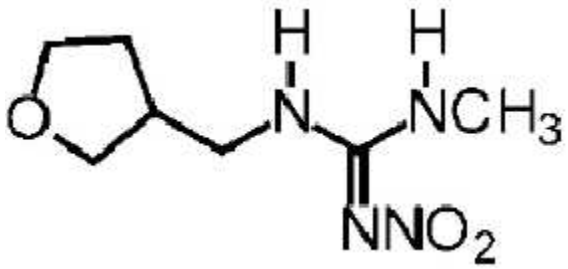
► 1.1 New generation of pesticides + their metabolites

Other neonicotinoids



◄ **Thiacloprid**
Commercial name:
Calypso®

◄ **Acetamiprid**
Commercial name:
Supreme®



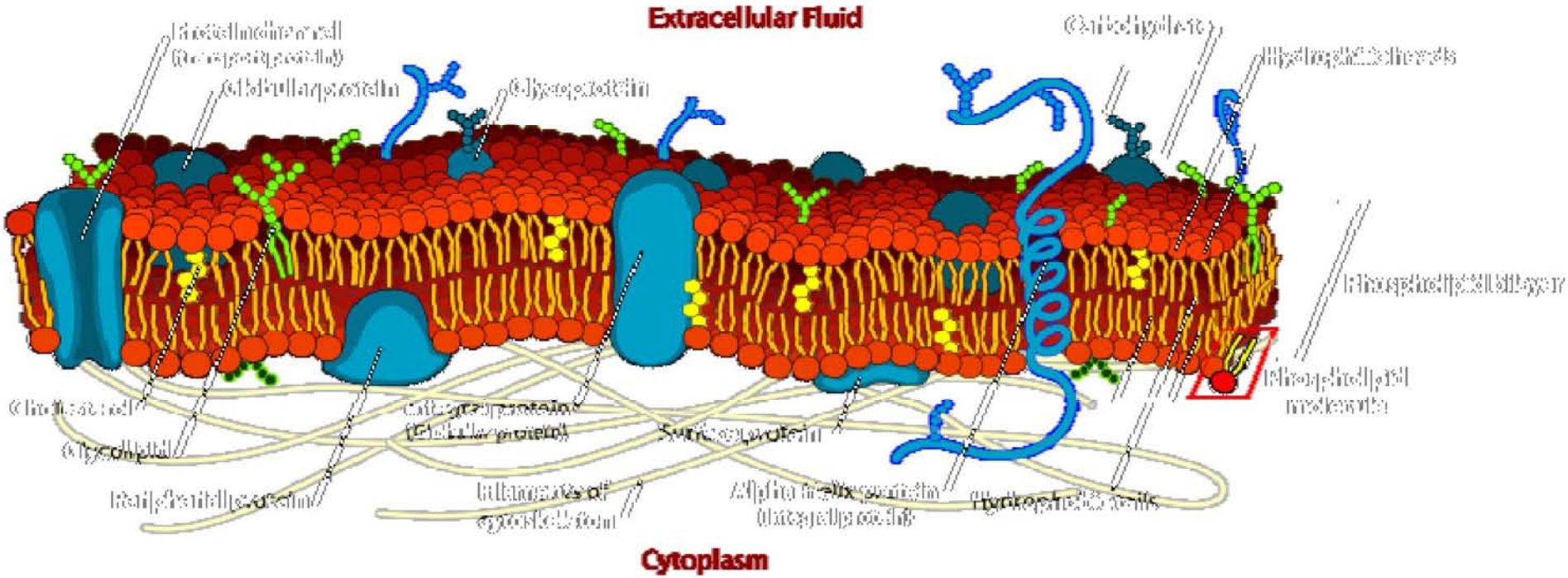
◄ **Dinotefuran**
Commercial name:
Safari®

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

pesticide	®	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	6 750
imidaclopride	Gaucho	insecticide	3,7	7 297

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.

1) Pesticides

- ► 1.1 New generation of pesticides + their metabolites
- ► 1.2 Other conventional pesticides + their metabolites

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) Pesticides

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- 1.3 The possible synergism between them

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- 1.2 Other conventional pesticides + their metabolites
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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

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- ► 1.1 New generation of pesticides + their metabolites
- ► 1.2 Other conventional pesticides + their metabolites
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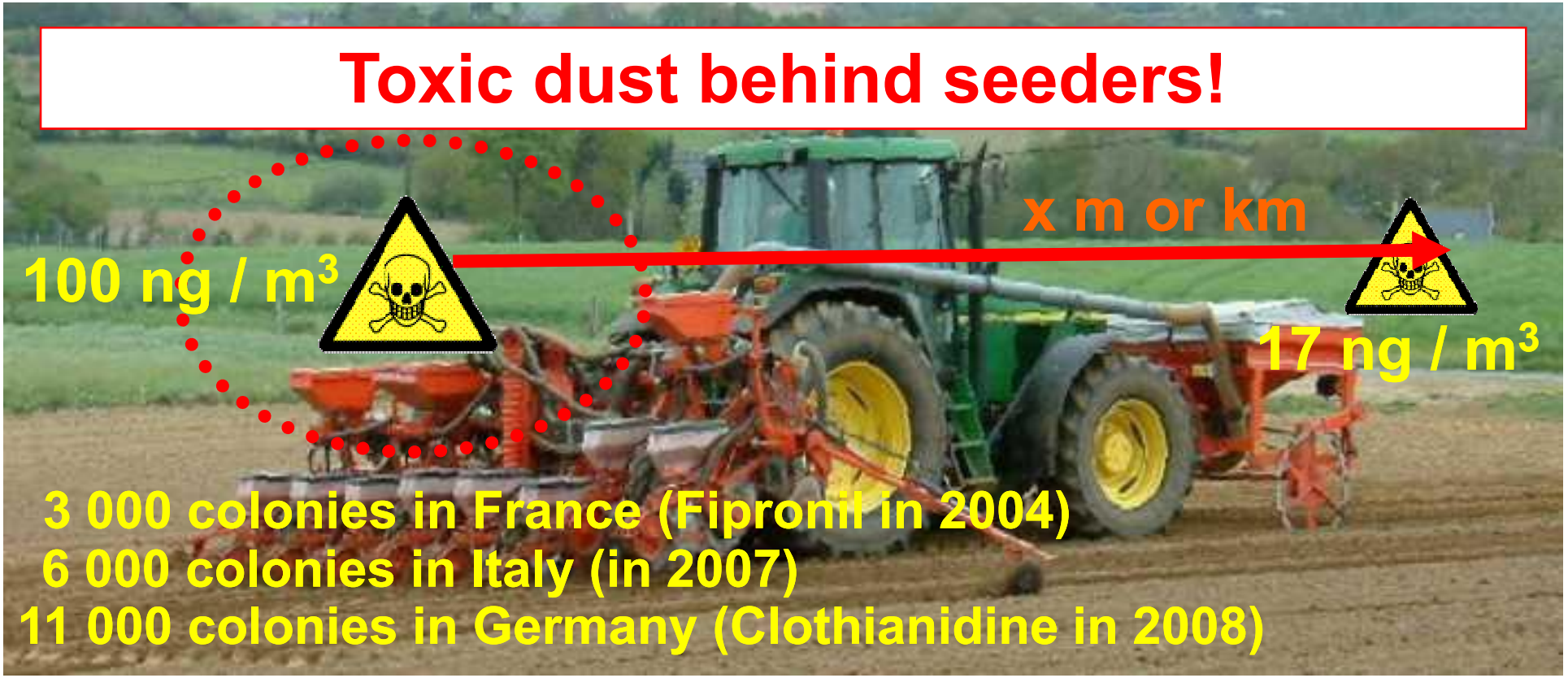


