



# BIOCOMES

New biological control products  
for sustainable farming and forestry

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## Parasitoids against aphids in fruit tree crops

### Introduction

**Fruit tree crops such as apples, pears, cherries, plums and peaches are of great economic importance for European markets. Aphids are among the most problematic pests in fruit orchards. Biocontrol strategies based on preventive releases of aphid parasitoids have been successfully used in most covered crops for several decades. However, this kind of strategy remains to be developed for outdoor crops such as fruit tree orchards. In this context the objective of BIOCOMES was to develop a parasitoid-based product and the associated release strategy for the biocontrol of aphids in at least one economically important fruit tree crop.**

### Approach

In a literature review, tritrophic (plant-aphid-parasitoid) associations on *Prunus*, *Malus* and *Pyrus* species in Europe were identified. Based on this analysis, 10 parasitoid species were selected as potential new biocontrol agents against fruit orchards aphids. Several parasitoid species produced by Viridaxis were also promising.

In a sampling campaign, individuals were collected for most of the 10 parasitoid species previously identified as promising new biological control agents. Also specimens of problematic aphid species were sampled. Small-scale rearings of both aphids and parasitoids of interest were established in order to perform efficiency tests.

Data on fauna (beneficials and other pests) were collected and current crop protection practices in fruit tree crops were analysed. Regarding biological control possibilities of the most common pests in fruit tree crops and the potential integration of preventive parasitoid releases to control aphids, it was decided to focus on stone fruit trees.

Finally, in a gradual three-step approach (laboratory test, cage trials and open-field trials) the efficiency of the parasitoid species of interest against the entire aphid spectrum attacking cherry and peach trees has been measured.

Also mass-rearing possibilities were assessed for the most promising parasitoid species to develop the mixes of parasitoid species for field trials in cherry and peach orchards.

A complete biocontrol strategy based on successive preventive releases of aphid parasitoids has been developed and its efficiency tested in field trials. This strategy has been optimized over three years of experimentations in fruit tree orchards in Belgium and Spain.

Crop	Cherry trees		Peach & Plum trees				
	<i>M. cerasi</i>	<i>M. persicae</i>	<i>B. helichrysi</i>	<i>B. cardui</i>	<i>H. pruni</i>	<i>B. persicae</i>	<i>B. schwartzi</i>
<i>Aphidius matricariae</i>	+++	+++	++	+++		+++	++
<i>Aphidius colemani</i>	+++	+++	+				
<i>Ephedrus cerasicola</i>	++	+++	+				
<i>Ephedrus plagiator</i>	+++	+++	++		+		
<i>Diaeretiella rapae</i>		++	+				
<i>Praon abjectum</i>		++	++		X		

X: field observation, +: parasitism observed in trials,  
 ++: good efficiency in trials, +++: very good efficiency in trials



## Results

Laboratory tests and cage trials successfully showed that aphid spectrum of stone fruits could be controlled efficiently by a mix of parasitoid species already produced or which could be mass-reared. Following the cage trials, the parasitic wasps *Ephedrus plagiator* and *Diaeretiella rapae* were developed as new BCAs and can now be produced. However, production and application costs remain high, which limits the commercial use of these two species for now. The species *Praon abjectum* showed promising results at a small-scale production and could also be mass-reared if needed. The strategy based on successive parasitoid releases in orchards was gradually optimized and its costs significantly reduced.

In conventionally managed orchards, parasitoids prevented economic aphid damages and two insecticide treatments were in mean avoided. In organic orchards, strong parasitism rates were observed and despite high aphid infestations, the level of control was better than in the control orchards, where a higher number of biopesticides had been applied (mainly neem oil and natural pyrethrins).

## Next steps

Despite the significant optimization of the release protocol, the cost of the developed strategy remains too high for a wide usage by European fruit growers, especially in conventional production systems where cheap chemical solutions exist. However, preventive releases of aphid parasitoids could be of interest for higher added-value organic fruit productions, where existing biopesticide strategies do not always offer a satisfying control of aphids and can impair the efficiency of naturally occurring beneficials such as *Syrphidae*, *Coccinellidae* or *Chrysopidae*.



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