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French agency for food, environmental and occupational health safety

The colony collapse disorder

Marie-Pierre CHAUZAT

Anses – Sophia Antipolis

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



- Starting 2006
- East coast of USA
- Severity and unusual circumstances of these colony declines
- Losses estimated at
    - 32% during the winter 2006/2007
    - 36% during the winter 2007/2008
    - 29% during the winter 2008/2009
    - 34% during the winter 2009/2010

Honey bees

Canola pollination

Apple pollination

Almond pollination

Hive products

Pollination →

Human food

Animal food

Biodiversity

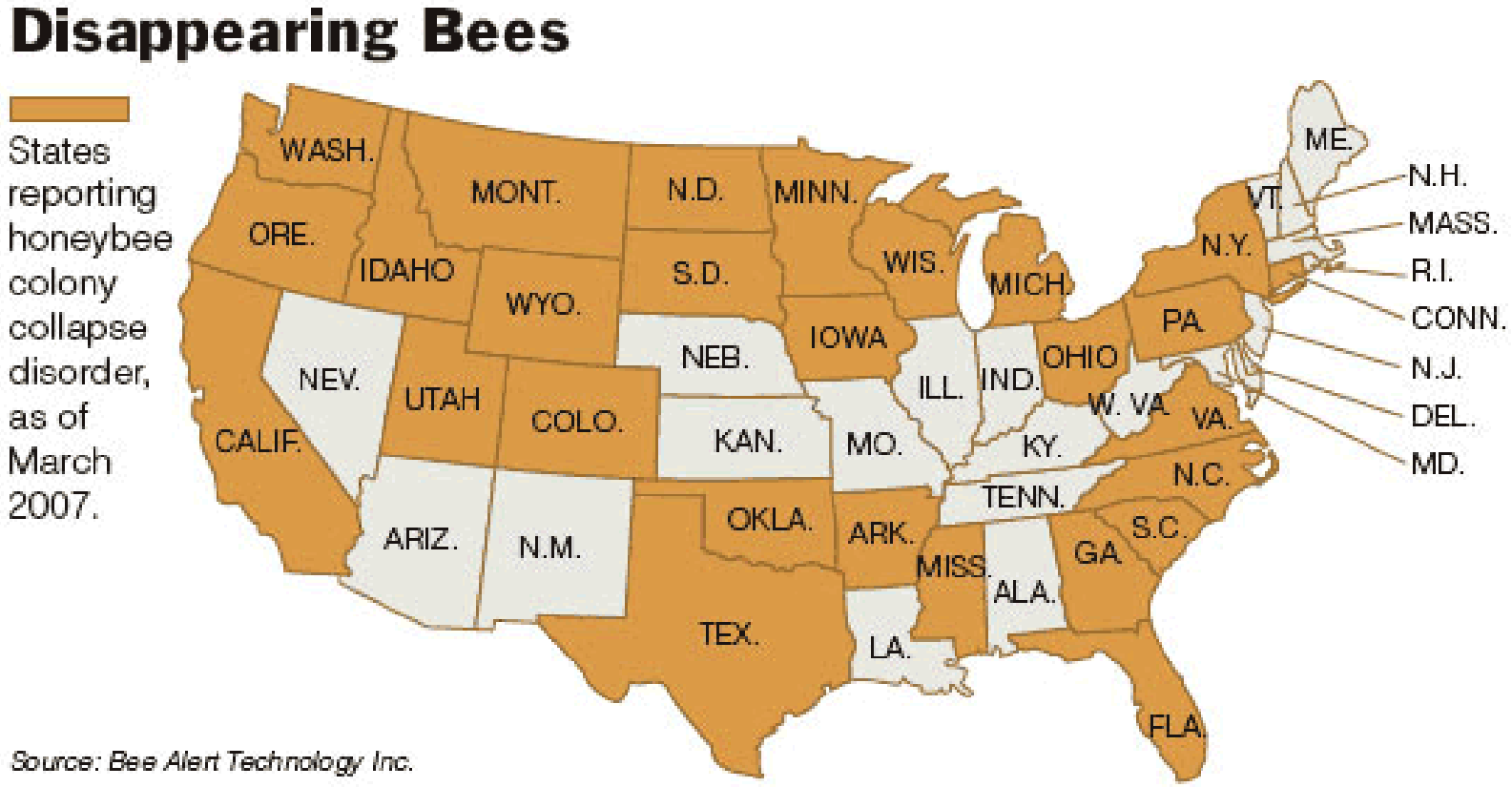
Importance of honey bee pollination

Production of 39 of the world's 57 most important monoculture crops still benefits from pollination