1) Pesticides

- ► 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

1) Pesticides

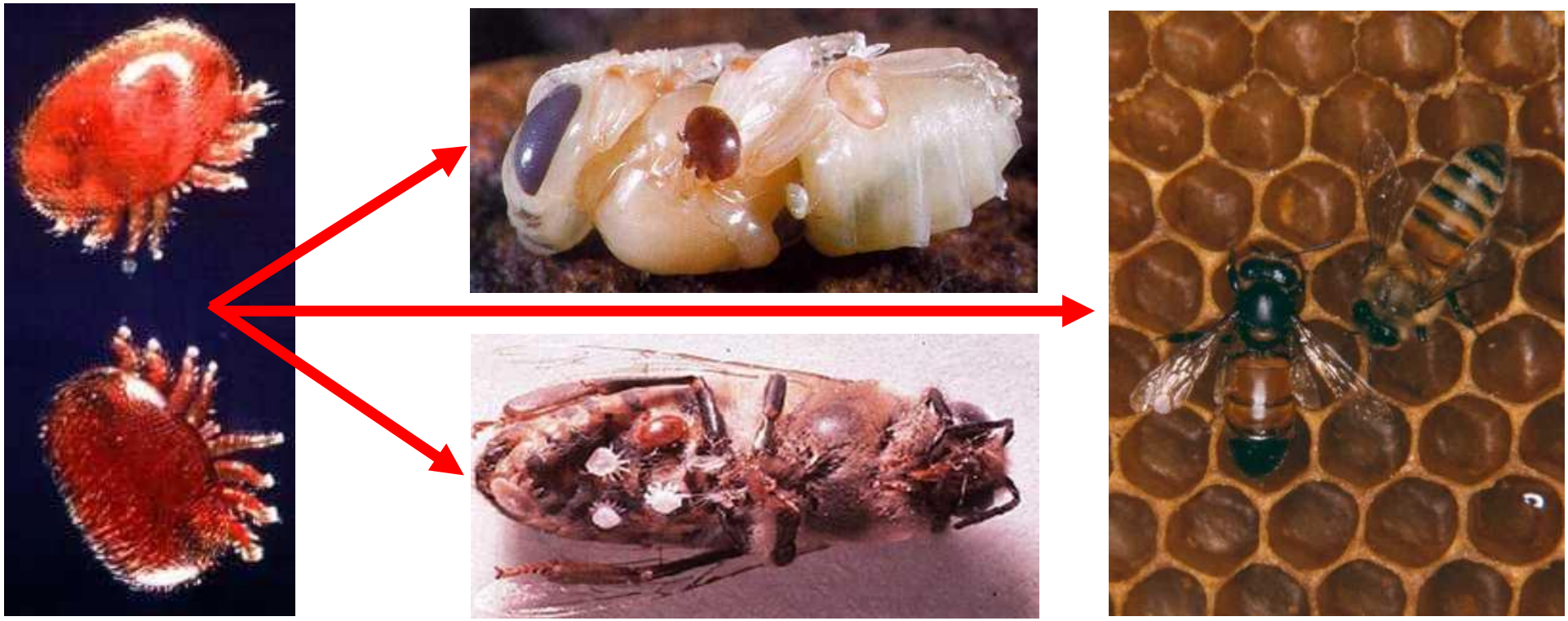
- ► 1.1 New generation of pesticides + their metabolites
- ► 1.2 Other conventional pesticides + their metabolites
- ► 1.3 The possible synergism between them
- ► 1.4 Other sources of intoxication

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

Possible factors

1) **Pesticides**
2) **Varroas**



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

Possible factors

1) **Pesticides**
2) **Varroas**
3) **Bee diet**
   - ► 3.1 **Biodiversity: decrease of pollen sources**

Monocultures + weedkillers

Vicious circle!


But, where are the flowers?

Possible factors

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

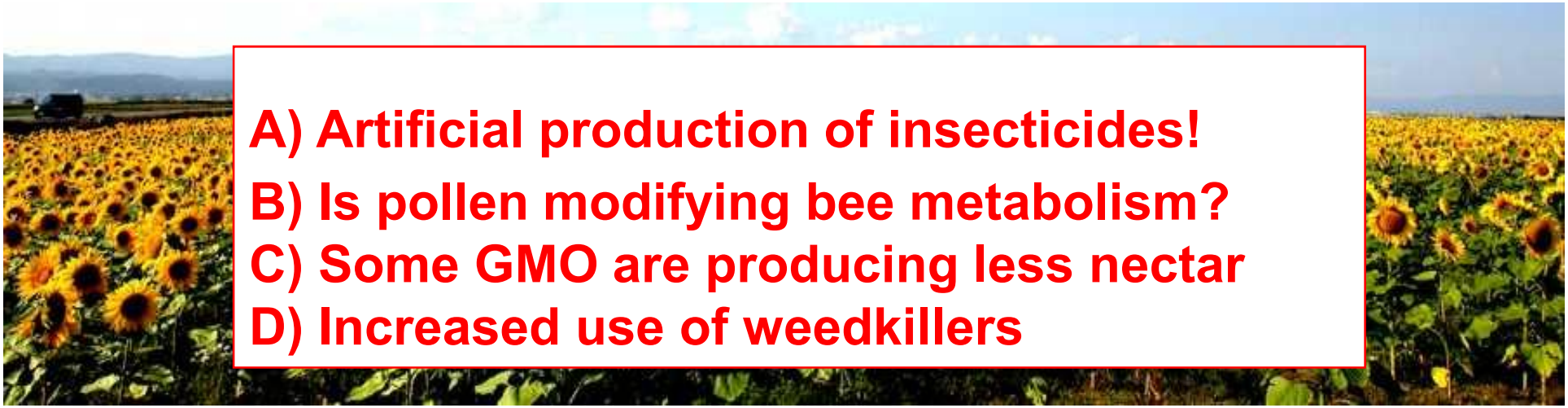
(+ GMO?)

Bee metabolism impact

Possible traces of pesticides

Possible factors

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

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

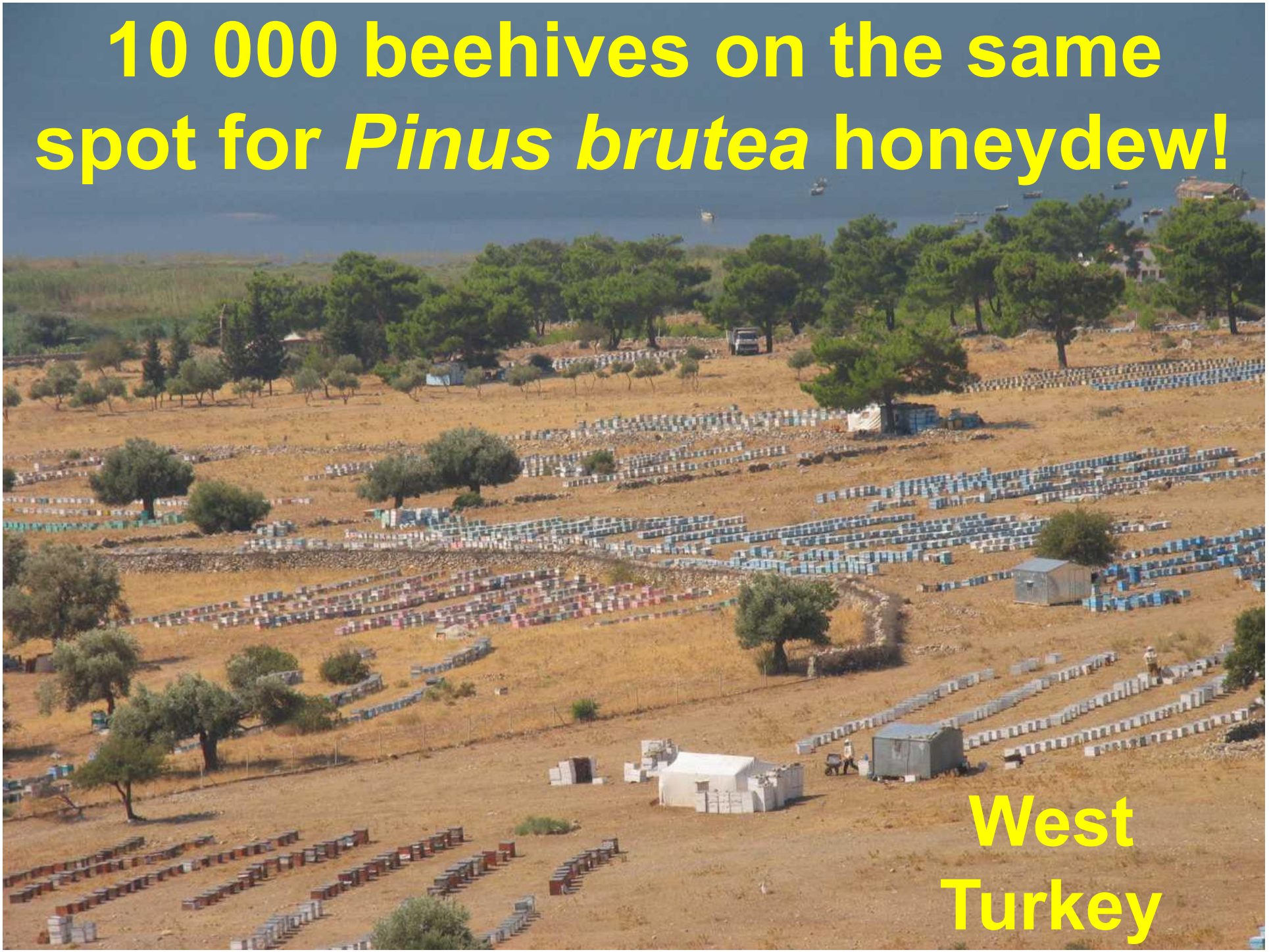
Thousands of km

several times / year

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**
  + unhealthy environment


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

Rounding-up in the USA before migration on almond trees

Rounding-up in Japan before migration via ferry-boat

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) Biotope inadequacy
B) Disease vectors

