anses
French agency for food, environmental and occupational health safety

Pesticides and Honeybees

Marie-Pierre CHAUZAT

Anses – Sophia Antipolis

OIE – Regional workshop on honeybee diseases
Ezulwini, Swaziland – June 14-17, 2011

Honey bees

Scientific & poetic interest

Hive products

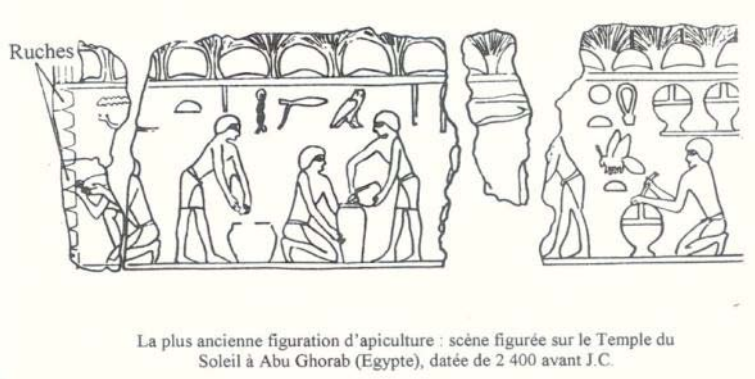
Pollination →

- **Human food**
- **Animal food**
- **Biodiversity**

Other pollinators

anses

Apis mellifera is easy to bread and ubiquitous



La plus ancienne figuration d'apiculture : scène figurée sur le Temple du Soleil à Abu Ghorab (Egypte), datée de 2 400 avant J.C.

Ruche grecque ancienne à cadres mobiles

Several reasons for bee losses

CLIMATE

Seasons

Genetics

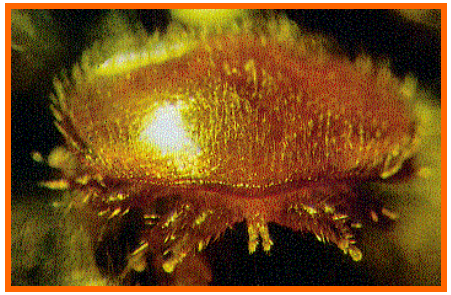
Physiology

Behaviour

Apiary management

Pesticides

Environment



Diseases

Pesticide exposure

Acute intoxications

Systemic pesticides

Exposure → **Acute**

Chronicle

Acute intoxications

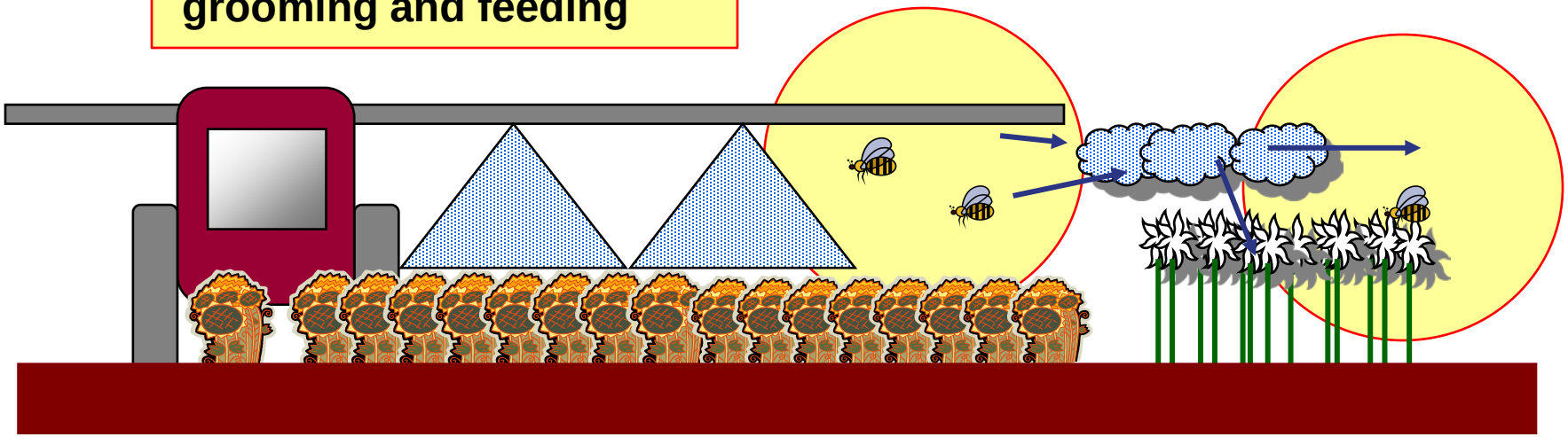
Honey bees get killed because they

are on the field (direct exposure)

are on the hedges : drift effect (indirect exposure)

