HONEY BEE HEALTH MONITORING CAMPAIGN IN EMILIA-ROMAGNA REGION (NORTHERN ITALY): RURAL AREAS AND NATURAL RESERVES

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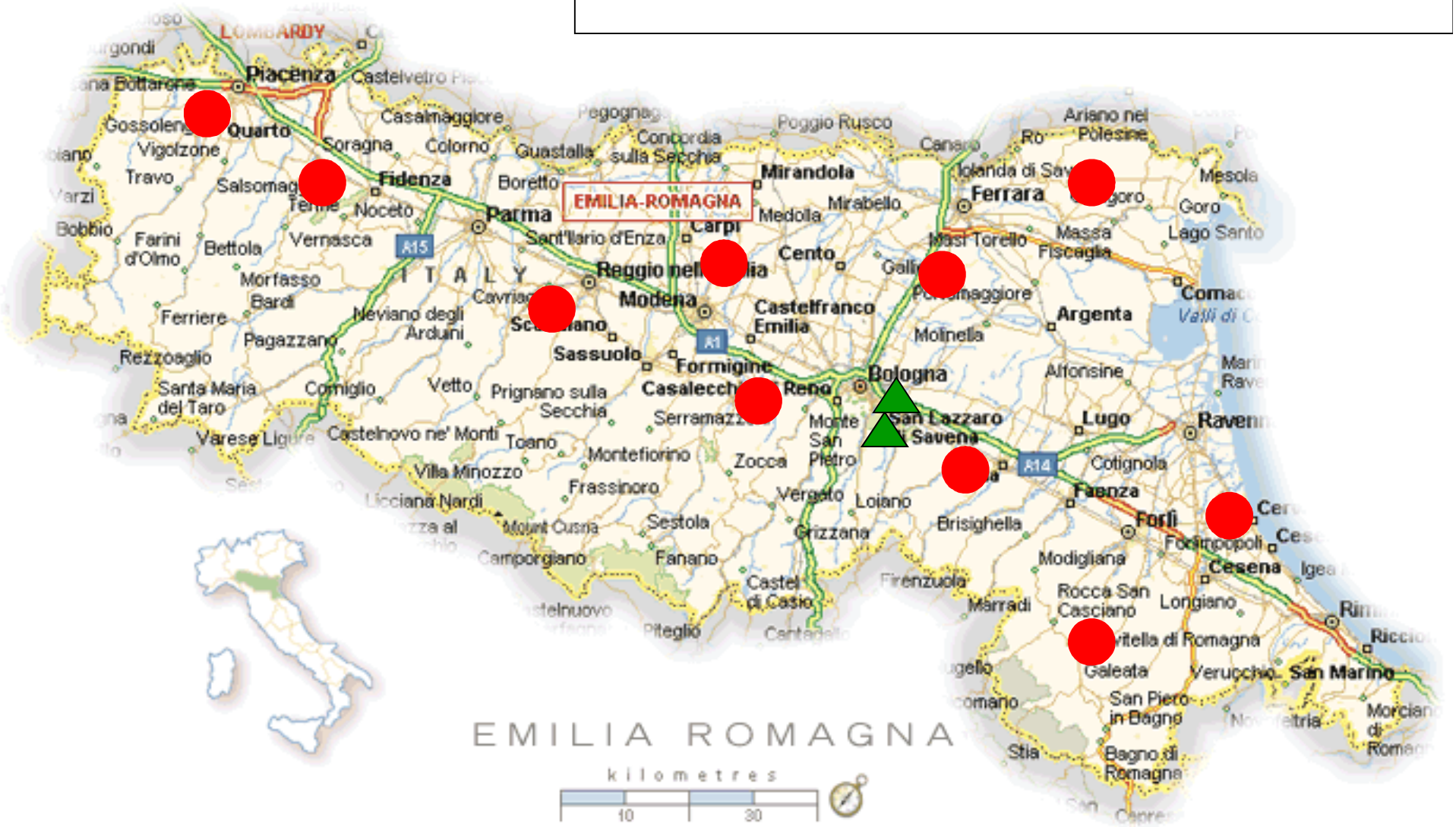
• During 2010, within the national network for honey bee health monitoring (Apenet project), a regional campaign (supported by CRPV) was conducted throughout Emilia Romagna (northern Italy), in order to understand recent colony losses and to evaluate the effect of pathogens and agrochemicals on honey bees in different areas.

• A similar investigation was conducted simultaneously in a natural reserve of the same region (*Parco Regionale Gessi Bolognesi e Calanchi dell'Abbadessa* – nearby Bologna), within a broader project (Apepark) which involved four other Italian natural parks.

apeNet

CRPV soc. coop. CENTRO RICERCHE PRODUZIONI VEGETALI

Parco Regionale Gessi Bolognesi e Calanchi dell'Abbadessa



Location of honey bees stations **CRPV-Apenet** and **Apepark project** in Emilia-Romagna in 2010

Methods

For the **CRPV-Apenet** investigations, we used 10 apiaries of 10 hives each; the apiaries were distributed in both natural and cultivated areas. We visited the hives four times from **March to November 2010** and we sampled live bees, wax, honey and pollen.