Possible factors

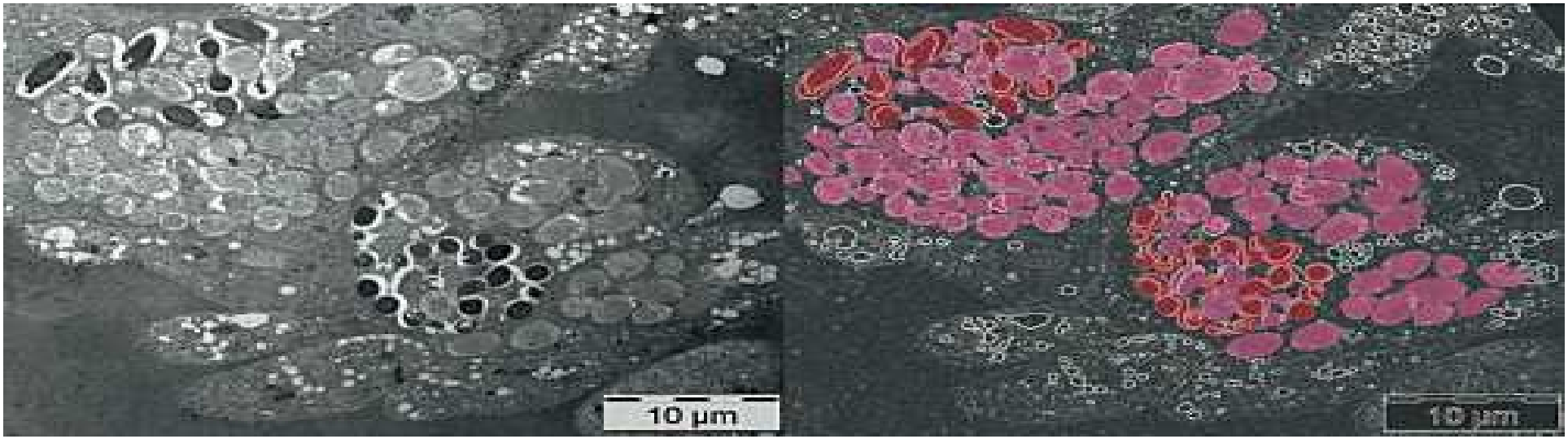
1) **Pesticides**
2) **Varroas**
3) **Bee diet**
4) **Colony management**

- ► 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!

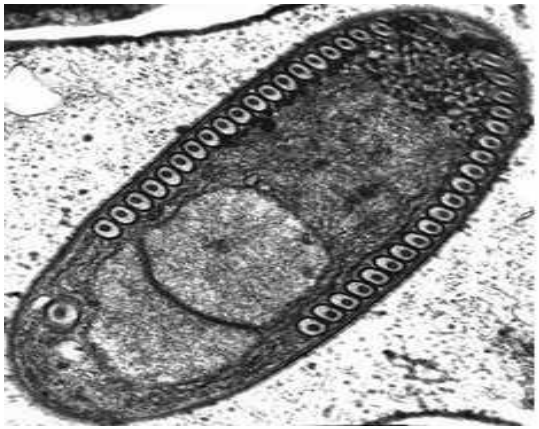
Possible factors

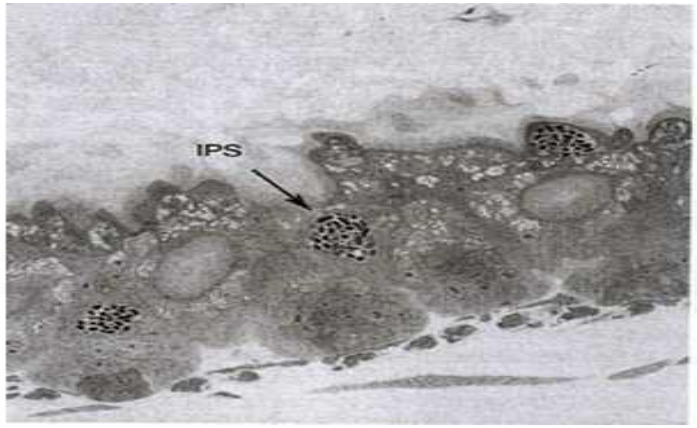
1) Pesticides
2) Varroas
3) Bee diet
4) Colony management
➡ 5) Diseases, virosis and parasitism
6) Other exogenous pollutions
7) Other endogenous pollutions
8) Climate changes
9) Synergism between factors
10) Single factor still unknown

Possible factors



► 5.1 *Nosema ceranae* Opportunistic? / Marker?

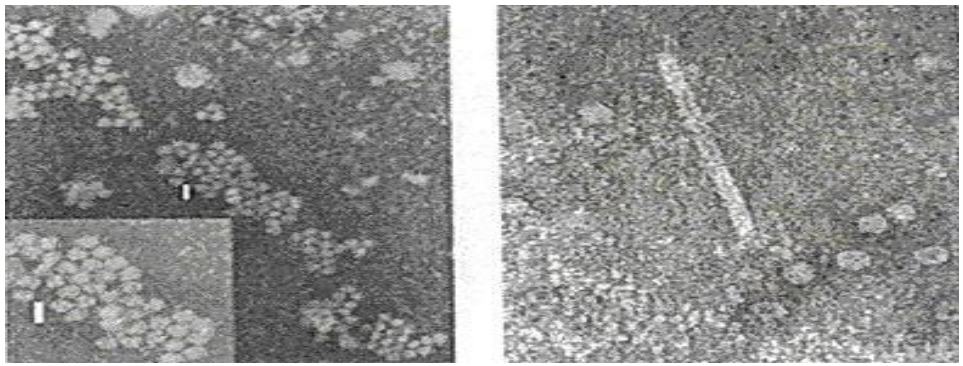




Possible factors

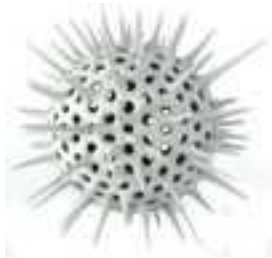
1) Pesticides
2) Varroas
3) Bee diet
4) Colony management
5) Diseases, virosis and parasitism
   - ► 5.1 *Nosema ceranae*
   - ► 5.2 IAPV = Israeli Acute Paralysis Virus

Opportunistic? / Marker?



APV	Acute Paralysis Virus
ArkBV	Arkansas Bee Virus
BQCV	Black Queen Cell Virus
BVX	Bee Virus X
BVY	Bee Virus Y
CBPV	Chronic Bee Paralysis Virus
CWV	Cloudy Wing Virus

A few other known viruses



+ how many more?

DWV	Deform Wing Virus
EBV	Egypt Bee Virus
FBV	Filamentous Virus
JEBV	Japon strain of Egypt Virus
KBV	Kashmir Bee Virus
SBV	Sacbrood Bee Virus
SPV	Slow Paralysis Virus

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
   - ► 5.3 Arrival of new parasites and predators

