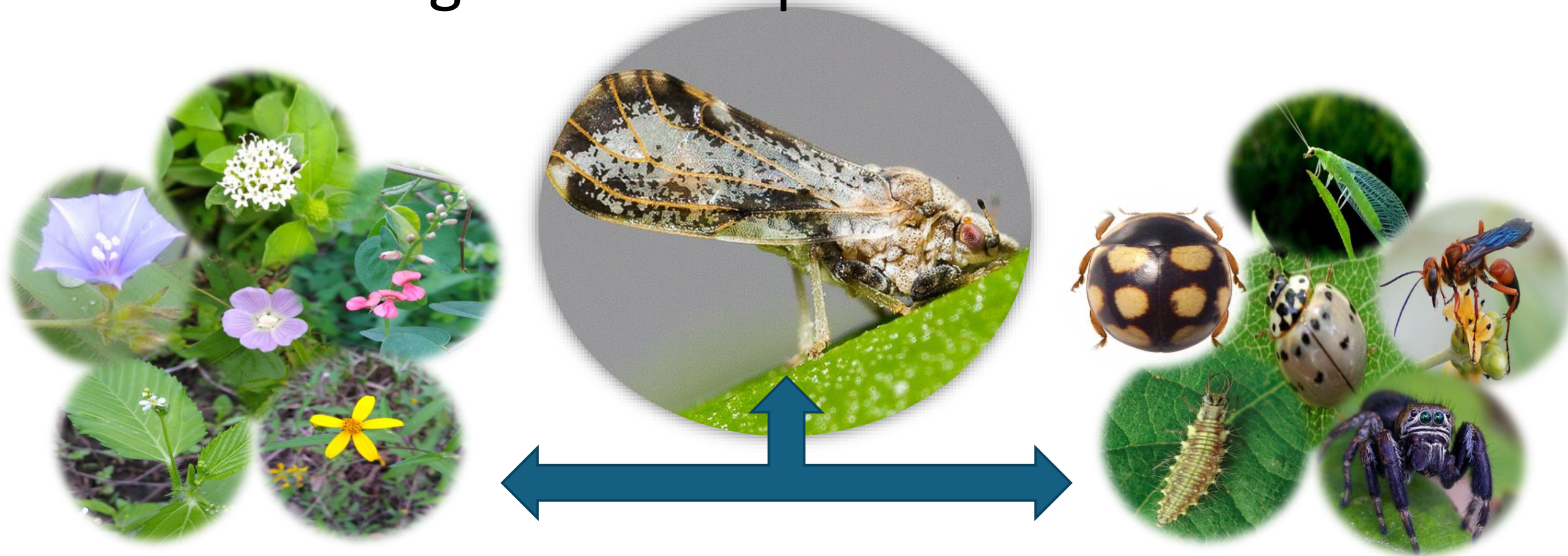




# Biodiversity management for the control of *Diaphorina citri* in organic citrus production

**FiBL**

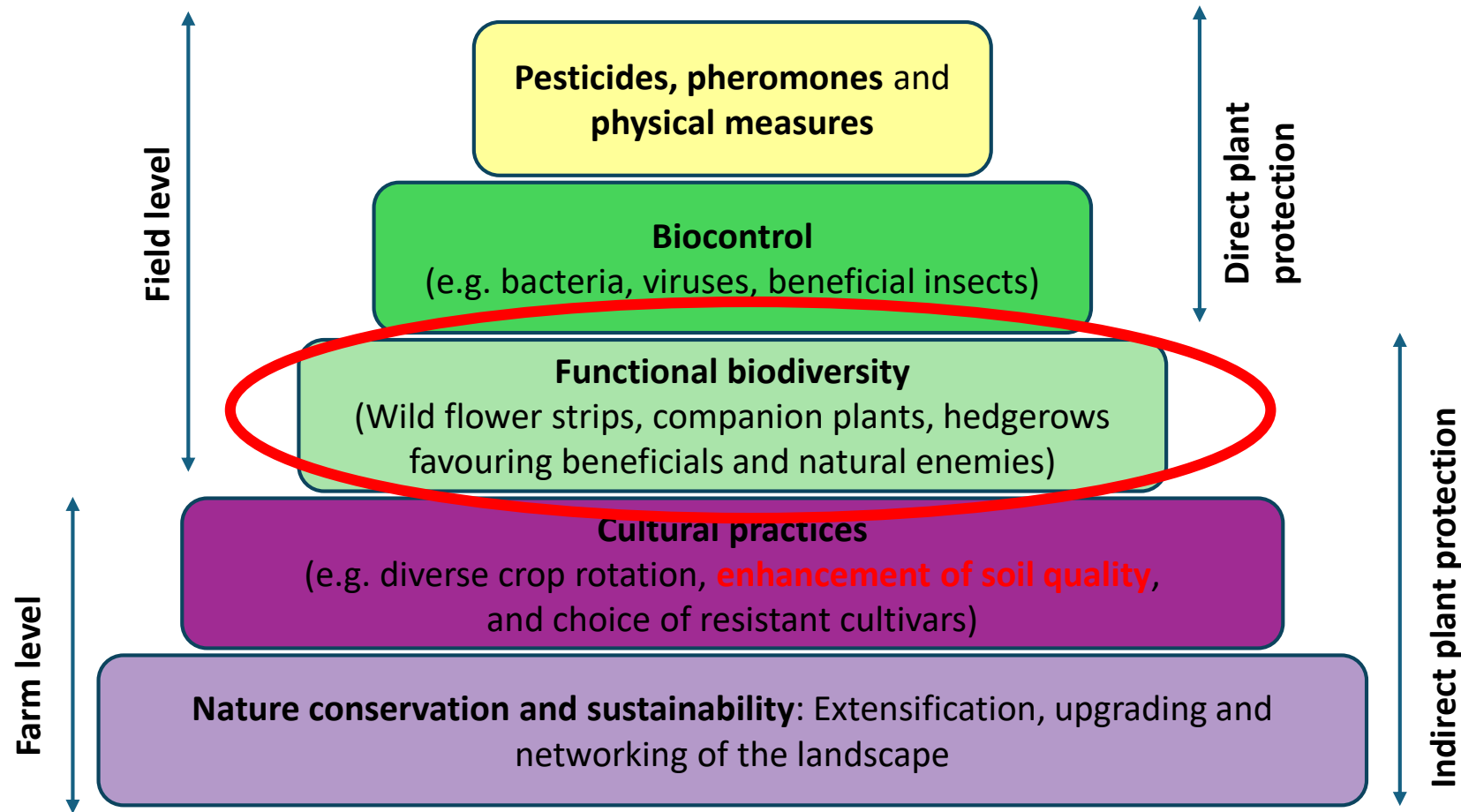


Dr. Carlos Castillejos Cruz  
Facultad de Estudios Superiores Zaragoza UNAM

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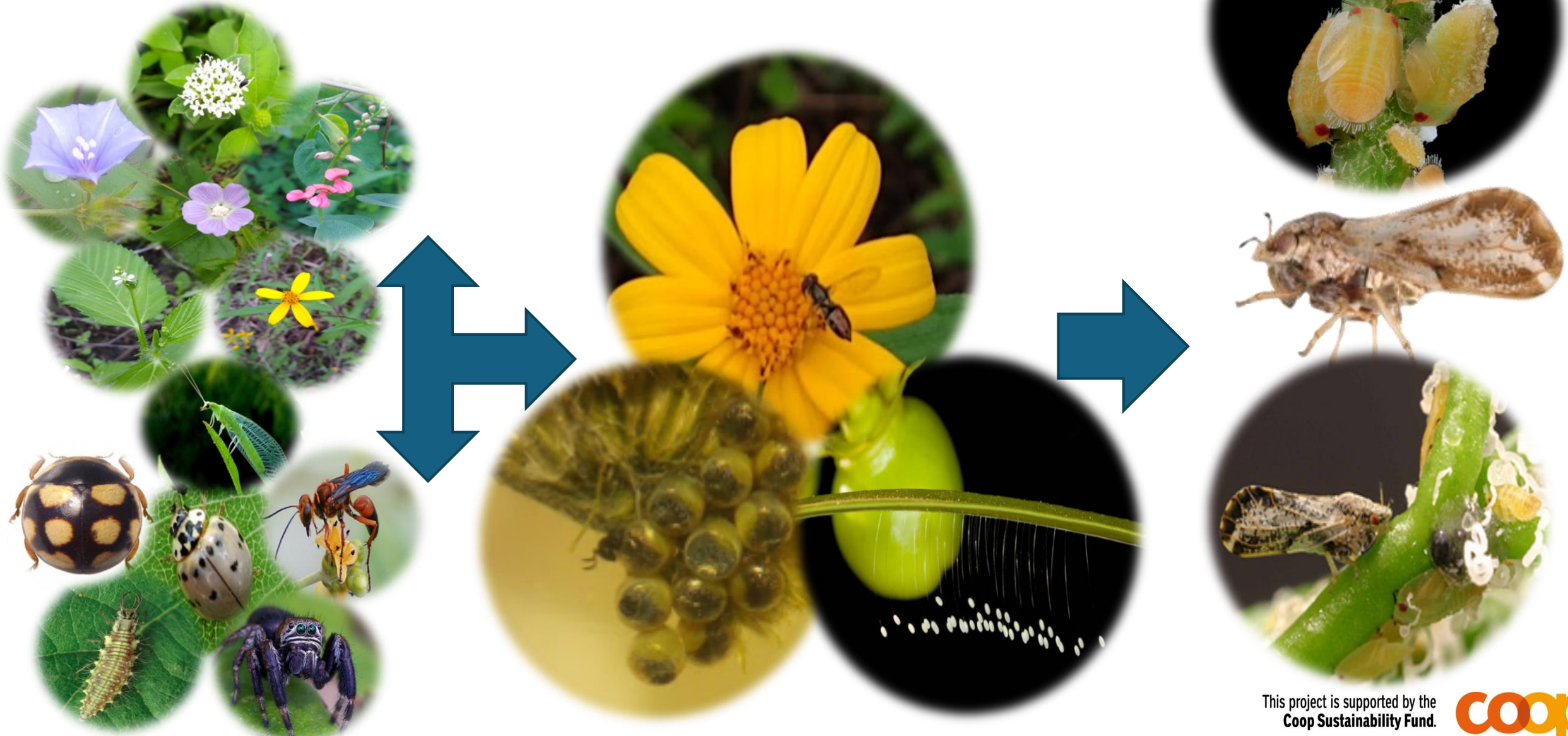