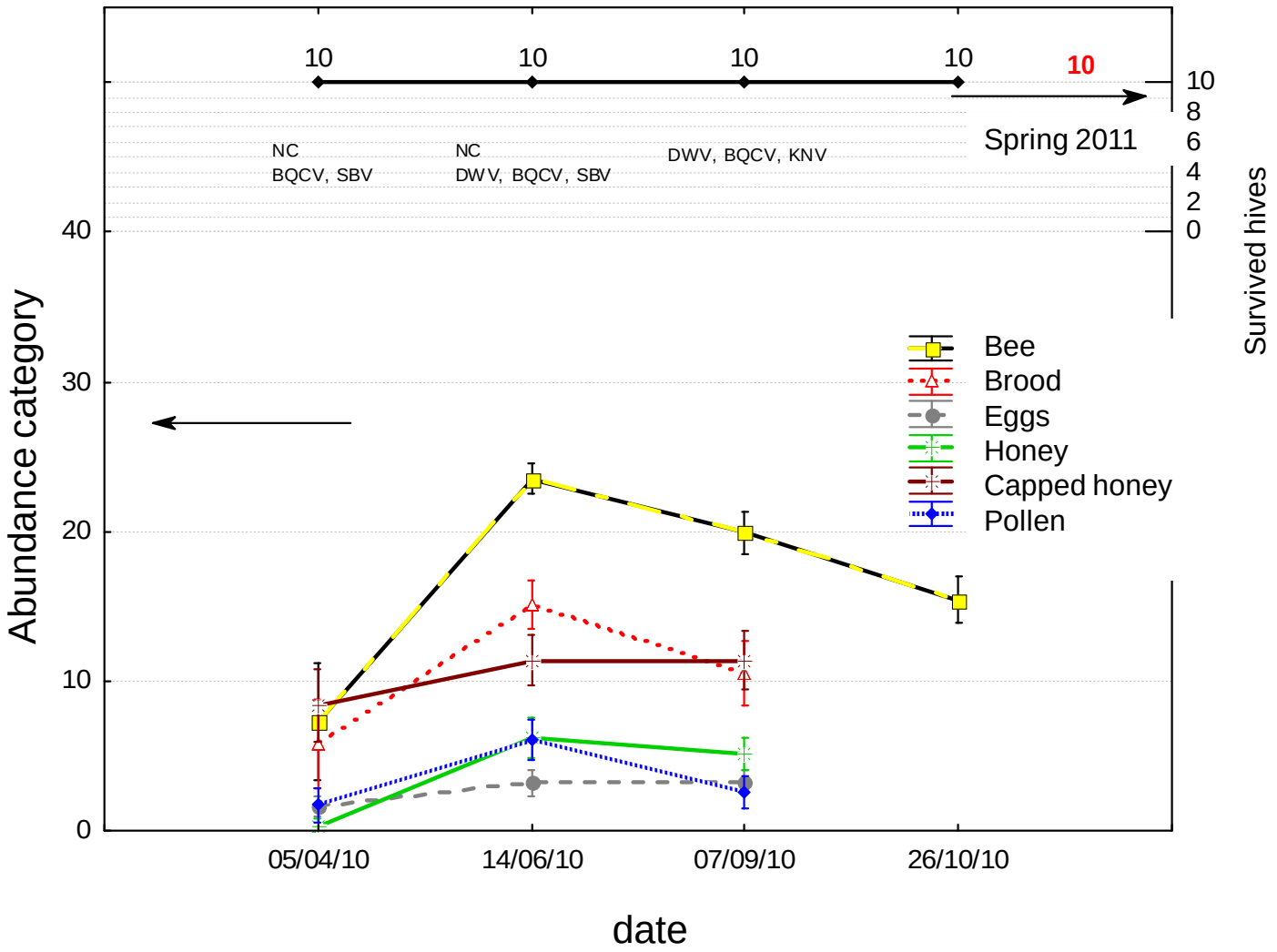
The **Apepark project** followed a different protocol; we employed 2 apiaries, of 20 hives each, located in two different areas within the park: cultivated and non cultivated. Both apiaries were monitored for 41 weeks, **from September 2009 to September 2010**. The inspections were carried out monthly with sampling of honey and dead bees. In this project, the protocol also included the weekly control of the mortality of honey bees.

During the inspections of the apiaries of both projects we evaluated the number of bees, the brood extension, the pathological symptoms and some behavioural and environmental parameters.
All the collected samples were analyzed in order to identify pathogens such as *Nosema* spp. and viruses and to detect traces of pesticides.