Contact exposure

Oral exposure
grooming and feeding



Thompson et al. 2007; Chauzat et al. 2011

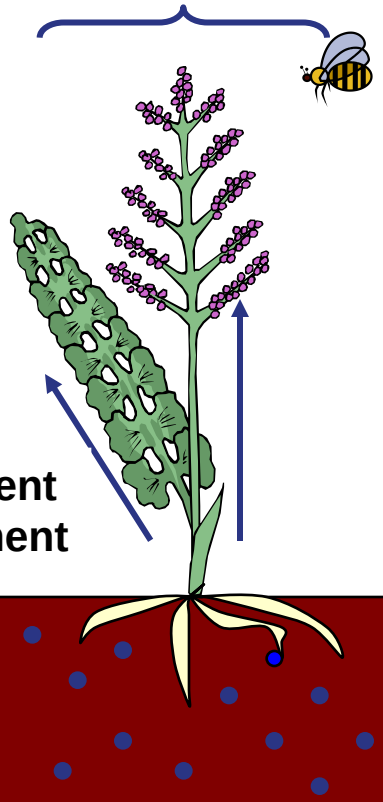
Systemic pesticides

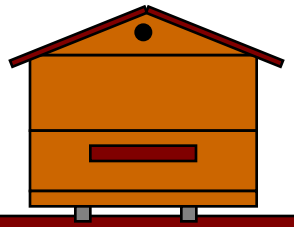
Residues in pollen and/or nectar

Different classes are exposed
acutely
chronically

Nectar and/or pollen brought back to the hive

soil treatment
seed treatment

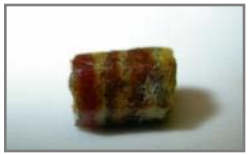


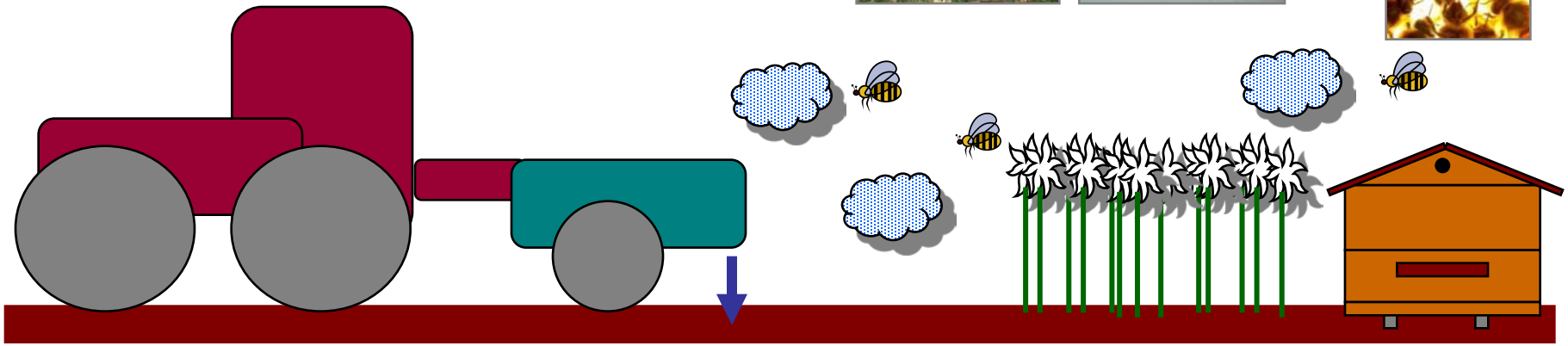


Systemic pesticides

Honey bees are exposed to pesticide through dusts

- **covering hedges**
- **reaching directly apiaries**





Rosenkranz et al. 2008; Thompson 2010

The sunflower culture

- Sowings in March with pneumatic seed drills

- The seeds are coated with insecticides : protection against soil insects and against sap sucking insects
  - The taupin coleoptera
  - The greenflies
  - European corn borer
  - Sesamia

The sowing dusts

Historical elements from field observations

(France)

- 2002: heavy mortalities of honeybee colonies and adult honeybee during the spring.

