

***Rhagoletis cerasi* (L.) (Diptera: Tephritidae) in Western Sicily: presence, damages and control in organic cherry orchards**

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Abstract: The research was carried out from 2006 to 2010 in 12 cherry orchards in Western Sicily, where *Rhagoletis cerasi* (L.), the cherry fly, represents a problem for medium late ripening cultivars. Presence and infestation of the dipteran were monitored on local cultivars and effectiveness of some products allowed in organic farming was tested compared with net bags. The presence of the cherry fly was recorded in all cherry orchards except in two recently planted and isolated. The infestation on fruits was not very high until the end of May. Pyrethrum and spinosad did not lower the infestation, on the contrary nets reduced it.

Key words: cherry fly, sex ratio, organic farming, pyrethrum, spinosad, physical protection

Introduction

Rhagoletis cerasi (L.), the cherry fly, represents a problem for medium and late ripening cultivars with a difficult control in organic farming. In Western Sicily, cherry orchards are spread over about 160ha, (140ha in Chiusa Sclafani, Palermo); in literature we found no news about presence of the cherry fly and its damages in this area; few studies regard *R. cerasi* in Eastern Sicily (Fimiani *et al.* 1978, 1979).

The aim of the research was to evaluate the incidence of *R. cerasi* in organic cherry orchards in Western Sicily through: a) a survey on presence and population dynamic of the dipteran; b) an assessment of damage in cherries and susceptibility of some late ripening cultivars; c) control tests by tools allowed in organic farming (nets, pyrethrum and spinosad).

Material and methods

The research was carried out from 2006 to 2010 in 12 cherry orchards in 7 sites of Palermo and Agrigento Provinces (Tab. 1) located in 3 different areas: traditional cherry area (Bivona, Chiusa Sclafani and San Giuseppe Jato); few cherry orchards area (Castrofilippo and Grisi); isolated cherry orchards, more than 10km from others cherry areas (Contessa Entellina and Sciacca). As shown in Tab. 1, two fields (Chiusa Sclafani 2 and San Giuseppe Jato 1) were monitored for 5 years.

Adult monitoring

We monitored the presence of *R. cerasi* adults in organic and conventional cherry orchards, untreated or treated only once with an insecticide (rotenone, pyrethrum, spinosad or deltamethrin) which did not greatly influence adult captures (Tab. 1). To monitor adult

presence in each field 3 yellow Rebell traps baited with ammoniacal substances were placed in April and observed weekly until the end of June, counting caught males and females.

Fruit sampling

The infestation on fruits was recorded in the same orchards (Tab. 1) sampling local cultivars (Cappuccia di Chiusa Sclafani and Moscatella) and not local ones (Sunburst and Lapins) all ripening in mid-June. Around the commercial ripening, 100 cherries per thesis were weekly collected and analysed under the stereomicroscope recording fruits infested by *R. cerasi* eggs and larvae and sterile punctures.

Table 1. Cherry orchards monitored during the research (Conv= conventional; Org= organic; Trad= traditional cherry area; Few= few cherry orchards area; Isol= isolated cherry orchards) and the only seasonal insecticidal treatment performed by some growers (r= rotenone from 9 to 19 May; d= deltamethrin from 25 May to 2 June; s= spinosad from 20 to 23 May; p= pyrethrum from 19 to 25 May).

| Cherry orchards | Area | Management | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
|----------------------------|-------------|---------------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Bivona | Trad | Conv | | | X | | | 1 |
| Chiusa Sclafani 1 | Trad | Org | X r | X | X | | | 3 |
| Chiusa Sclafani 2 | Trad | Org | X r | X r | X r | X s | X p | 5 |
| Chiusa Sclafani 3 | Trad | Conv | | X d | X d | | | 2 |
| Chiusa Sclafani 4 | Trad | Org | | | | | X | 1 |
| San Giuseppe Jato 1 | Trad | Org (Conv 06-08) | X d | X d | X | X s | X | 5 |
| San Giuseppe Jato 2 | Trad | Conv | | | | X | X p | 2 |
| Castrofilippo 1 | Few | Conv | X | X | X | | | 3 |
| Castrofilippo 2 | Few | Org | | | | | X | 1 |
| Grisì | Few | Conv | X | X | X | | | 3 |
| Contessa Entellina | Isol | Conv | | | | X | X | 2 |
| Sciacca | Isol | Conv | | | X | | | 1 |
| Total | 12 | | 5 | 6 | 8 | 4 | 6 | 29 |

Control tests

In 2009 and 2010 we also tested the effectiveness of sprays with spinosad and pyrethrum (both permitted by Annex II Reg. CE 889/08) comparing them with untreated plants and with the effectiveness of net bags (mesh 1 x 2mm) covering the branches from the veraison (20th May) to the commercial harvest. We performed 3 treatments (1 per week) with pyrethrum (Biopiren Plus, 160ml/hl) and spinosad (Laser, 30ml/hl) beginning the 20th May in both years.