Possible factors

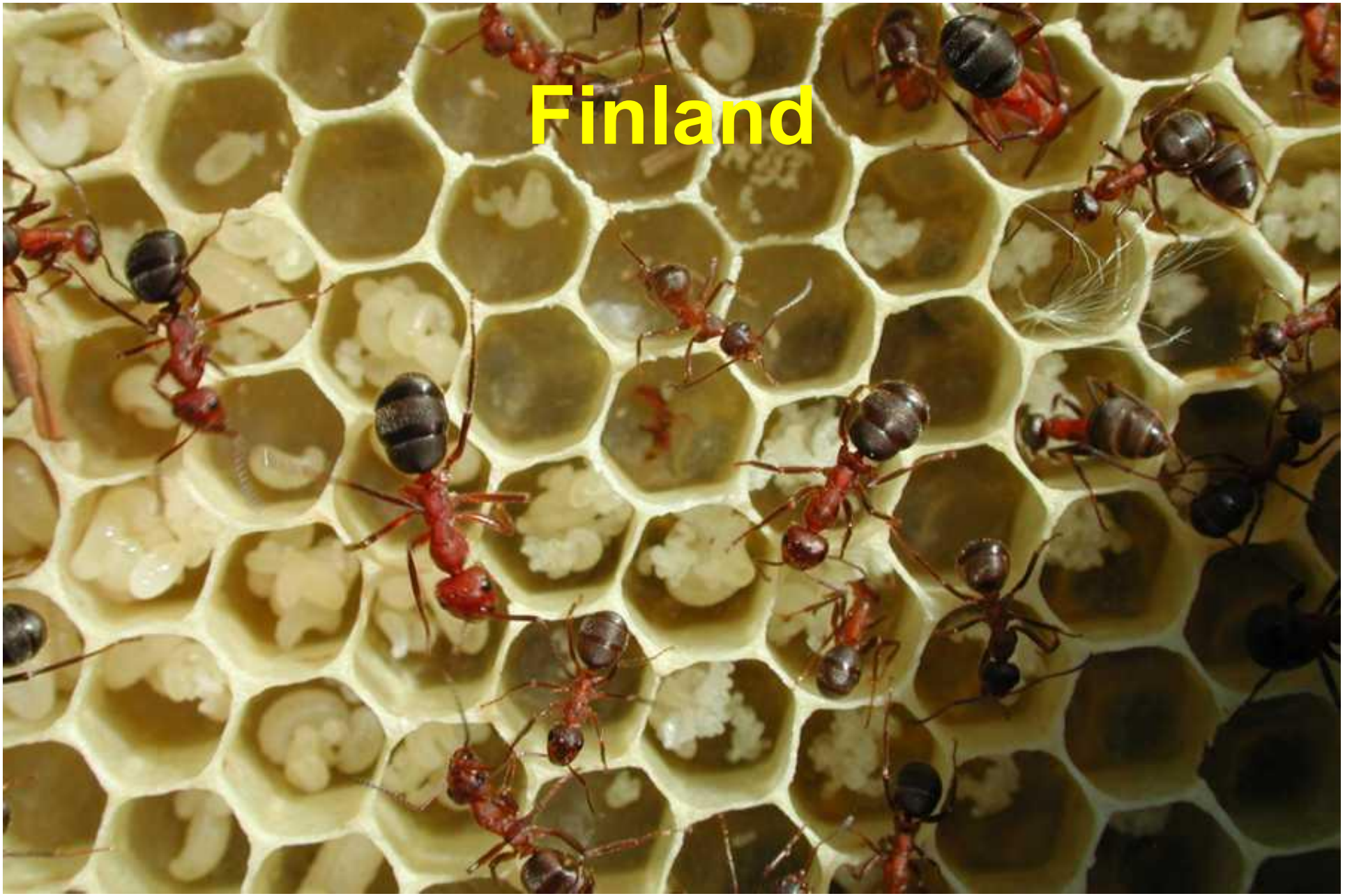
Asian hornet
Vespa velutina

“Crazy ants” Rasberry
Paratrechina longicornis

Small beetle
Aethina tumida

Fly
Senotainia tricuspis


Cambodia


Finland

Possible factors

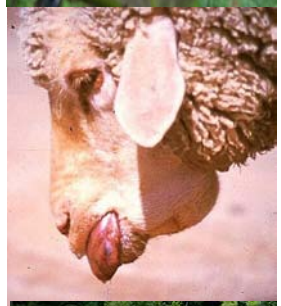
1) Pesticides
2) Varroas
3) Bee diet
4) Colony management
5) Diseases, virosis and parasitism
➡ 6) Other exogenous pollutions
7) Other endogenous pollutions
8) Climate changes
9) Synergism between factors
10) Single factor still unknown

Possible factors

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

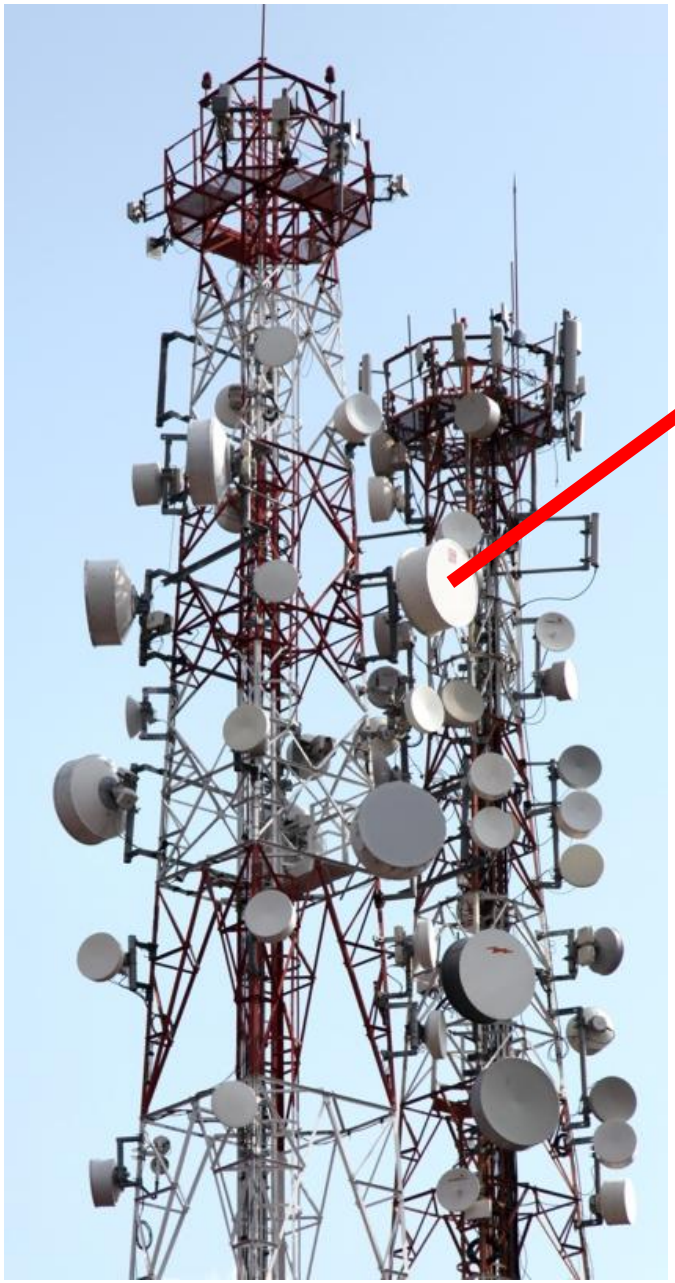
Possible factors

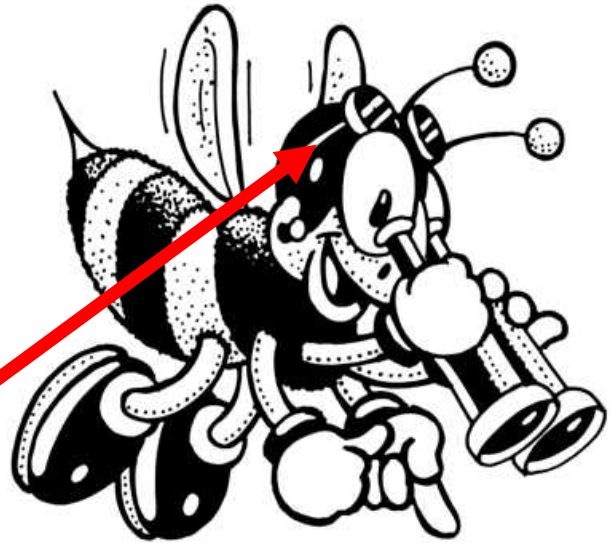
1) Pesticides
2) Varroas
3) Bee diet
4) Colony management
5) Diseases, virosis and parasitism
6) Other exogenous pollutions
   - ► 6.1 Industrial
   - ► 6.2 Agricultural (other than on crops)


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





Controversial subject
involving several sources:
GMS + Edge + UMTS + HDPSA+ Wifi +
WiMax + HD TV + meteorological radars
+ satellites, etc.

