

Genetics and biology of the mango blossom gall midge, *Procontarinia mangiferae*, a pest with highly adaptable life strategies



P. Amouroux, H. Delatte, S. Nibouche, J. Chadœuf and F. Normand
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Photo: A. Franck - CIRAD

The mango blossom gall midge, *Procontarinia mangiferae*

The only *Procontarinia* species feeding on several mango organs



Inflorescences



Very young fruits

Reproductive organs

Vegetative organs

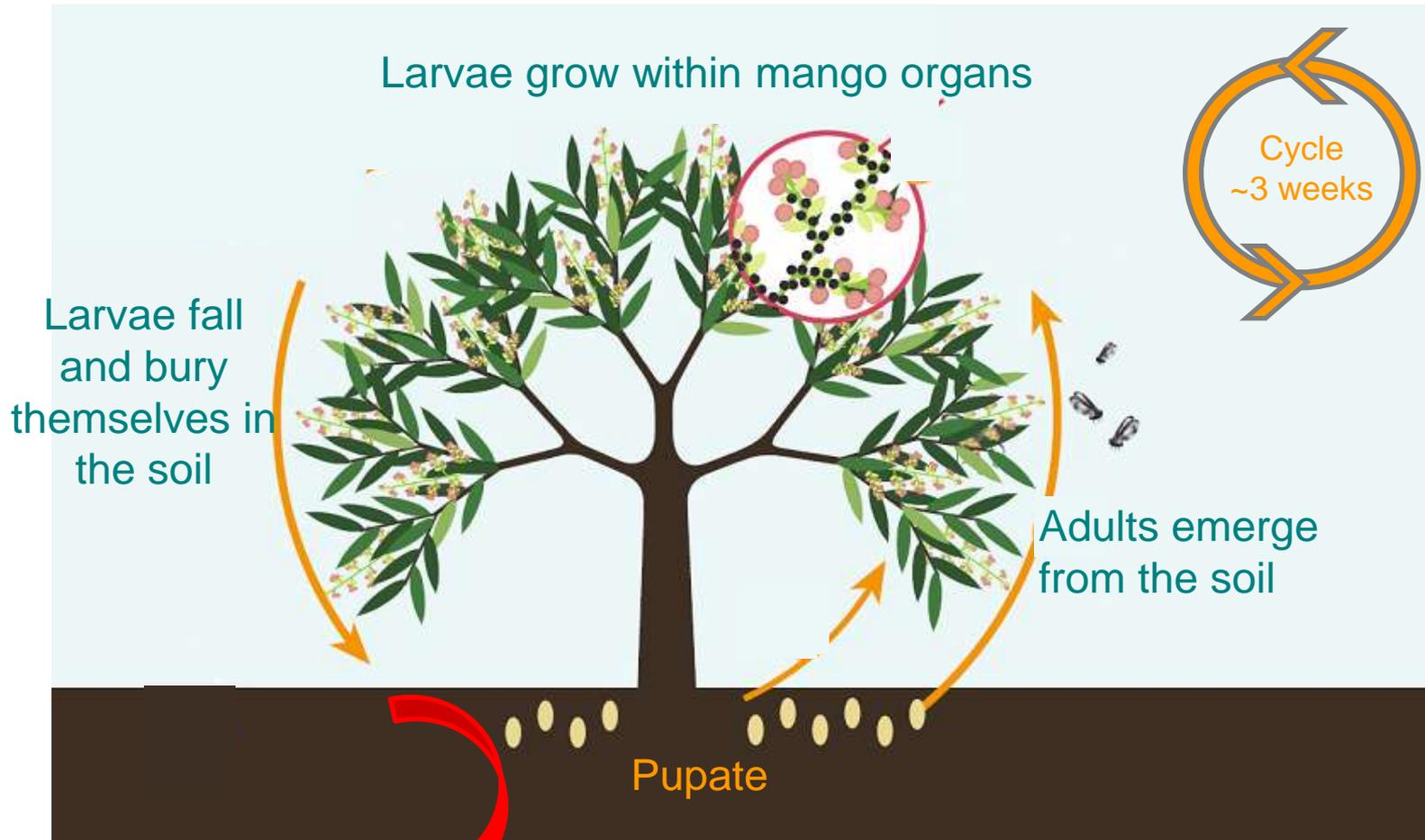
Young growth units



Young leaves



Biological cycle of *P. mangiferae*



End of the flowering season
→ 100% diapause (Prasad, 1971)

