

# XXXXIII International Apicultural Congress

**APIMONDIA 2013**

**KYIV**



**HEALTH**

Morning session: Symposium 1

Monday 30<sup>th</sup> September

## **DISTRIBUTION OF NEONICOTINOIDS AND PYRETHROIDS IN BEES AND APIARIAN PRODUCTS: BEEBREAD AND BEESWAX**



Claire JABOT  
Hervé CASABIANCA  
Emmanuelle VULLIET  
Audrey BULETE

- **Context and objectives**
- **Analytical development**
- **Results**
- **Conclusions and perspectives**

- Abnormally high death rate



- Development of analytical methods:  
tools to better understand the impact of  
insecticides on bees

- Study :

=> 3 molecule families

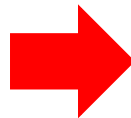
{  
neonicotinoids  
pyrethroids  
carboxamids

=> 3 matrices

{  
bee  
beebread  
beeswax

## CONTEXT AND OBJECTIVES

	Physico-chemical properties	
	log K <sub>ow</sub> range	Meaning
Neonicotinoids	0,57 - 1,26	Hydrophilic
Carboxamids	2,96	Between both
Pyrethroids	6,15 - 7,3	Lipophilic



**Different physico-chemical properties**



Beebread



Beeswax



Bees



**Complex compositions**

Targeted level



**≤ ng/g**

**ANALYTICAL CHALLENGES**

## ○ Matrices



BEESWAX



BEEBREAD



BEE

- **Bees** : individual in direct contact with pesticides
- **Beeswax** :
  - Suspected to be an accumulator of pesticides
  - Continuous contact with bees => chronic intoxication ?
- **Beebread** : bee food (winter), suspected to be the cause of end-winter mortality

## ○ Matrices



BEESWAX



BEEBREAD



BEE

➤ **Bees** : individual in direct contact with pesticides

➤ **Beeswax** :

- Suspected to be an accumulator of pesticides
- Continuous contact with bees => chronic intoxication ?

➤ **Beebread** : bee food (winter), suspected to be the cause of end-winter mortality

Only available matrices during mortality to obtain information about pesticides which may be involved

## ○ Analytical methodology



**Pre-treatment**



Beebread



Beeswax



**Extraction**



Sample preparation



**Purification**

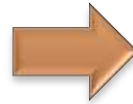


**Analysis**

- Sample preparations and protocols



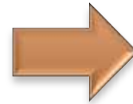
BEEBREAD  
and  
BEES



QuEChERS extraction  
Salting-out extraction  
(with Acetonitrile)



BEESWAX



Solid support extraction  
(Diatomaceous earth)



### Validation of analytical methodologies

#### ➤ **Why ?**

Essential to guarantee the reliability and traceability of results

#### ➤ **Parameters**

- Limit of detection (LOD)
- Limit of quantification (LOQ)
- Linearity ( $r^2$  and Fisher test)
- Recovery (%)
- Precision

- Validation of analytical methodologies

	Parameters			
	Recoveries (%)	Repeatability (%)	LOQ (ng/g)	
<b>BEEBWAX</b>	78 - 105	1 - 19	pyrethroids	11,7 - 116,6
			neonicotinoids	0,038 - 13,2
			carboxamids	3,66
<b>BEEBREAD</b>	70 - 100 (except 6-CNA : 46 bif : 53)	2 - 17	pyrethroids	0,044 - 40
			neonicotinoids	0,13 - 7,4
			carboxamids	/
<b>BEEES</b>	89 - 111 (except 6-CNA : 48)	7 - 24	pyrethroids	0,08 - 0,74
			neonicotinoids	0,49 - 5,48
			carboxamids	0,68