CRPV-Apenet

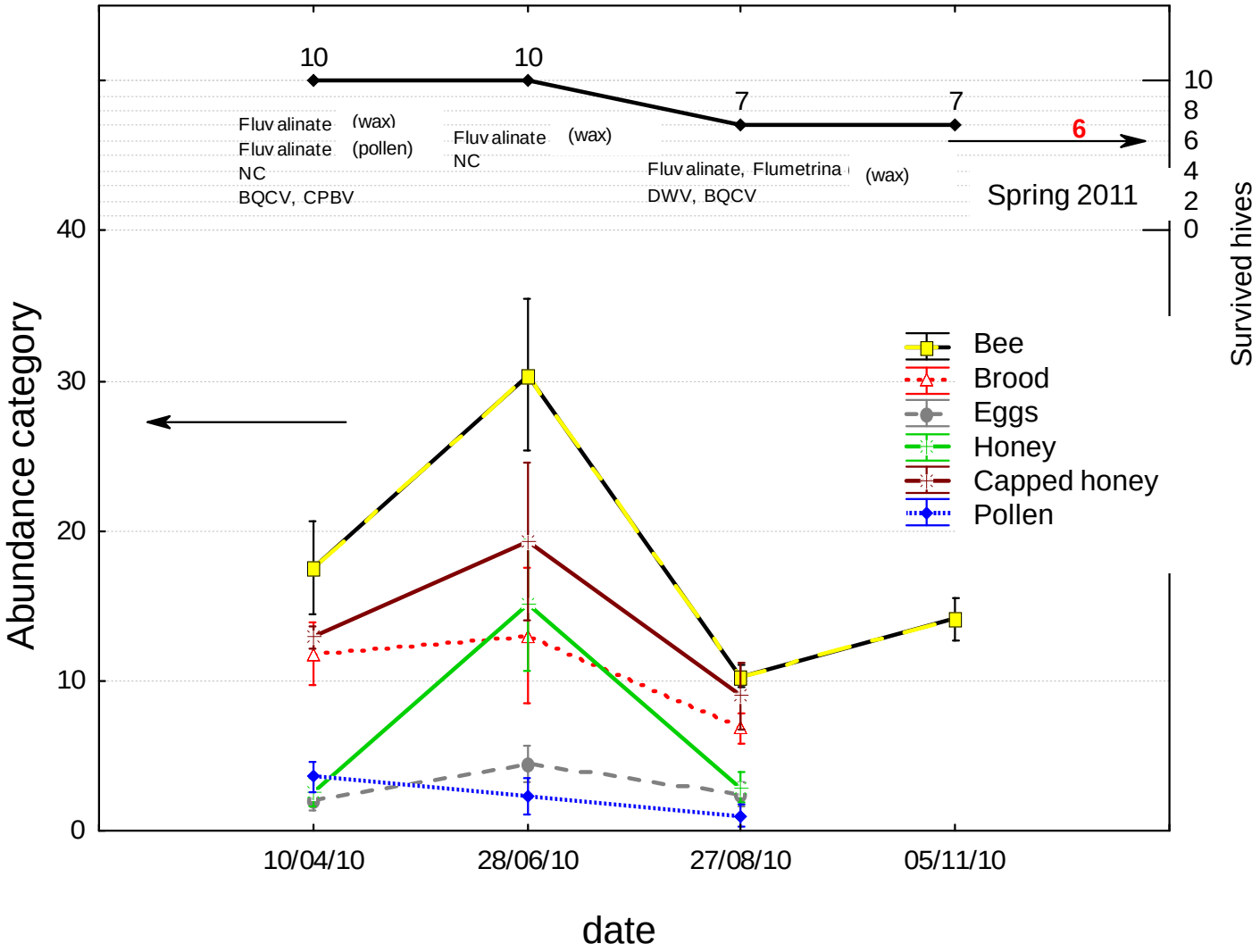
CRPV-Apenet EMR 3-3

Evaluation of honey bee colonies during 2010 (NC=*Nosema ceranae*)