Objective : to improve our knowledge of the biology of *P. mangiferae* in order to develop IPM strategies

- by describing its **genetic diversity** and assessing the determinants of the genetic structure of its population
- by understanding **the diapause strategies** involved in maintaining populations from one flowering season to the other
- by modeling **the female dispersion** within and between orchards

Genetic diversity and structure of populations

- **Objectives of this study**

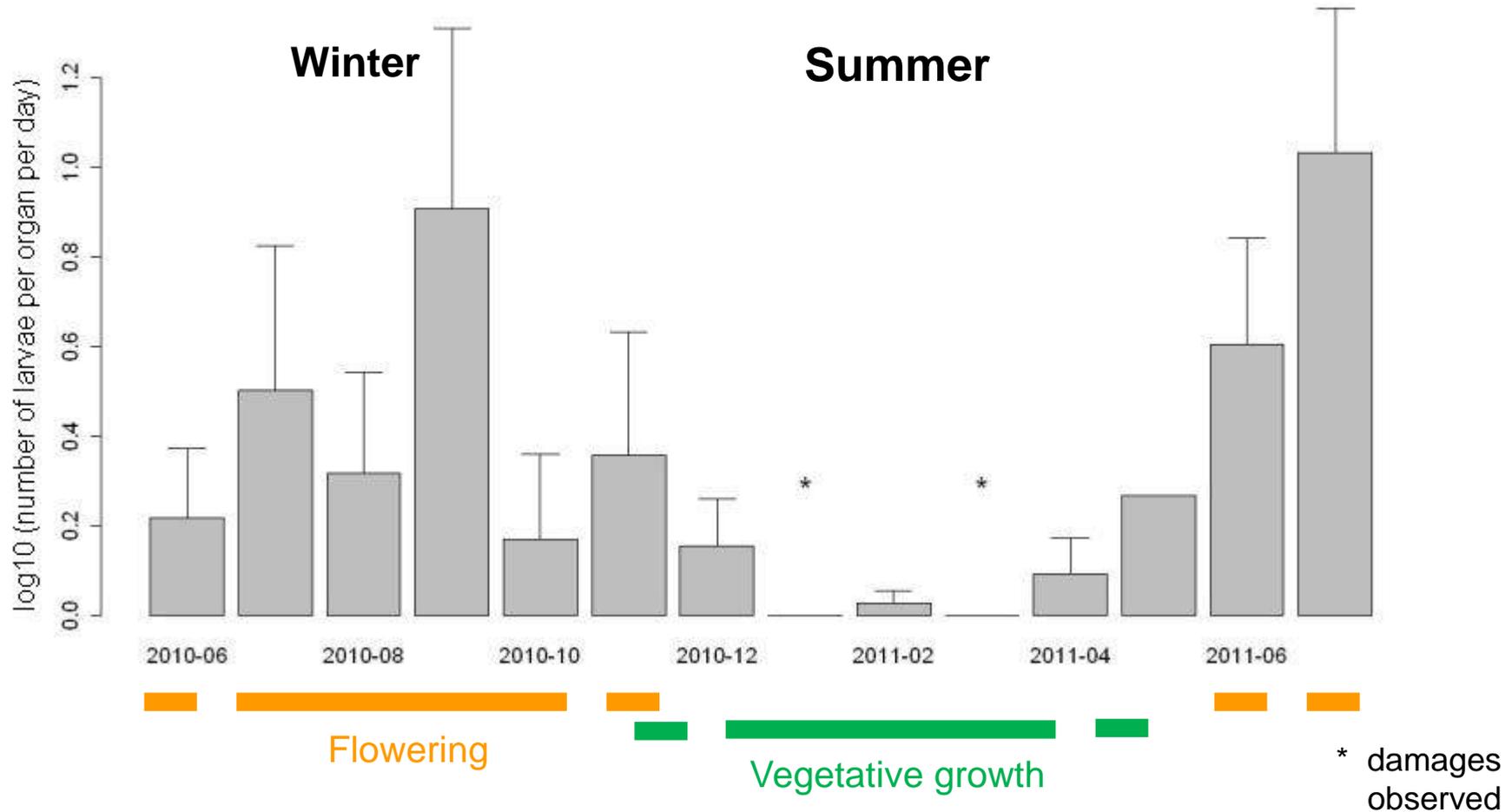
- When is *P. mangiferae* present in Reunion island?
- Are the populations genetically structured according to biotic and/or abiotic factors?