Statistical analyses

Statistical analyses (repeated measurements ANOVA and one way ANOVA, followed by post-hoc test of Tukey ($p < 0.05$)) were performed on the total infestation of the same cultivar in different cherry orchards, and on data concerning different cultivars in the same field.

Results and discussion

Adult captures and sex ratio

The presence of *R. cerasi* was recorded in 5 out of 7 sites, and in 10 out of 12 cherry orchards of Western Sicily; the tephritid fly was absent in two sites (Contessa Entellina and Sciacca) where cherry orchards were recently planted more than 10km far from other cherry orchards. The peak of caught flies was recorded in the second half of May every year; at this date there was an average of 25 adults caught per trap per week; the highest number of adults over the 5 years, 83 adults per trap per week, was recorded in 2007 Chiusa Sclafani 2 orchard. The intervention threshold of 5 adults caught per trap per week was exceeded every year in cherry orchards of the traditional area (Figs. 1-2), in this area we found the highest capture levels.

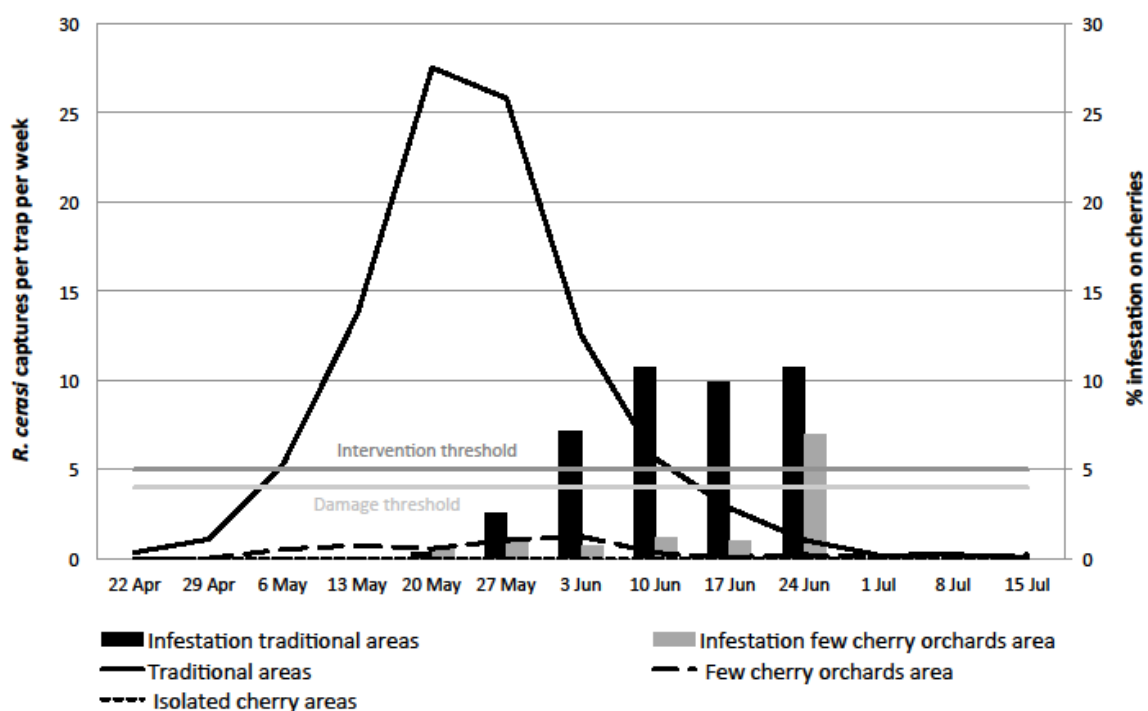


Figure 1. Captures and infestation in three different types of cherry orchards areas (2006-2010).