The production value of a ton of the crop categories that do not depend on insect pollination averaged €151 while that of those that are pollinator-dependent averaged €761 (Gallai et al. 2008)

In the United States, value of pollination on commercial crops is estimated at 15-20 billion $ annually (2010)

CCD extension in the US (2009)



Symptoms

(i) sudden loss of the colony adult bee population
with very few bees found near the dead colonies

(ii) several frames with healthy, capped brood with low levels of parasitic mites, indicating that colonies were relatively strong shortly before the loss of adult bees and that the losses cannot be attributed to a recent infestation of mites

(iii) food reserves that have not been robbed, despite active colonies in the same area, suggesting avoidance of the dead colony by other bees

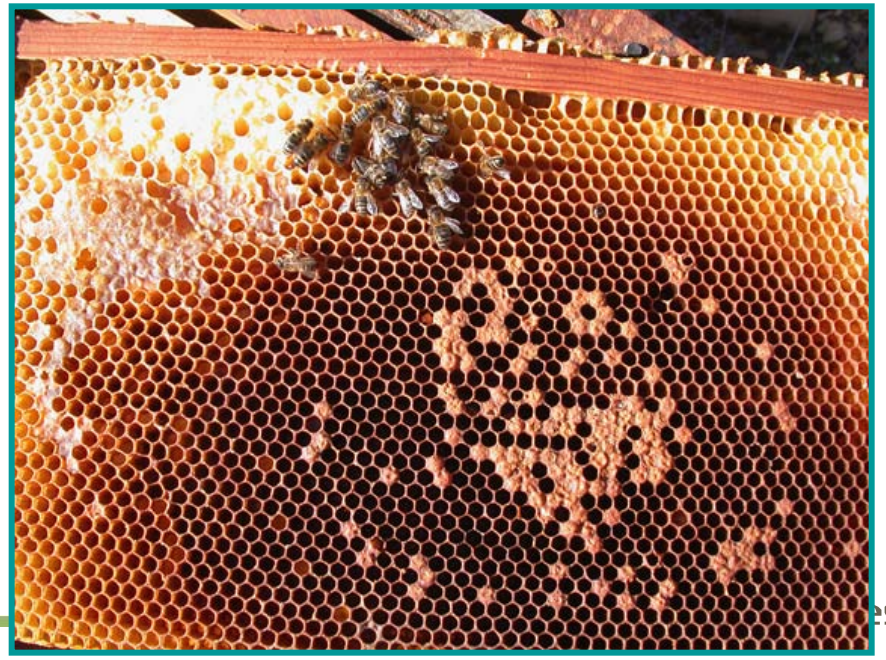
(iv) minimal evidence of wax moth or small hive beetle damage

(v) a laying queen often present with a small cluster of newly emerged attendants

Symptoms

Large reserves
Small cluster of remaining honeybees

Symptoms



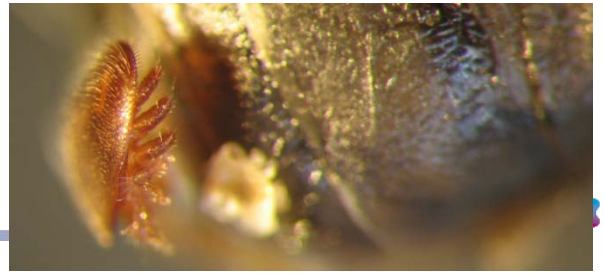
2007: CCD Action plan

1. Survey/data collection to determine the extent of CCD and the current status of honeybee colony production and health

2. Analysis of bee samples to determine the prevalence of various pests and pathogens, bee immunity and stress, and exposure to pesticides