- **Materials and Methods**

- Field surveys of larvae populations during 14 months in three orchards
- Genetic studies were performed using:
 - 1 mitochondrial gene (COI – 370 bp)
 - 11 newly developed microsatellites

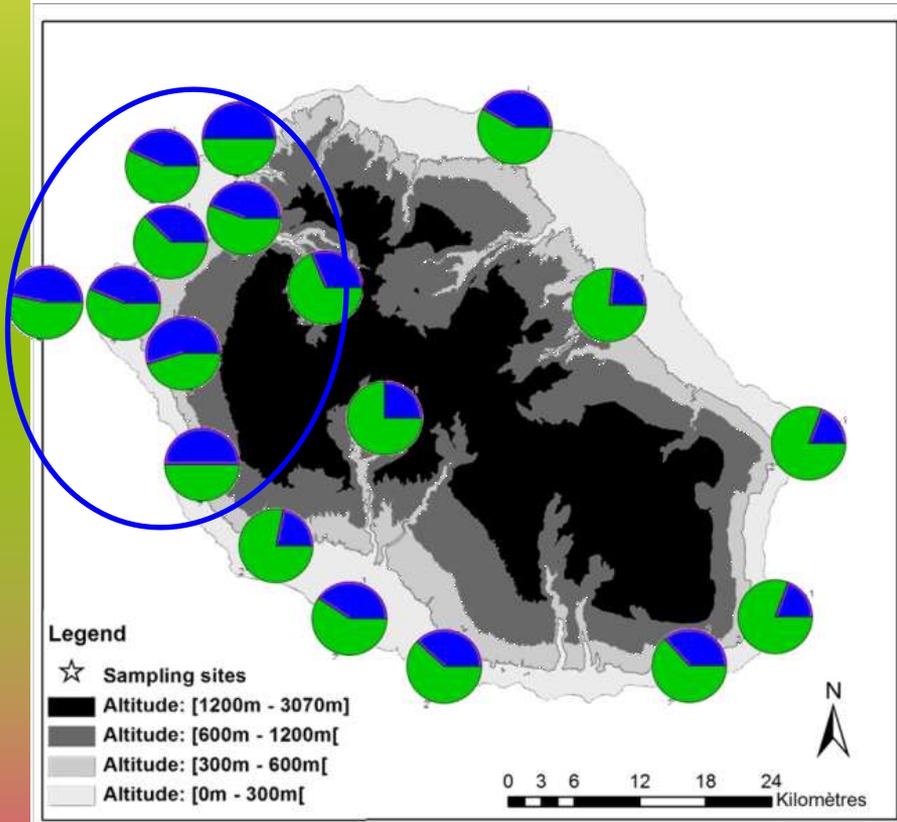
(Amouroux et al., 2012, *Mol Ecol Ressources*)

When is *P. mangiferae* present in Reunion island?



- ✓ *P. mangiferae* is **present all year** round in mango orchards, feeding on **young leaves or inflorescences**

Genetic structure of the populations



- Two clusters in sympatry
- One cluster more frequent in the West coast
- West coast = the main mango production area
 - Agricultural practices
 - Density of resources

(Amouroux et al. 2013, *Biological Invasions*)

