

**EFFECTS OF PESTICIDE USE ON THE DEVELOPMENT OF BEE  
DISEASES-ANALYTICAL AND ECOTOXICOLOGICAL THREATS AND  
CHALLENGES**

*National Institute for Agricultural and Food Research and Technology, INIA  
7<sup>th</sup>- 8<sup>th</sup> November 2016*



# Methodologies for field assessment of the effects of insecticides on wild pollinators: foliar treatment on peaches



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# Importance of pollinators

About 90% of plants are pollinated by animals, mainly insects

## Environmental services

- Maintaining plant biodiversity



## Agricultural benefits

- 35% of global agricultural production comes from crops that depend on pollinators (i.e. one third of human food is mainly from plants pollinated by insects).
- 87/109 main crops for human consumption (80%) require insect pollination for seed production and/or to enhance product quality and yields) (Klein et al. 2007).
- Estimated value of crop pollination: 153 billion €/year worldwide and 22 billion €/year in Europe (Gallai et al. 2008).



# Main pollinators

Wild pollinators

Anthophila  
"Bees"

Other Hymenoptera  
"Wasps"...

Coleoptera  
"Beetles"

Diptera  
"Flies"

Lepidoptera  
"Butterflies"



Wild bees

*Apis* spp.  
"Honey bees"



*Bombus* spp.  
"Bumblebees"



"Solitary bees"



# Wild Bees

“Bumblebees” (*Bombus* spp.)



“Solitary bees”



- High diversity (>20,000 species worldwide; 2,000 in Europe; 1,000 in Iberian Peninsula)
- Underestimated role as pollinators (2/3 in UK, Breeze *et al.* 2011)
- Specialized pollinators: co-evolved with specific flowering plants (very effective)
- Different range of tolerances for environmental conditions
- Very sensitive to changes in habitats: need of nesting sites, lower flight distances
- Many endemism (400 to Europe) and threatened species

**Importance of checking abundance/diversity and identifying risk factors**

# Wild Bees - contamination with insecticides

Direct contact

Pollen and nectar from crops




Pollen and nectar from weeds and other non-crop plants

Soil (ground nesting species)



Material for nesting: vegetal, mineral



# Analysis of neonicotinoids impact on the abundance and diversity of wild pollinators in peach crops

Murcia

- An important fruit crop (14,363 ha, 392,548 t in 2015)
- Broad and common use of neonicotinoids

# Insecticides in peach orchards (Murcia)

Aphids

**Imidacloprid**

~~Winter (before flowering)~~

Spring (after flowering)

**Acetamiprid**

Spring (after flowering)

**Flonicamid**

Spring (after flowering)