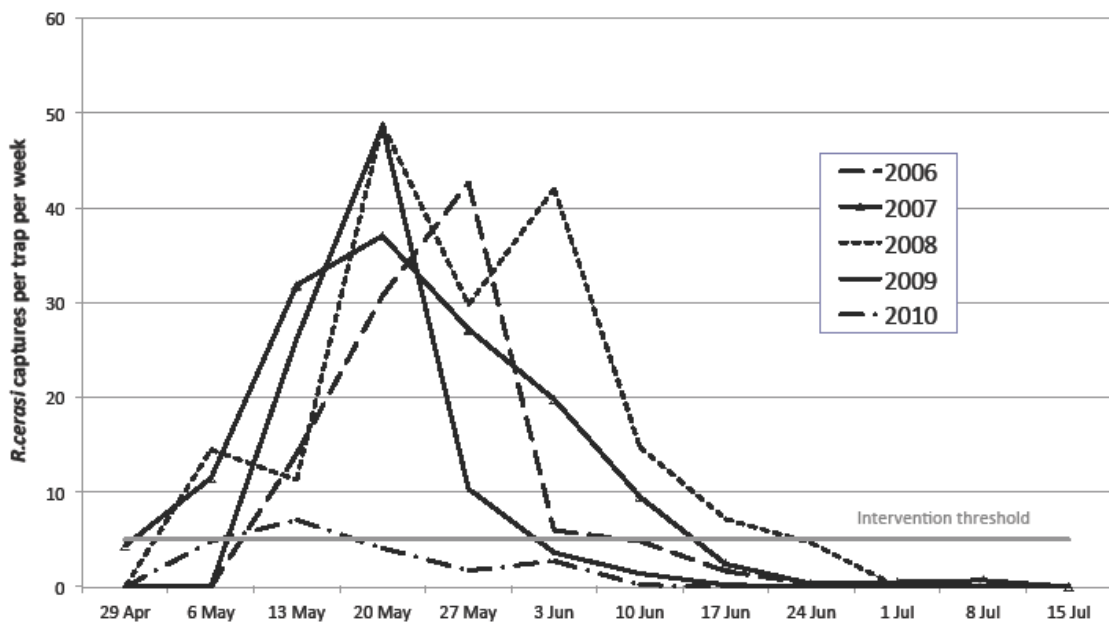


Figure 2. Levels of captures in traditional cherry orchard areas in five different years (2006-2010).

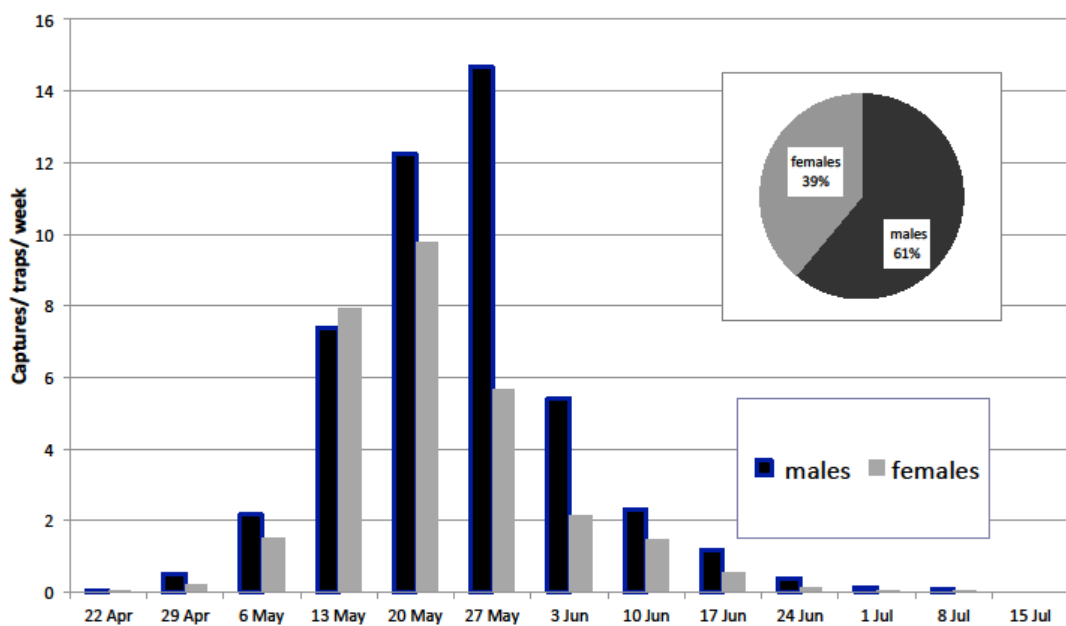


Figure 3. Males and females in Rebber traps baited with ammoniacal salts in four different years (2007-2010).