# Crop Protection Strategy in Organic Farming





# What is the role of biodiversity in the control of *Diaphorina citri*?



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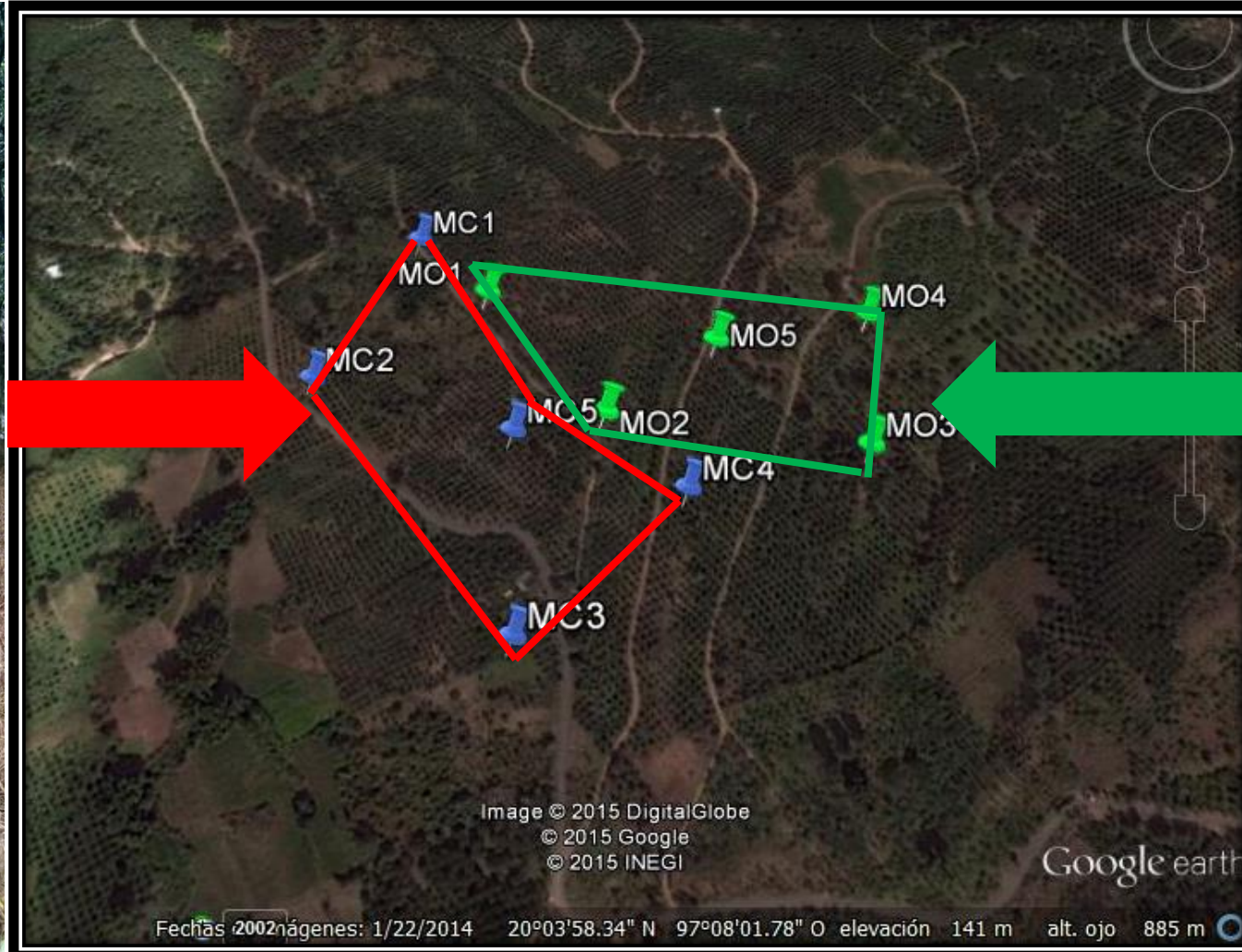




# Comparison Organic management vs. Conventional handling

## Conventional

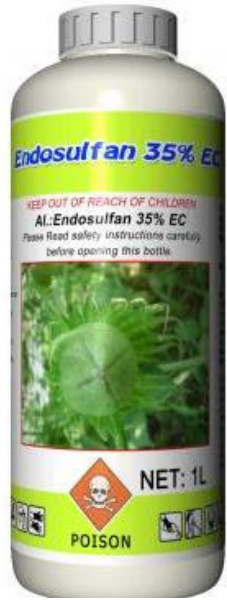
## Organic



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Insecticides  
systemic  
organophosphate