Diapause of *P. mangiferae*

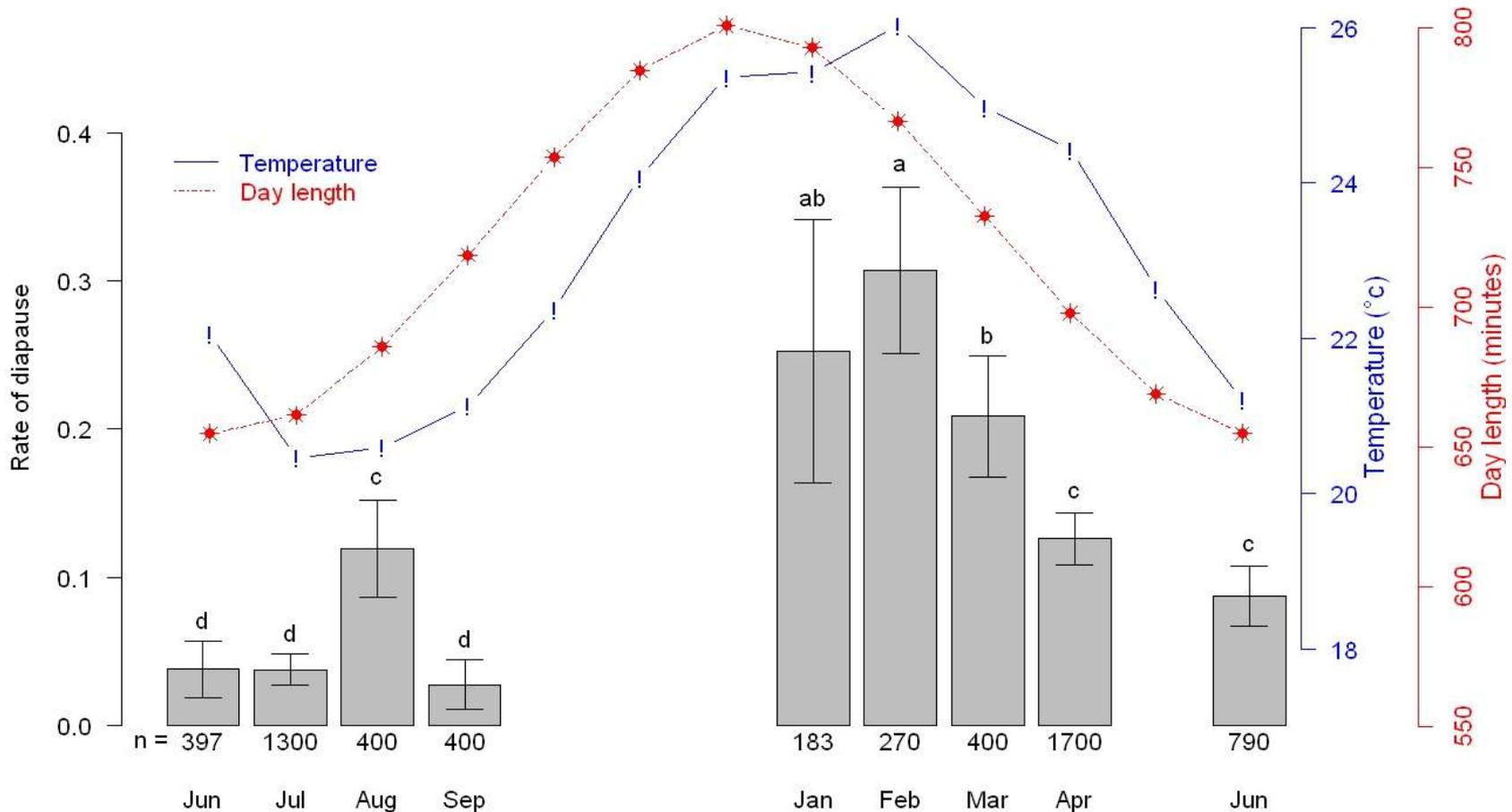
- **Objectives :**

- Is there variation in the rate of diapause induction during the year in natural conditions?
- Has temperature an effect on diapause duration in controlled conditions?

