# An experience of cherry fruit fly *Rhagoletis cerasi* control with nets in Trentino, Italy

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**Abstract**

*In 2007, we started a three-year survey in a sweet cherry orchard in order to assess the effectiveness of anti-insect net coverings in reducing the Cherry Fruit Fly (CFF), Rhagoletis cerasi Loew damage. The plantation was already previously infested; around 100% of the fruits were damaged by the pest in 2006. Three covering methods (net on the soil under the plants; net on the plants; net on the plants sewed up at the trunk level) and a control plot without net were compared each season in twice replicated blocks. The flight of the CFF adults was recorded by means of 1 yellow sticky trap (mod.Rebell Amarillo) per replicate. The damage was assessed at harvest time dissecting one by one 100-200 fruits/plant. Unfortunately, a low pest pressure and damage occurred every year in the plantation. The maximum damage level was recorded in 2008, when 6.8% of the fruits in the control plot were infested by R.cerasi. All the covering systems we tested reduced every year the damage compared with that in the control plot. The most effective method (but also the most complicated for the producers) was the net on the plants sewed up at the trunk level. The damage in this block was reduced by 91%, 85% and 88% respectively in 2007, 2008 and 2009.*

*Our results indicate that in order to effectively limit the CFF damage in already infested plantations, is necessary to prevent the activity both of the adults hibernated in the soil under the plants and the adults may come from surrounding infested orchards.*

*The synchronism between the phenological development of the crop and the flight of the pest may vary considerably from one season to the other and this seems to be crucial to determine the level of damage on the fruits at the harvest time.*

**Keywords:** *Rhagoletis cerasi*, sweet cherry, nets, damage

## Introduction

The cherry fruit fly, *Rhagoletis cerasi*, is one of the major obstacles to a wider spread of the organic cultivation of sweet cherry in Trentino. As resulted from our preliminary experience carried out from 2004 to 2006, the pest control strategies with commercial formulations of naturally derived insecticides (spinosad, rotenone, pyrethrum, azadirachtin) never reduced the damage below the threshold of tolerance and demonstrated a poor reliability due to a lack of constancy in terms of efficacy.

During that experience, some promising indications of good efficacy emerged by the use of anti-insect nets, to cover the plants and to prevent the egg-laying in the fruits by the female flies. In 2007, with the aim to investigate more about the effectiveness of these nets, we started a three-year study funded by the Autonomus Province of Trento. Comparing different methods of covering (net on the soil under the plants; net on the plants; net on the plants sewed up at the trunk level), we also aimed to further deepen our knowledge about the nature and behaviour of CFF infestations. Here we report on the main results of this experience.

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**Material and Methods**

The orchard where we carried out the trial was located in the upper Valle di Non, at an altitude of about 950 m a.s.l. It consisted of 56 plants, most of them of the late ripening cv.Regina and few plants of cv.Schneider and Kordia, planted in 2002 and arranged in a single long row, north-east/south-west oriented. The plants, on rootstock Gisela 5, averaged 4-5 m tall and were 2.5 m apart in the row. From the onset of ripening till the end of harvest, they were protected from the rain with nylon cover. A severe cherry fruit fly infestation occurred in 2006, when almost 100% of the fruits were damaged.

The effectiveness in reducing the pest damage on fruits of three different covering methods with the anti-insect net (Frustar ® brand, 2 mm mesh size) was compared with that of a control plot (without net) using randomized blocks, twice replicated. In treatment A (11 plants), the anti-insect net was laid directly on the ground under the plants. Several long double pointed iron nails were used to secure the net borders to the soil. In treatment B (14 plants), a strip of net positioned vertically along both sides of the row, was stitched to the nylon rain cover. The plants were then completely caged, sewing togheter at the trunk level the two vertical strips. In treatment C (15 plants), the net was still stitched to the nylon cover, positioned vertically along both sides of the row and fixed to the ground with the nails. In the control plot (13 plants) plants were only protected from the rain by the nylon cover. No insecticides for CFF control were applied during the trial on the whole plantation.

The flight of the adults was recorded each season by means of 1 yellow sticky trap (Rebell ® Amarillo) per replicate. The percentage of fruits damaged by the cherry fruit fly larvae in each replicate was assessed at the harvest time, dissecting one by one 100 (2008 and 2009) or 200 (2007) fruits/plant. Sample size varied depending on the total yield of the trees. An half of each sample was collected from the upper middle part of the tree.