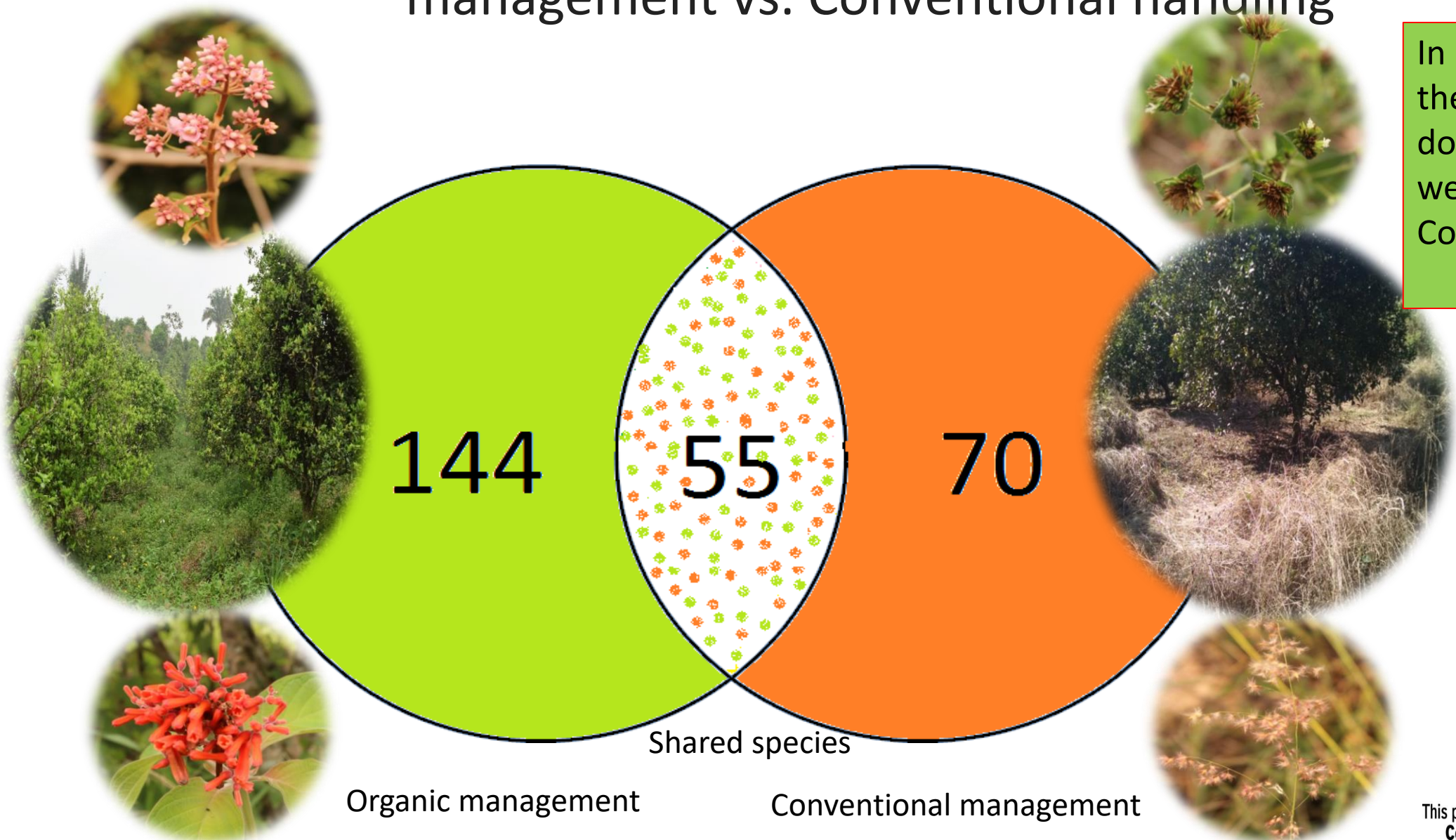


Herbicides  
Glifosate and 2,4-D



# Total species of weeds in the comparison organic management vs. Conventional handling

In the organic orchard there are almost double the species of weeds compared to the Conventional orchard

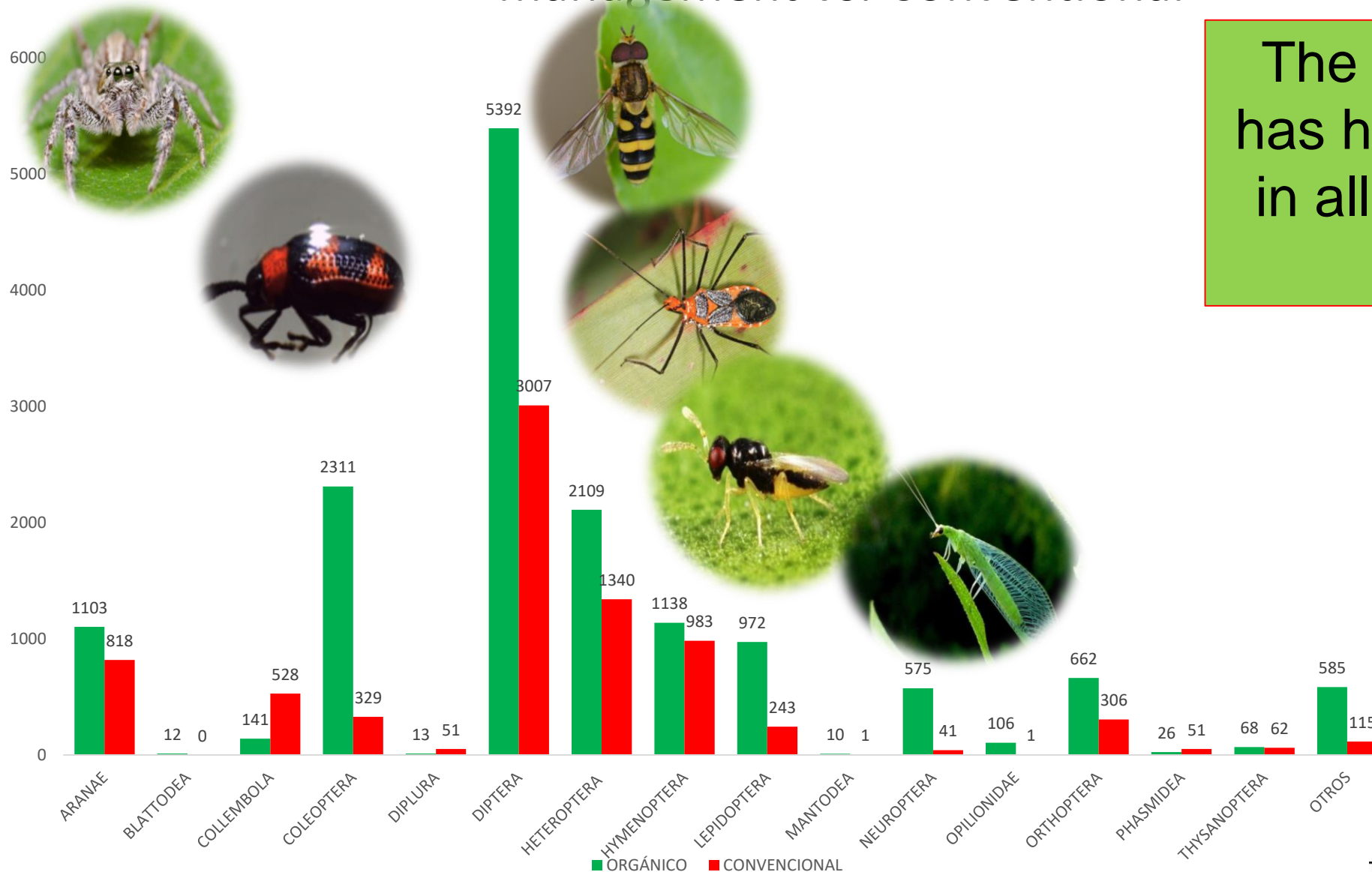


Organic management

Conventional management



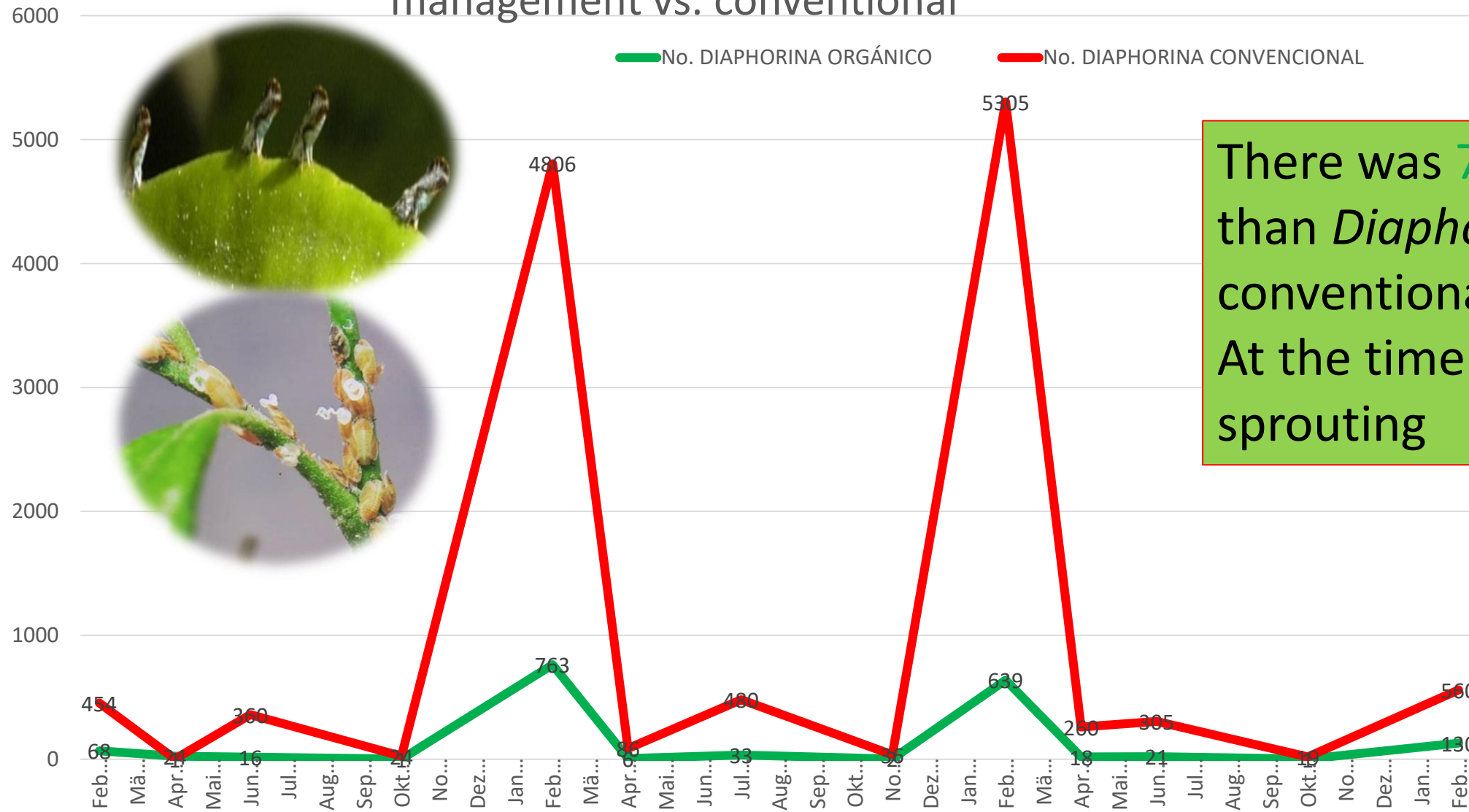
# Abundance of total orders of insects and other arthropods in comparison Organic management vs. Conventional