Every year we caught more males than females, with an average of 61% of males (Fig. 3) with a sex-ratio males/females of 1/0.5 as average (from 1/0.3 to 1/ 1.9), according with others studies conducted in Italy (Fimiani *et al.*, 1981) and Hungary (Tuba, 2009). The peak

of caught females anticipated one week that of males, but in 2007 and 2009 it occurred in the same week (Figs. 3-4).

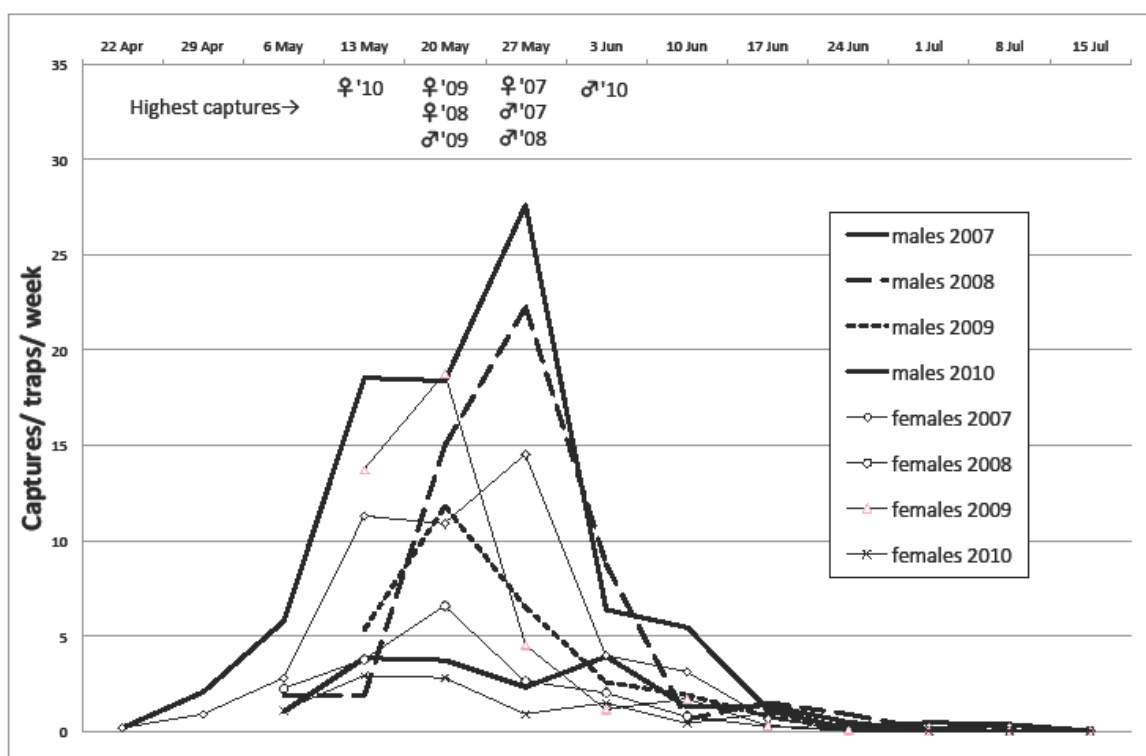


Figure 4. Trend of *R. cerasi* male and female captures in four different years (2007-2010).

Infestation in fruits

The number of adults in traps was not strictly correlated to the infestation level reached in cherries (Fig. 5). Considering the result of each orchard in a single year as a single case, the damage threshold on cherries (4% of total infestation) was exceeded in 14 out of 29 cases, and in 34% of cases (10 out of 29) the application of the intervention threshold based on captures of adults in traps provided a suggestion (treat or do not treat) in contrast with the subsequent damage recorded in untreated cherries.

All cherries were not much infested until the end of May (<4%), the damage threshold was exceeded in cherry orchards of the traditional area every year and only in one date in orchards of the few cherry orchards area (Figs. 1,6). In June the infestation exceeded the damage threshold every year at San Giuseppe Jato (6-60%), in 2007 and 2008 at Chiusa Sclafani (6-16%) and in 2008 at Bivona (7-40%). But, considering the average infestation of five years, in the last two years in cherry orchards of the traditional area the damage threshold was not exceeded and in these years infestation was lower than the other years (Fig. 6). Although several times the damage threshold was exceeded in fruits the perception of the infestation by the growers and the consumers was low because most of the infestation at the harvest was due to *R. cerasi* eggs and small larvae.