  Mixtures of insecticides and additives were tested : no acute toxicity for the honeybees

- 2003: mortalities are observed in the field at the same time of the year (spring).

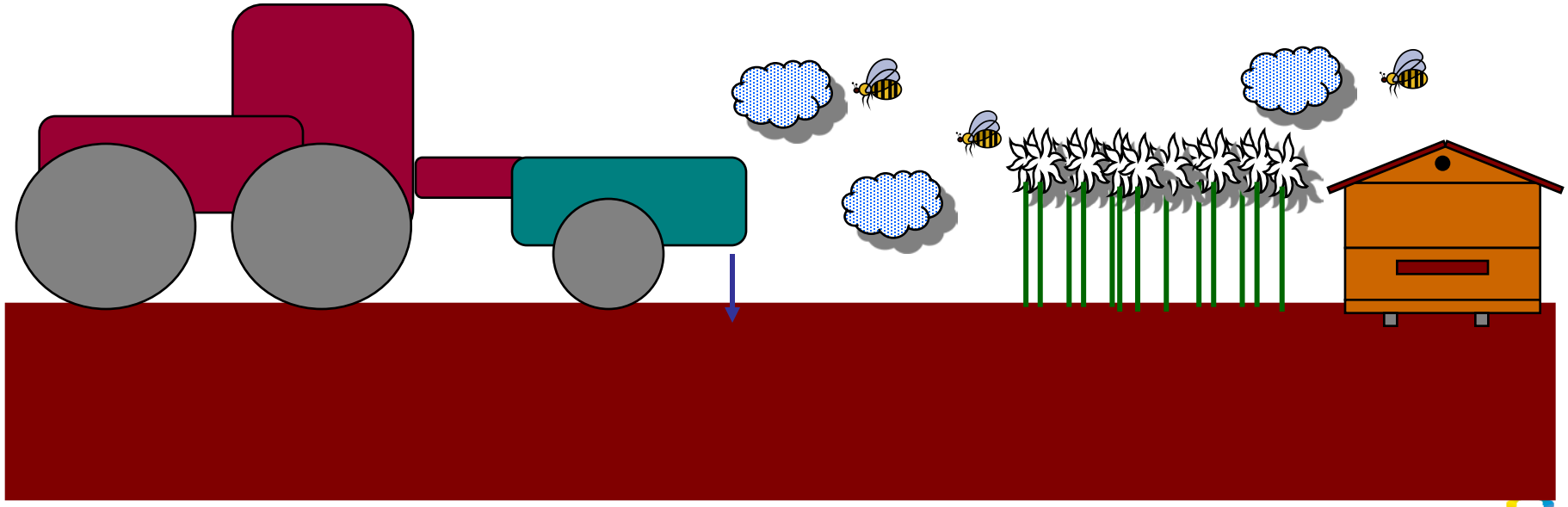
  Residues of fipronil and metabolites are detected in the dead honeybees and in the plants

  Hypothesis: dusts from sowings

- Hypothesis
  - Production of dusts during the sowing
  - Honeybee exposure

    during foraging for nectar & pollen collection on the plants located closed to apiaries

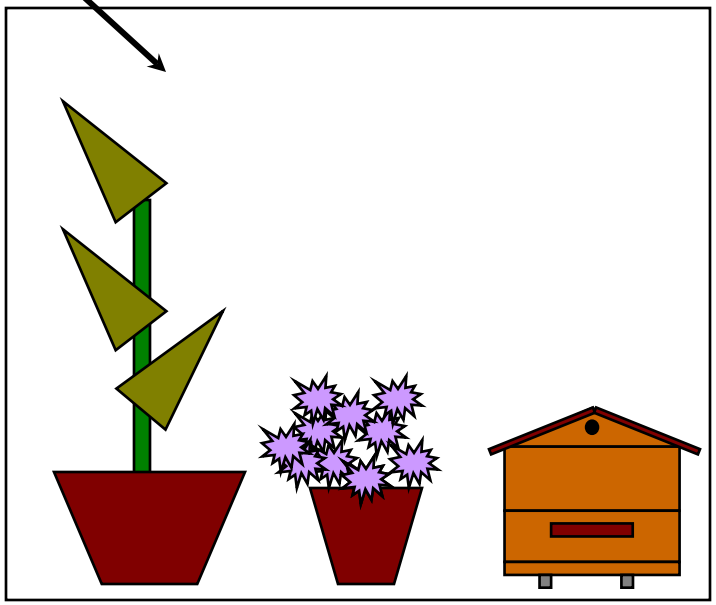
    or directly on the hives



The dusts from sunflower sowings

- Experiment with a high media risk
- Coordinated by the Ministry of Agriculture
- Joint action of BASF, ORAMIP and AFSSA
  (future-Anses)
- In July 2003 very secretly