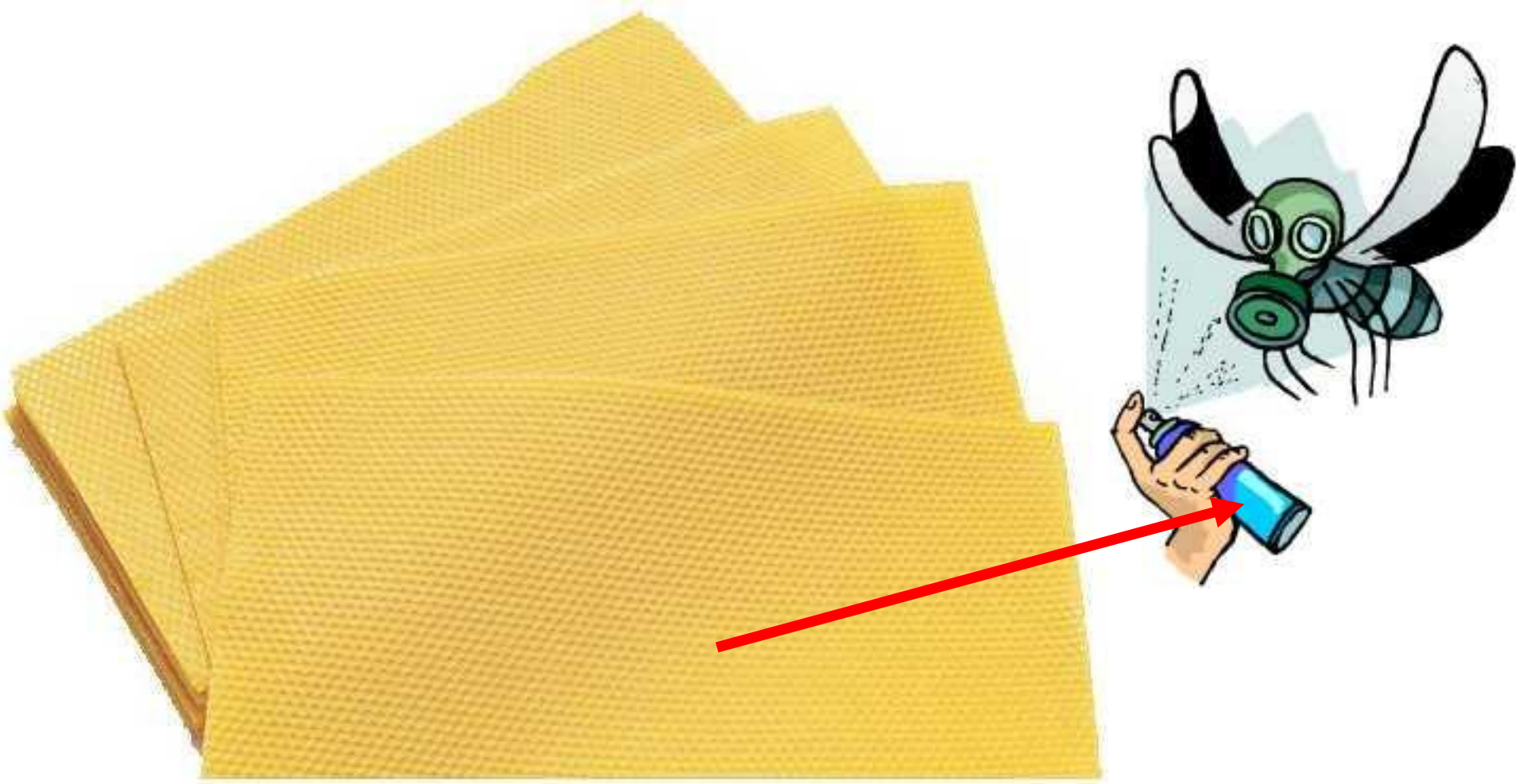
Possible factors

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

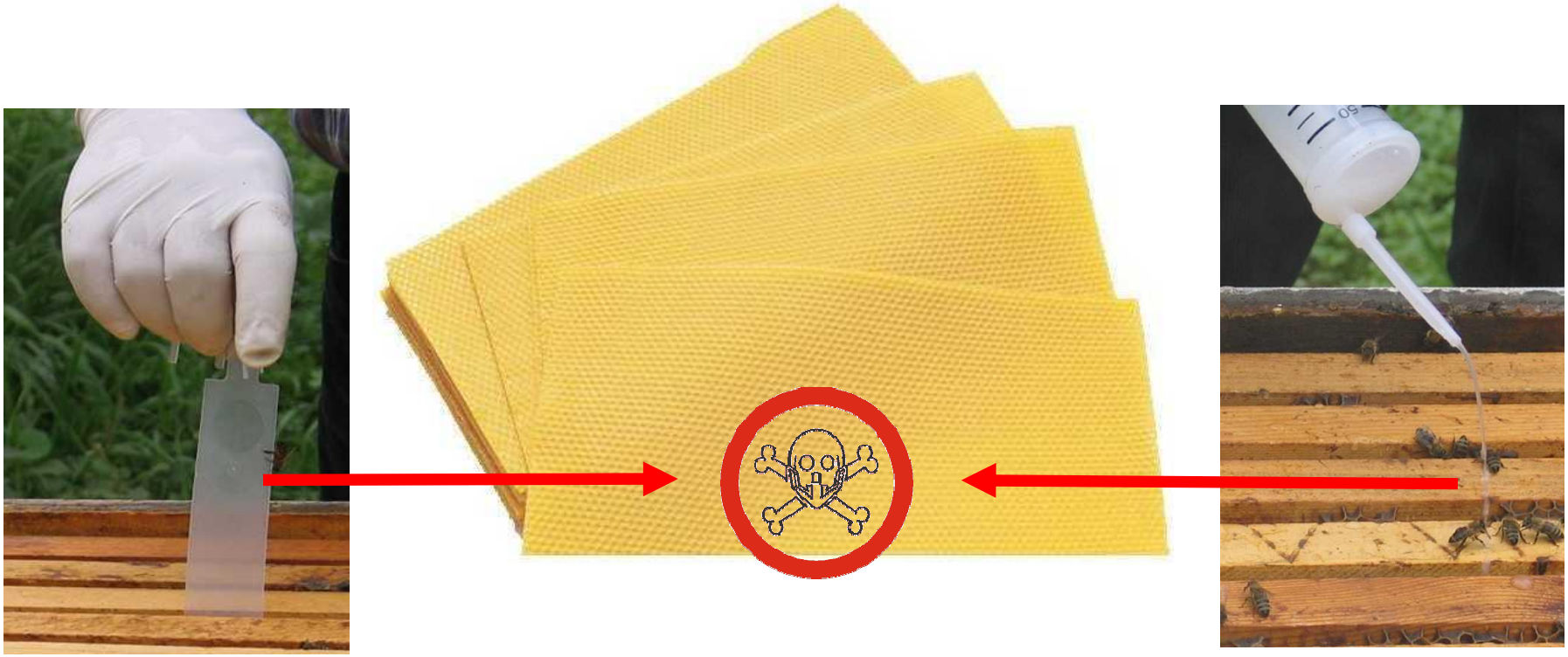
Possible factors

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


Liebig-Dispenser



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




Original Scent
Moth Balls

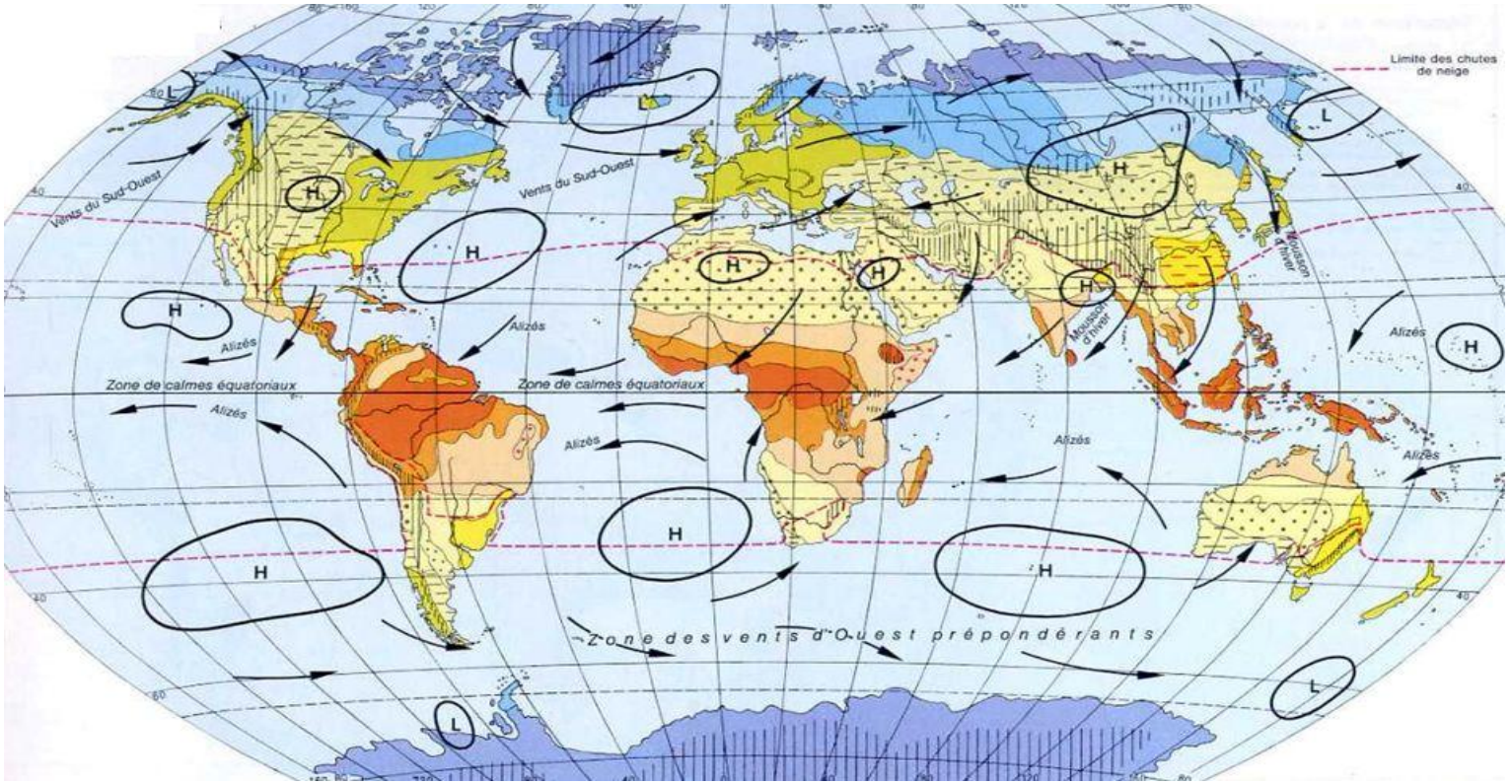
Possible factors

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

Possible factors

► 7.3 Products to protect wood

Possible factors



➡ 8) **Climate changes**

9) Synergism between factors

10) Single factor still unknown

► 8.1 More frequent droughts and fires

► 8.1 More frequent droughts and fires

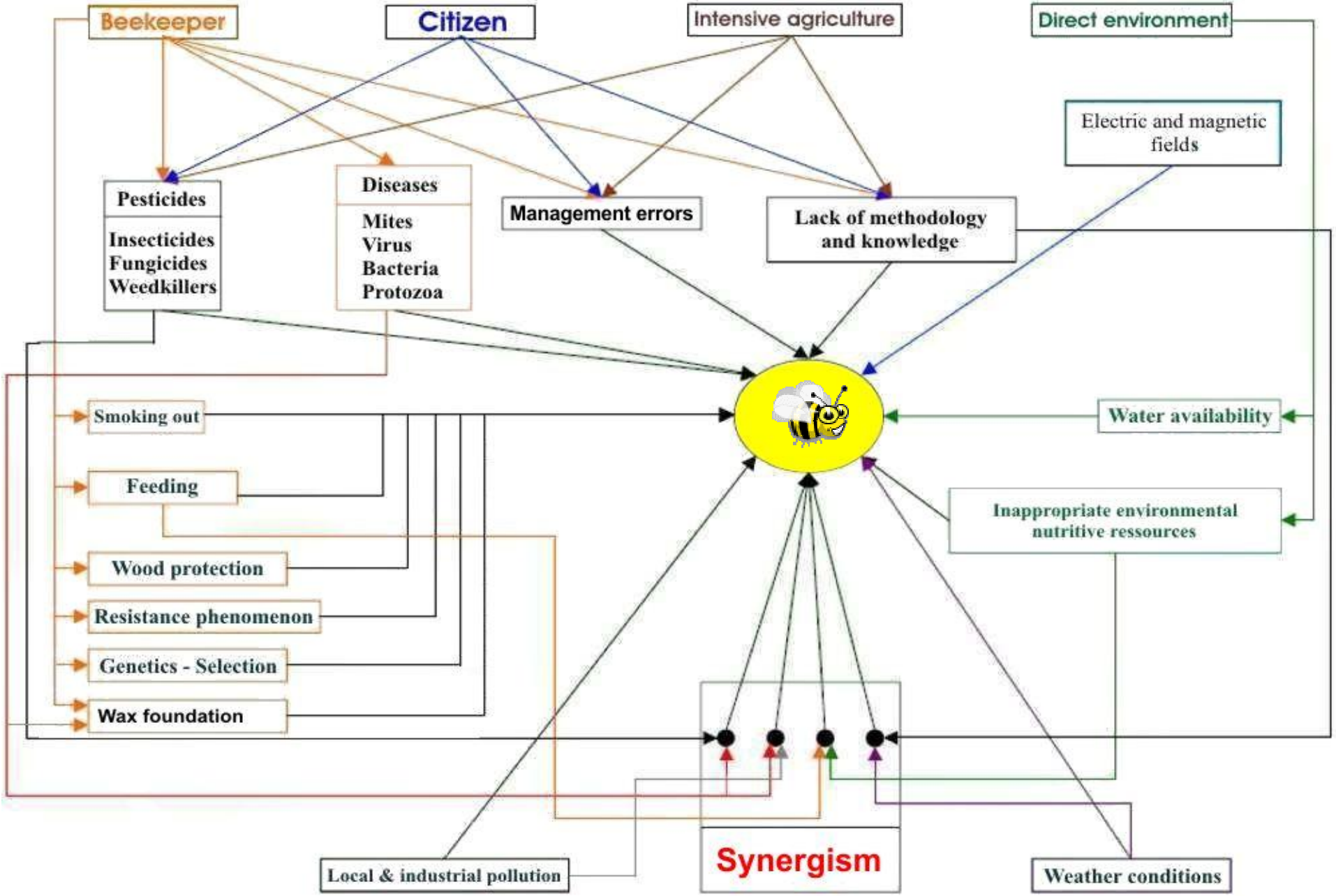
► 8.2 More frequent floods

► 8.2 More frequent floods

► 8.3 Decrease in aphid population