Sterile punctures were present every year in all the sampled period (Fig. 7).

Susceptibility to cherry fly in studied cultivars was confirmed as linked to the ripening period and not to a different attractant power of cultivars.

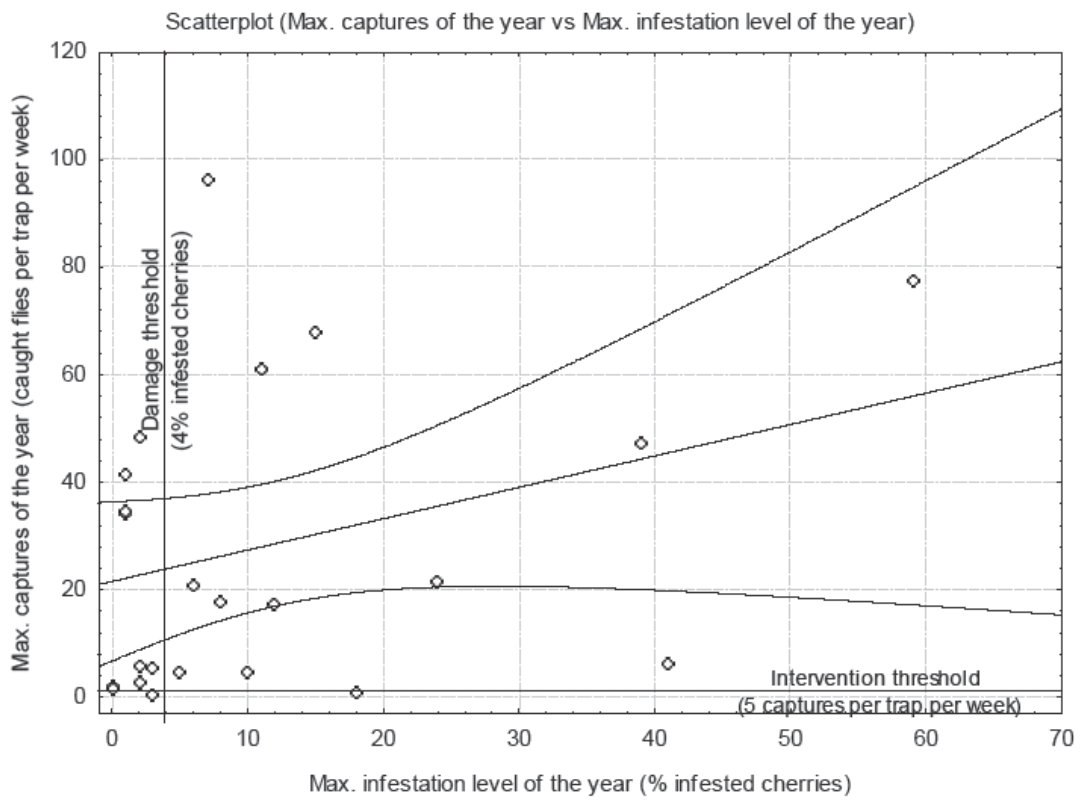


Figure 5. Scatterplot max. captures of the year vs max. infestation of the year.