- Study

- 2 years
- 3 matrices per beehive
- collaboration with two beekeeping organizations



and ADARA



- Sample collection

- Performed by beekeepers



- 30 samples / matrix / year over 2 years

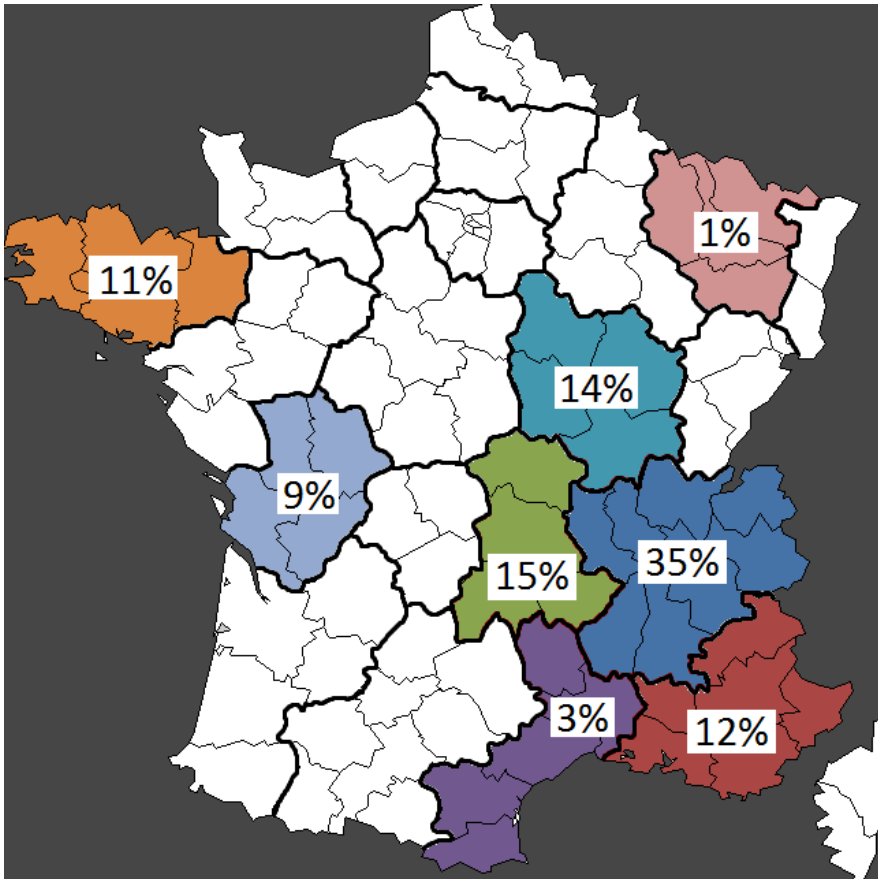
=> 180 samples

- Stored at -18°C until analysis

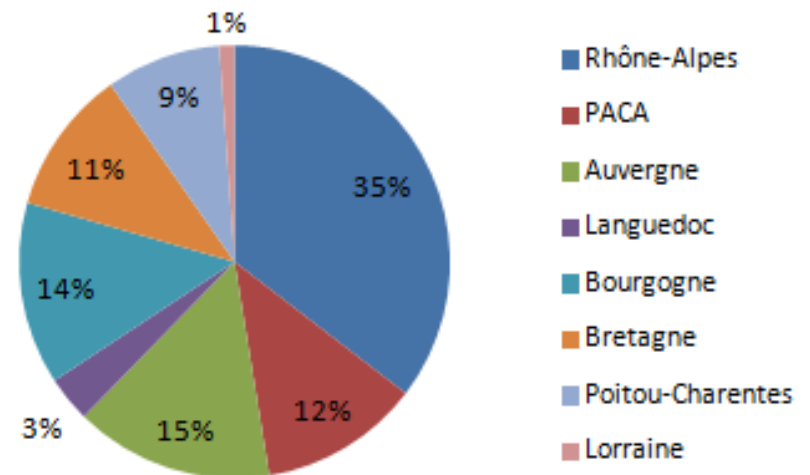


## ○ Samples

From different regions of France :