3. Hypothesis-driven research on four candidate factors including new and reemerging pathogens, bee pests, environmental and nutritional stresses, and pesticides

4. Mitigative/preventive measures to improve bee health and habitat and to counter mortality factors.



Several reasons for bee losses

CLIMATE

Seasons

Genetics

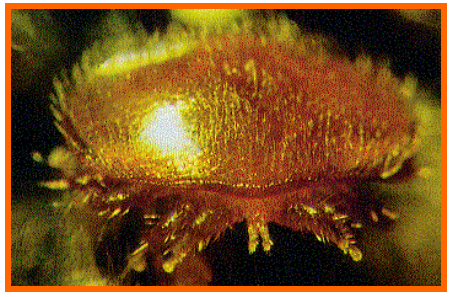
Physiology

Behaviour

Apiary management

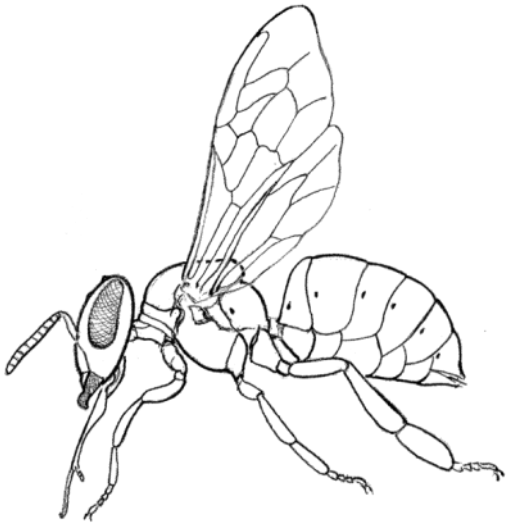
Pesticides

Environment



Diseases

Honeybee pathogens



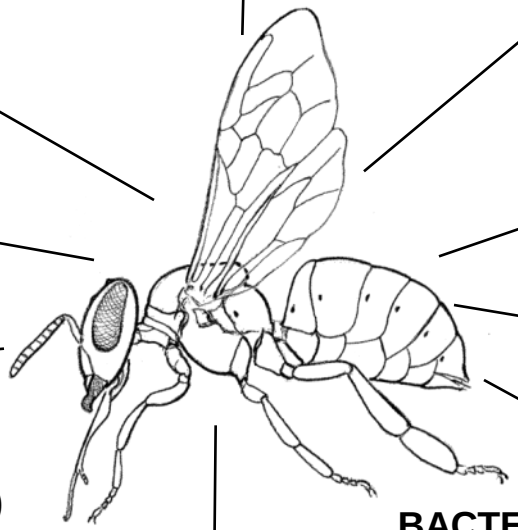
Honeybee pathogens

MITES
***Acarapis woodi* (Acariosis)**
***Varroa destructor* (Varroasis)**
Tropilaelaps clareae

HYMENOPTERA
***Vespa velutina* (Asian hornet)**

FUNGI
***Nosema apis* (Nosemosis)**
***Nosema ceranae* (Nosemosis)**
***Ascosphaera apis* (Chalkbrood)**
***Aspergillus flavus* (Stonebrood)**

COLEOPTERA
Aethina tumida
(*Small hive beetle*)



DIPTERA
***Braula caeca* (Bee louse)**

PROTOZOA
Malpighamoeba mellificae
(Amibiasis)

VIRUSES
ABPV (Acute bee paralysis virus)
BQCV (Black queen cell virus)
CBPV (Chronic bee paralysis virus)
DWV (Deformed wing virus)
IAPV (Israeli acute paralysis virus)
KBV (Kashmir bee virus)
SBV (Sacbrood virus)
SBPV (Slow bee paralysis virus)
CWV (Cloudy wing virus)
BVX (Virus X)
BVY (Virus Y)
FV (Filamentous virus)

LEPIDOPTERA
Galleria mellonella
Achroea grisella

BACTERIA
***Paenibacillus larvae* (American Foulbrood)**
***Melissococcus plutonius* (European Foulbrood)**
Paenibacillus alvei
Enterococcus faecalis
Achromobacter eurydice
Brevibacillus laterosporus
Associative Agents
***Pseudomonas apiseptica* (Septicemia)**
***Spiroplasma apis* (Spiroplasmosis)**
***Spiroplasma melliferum* (Spiroplasmosis)**