The organic orchard has higher abundance in all order of insects



# Abundance of *Diaphorina citri* in comparison organic management vs. conventional



There was **700%** more than *Diaphorina* in the conventional orchard. At the time of tree sprouting

Genus in **Coccinellidae** family:

*Chilocorus*,

*Brachiacantha*

*Hyperaspis*

*Olla*

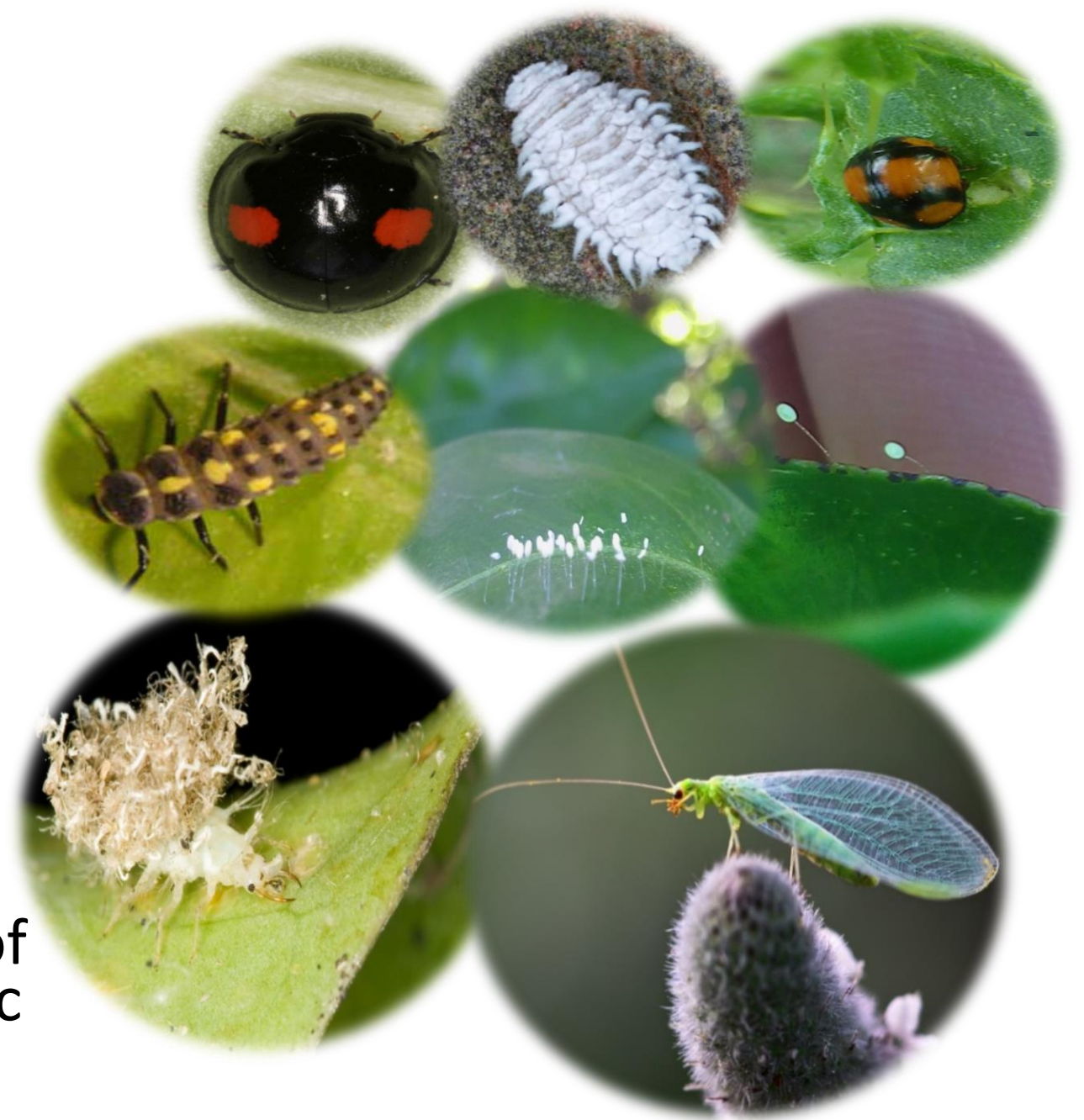
**Chrysopidea**

*Chrysoperla*

**Hemerobidea**

*Ceraeochrysa*

are the most generalist predators of *Diaphorina citri*, presents in organic orchards.





# Conclusions

- More diversity of plants, more insects and less *Diaphorina citri* population.
- Organic management promotes the biological diversity of insects and weeds, which allows the orchard to be more resistant to pest proliferation, therefore, biological control is active and effective against *Diaphorina citri*.
- If herbicides are not applied and weeds, especially broadleaf weeds, are allowed to develop, the population of *D. citri* is reduced (<700%) and this is also applicable to conventional orchards.





# HOW DO WEED MANAGEMENT INFLUENCES THE CONTROL OF *Diaphorina citri*?



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To understand the impact of biodiversity in organic management, we worked in a long-term experimental orchard with differential weed management.