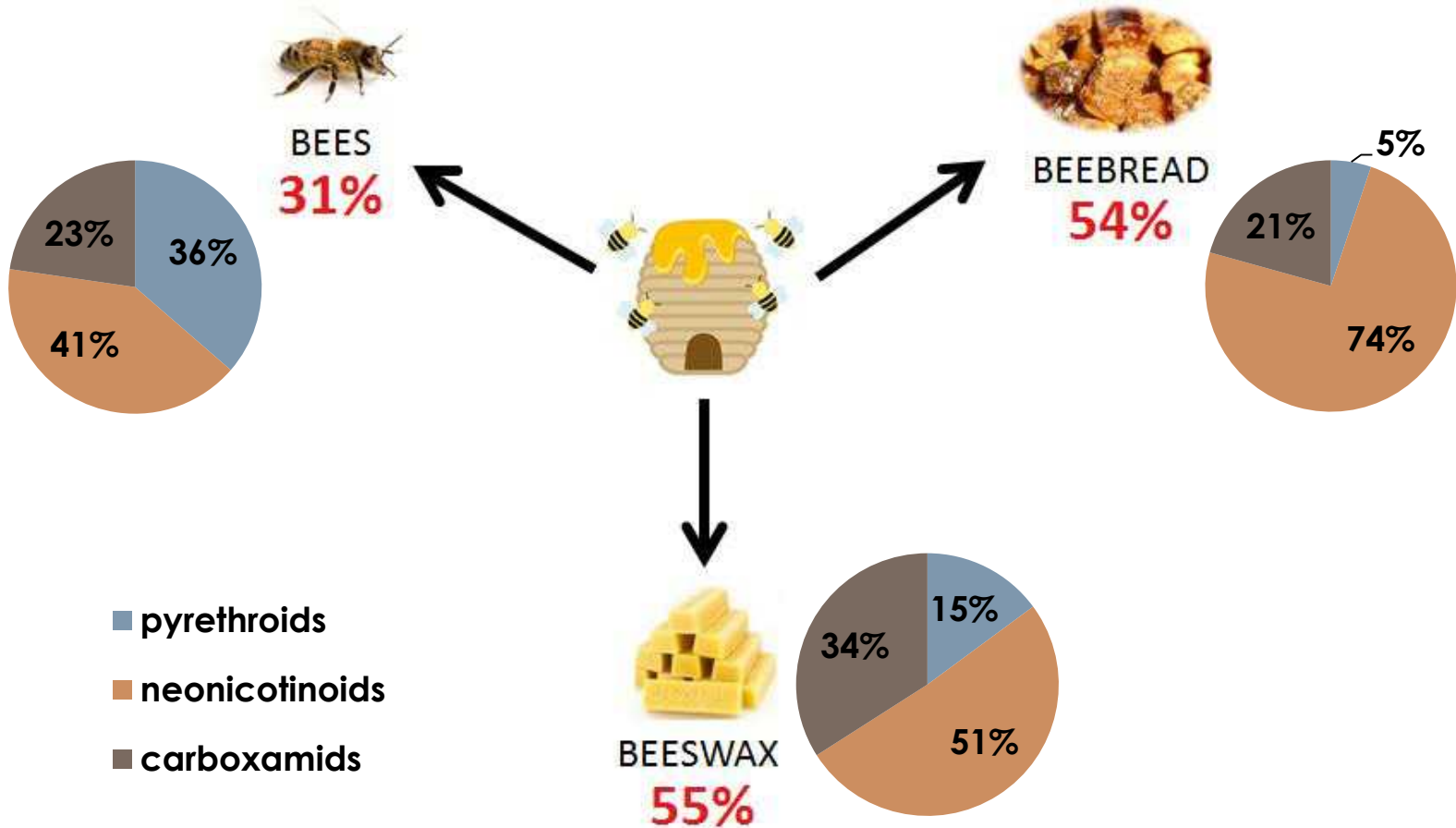


**Geographic sample distribution**



Results

*Percentage of positive samples by matrix and molecule families repartitions*