Trips

**Acrinatrín**

Flowering, after flowering

**Spinosad**

After flowering

Anarsia

**Deltramethrin**

After flowering

**Thiamethoxam**

After flowering

**Thiacloprid**

After flowering

Ceratitis

**Lambda-cyhalothrin**

After flowering

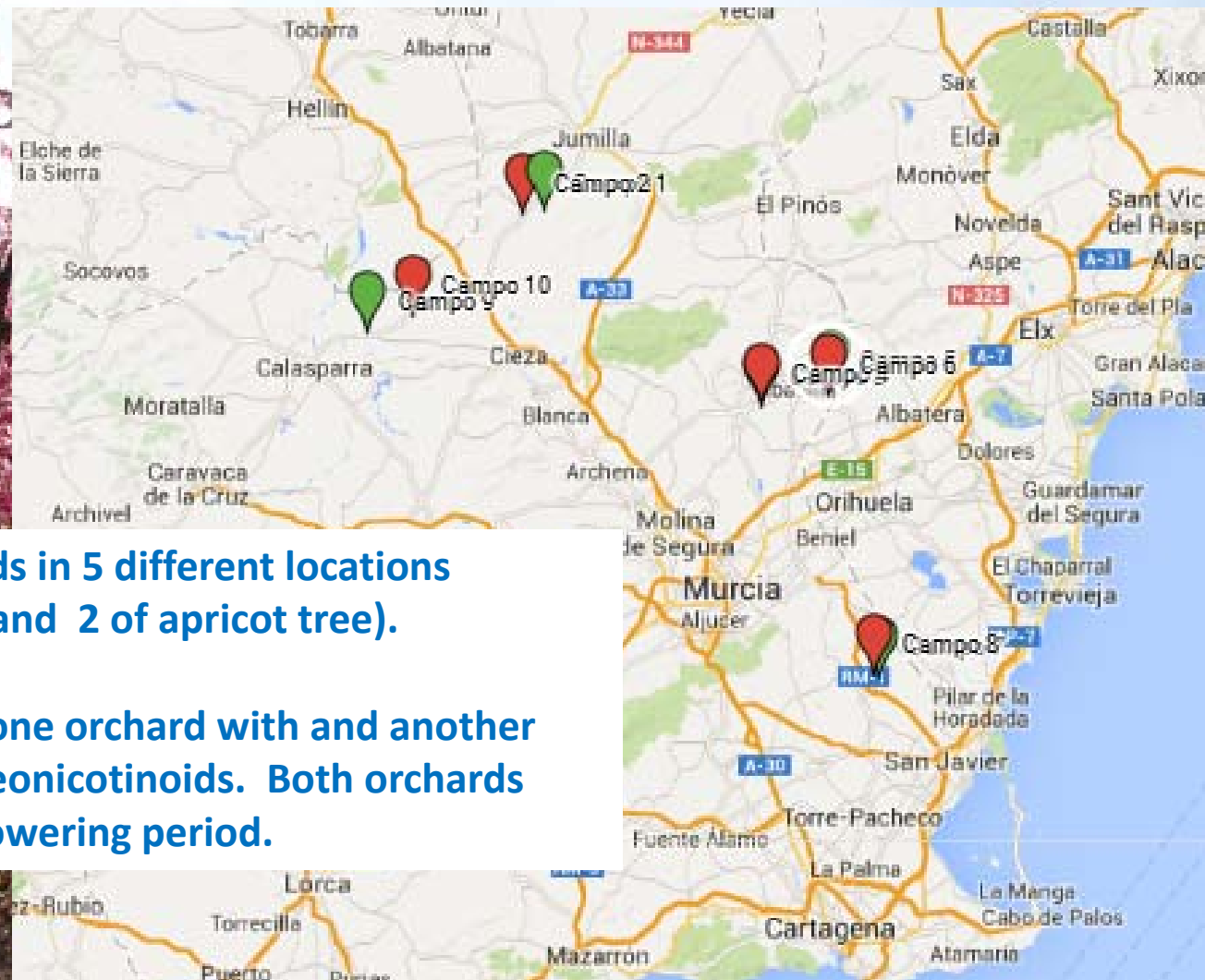
**Cypermethrin**

After flowering

**Spinosad**

After flowering

## SELECTION OF SAMPLING ORCHARDS



- 10 paired orchards in 5 different locations (8 of peach tree and 2 of apricot tree).
- In each location one orchard with and another without use of neonicotinoids. Both orchards with the same flowering period.



## MEASURING BEE DIVERSITY and ABUNDANCE

Pan traps



Preferred colors of bees: yellow, white, and blue (UV-bright).  
Water with soap.

Observation



“Observation plots” or “transect walks”.  
Experienced surveyors and a known fauna.

Trap nests



Reed internodes (*Phragmites australis* or *Arundo donax*), or paper tubes.

WESTPHAL et al. 2008. Measuring bee diversity in different european habitats and biogeographical regions. *Ecological Monographs*, 78(4), pp. 653-671

The most efficient, unbiased, and cost-effective method.

For detailed studies focusing on plant–pollinator associations.

Complementary method to maximize the numbers of collected species. Good indicator of bee diversity.

# MEASURING BEE DIVERSITY and ABUNDANCE

WESTPHAL et al. 2008. Measuring bee diversity in different european habitats and biogeographical regions. *Ecological Monographs*, 78(4), pp. 653-671



## Pan traps

- 500-mL plastic soup bowls.
- Painted with UV-bright colours:
  - yellow, Sparvar-RAL-3104
  - white, Sparvar-RAL-3108
  - blue, Sparvar-RAL-3107
- Mounted on a wooden pole at vegetation height.
- 400 mL of water and a drop of detergent.
- Active for 48 hours.
- At flowering stage and in early summer.