## Results

Figure 1 and table 1 summarize the main information about the flight and the damage of *Rhagoletis cerasi* we obtained during this three year study.

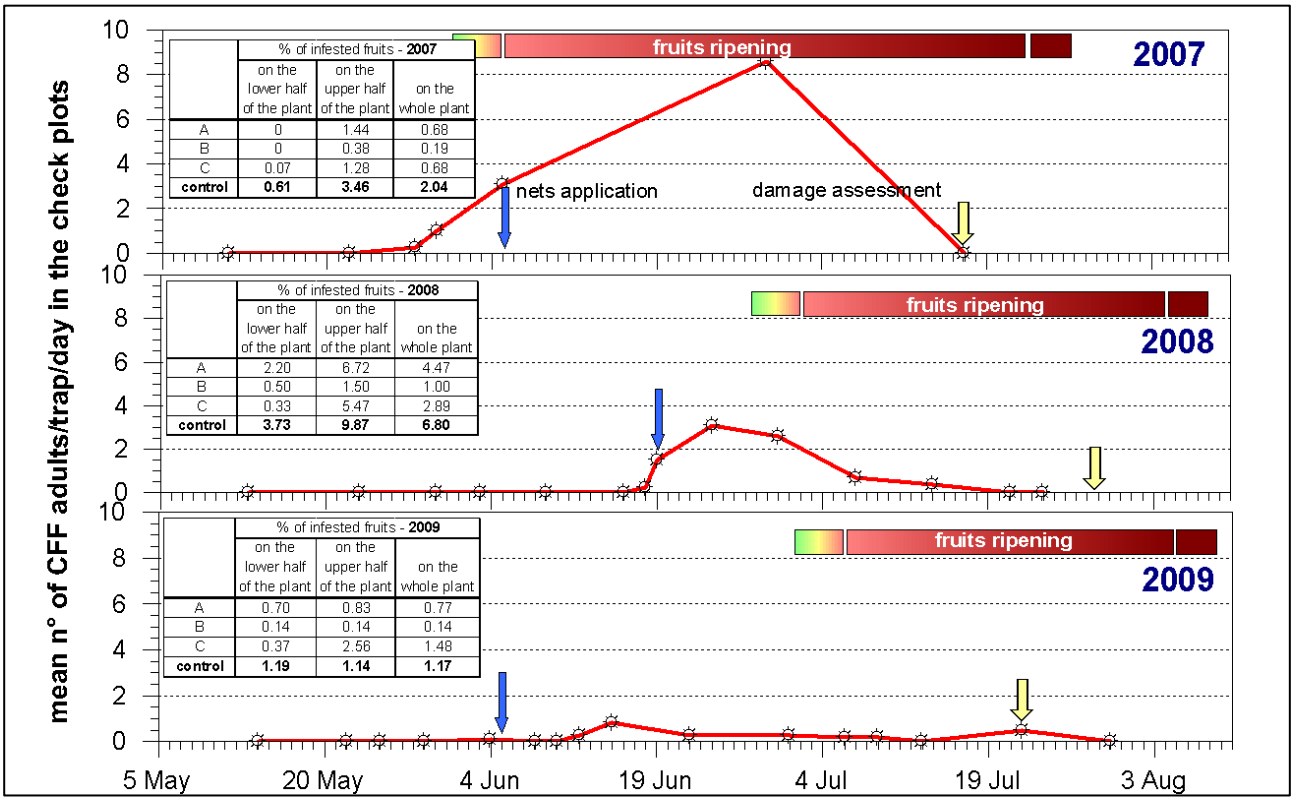


Figure 1: *Rhagoletis cerasi* flight and damage recorded in the three year study

Table 1: additional information about the catches of CFF adults on the yellow traps in the control plot and the damage on the fruits at harvest

| | cumul. n° of adults/trap | | % of injured fruits at harvest time |
|---|---|---|---|
| | at the beginning of fruit colouring (BBCH 81) | at the end of the season | |
| 2007 | 2 | 228 | 2.03% |
| 2008 | 33 | 40.5 | 6.8% |
| 2009 | 8.5 | 13.5 | 1.17% |

The pest pressure during the trial was very low, much less than we expected after the severe infestation occurred in 2006 season. The maximum level of damage was recorded in 2008, when just 6.8% of the fruits in the control plot were injured by the CFF larvae. The number of adults caught by yellow sticky traps decreased year after year.