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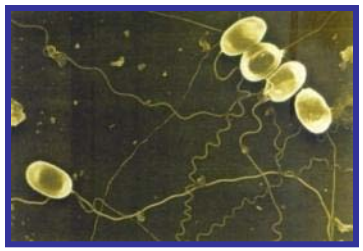
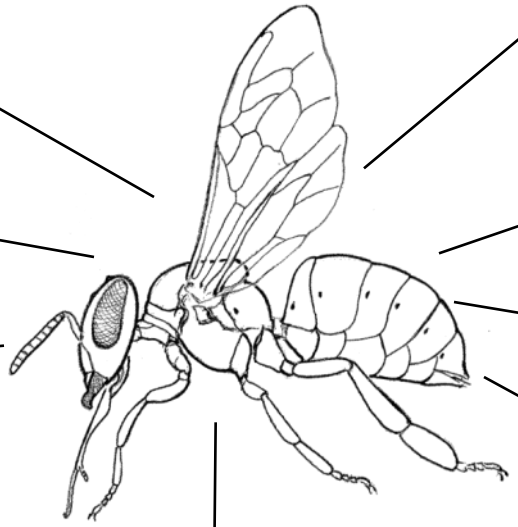
Honeybee pathogens





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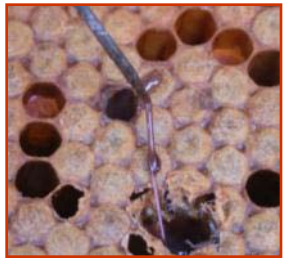


LEPIDOPTERA
Galleria mellonella
Achroea grisella

Faucon et al. 2002; Ribière et al. 2010

However, other explanations exist

29% (mortality) during the winter 2008/2009

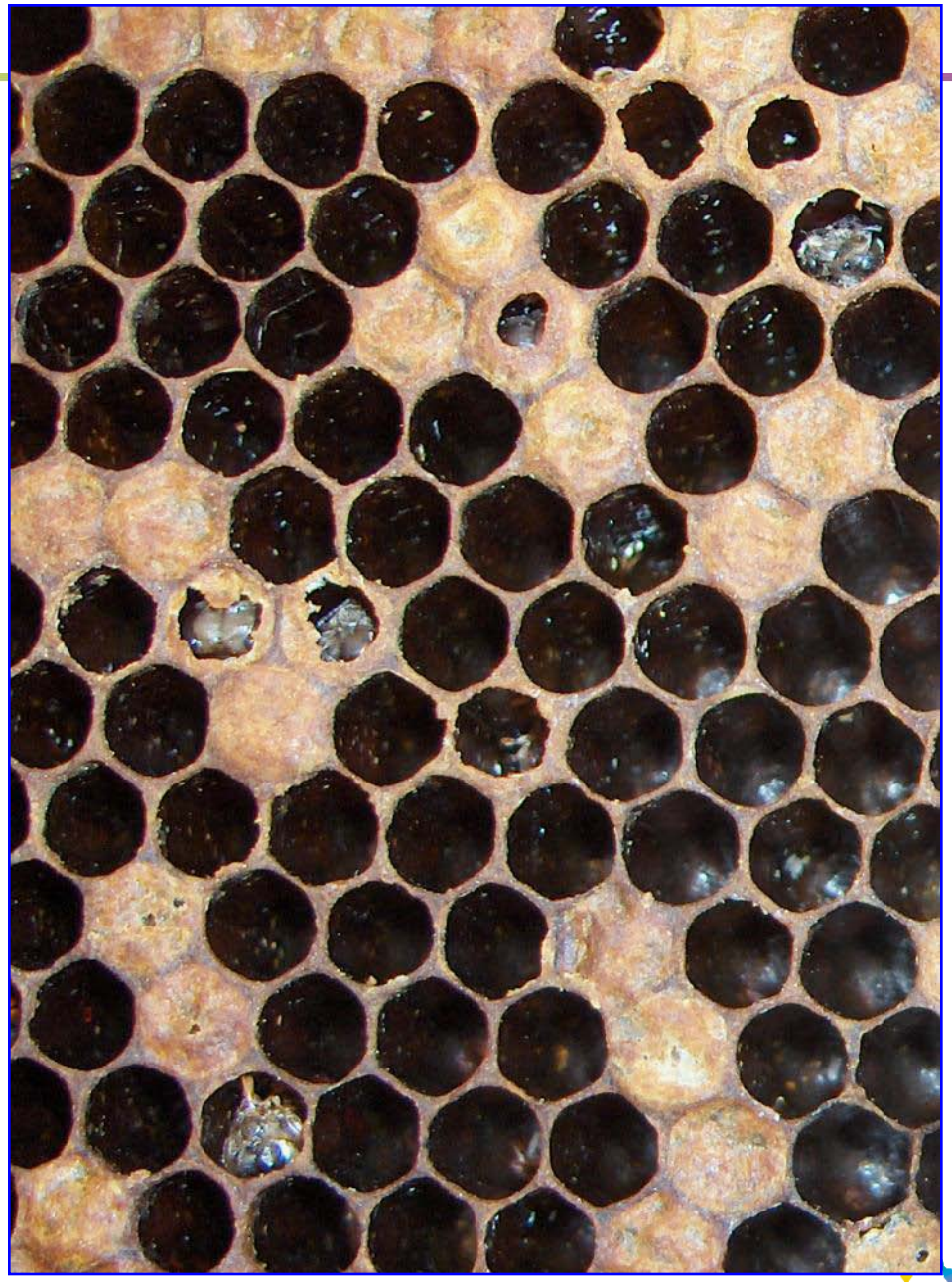
10% of the 2,3 million managed honey bee colonies died of “CCD-like” symptoms