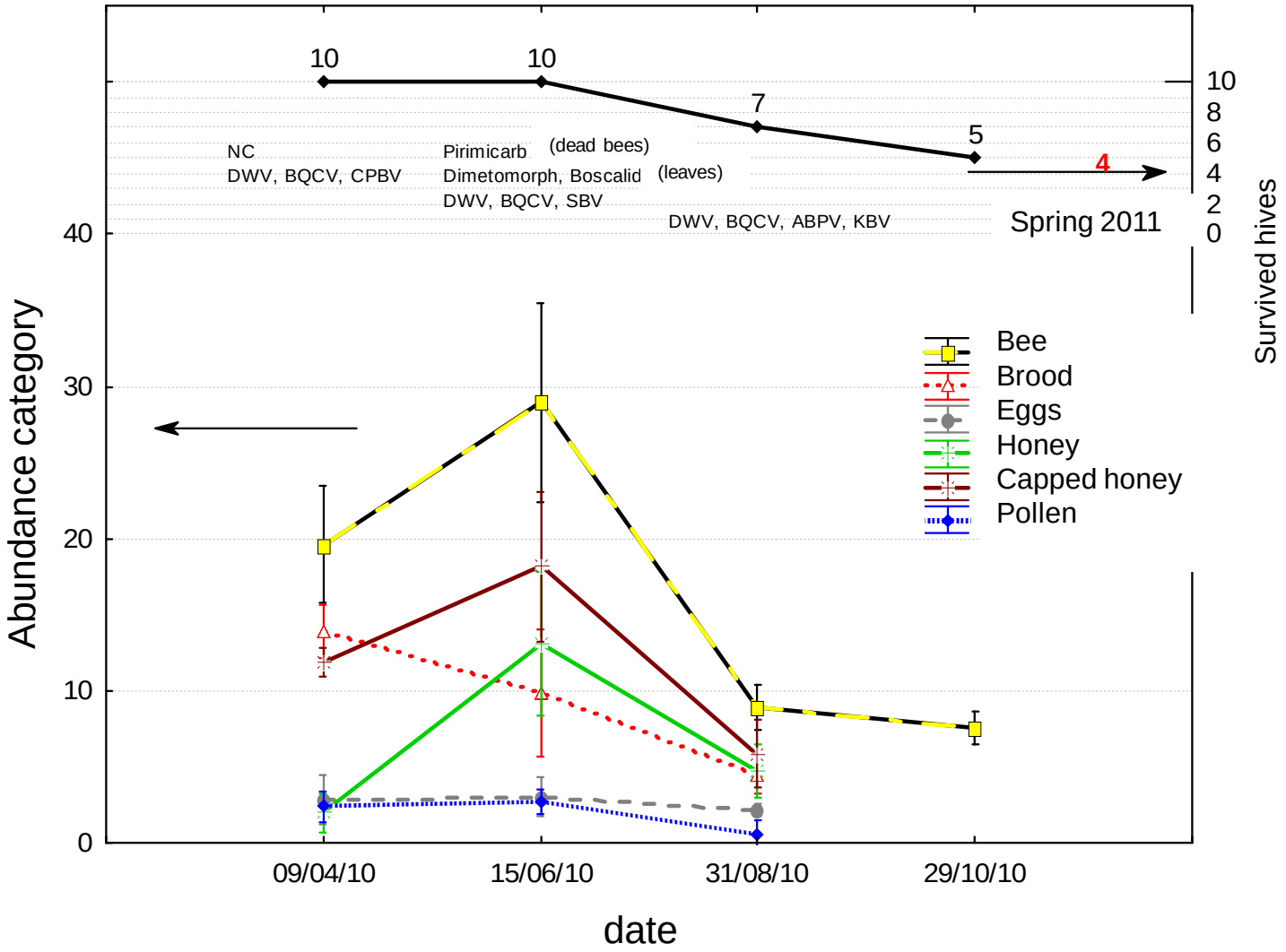
CRPV-Apenet EMR 4-4

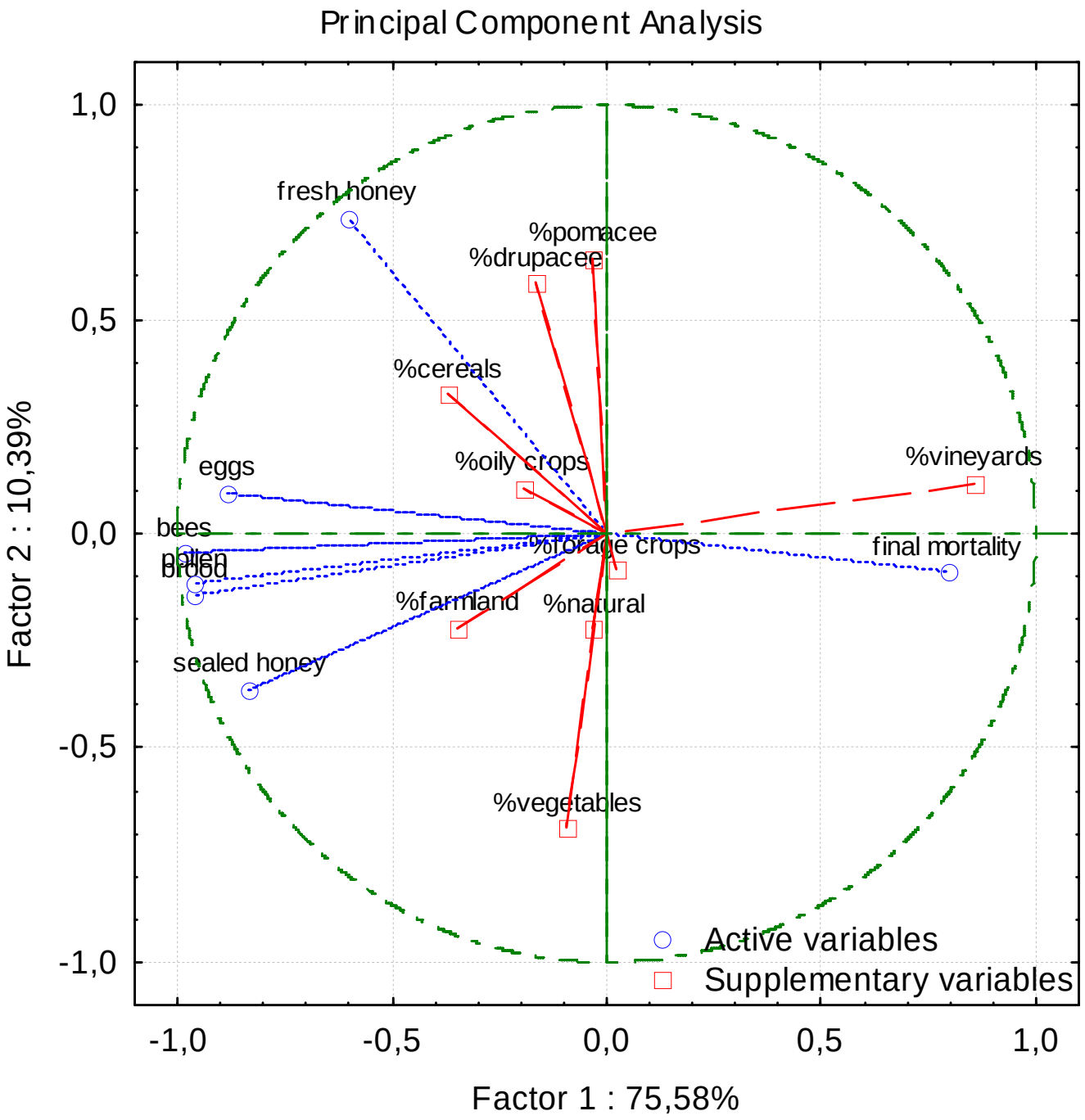
Evaluation of honey bee colonies during 2010 (NC=*Nosema ceranae*)