- In order to get conditions as close to the field reality as possible, there has been a precise description of the parcel, the type of sowing, the honeybees, the trap plants, the flight cages and exposure modalities

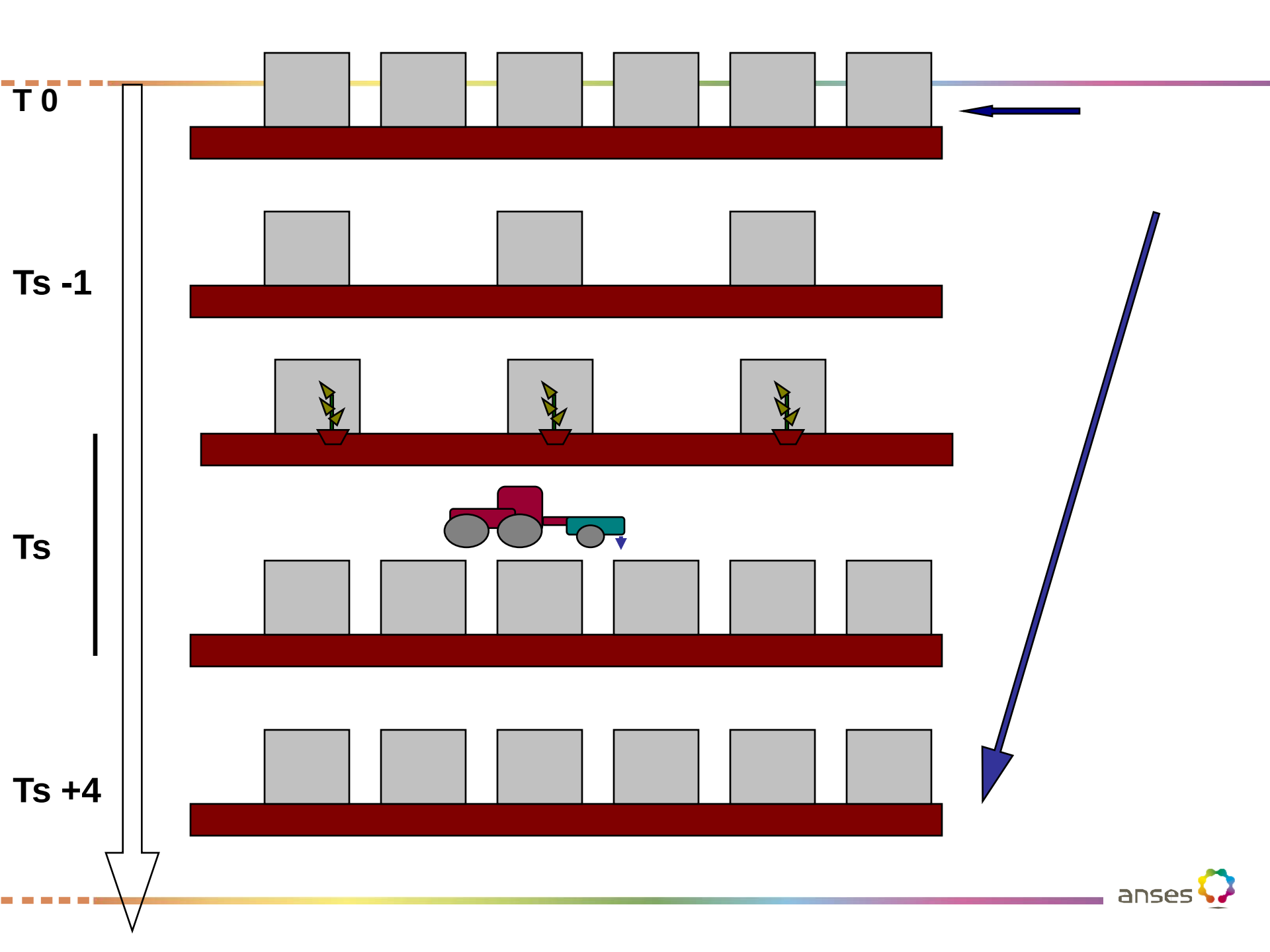


One hive

Trap plante: the Tibouchina

Lavander

Water available


T 0
Ts -1
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Apidology

- Mortality
- Adult population
- Brood population
- Eggs
- Health indicators

Pathologies

- *Acarapis woodi*
- *Nosema apis*
- Chronic Bee Paralysis Virus
- Acute Bee Paralysis Virus

Residues

- In the air
- On the tibouchina leaves
- In the « honey »
- In the honeybees
- In the brood

	Before	After
Adult mortality	-	+
Adult population	2.8	2.4
Brood population	2	2
Eggs	+	+
Health indicators	+	-
Acarapis woodi	-	-
Nosema apis	-/+	-/+
CBPV	-	-