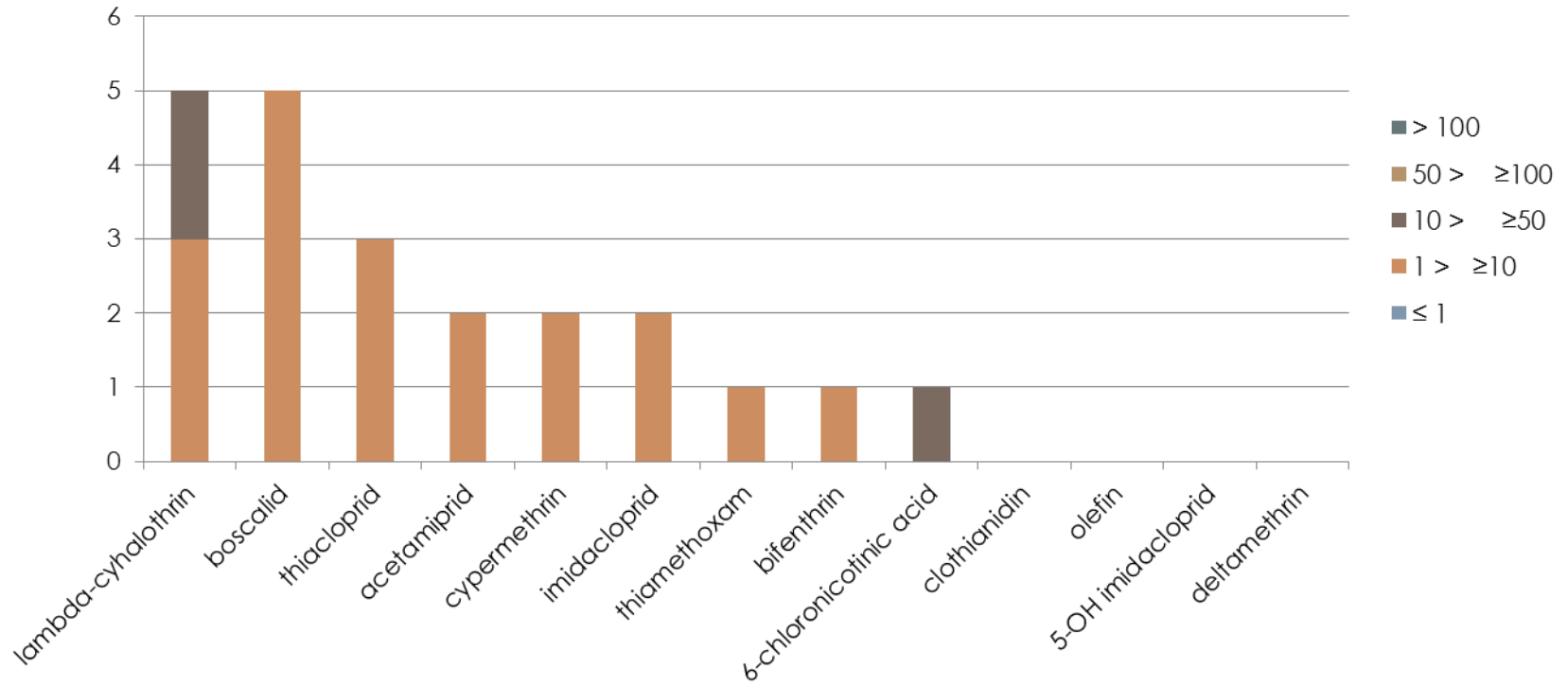
## Results

### BEES



#### Details of the results: molecules and concentration range (ng/g)

Number of positive samples