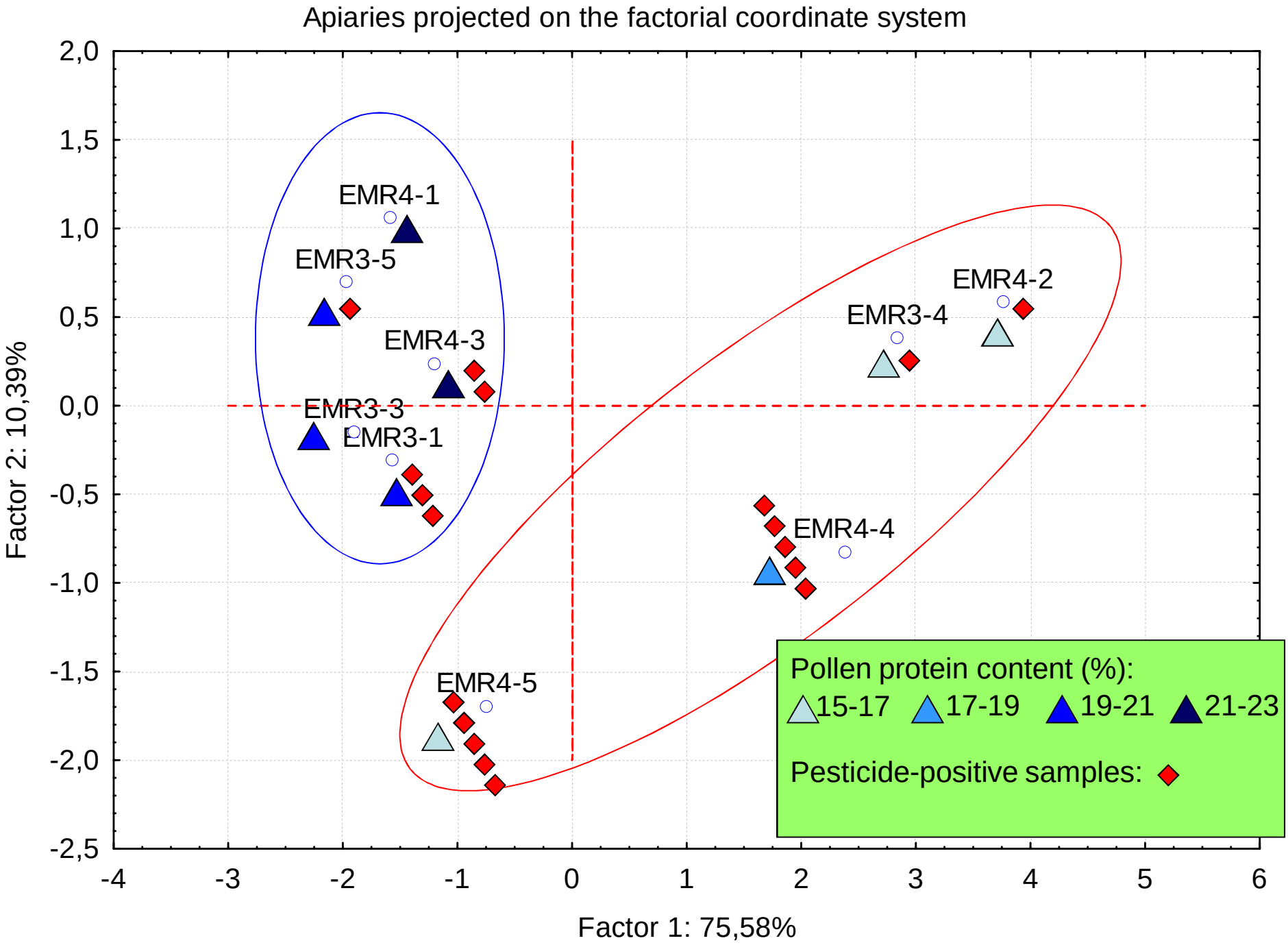
CRPV-Apenet EMR 4-2

Evaluation of honey bee colonies during 2010 (NC=*Nosema ceranae*)





Principal component analysis (PCA) is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of uncorrelated variables called **principal components**.


Apiaries projected on the factorial coordinate system
Factor 2: 10,39%
Factor 1: 75,58%
2,0
1,5
1,0
0,5
0,0
-0,5
-1,0
-1,5
-2,0
-2,5
-4
-3
-2
-1
0
1
2
3
4
5
6
EMR4-1
EMR3-5
EMR4-3
EMR3-3
EMR3-1
EMR4-2
EMR3-4
EMR4-4
EMR4-5
Pollen protein content (%):
15-17
17-19
19-21
21-23
Pesticide-positive samples:

Results

CRPV-Apenet

Nosema: *N. apis* was never detected, but ***N. ceranae*** was found in 9 of the total stations (10) and in **53,3%** of the analyzed samples.

Viruses: **BQCV** is the most detected virus as it was found in all the stations and in **96,5%** of the samples, followed by: **DWV** detected in 8 stations and in **55,1%** of the samples, **SBV** detected in 8 stations and **48,2%** of the samples; **CPBV** found in 5 stations and in **17,2%** of the samples; **APBV** and **KBV** both found in 4 stations and in **13,8%** of the overall samples.

Pesticides: in 93 analyzed samples of honey, wax, pollen, no neonicotinoid residues was found; but 16 samples (among wax, pollen and honey bees), were positive to other pesticides (coumaphos, fluvalinate, flumetrina, metalaxil, fludioxonil, propamocarb, fenbuconazolo, pirimicarb).

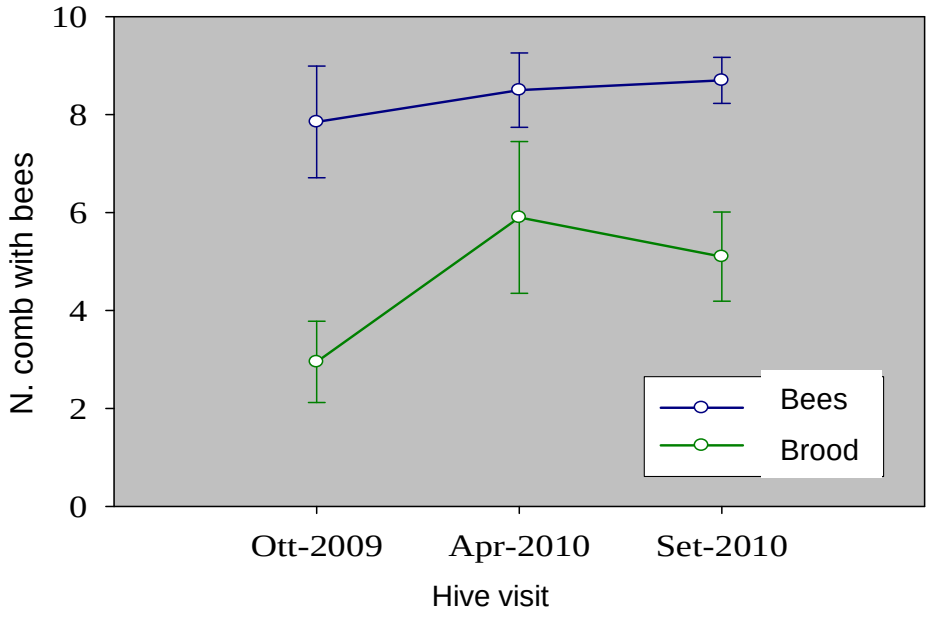
Pollen protein rate (% N): from 15% to 23%