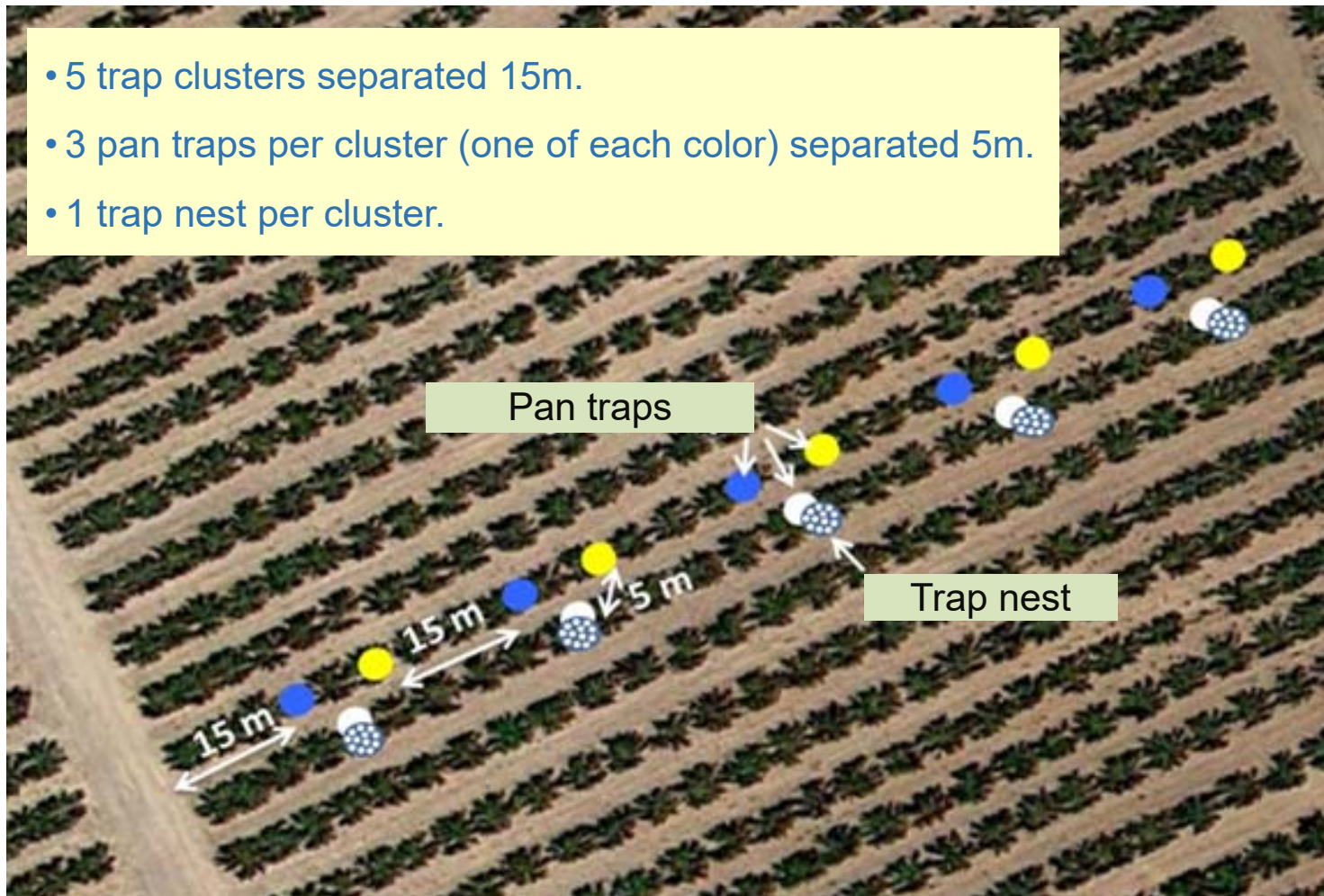
## Trap nests

- Reed internodes (*Phragmites australis* and *Arundo donax*) (60-100 stems per trap; 6-12mm Ø; 10-15cm long).
- In a PET bottle and mounted on a wooden pole at vegetation height.
- Active from flowering to fall foliage.
- 3 months at 4°C and hatched adults identified.

# MEASURING BEE DIVERSITY and ABUNDANCE

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- 5 trap clusters separated 15m.
- 3 pan traps per cluster (one of each color) separated 5m.
- 1 trap nest per cluster.



# SAMPLES PROCESSING



- Specimens stored frozen.
- Dried and pinned (extraction of male genitalia).
- Identified to species.



Abundance  
and diversity

Chemical analysis for  
insecticidal residues



*Thank you!!!*