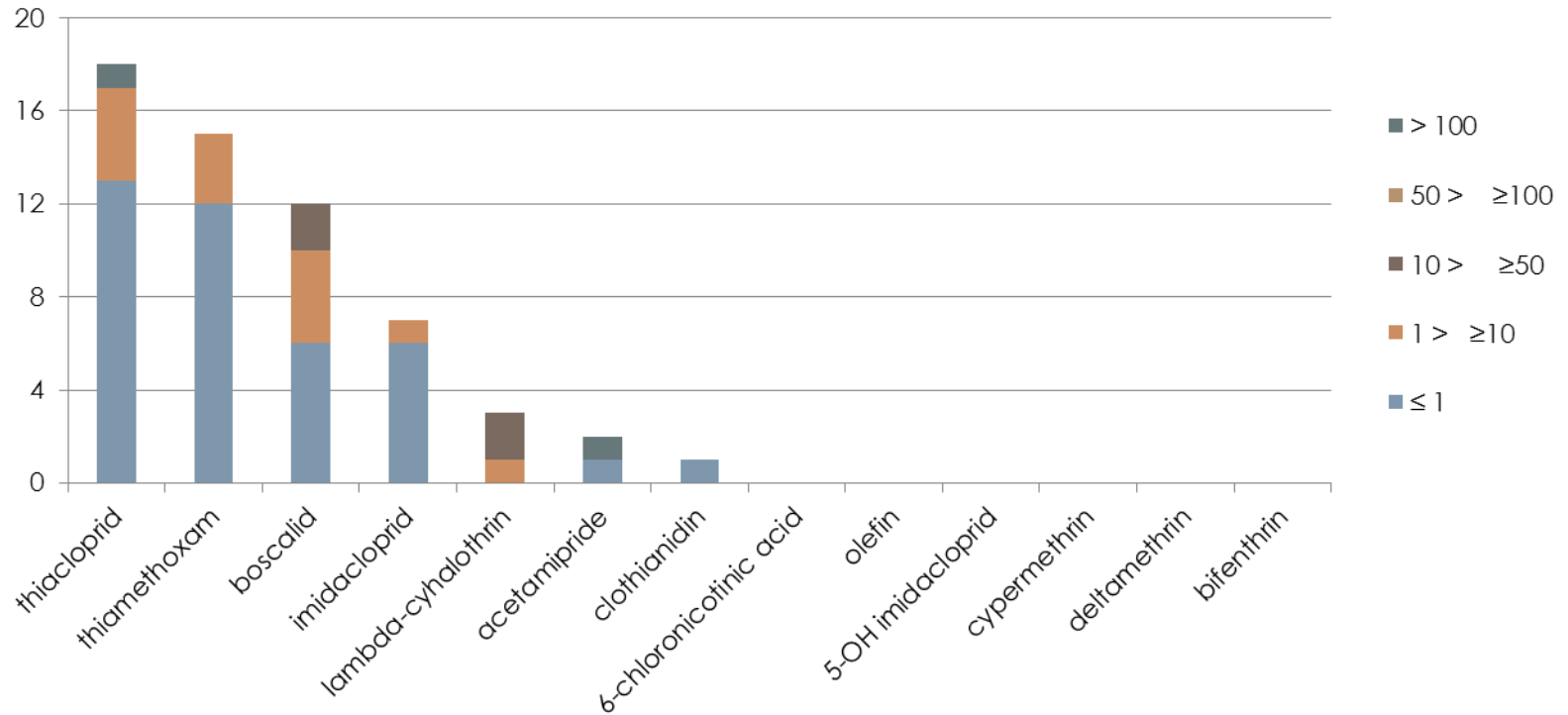
## Results

### BEEBREAD



Details of the results: molecules and concentration range (ng/g)