ABPV	-	-

Results and consequences

- Results of bee pathology do not explain the troubles observed
- Residue results showed a clear contamination of apiculture matrices by the fipronil and its metabolites

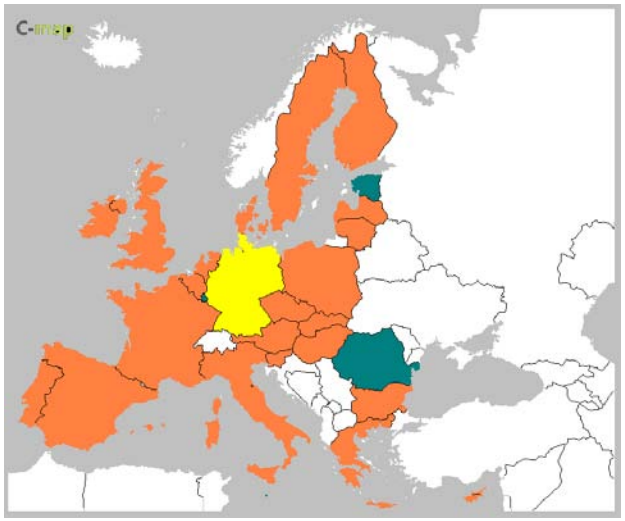
- The Ministry took some measures called the « dust plan » for the reduction of dust emission during sowings

Decree of the 13 April 2010:

- 3 g/quintal (100 kg)
- sowings only during optimum meteorological conditions
- use of baffle

No acute honeybee mortalities during sowings after 2003.

Honeybee mortalities in the Rhein valley in 2008 Germany



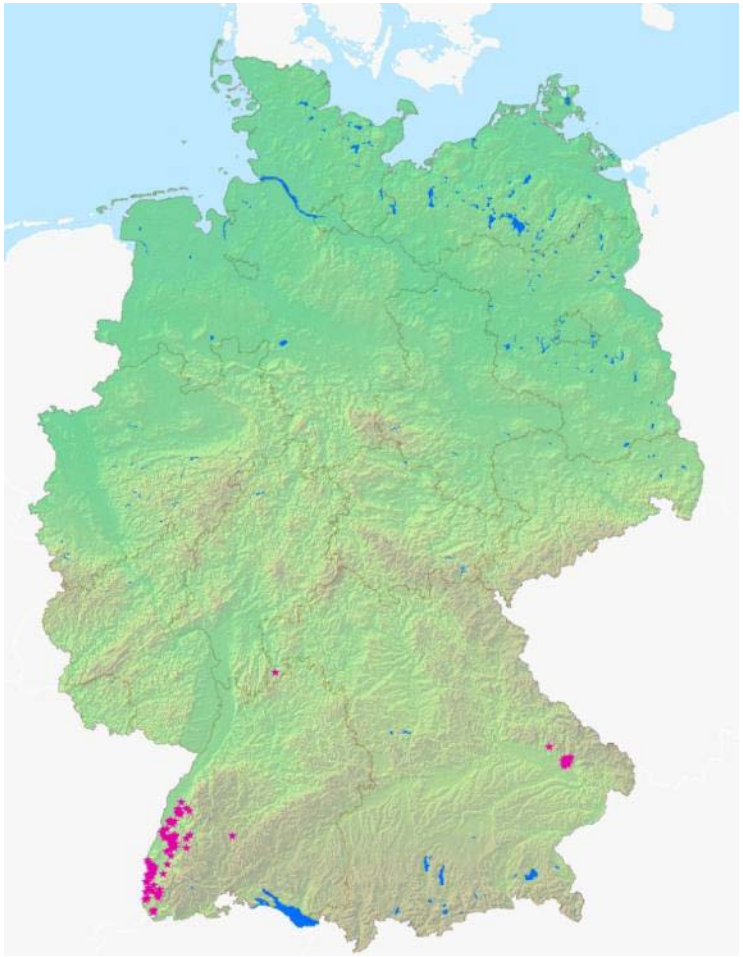
- First mortalities in April 2008
- The number of dead colonies increases, suggesting a vast problem, linked with corn sowings
- The first analysis have shown residues of clothianidine in dead honeybee (PonchoPro®)