Colony losses: during the year and the following winter (2010 – 2011) the colony loss was approx. 22%. The stations where the colony loss was stronger, had also the lowest pollen protein content, the greatest varroa infestation and the highest level of pesticide residues (pirimicarb e fluvalinate).

Apepark project

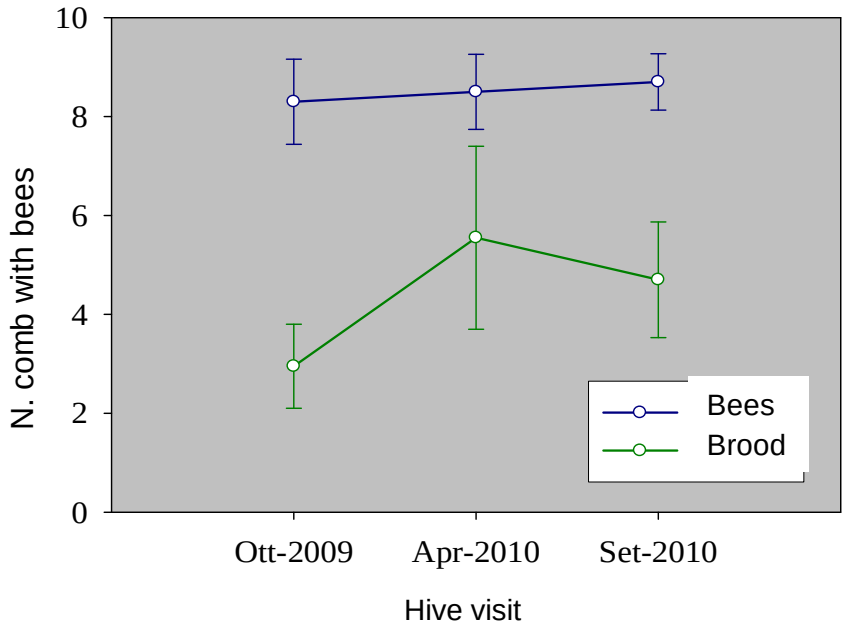
Apepark project

Evaluation of honey bee colonies



Apiary A (not exposed)

(The values represent the mean of 20 colonies)