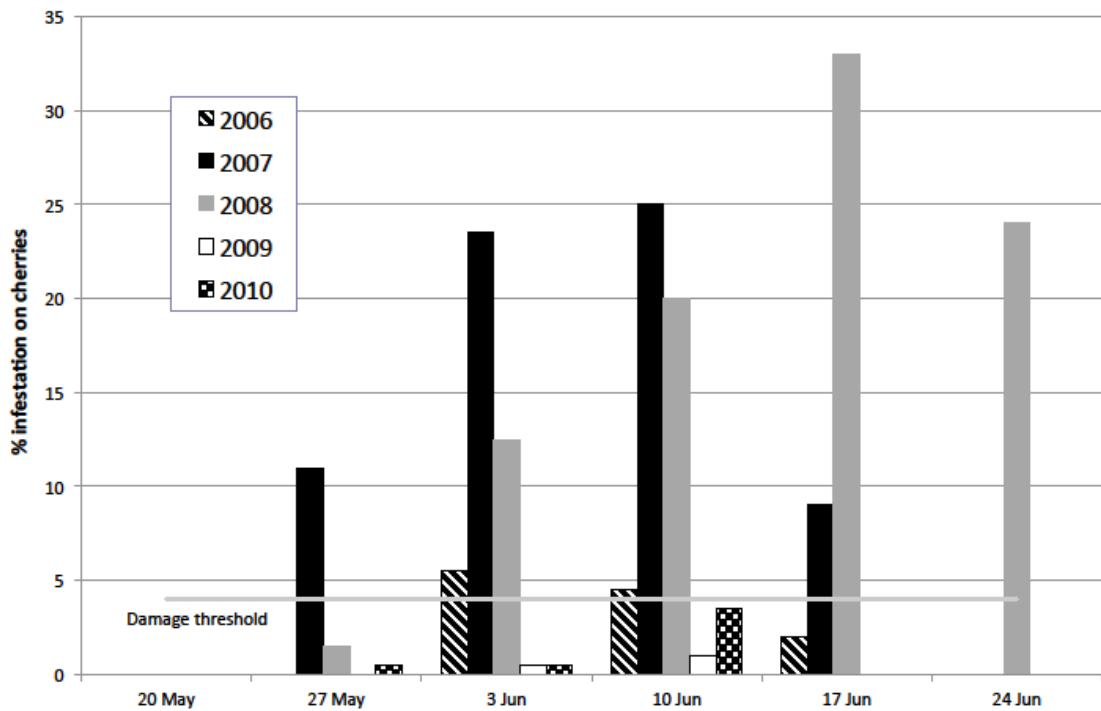


Figure 6. Average infestation in traditional cherry orchard areas in five years (2006-2010).

Control tests

In control tests we found statistical differences only in 2010 in San Giuseppe Jato between the net and pyrethrum sprays (Figs. 8-10), but in the last two years infestation level was very low. Three sprays of spinosad and pyrethrum did not lower cherry fly infestation more than in the untreated plot; the only tool that reduced infestation was the net.

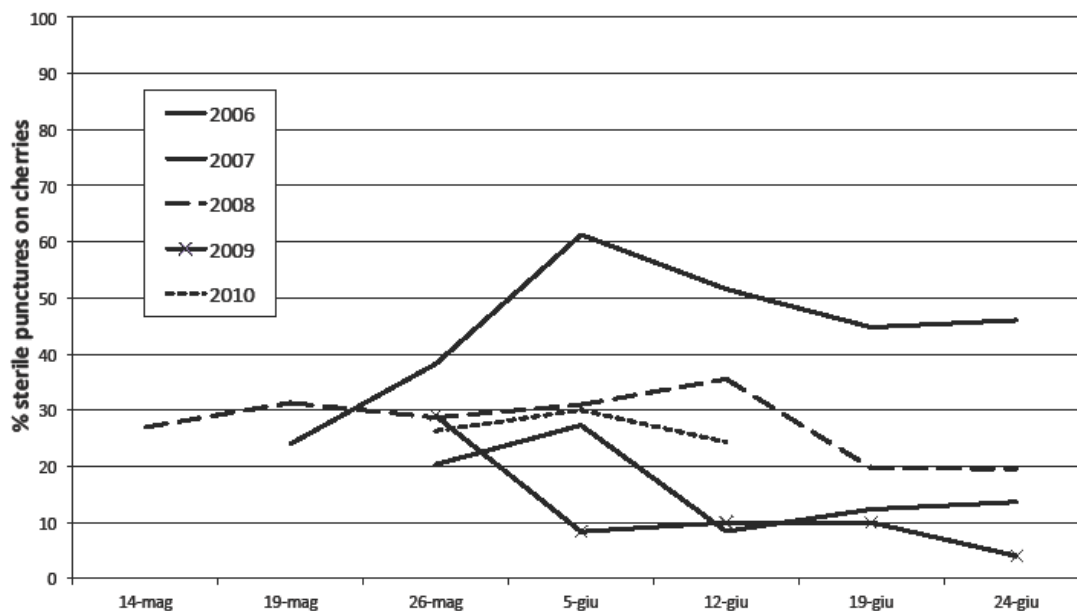


Figure 7. Sterile punctures of *R. cerasi* on cherries in five years (2006-2010).