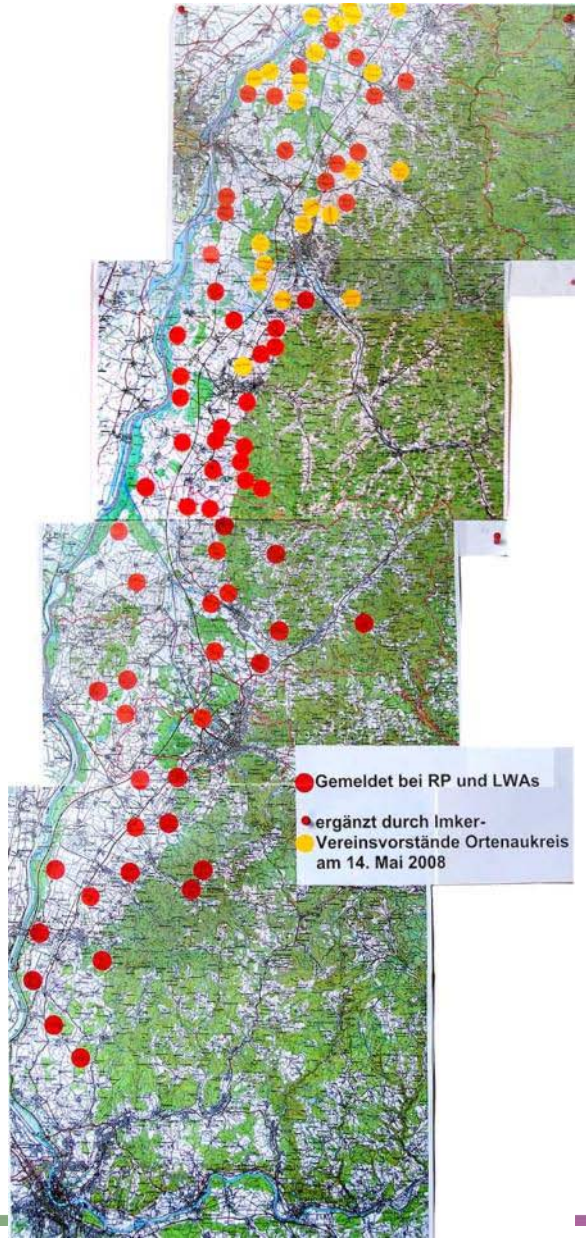
Mean concentration in dead adults: 8,8 µg/kg

(5,1 – 14,7 µg/kg)

Diabrodica virgifera was found in 2007 in this zone

The species originates from the USA




Gemeldet bei RP und LWAs
ergänzt durch Imker-
Vereinsvorstände Ortenaukreis
am 14. Mai 2008

Chronology of actions

- After the alert, colonies were transferred with their reserves into new hives

- The mortalities continued after the end of canola and orchards blooming

- The Ministry of Agriculture set up the collect and destruction of beebread frames

  Beebread : 26,8 µg/kg (14,4 - 77 µg/kg)

- 7 000 frames of bee bread have been burnt
- 12 000 affected colonies
- 700 beekeepers