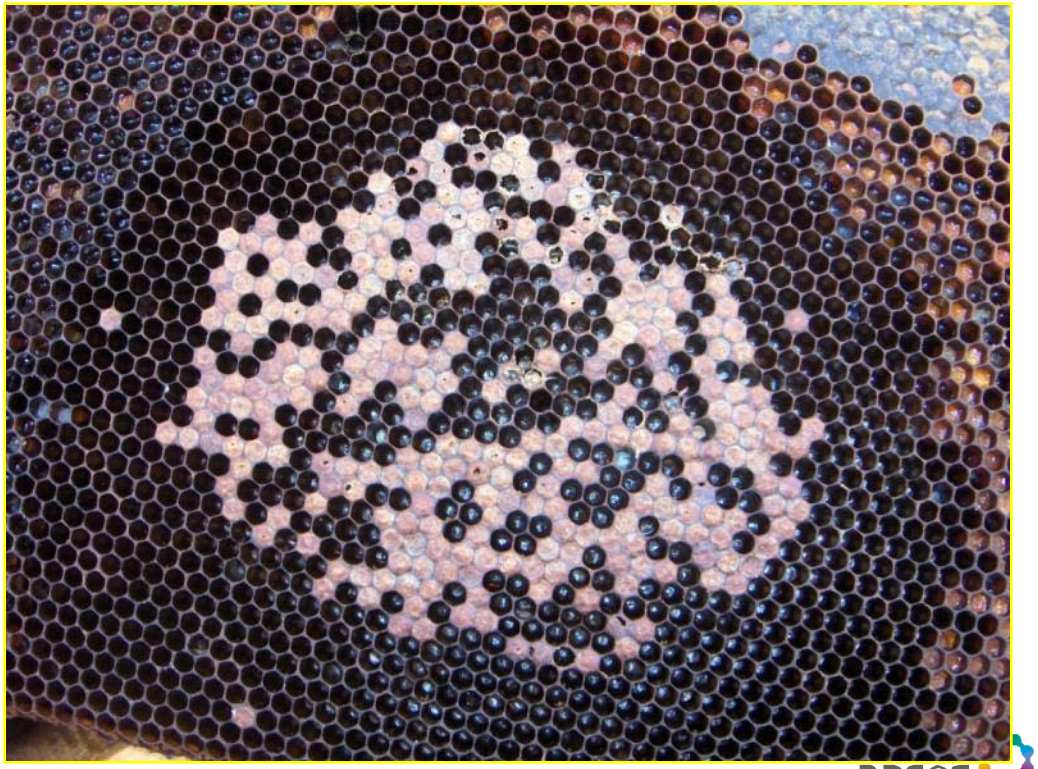
US beekeepers self-diagnosed CCD as only the 8th most important contributor to colony mortality, behind starvation, queen-related issues, and parasites