- **Materials and Methods**

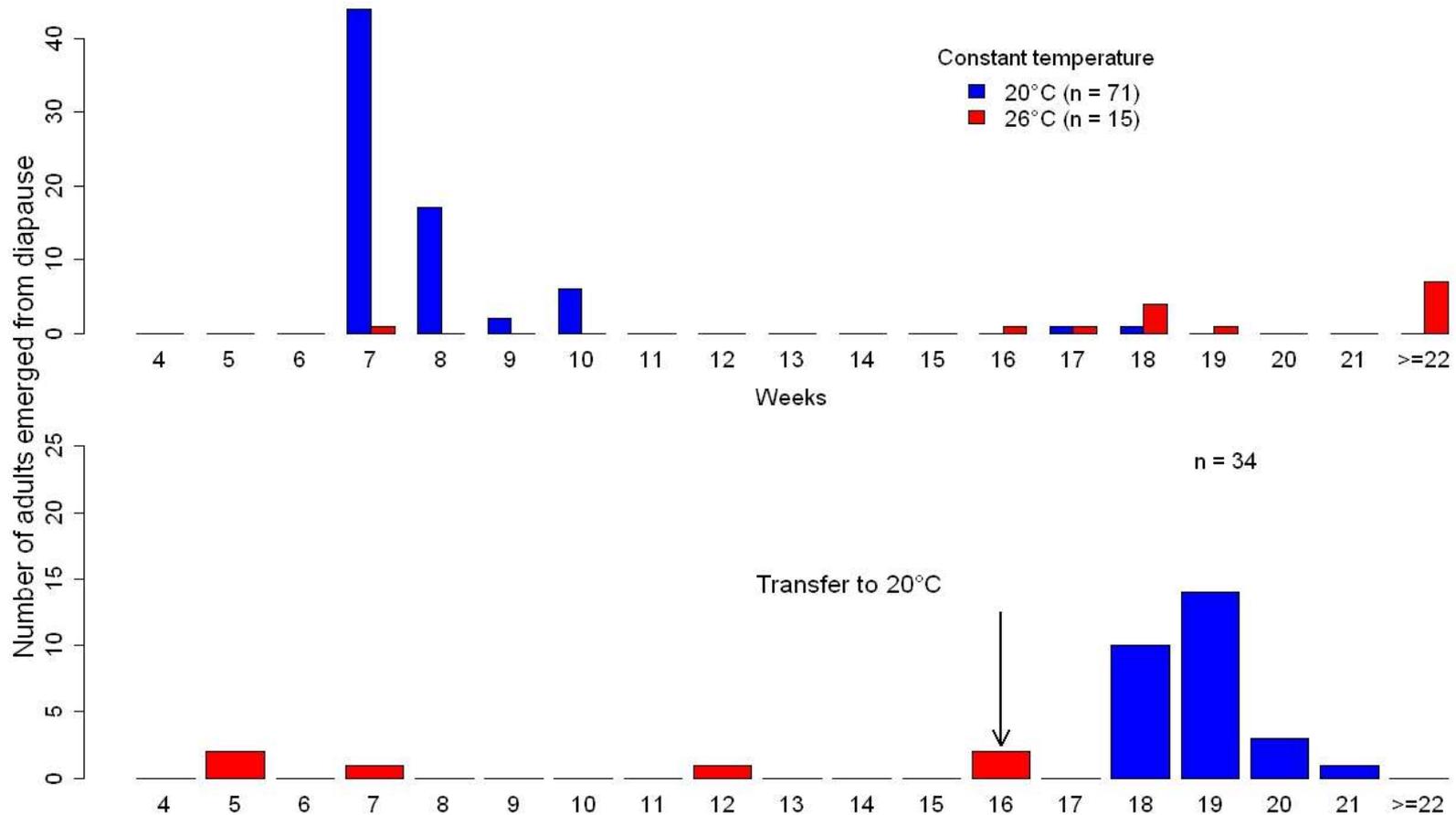
- Measure of the rate of diapause every month during one year
- Laboratory experiments at constant temperatures (26 C and 20 C) and with transfer from 26 C to 20 C

Rate of diapause induction during the year in natural conditions



- ✓ Maximum average rate of diapause : 30%
- ✓ The highest rates of diapause were observed on larvae collected in summer from mango leaves.

Effects of temperature on diapause duration in controlled conditions



- ✓ Diapause duration longer at 26 C than at 20 C
- ✓ A temperature decrease from 26 C to 20 C triggered off the emergence of adults

Dispersal abilities of *P. mangiferae*

- **Objective :**
 - to investigate the ability of *P. mangiferae* females to contaminate a new orchard from surrounding orchards
- **Materials and Methods**
 - measurement and modelling of the number of larvae produced by non-native females in an orchard without native *P. mangiferae*



Main results of the dispersal model

- On average, 4 000 females arrived each day in the orchard (0,5 ha)
- Females landing in the orchard is controlled by the resource density
- Resource attractivity varied according to the phenological stages
- Resources were attractive up to 8 m
- Damages were limited in the « covered » orchard

Conclusions

- One single species is present all year round, feeding on inflorescences and young leaves
- Diapause can occur each month, is maximal in summer but did not exceed 30%
- Emergence after diapause is synchronized by cool temperature
- Numerous non-native individuals can colonize an orchard
- Resources orientate the female flight and are attractive up to 8 m

Consequences for IPM

- Populations must be controlled at a large scale
- Development of strategies to break the cycle of *P. mangiferae* by intercepting larvae falling from mango trees
- Development of strategies against larvae in diapause in the soil and against permanent populations in summer
- Development of orchard management practices favoring the natural predators and parasitoids
- To favor the phenological synchrony in mango orchard

Thanks for your attention