Low cutting of weeds



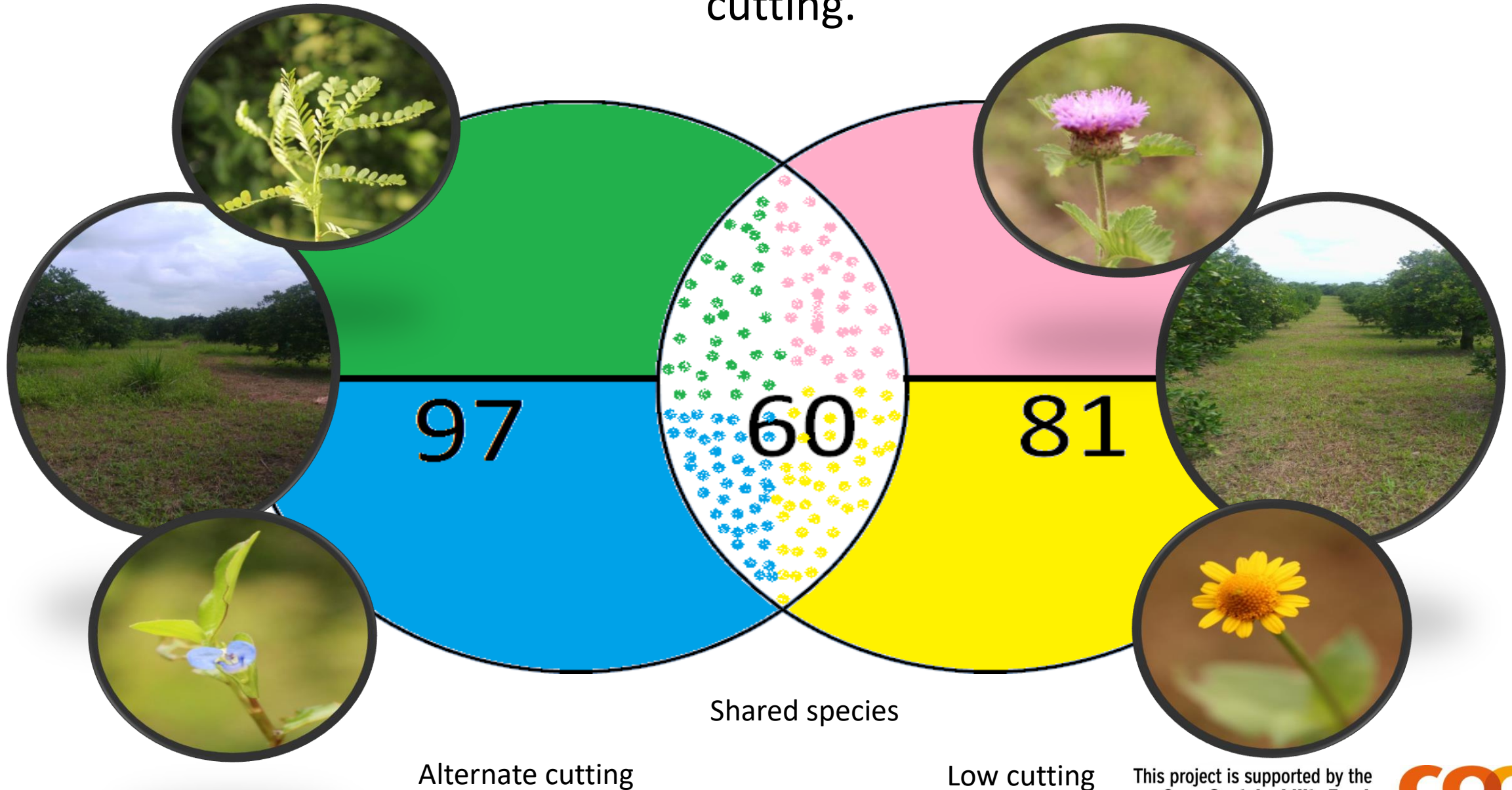
Alternate cutting of weeds

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# Total weed species in the experimental orchard with low and alternate cutting.



Alternate cutting

Low cutting

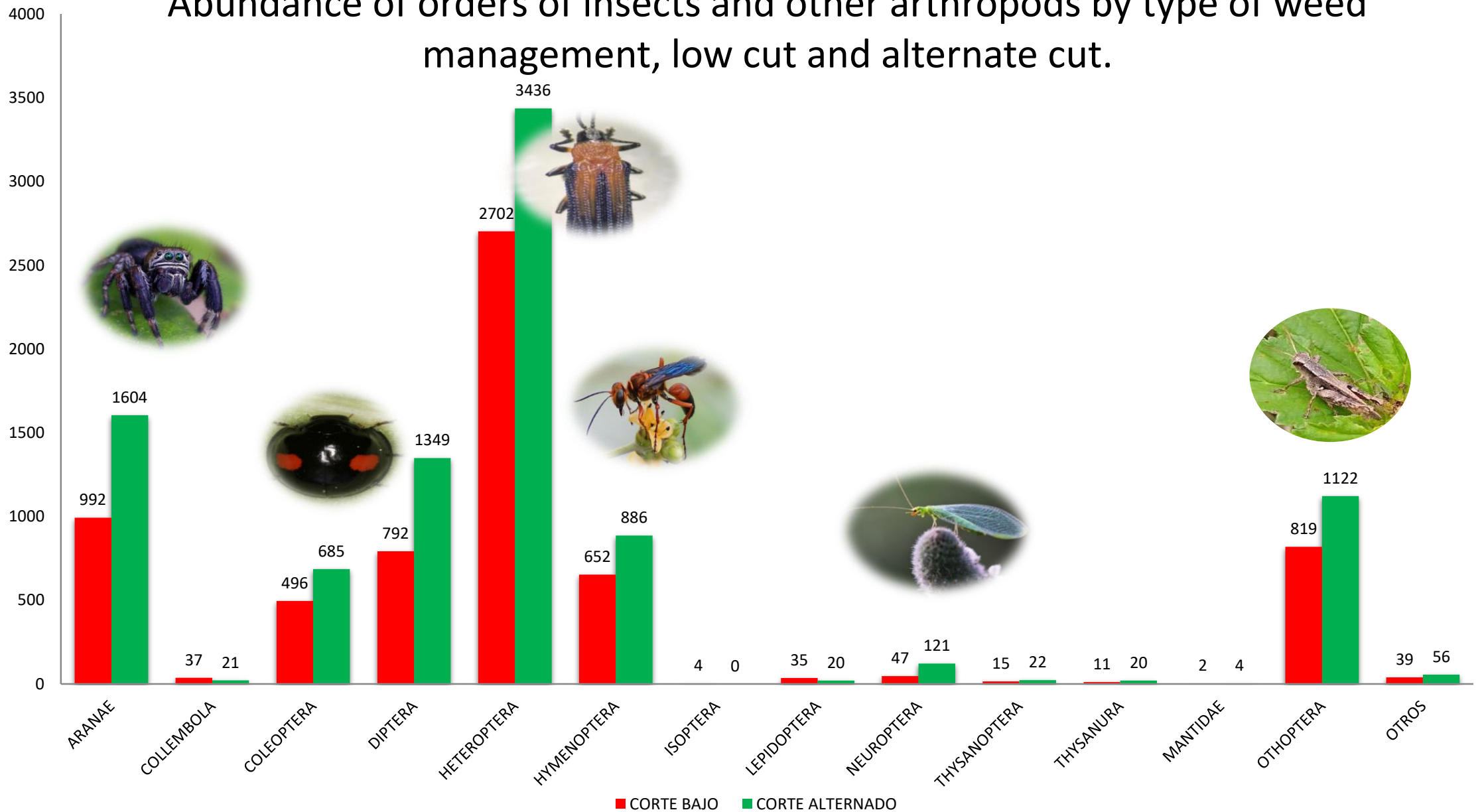
Shared species

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# Abundance of orders of insects and other arthropods by type of weed management, low cut and alternate cut.





# Structural diversity and habitat heterogeneity



Alternate cut (10 -80 cm)

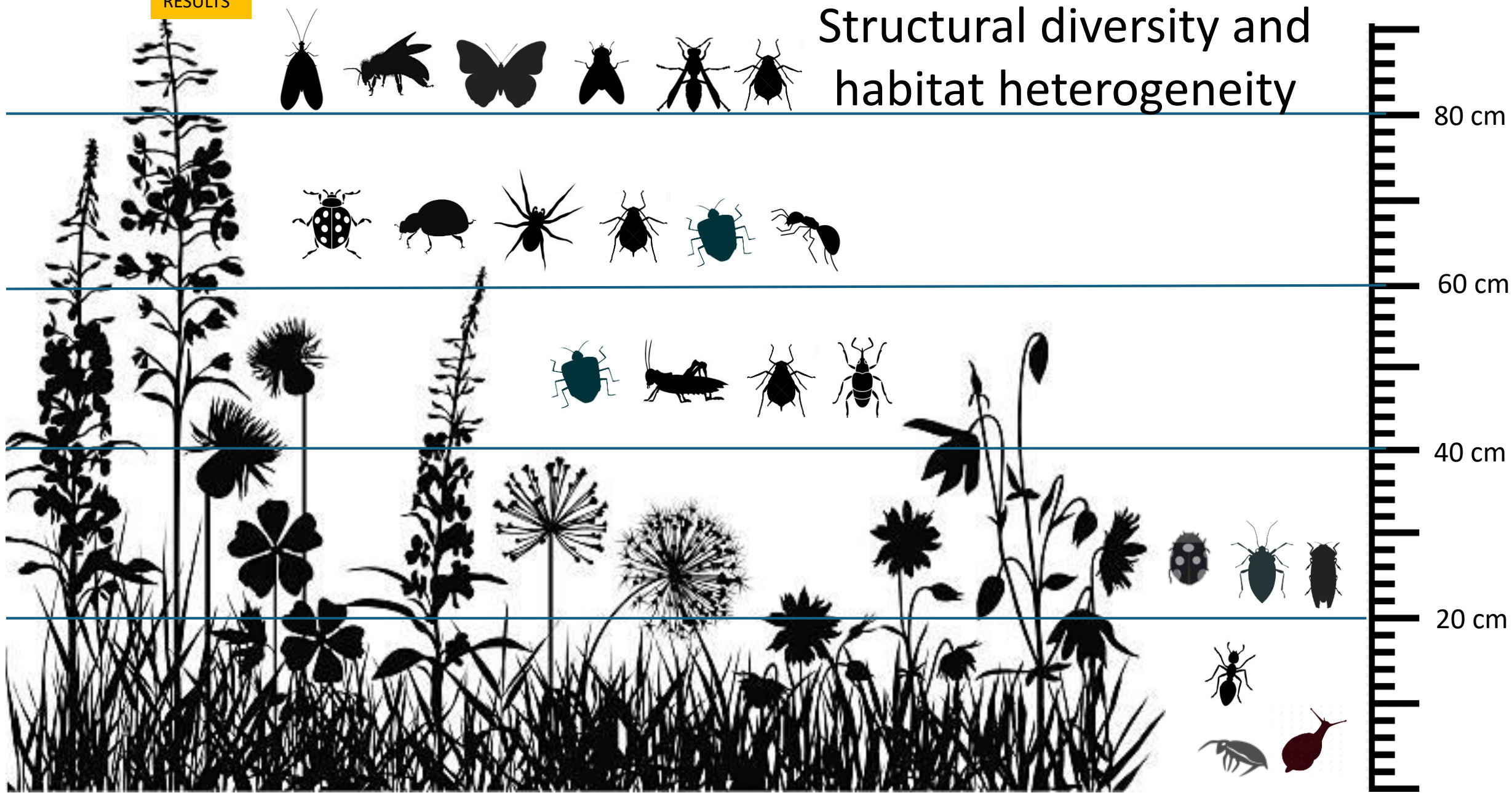
Low cut= (5 -10 cm)