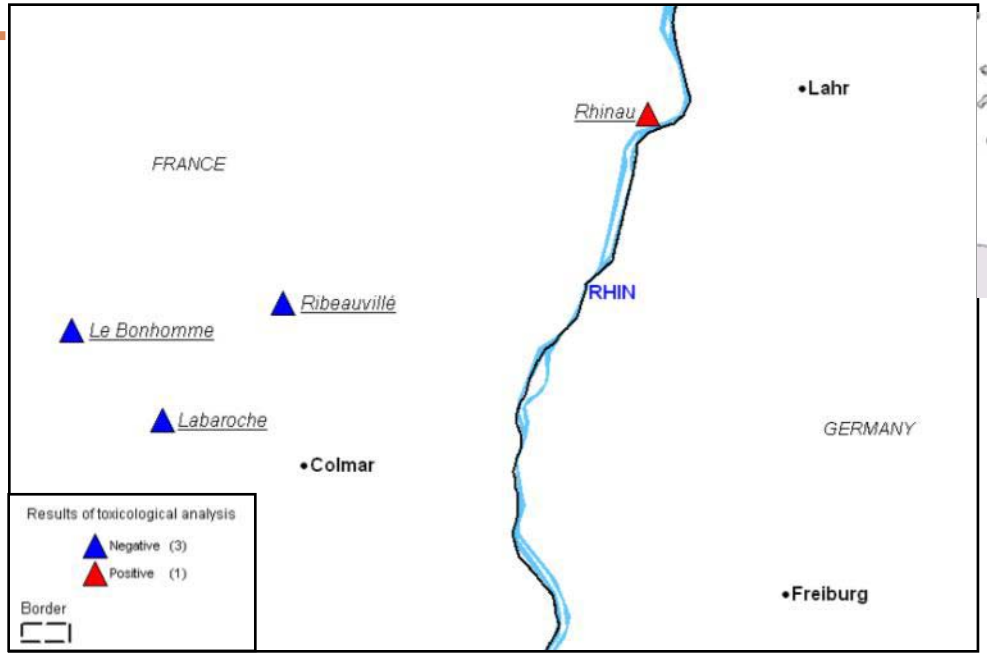



Worst case scenario

- Bad quality of the coating produces
- Use of pneumatic seed drills
- Climat: the sowings were delayed. Sowings took place when conola and orchards were blooming.
- The weather was dry, windy and no rain falls during 2 weeks after the sowing.

The Lorraine case (in France)

- Following the accident in Germany
- Mortalities were observed en France during the spring
- Samples were taken in 4 apiaries



Residues of clothianidine

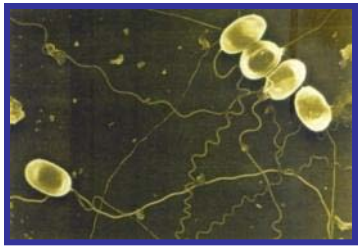
	Colonies with pb (%)	Clinical obs	ABPV	IAPV	CBPV	Honeybees (ng/ab)	Beebread (µg/kg)	Palynological analysis
Colmar 1	40 (16/40)	Depopulation	Neg	Neg	Pres	< LOD	Not perf.	Not perf.
Colmar 2	100 (7/7)	Dead Hb	Neg	Neg	Neg	< LOD	< LOD	Chestnut (93.5 %)
Colmar 3	30 (18/60)	Dead Hb Depopulation	Neg	Neg	Disease	< LOD	< LOD	Chestnut (96.5 %)
Rhinau	100 (120/120)	Dead Hb	Neg	Neg	eég	1.8	25.0 40.0	Canola (82.0 %)

Interaction between factors

Pathogens + pesticide

Nosema and imidacloprid

↓ **social immunity** *Alaux et al. 2009*



Diversity of pollen diets

Polyfloral against monofloral

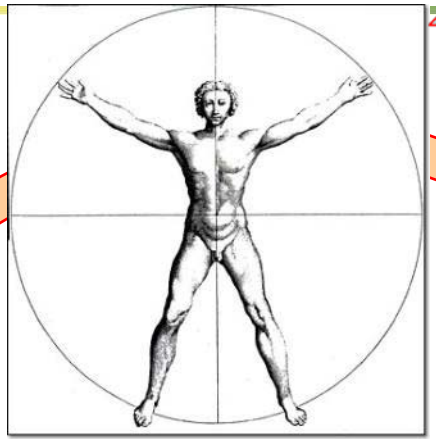
↓ **social immunity** *Alaux et al. 2010*