Possible factors

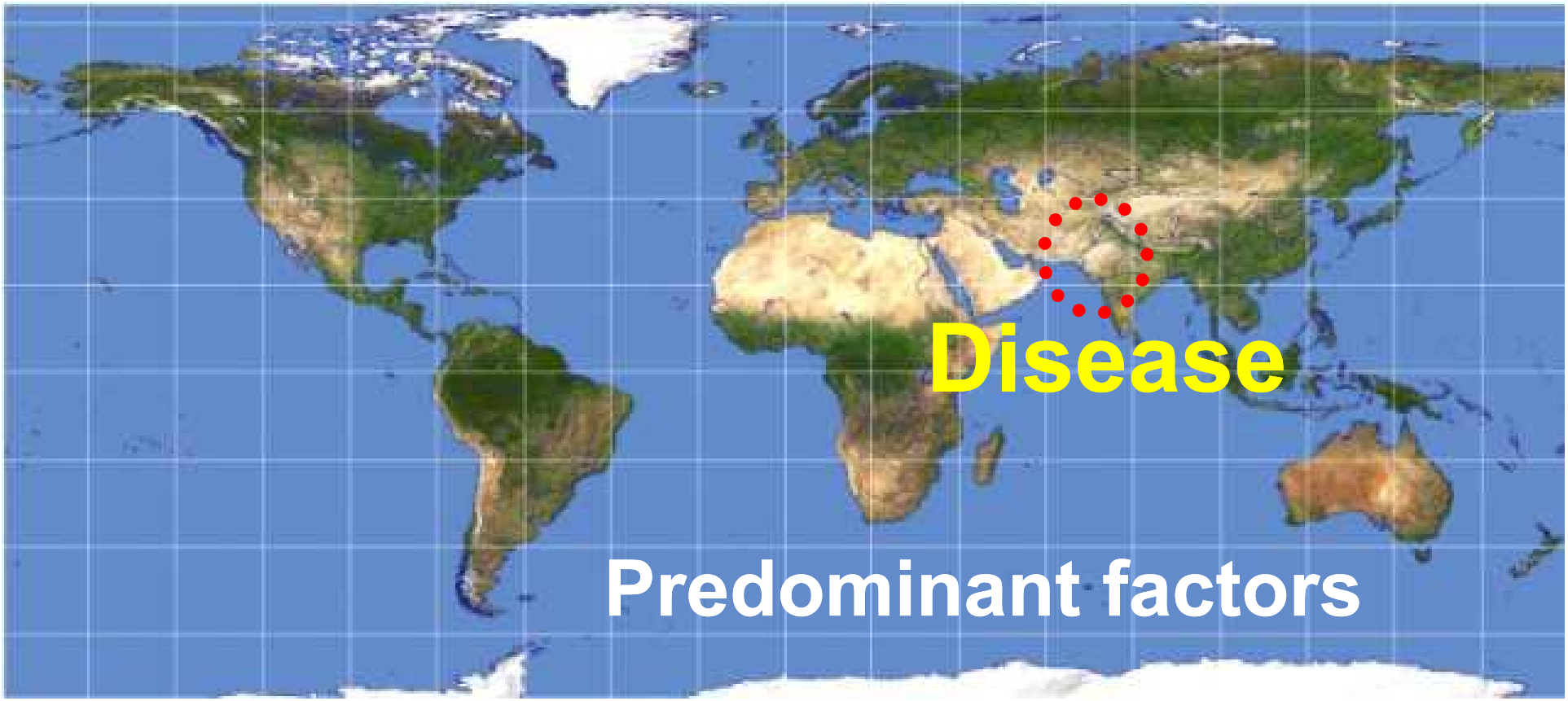
1) Pesticides
2) Varroas
3) Bee diet
4) Colony management
5) Diseases, virosis and parasitism
6) Other exogenous pollutions
7) Other endogenous pollutions
8) Climate changes
➡ 9) Synergism between factors
10) Single factor still unknown


Beekeeper
Citizen
Intensive agriculture
Direct environment
Electric and magnetic fields
Pesticides
Insecticides
Fungicides
Weedkillers
Diseases
Mites
Virus
Bacteria
Protozoa
Management errors
Lack of methodology and knowledge
Smoking out
Feeding
Wood protection
Resistance phenomenon
Genetics - Selection
Wax foundation
Water availability
Inappropriate environmental nutritive ressources
Local & industrial pollution
Synergism
Weather conditions

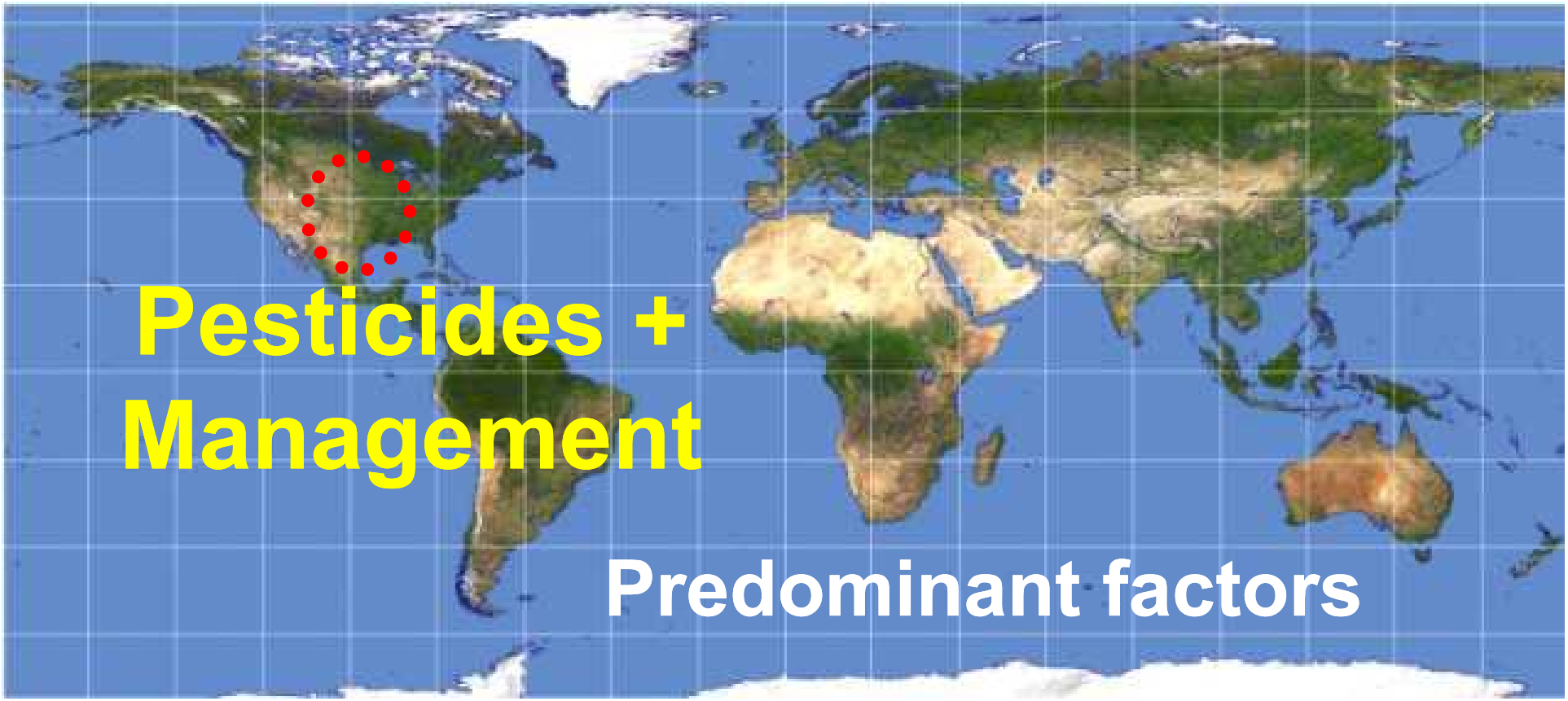
Different readings depending on the local context