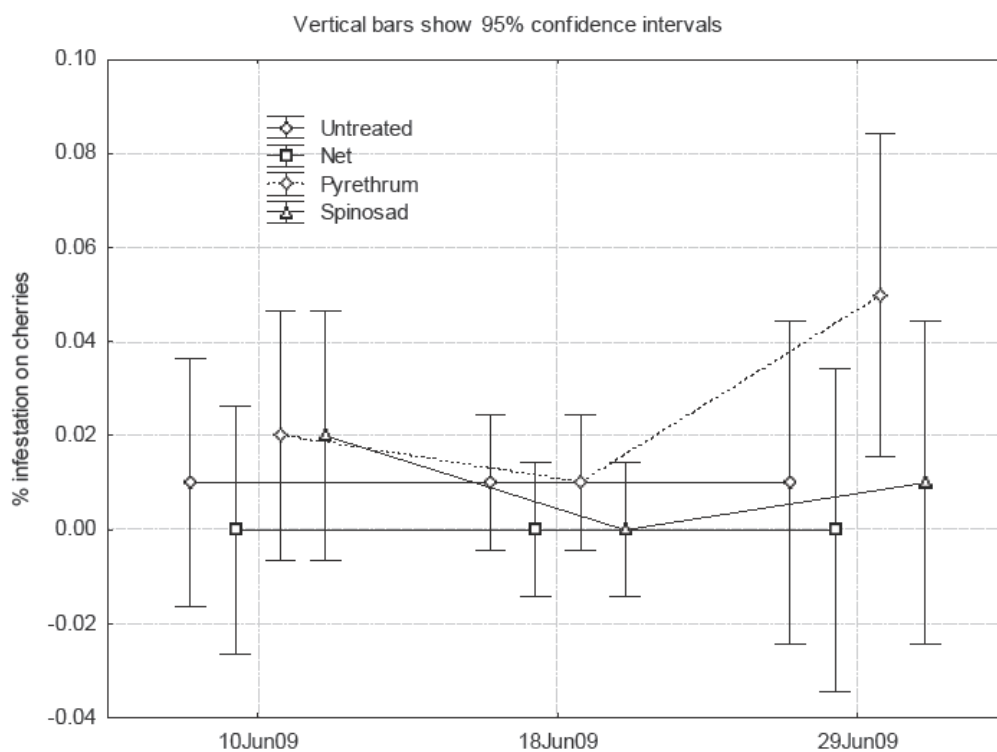


Figure 8. Infestation in San Giuseppe Jato on cv Sunburst in 2009.

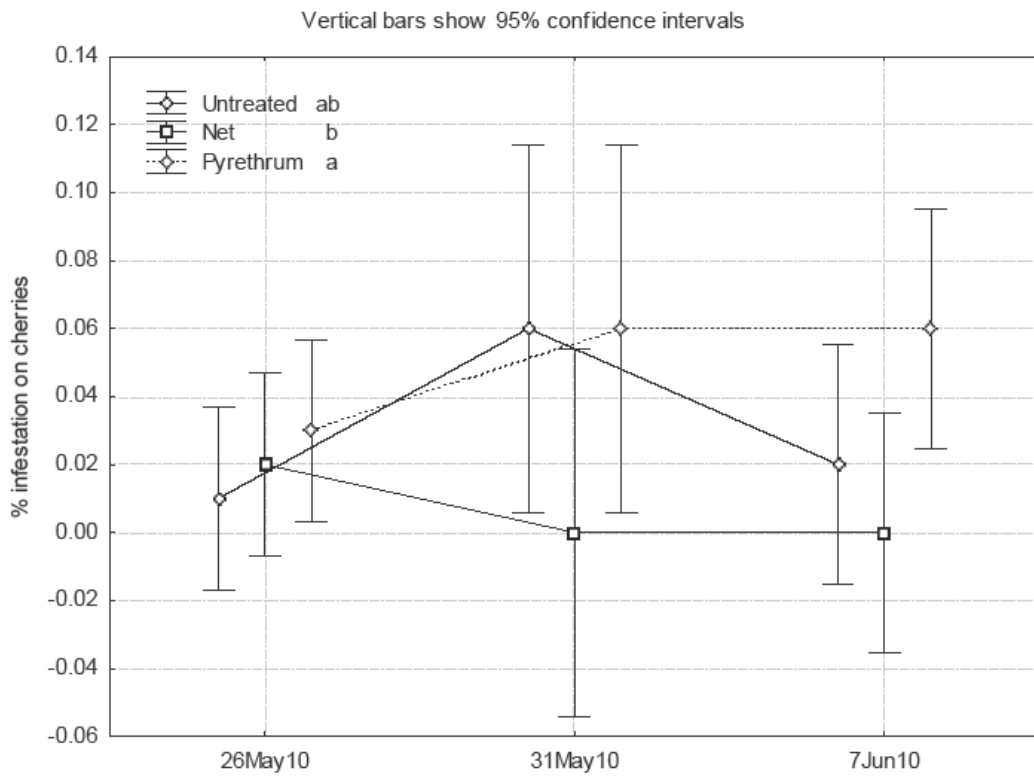


Figure 9. Infestation in San Giuseppe Jato on cv Lapins in 2010.