Pesticides together

Neonicotinoids and fungicides

↑ **toxicity** *Iwasa et al. 2004*

Causes and consequences of bee decline are linked



Lysenkov 2009

Thank you for your attention

Thank you to OIE for inviting me

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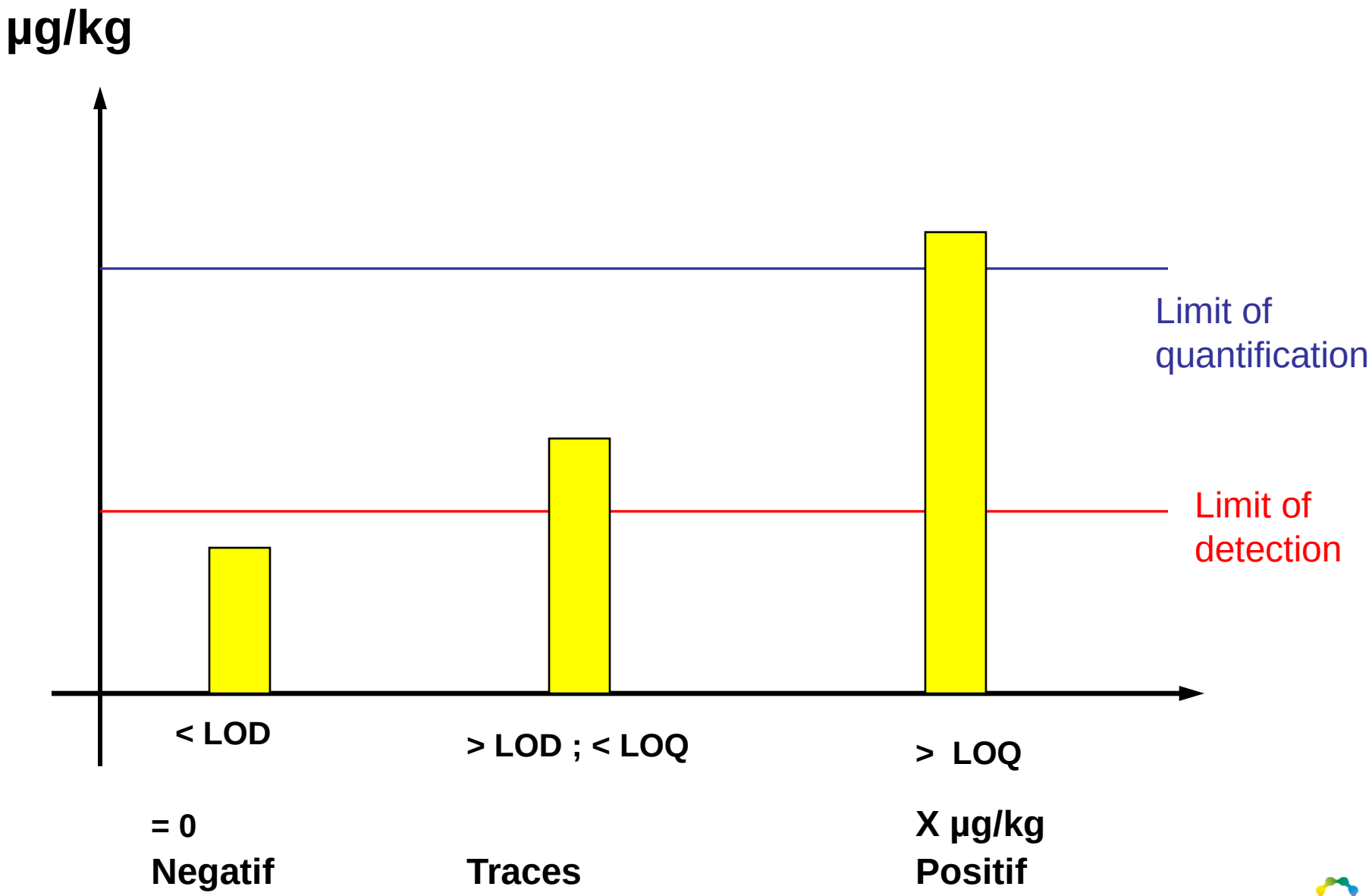
Stech and Held
Bart Smith
Bernard Vaissière

marie-pierre.chauzat@anses.fr

LOD and LOQ


µg/kg
Limit of quantification
Limit of detection
< LOD
> LOD ; < LOQ
> LOQ
= 0
Negatif
Traces
X µg/kg
Positif