Different readings depending on the local context

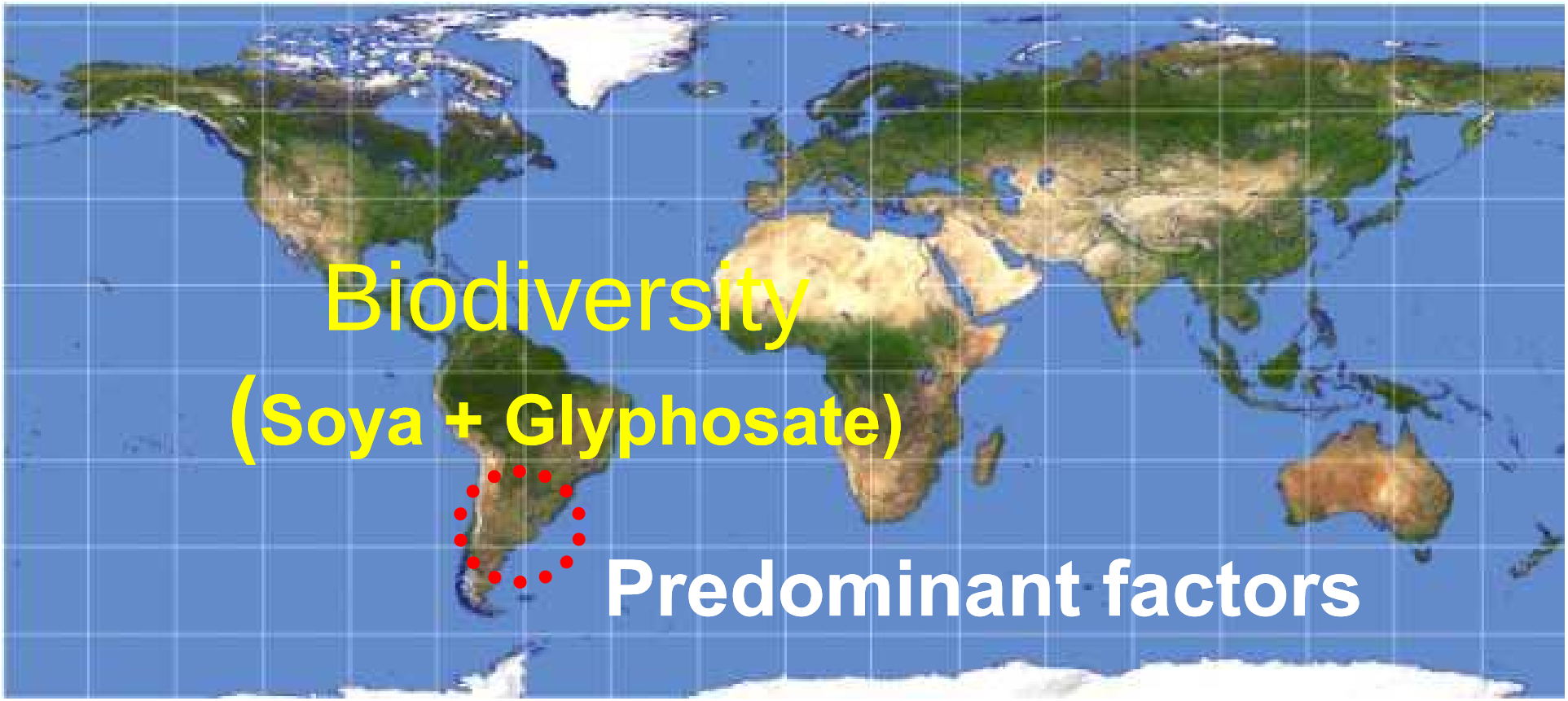
Different readings depending on the local context



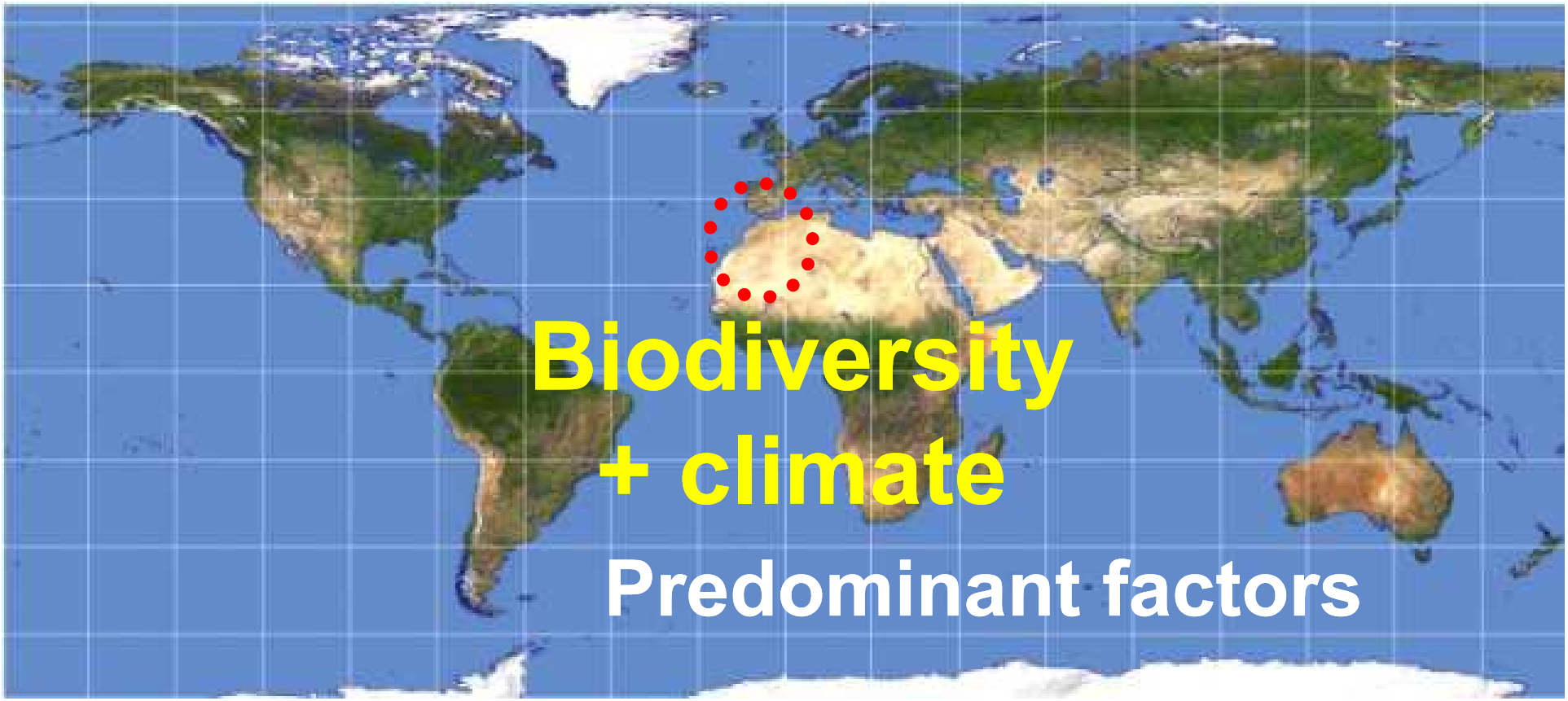
Different readings depending on the local context