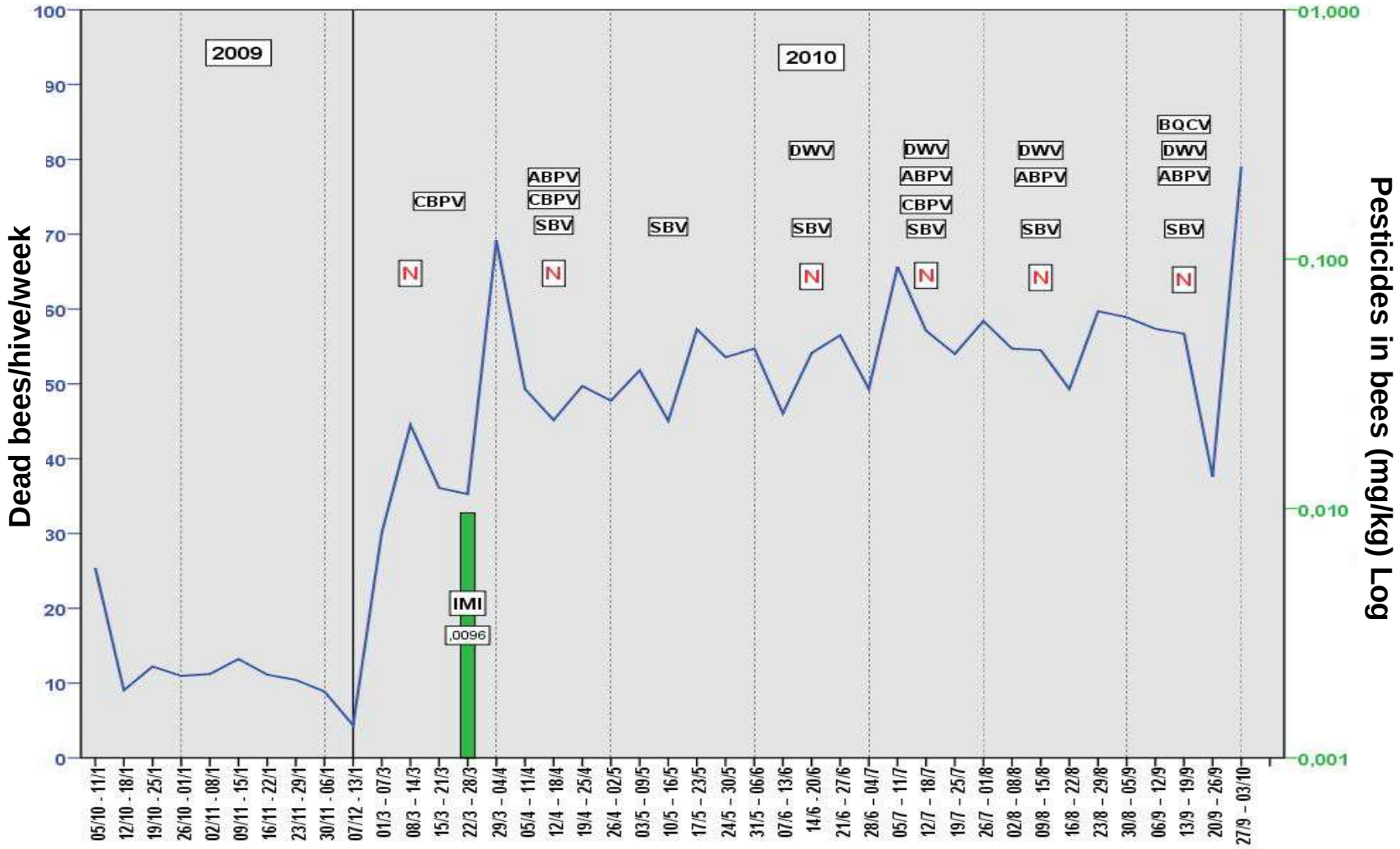


Apiary B (exposed)

(The values represent the mean of 20 colonies).

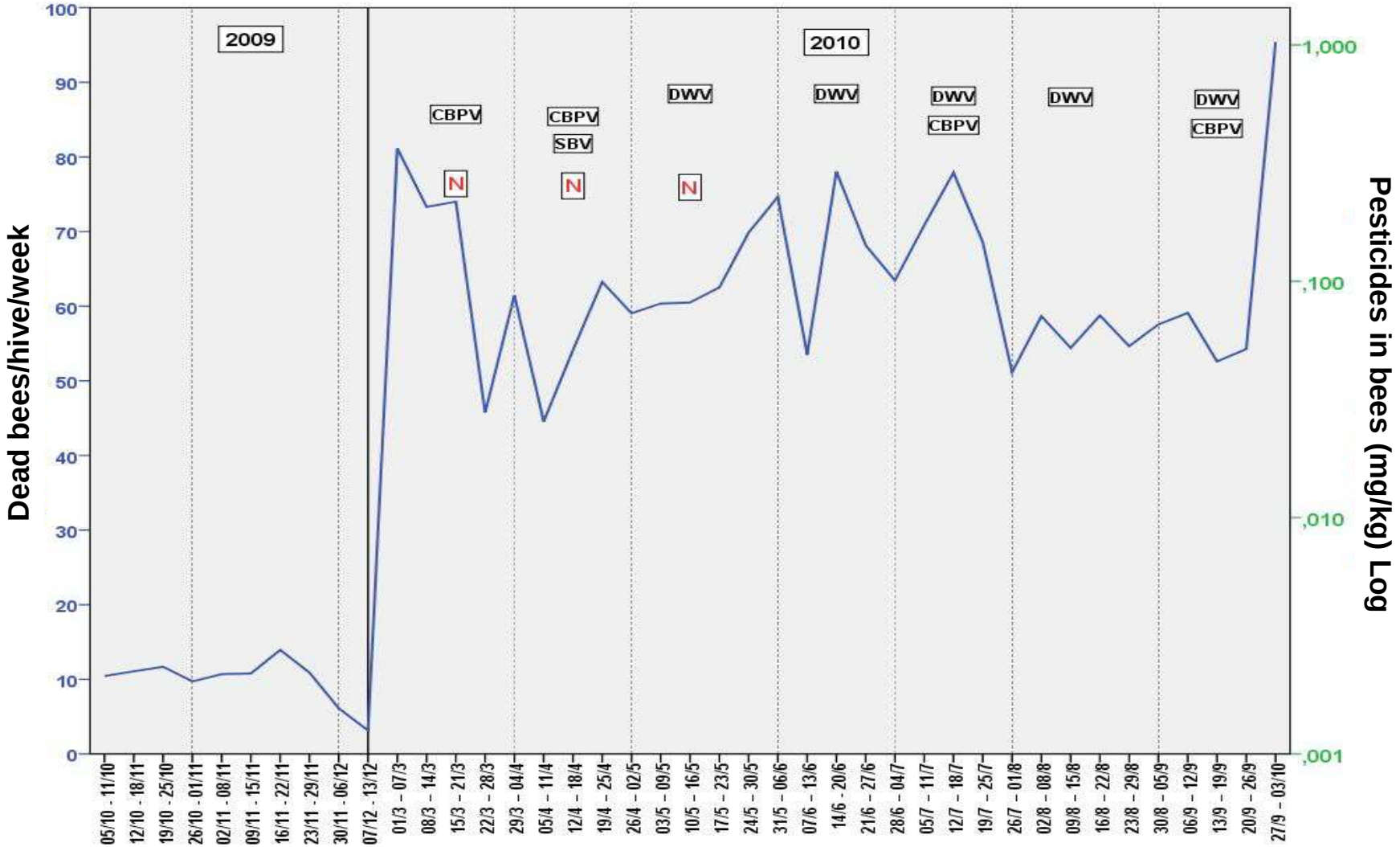
Apepark project (Station A – not exposed)

Weekly mean mortality, viruses, *Nosema* (N) and pesticides (IMI: Imidacloprid) detected in honey bee samples.



Apepark project (Station B - exposed)

Weekly mean mortality, viruses, *Nosema* (N) and pesticides (IMI: Imidacloprid) detected in honey bee samples.



Results

Apepark project

Nosema: ***N. ceranae*** was found in 9 of 14 samples (**64,3%)**, 3 in the "exposed" station and 6 in the "not exposed" one. *N. apis* was never found.