Beside the effects of the anti-insect nets we tested, one of the factors may have affected the pest development is probably the use of dimethoate to control the cherry fruit fly in the surrounding cherry orchards, converted from the organic production system to the conventional one after 2006 season. This insecticide probably reduced the *R.cerasi* infestation in treated fields and consequently much less adults may have migrated from these plantations to our experimental site. We also suspect some disturbing effects of this chemical on pest populations at long distance from the point of spray application and this may have occurred in our trial, even if a just detectable amount of dimethoate residues

was found on the fruits. Climatic factors may have contributed to this decreasing trend of the infestation. Due to a particularly intense and regular wind that blew in this location from May to the end of June 2009, the flight activity in this period remained at a low level, with consequences probably on the fruits infestation. Finally, a progressive reduction of adult population may be the consequence of aspects related to the biology of the pest, as for example the possibility of delaying the emergence from the soil till the next season for some of the overwintering adults.

Data in the table 1 suggest that there seems to be no correlation between the cumulative number of adults caught by yellow sticky traps and the damage on the fruits at harvest time. In the control plot, 228 adults were caught on a trap during the whole 2007 season, but damage was less than in 2008, when the cumulative number of adults was only 40.5. But if we consider the cumulative n° of adults caught/trap at the beginning of fruit colouring, that's the most susceptible phenological stage for the eggs laying by the adult females, there is evidence of a better relationship with damage on the fruits, since the heaviest damage corresponds to the highest cumulative number of adults/trap. So, Rebell ® Amarillo traps may be useful to predict the risk of damage and to decide wheter or not to apply an insecticide.

Concerning the effectiveness of the anti-insect net, all the covering systems we tested reduced every year the damage compared with the control plot. Anyway the net was used, it partially prevented the flight of the adults infesting our orchard. The most effective method was the net on the plants sewed up at the trunk level (treatment B). The damage in this block was reduced by 91%, 85% and 88% respectively in 2007, 2008 and 2009.

Results obtained with the treatment A (net laid on the soil under the plants) suggest that even in an already infested plantation, an important part of the seasonal CFF infestation is probably due to adults coming from outside the orchard, from surrounding infested plantations or wild hosts.

Except for 2007 season, we succeeded in placing the anti-insect net covers before the beginning of fruit colouring, but every year we failed to precede the beginning of the *R.cerasi* adults flight. This may explain the damage recorded at the harvest in treatment B, probably due to a few adults were caged underneath the cover when it was set up.

About the behaviour of this pest, our data confirm that most of its damage occurs on the fruits in the upper middle part of the tree. The reasons for this are still not clear, but obviously the flies find optimal conditions for their activity in this part of the canopy.

**Discussion**

Unfortunately, due to the very low damage occurred, our three-year experience may be poorly representative and useful. In any case, in our experimental conditions results obtained with the anti-insect net covering system evaluated in treatment B may be considered satisfying, even if this method is also the most complicated to apply by the producers and is suitable for small size orchards, arranged in a single row or in a few rows. Moreover, due to the necessity to set up the net prior to the beginning of the CFF adults flight, that often occurs long before the reddening of the cherries, the covering period may be very prolonged, increasing so the susceptibility of the crop to diseases and making difficult for the growers to carry out some of the agricultural practices.

Our results indicate that in order to effectively limit the *R.cerasi* damage in already infested orchards using the anti-insect nets, is necessary to prevent the activity both of the adults hibernate in the soil under the plants and the adults may come from surrounding infested fields and wild hosts.

The synchronism between the phenological development of the crop and the flight of the pest may vary considerably from one season to the other and this seems to be crucial to determine the level of damage on the fruits at the harvest.

Considering the extreme seasonal variability of the pest population dynamic and of its relationships with the crop, the climate, the environment and the agricultural practices we observed in our survey, is necessary and important to deepen our knowledge about the pest biology and behaviour in our local conditions. This may also help us to better manage this insect and to carry out experimentations and surveys with more reproducible results.

Doubtless, an unifested cherry orchard represents the optimal situation for the application of the anti-insect nets. In this case, a more practical covering method for the growers like that tested in treatment C (net stitched to the nylon shelter, positioned vertically along both sides of the row and fixed to the ground with the nails, without sewing the two lateral strips), may presumably be successfull in controlling CFF infestation.