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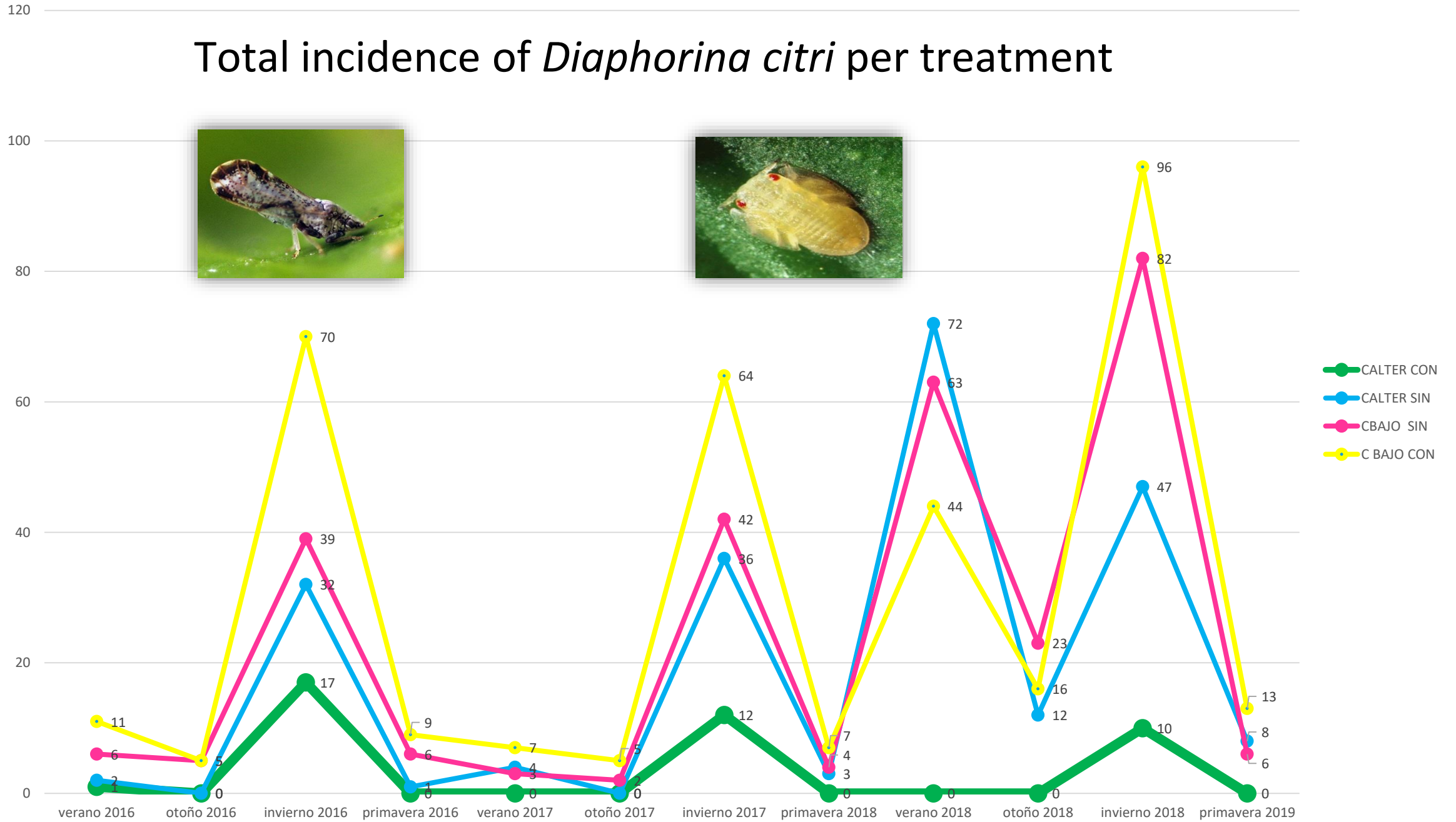


# Structural diversity and habitat heterogeneity





# Total incidence of *Diaphorina citri* per treatment





# HOW DOES ARVENSES AND INSECT DIVERSITY INFLUENCE THE CONTROL OF *Diaphorina citri* IN HIGH INCIDENCE ORCHARDS?



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# Pilot Farms



Alternate cut



Low cut



Grower's cut



Conventional management



# Total number of families, genera, and species found by type of cutting

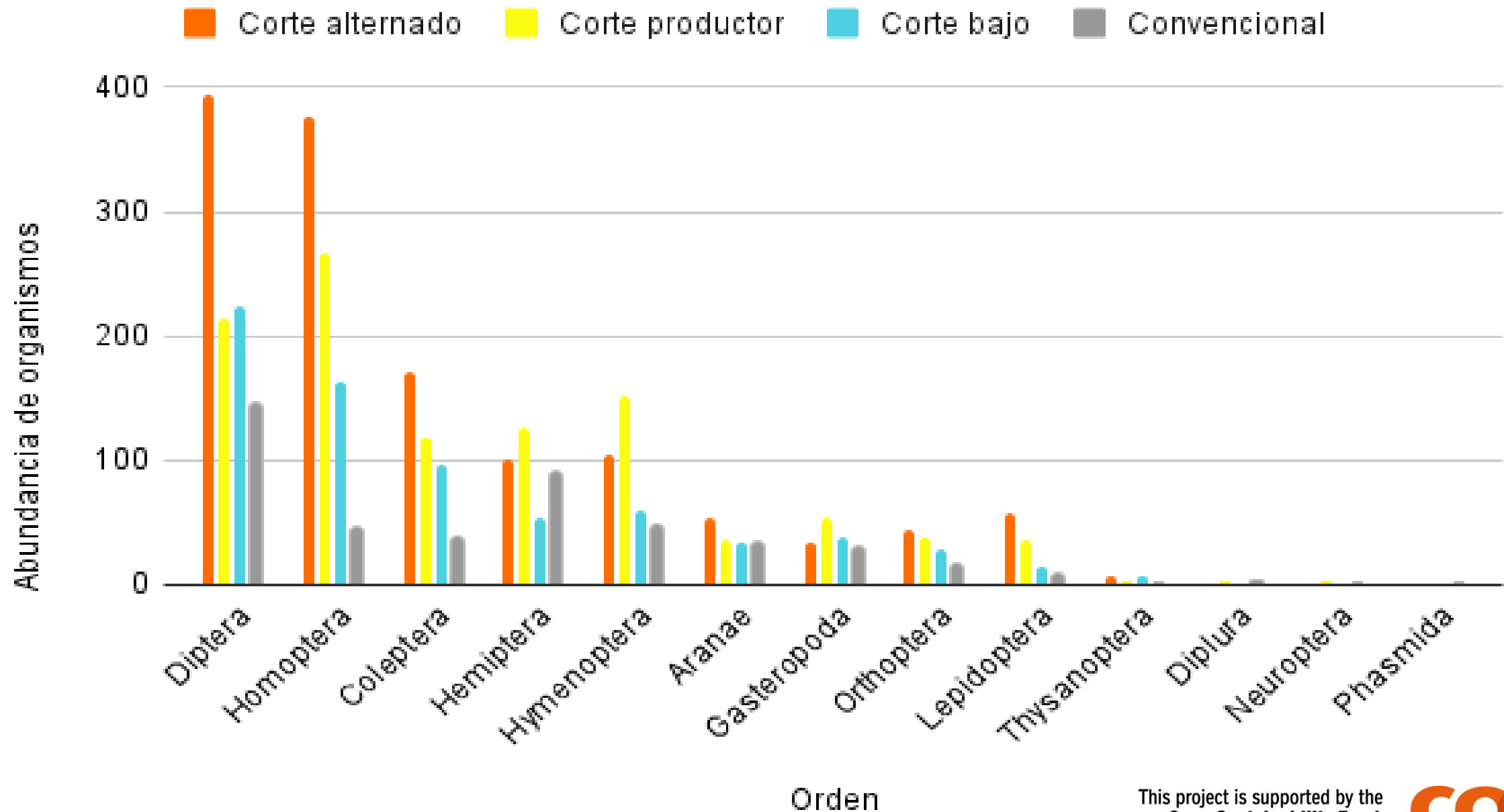
type of cutting	Families	Genera	Species
<b>Alternate cut</b>	20	64	82
<b>Low cut</b>	20	57	75
<b>Grower's cut</b>	17	47	65
<b>Conventional management</b>	9	20	22