Mortality is the produce of multiple factors, both known and unknown, acting singly or in combination

Parasitic mite syndrom

- concave cappings
- cappings with a small hole
- uncapped yellow-coloured nymphs or larvae
- cannibalised nymphs (remaining abdomens)
- “dried” larvae
- dead bees still in the cells sometimes with atrophied wings.
- mosaic brood (larva or nymph deaths replaced by more recent eggs)



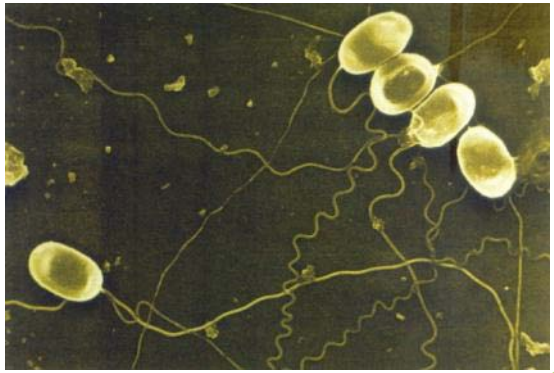


Survey and data collection

Absence of damaging levels of Nosema and Varroa

Pilot national survey to look for exotic pests and diseases

Development of new toxicity testing protocols to determine the potential effects of pesticides
SETAC Pellston workshop (early 2011)



Analysis of existing samples

Analysis of bee samples for pesticide residues & pathogen loads

Honeybee decline might be resulting from immune suppression

Combination of factors

Interactive effects among pesticides, the parasite Nosema and viruses

Sublethal effects of neonicotinoids and fungicides

Improved diagnostic assays

Research to identify factors

Pesticides: could weaken honeybee immune system

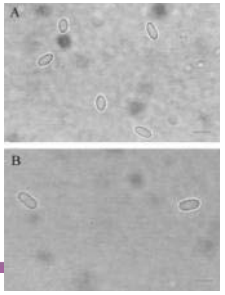
Secondary plant compounds might be toxic to bees

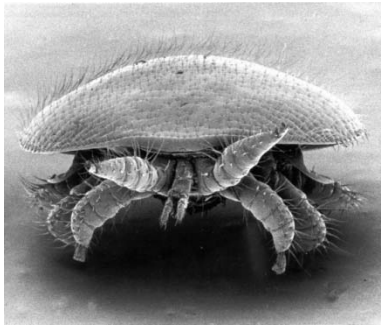
Pesticide residues can affect honeybees sub-lethally or acutely

Synergetic effects of different chemicals

Knowledge on pathogens loads and diseases

Sequencing of the major pathogens (*N. apis* & *N. ceranae*)





Mitigation and Management measures

Efforts to enhance mite-resistant stocks

Information on honeybee diet recomandations for beekeepers

Development of non-Apis pollinators to provide alternative to honeybee pollination

Determine the relationship between bumble bee and honeybee pests

Develop guidelines to coordinate regulation and importation of bees

National pilot project on pests in 3 states to be expand to 13 states

To be continued…

Congressional Research Service

Honey Bee Colony Collapse Disorder

Renée Johnson
Specialist in Agricultural Policy

January 7, 2010

Insights & Perspectives

Colony Collapse Disorder in context

Geoffrey R. Williams[1)2)], David R. Tarpy[3)], Dennis vanEngelsdorp[4)], Marie-Pierre Chauzat[5)], Diana L. Cox-Foster[4)], Keith S. Delaplane[6)], Peter Neumann[7)8)], Jeffery S. Pettis[9)], Richard E. L. Rogers[10)] and Dave Shutler[2)]*

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Thank you for your attention

marie-pierre.chauzat@anses.fr