Viruses: in the "not exposed" station (A) 5 virus were found in the samples while in the "exposed" station (B) only 3 viruses were found.
In the 14 sampling, the following viruses have been detected: **DWV and CBPV 64,2%, SBV 50%, ABPV 28,5%; BQCV 7,1%** (in A: SBV 85,7%; CBPV 71,4%; DWV and ABPV 57,1%; BQCV 14,2%. In B: DWV 71,4%; CBPV 57,1% and SBV 14,2%).

Pesticides: **imidacloprid** was found in dead honey bees, sampled on March 2010 in the "not exposed" station (A). The detected quantity, 0,0096 mg/kg, is about 4 times lower than LD_{50} and it seems not to have caused lethal effects to the bees, even if, soon after, a high mortality has been registered, though it didn't pass the threshold.

Bee mortality and colony losses: the weekly count of dead honey bees collected from the u*nderbasket* traps has never exceeded the critical threshold (200 bees/hive/week). No colony loss was observed during the experimentation.
At the end of the winter season 2010/2011 (**March 2011**), 1 colony in the "not exposed" station and 2 colonies from the "exposed" station died.

Conclusions (1)

- *N. apis* has never been found, whereas more than 50% of the overall collected bees contained *N. ceranae*.
- Six virus species have been found: ABPV, BQCV, CBPV, SBV, DWV and KBV.
- The most frequent pesticides, detected in various bee matrices, especially in cultivated areas, were fungicides, followed by miticides and insecticides (carbamates and pyrethroids), while in the natural (park) areas we detected traces of imidacloprid only in a single honey bee sample.

- The data collected from that survey, carryed on in one of the most important Italian agricultural region (Emilia Romagna), show that, in the stations in which the highest colony loss was observed (3 colonies in cultivated areas and 1 colony in non cultivated areas), also *N. ceranae*, viruses and fungicides were detected.

- However a stronger Varroa infestation was found in those stations, together with more pesticide residues namely pirimicarb and fluvalinate.

- A lower protein rate in the pollen was also observed.

Conclusions (2)

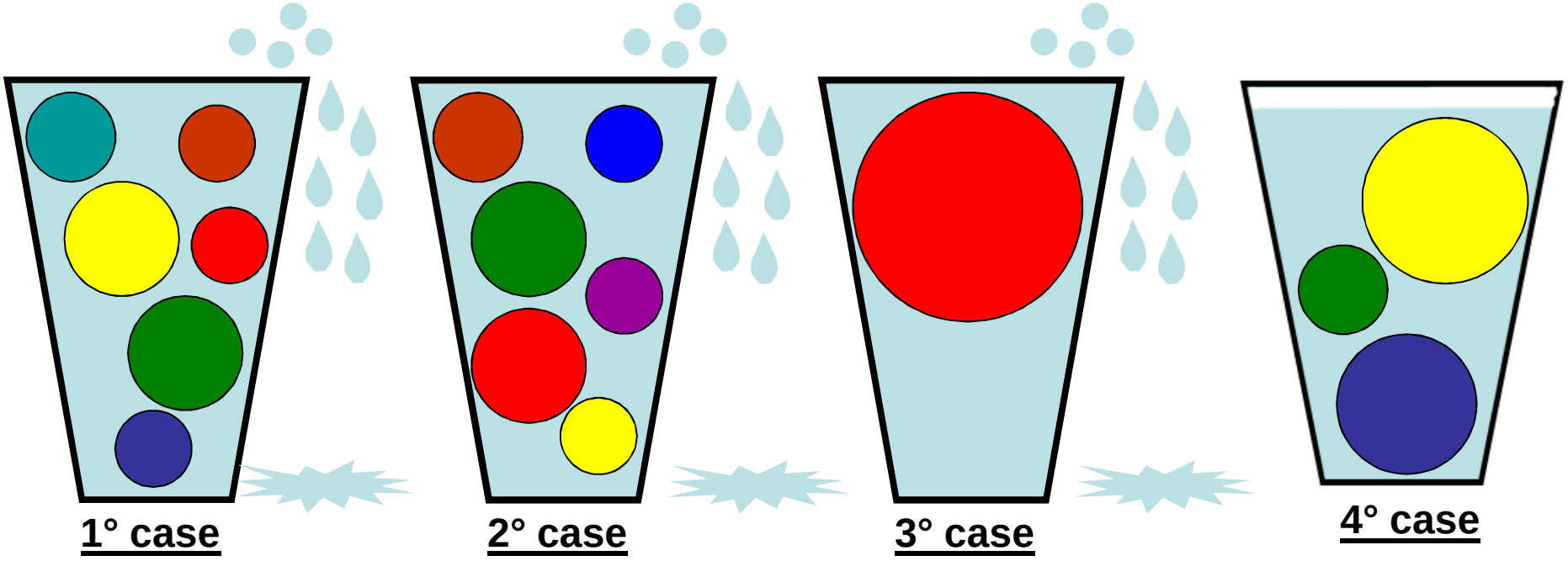
- These results point out that the colony collapse is due to different causes, both environmental and apicultural ones, showing a concurrent effect on the honey bee colony, as the “overflowing pot theory” can explain.

- The different causes, both environmental (crops, pesticides, weeds, weather conditions etc.) and apicultural ones (beekeeping, diseases etc.) play together a role in the colony collapse.

- For example, in some colonies, the presence of *Nosema*, viruses, varroa and pesticides, did not cause high honey bee mortalities, and colony losses.

- Under other conditions, the same factors caused the collapse of the colony.

“Overflowing pot theory”



Depending on the area, the period and the honey bee ecotype

Drops key

- Beekeeping
- Viruses
- Varroa
- Nosema
- Low proteic rate in pollen
- Pesticides
- Other causes