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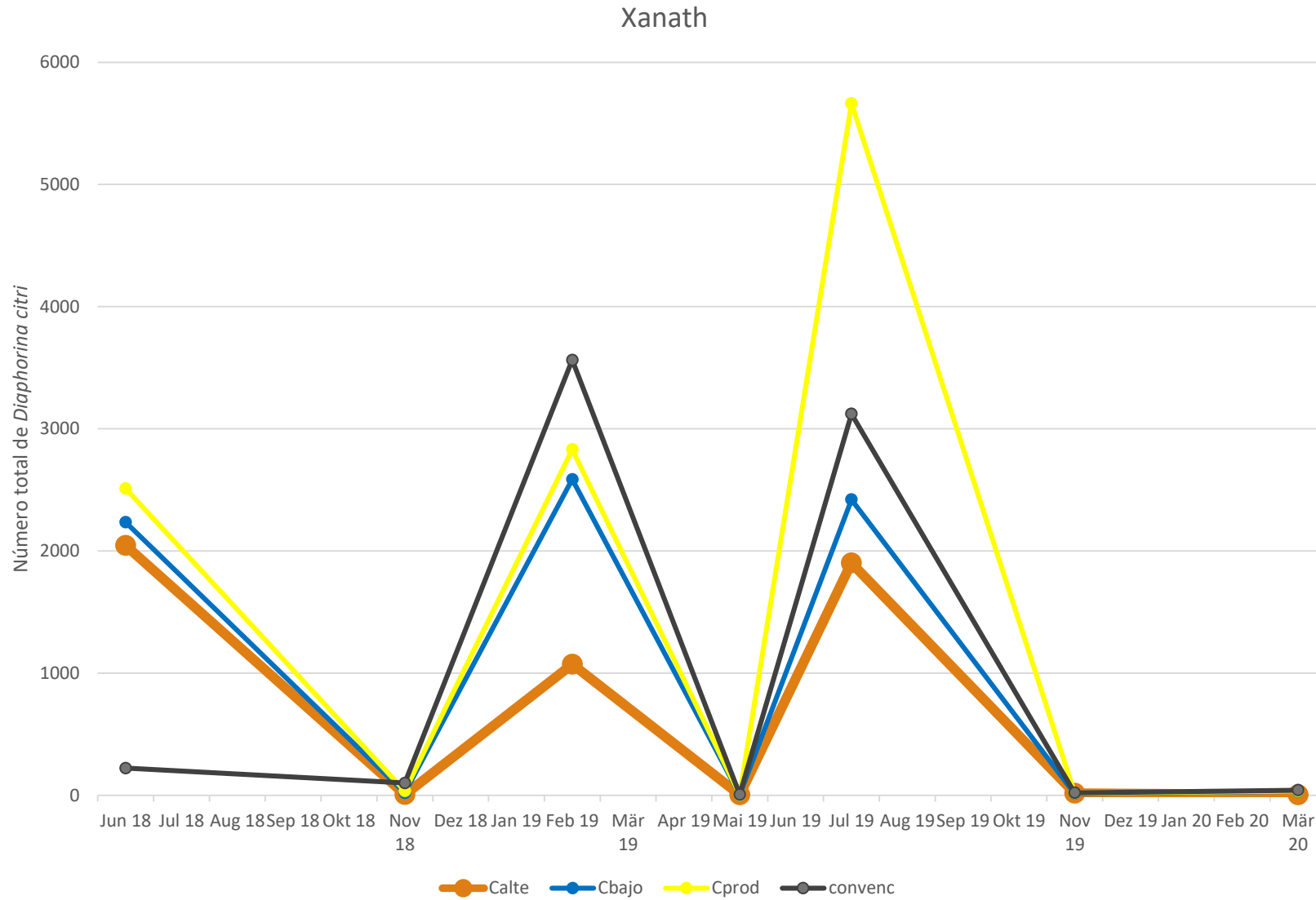


# Insects Richness





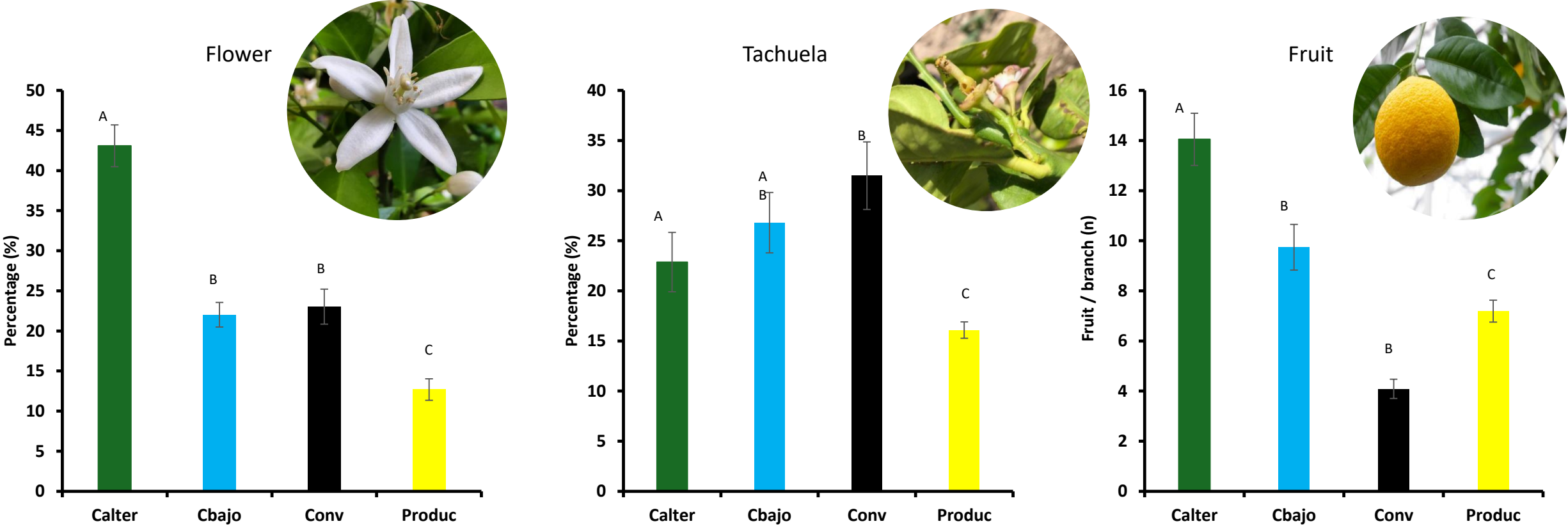
# Abundance of *Diaphorina citri* on pilot farm