Number of positive samples



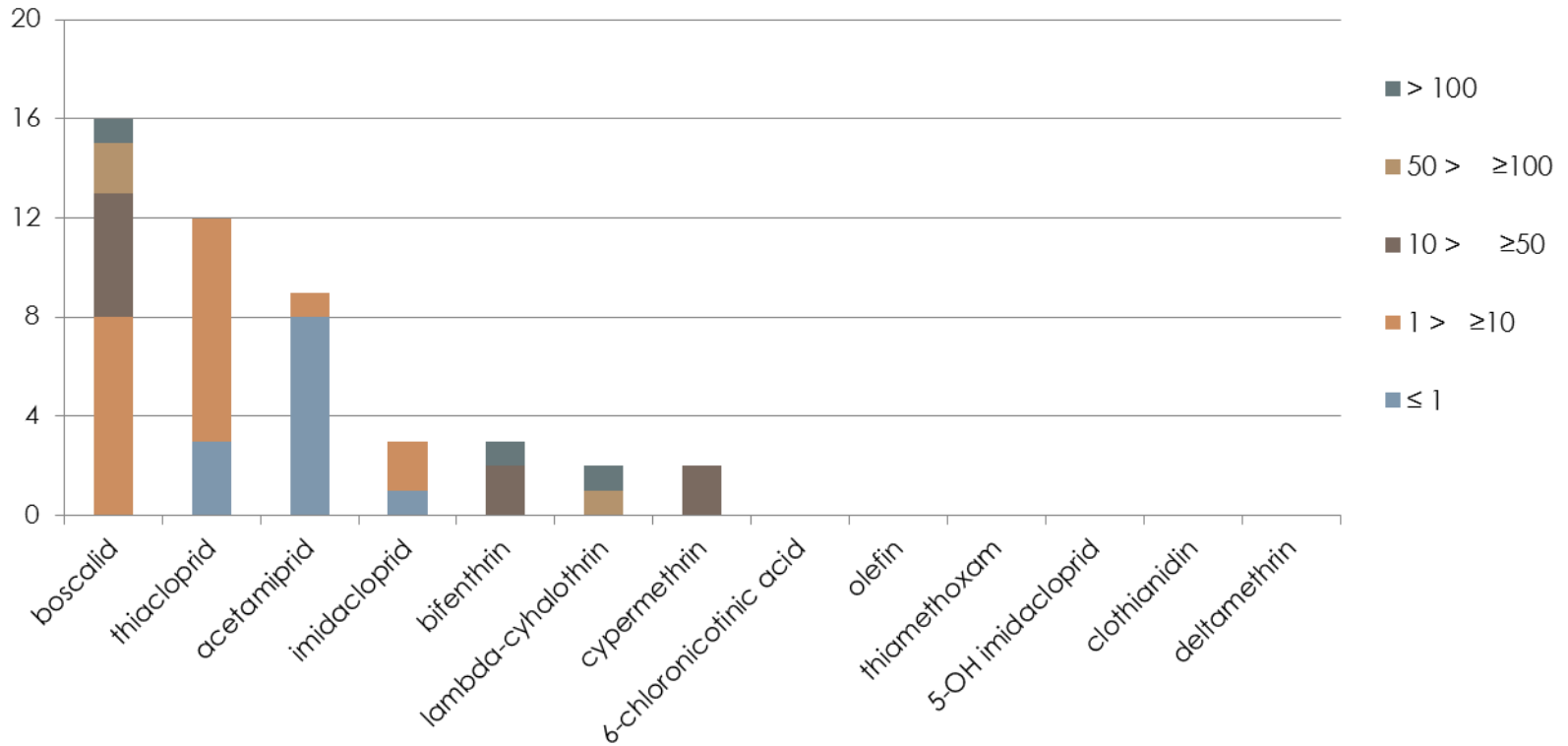
## Results

### BEESWAX



Details of the results: molecules and concentration range (ng/g)

Number of positive samples





○ **Results**

**Number of  
detected  
compounds**



**BEES**



**BEESWAX**



**BEEBREAD**

**Found  
concentrations**

## ○ Results

- Results interpretation currently continues with beekeeping associations
  - geographic distribution
  - contamination distribution in beehives
  - environment
  - history
  - ...
  
- Global results soon published



- Analytical: 3 analytical extraction methods for the 3 matrices for native molecules and known metabolites
- Application: first results show the presence of the 3 pesticide families in the 3 matrices
- Work to come:
  - To extend interpretation of results with beekeepers
  - To follow new metabolites in bees
    - Establish a link with toxicology (collaboration with Pr. Luc Belzunces I.N.R.A - France)

# ACKNOWLEDGEMENTS



Rhône-Alpes <sup>Région</sup>



## CONTACT DETAILS

**First name**

**and name:** Claire Jabot

**E-mail:** [c.jabot@sca.cnrs.fr](mailto:c.jabot@sca.cnrs.fr)

**Function:** PhD student

**Address:** Equipe T.R.A.C.E.S (CNRS)  
I.S.A (Institut des Sciences Analytiques)  
5, rue de la Doua  
69100 Villeurbanne  
FRANCE