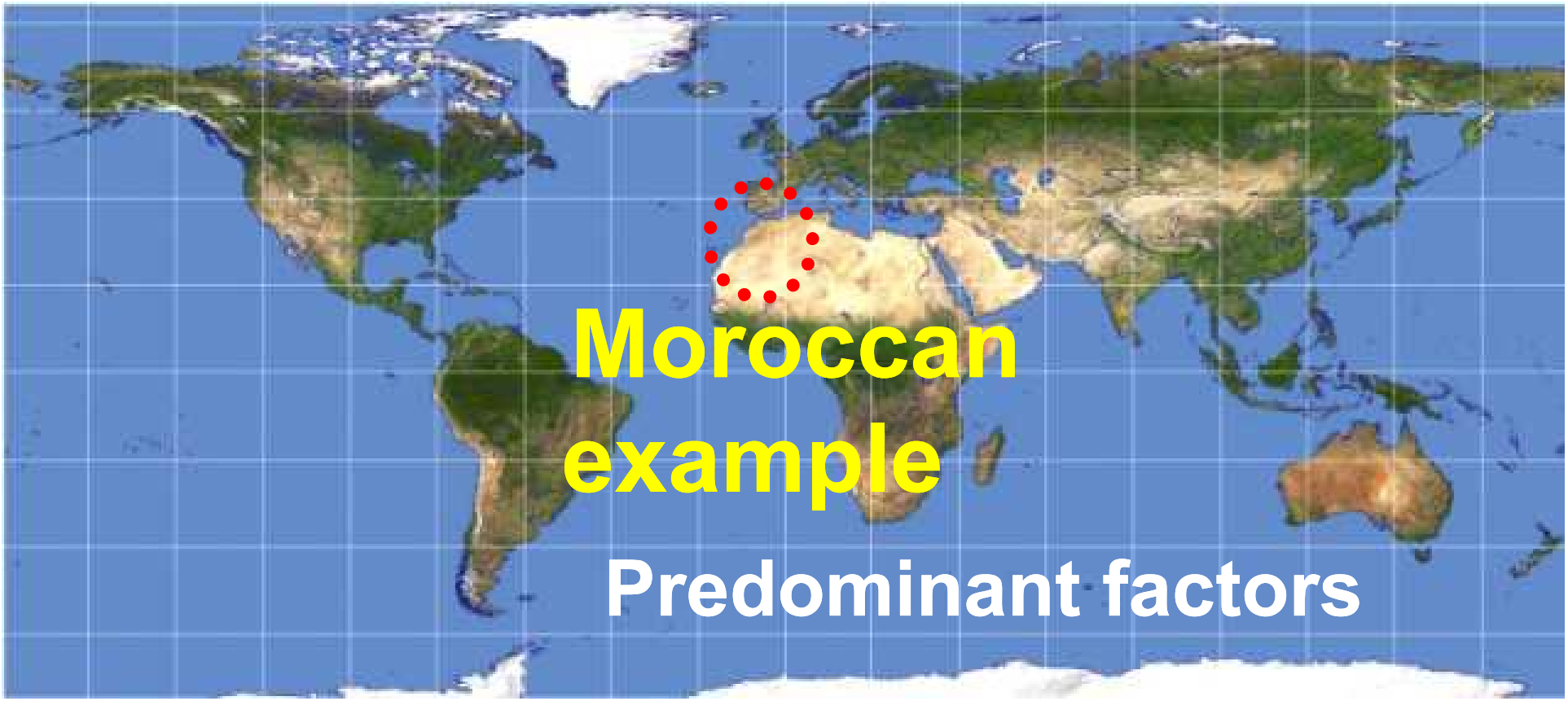
Different readings depending on the local context



Different readings depending on the local context



Different readings depending on the local context



Plants pulled up by the shepherds

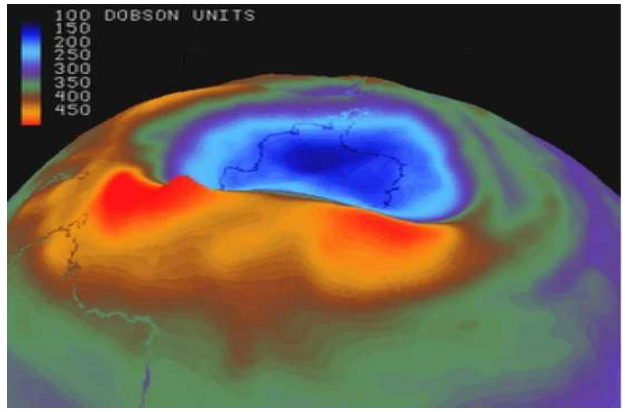
~~Thyme (*Thymus sp.*)~~
~~and Oregano (*Origanum vulgare*)~~

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**

11) Eccentric factors

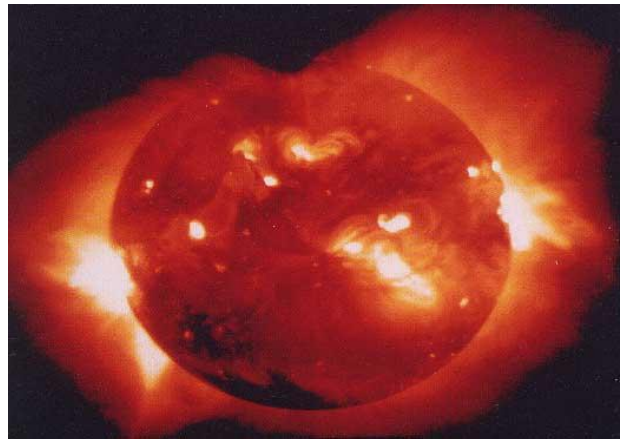
A) Ozone depletion



B) Plane trails

C) Solar eruptions

D) Even apocalypse described by few religious fanatics!



Keywords (Google)	French pages	English 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

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.

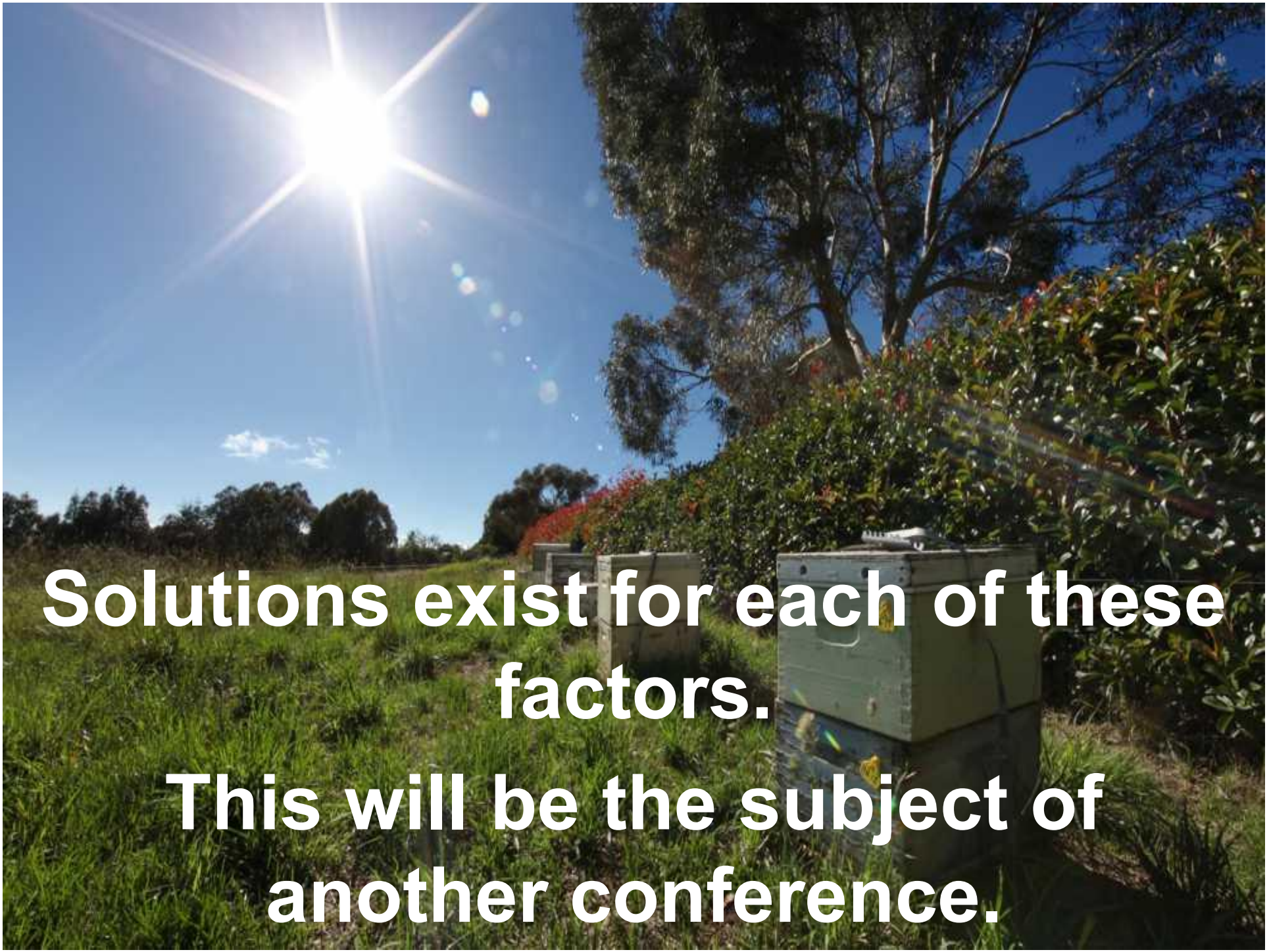
► These factors are much more prevalent in environments where agricultural AND beekeeping practices are intensive.

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

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.

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

Thank you

gilles@apiservices.com