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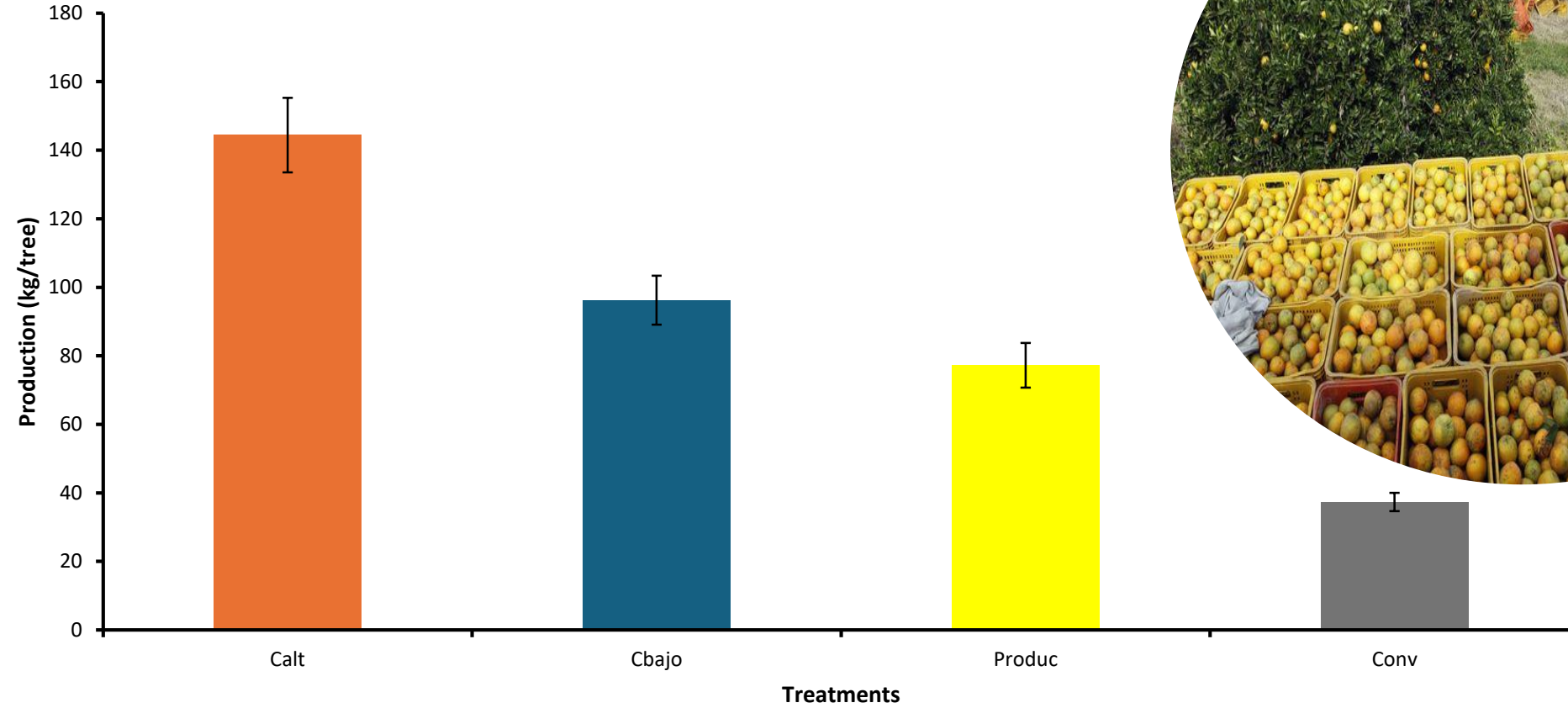
# Relative abundance of flowers, fruits and tachuela in pilot farms (Anthracnosis)



Relative abundance of flowers, tachuelas and fruits on branches in five orchards: Xanath, Rancho el Milagro, la Vega, el Gran Chaparral and la Fortuna.



# Performance of yield in pilot farms



Average production in the treatments in five orchards (Xanath, La Vega, Rancho el Milagro, La Vega, El Gran Chaparra and La Fortuna).



Alternate cutting treatments are generally more diverse in weeds and more diverse in insects.

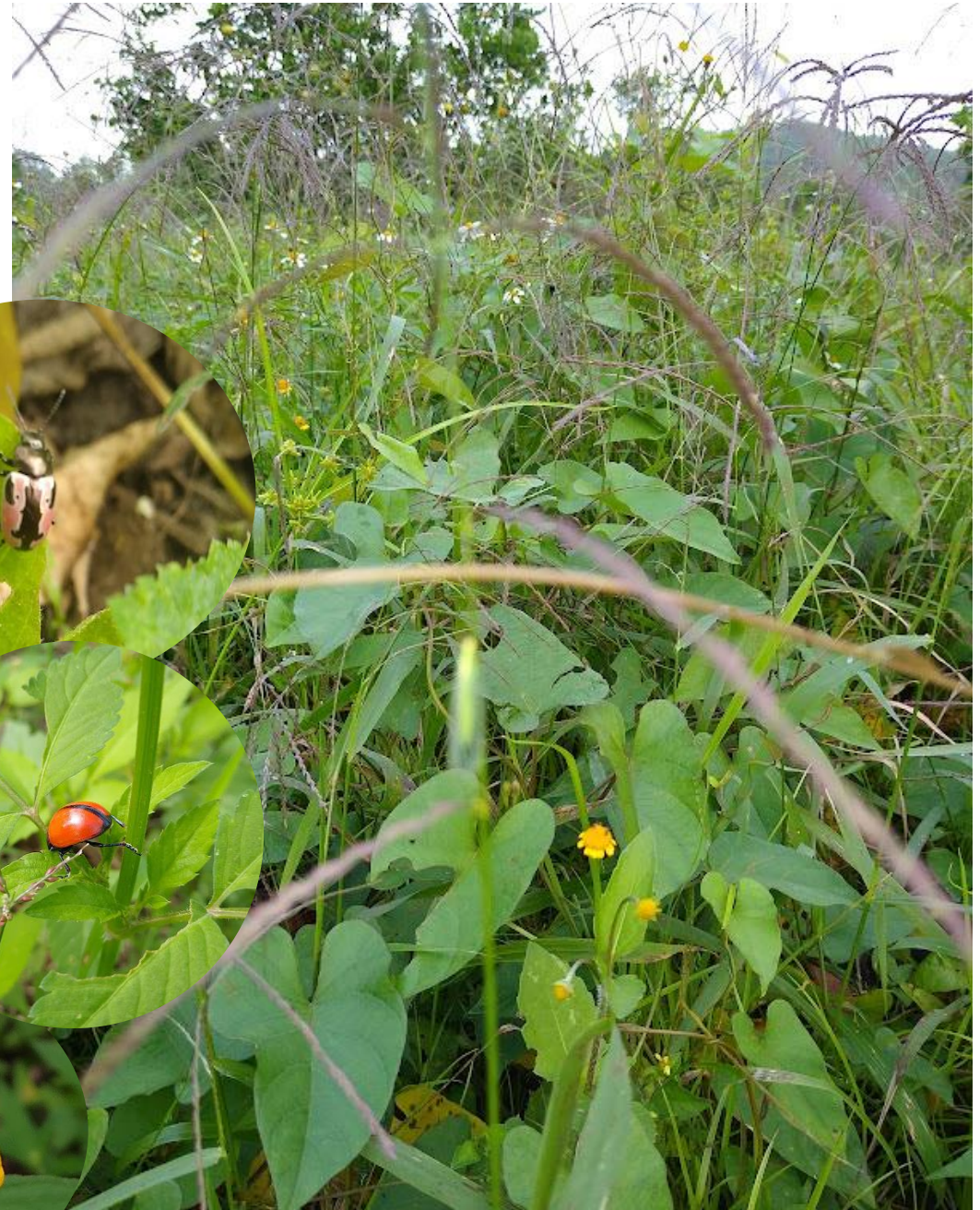
Alternate cutting has greater structural diversity:

Plants with their largest size.

Abundance of broad-leaved plants

Complex branching

Alternative food sources for insects (pollen, nectar and prey other than *Diaphorina*).





Alternate cutting favors the control of *Diaphorina citri* and prevents HLB from spreading.

Alternate cutting reduces the cost of managing weeds.

Alternate cutting can be implemented in organic as well as in conventional orchards.



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# FiBL



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