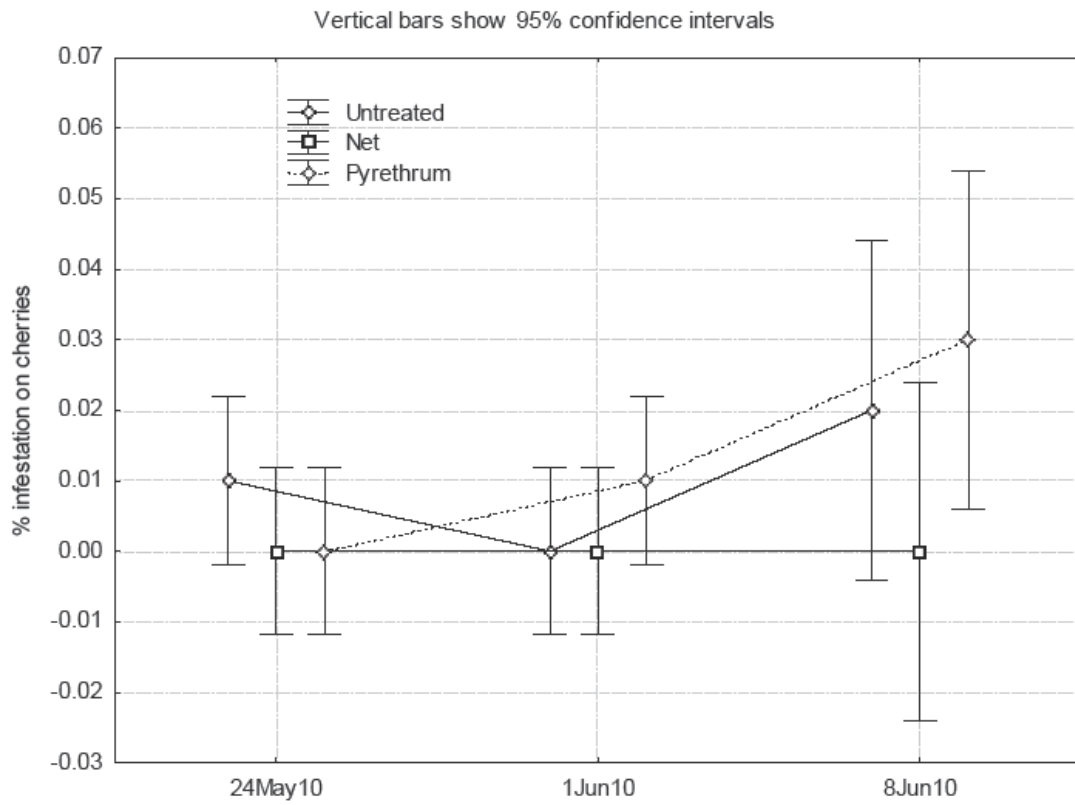


Figure 10. Infestation in Chiusa Sclafani on cv Cappuccia di Chiusa Sclafani in 2010.

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References

- Fimiani, P. *et al.* 1978: Two years of bio-ecological observations on *R. cerasi* in different regions of Italy. Bollettino del Laboratorio di Entomologia Agraria "Filippo Silvestri", Portici 35: 49-56.
- Fimiani, P. *et al.* 1979: Two years of bioecological observations on *Rhagoletis cerasi* L. in different Italian areas. Bulletin SROP 2: 151-152.
- Fimiani, P. *et al.* 1981: Ricerche coordinate su aspetti bioecologici della *Rhagoletis cerasi* L. in Italia. Bollettino del Laboratorio di Entomologia Agraria "Filippo Silvestri", Portici 38: 159-211.
- Tuba, K. 2009: Sex-ratio of european cherry fruit fly (*Rhagoletis cerasi* L.) populations in cherry and sour cherry orchards. Novenyvedelem 45: 6, 285-290.