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Tests on the effectiveness of mass trapping by Eco-trap (Vyoril) in the control of *Bactrocera oleae* (Gmelin) in organic farming

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Abstract: Tests on the effectiveness of mass trapping by Eco-trap (Vyoril) in the control of *Bactrocera oleae* (Gmelin) in organic farming were carried out in 2003 and 2004. The tests took place into two organic olive groves located in Agrigento and Trapani (Sicily); in both years the olive cultivar was Cerasuola. In Agrigento, it was considered the effectiveness of Eco-trap vs. bottle traps baited with diammonium phosphate; while in Trapani the effectiveness of Eco-trap added to other products admitted in organic farming (two products containing kaolin and one containing copper) was evaluated. In 2003, year with a low *B. oleae* population density, no statistically significant difference resulted among Eco-trap, bottle traps with diammonium phosphate and control. In 2004 *B. oleae* infestations were high; although some statistically significant differences among plots with Eco-traps and plots without them emerged, the additional power of Eco-trap in controlling *B. oleae* resulted very limited in plots sprayed with kaolin products and more consistent in the plot with copper hydroxide. The economic advantage of the use of Eco-trap, also in comparison with repellent and antiovipositional products, still remains doubtful.

Key words: olive fruit fly, attractive, repellents, antioviposition.

Introduction

The control of the olive fruit fly, *Bactrocera oleae* (Gmelin), in organic farming is mostly realized by mass trapping. In the organic farming, the Council Regulation (EEC) No. 2092/91 permits the use of two pyrethroids (deltamethrin and lambda-cyalothrin) only in traps to control *B. oleae* and *Ceratitis capitata* (Wiedemann).

In organic olive groves, mass trapping can be made by using poisoned bait, or various traps, such as: chromotropic traps, bottle traps with food attractants and traps with ammoniacal salts, sexual pheromone plus pyrethroids.

One of the most utilized trap is Eco-trap (Vyoril), a polyethylene small bag (15 x 20 cm) covered with special paper treated with deltamethrin, containing 70gr of ammonium bicarbonate and provided with a sexual pheromone (1,7-dioxaspiro-5,5-undecano) dispenser.

The aim of the research was to test the effectiveness of Eco-trap in the control of *B. oleae* infestation in Sicilian organic olive groves, in comparison with bottle-traps baited with diammonium phosphate or in addition to others repellent products permitted in organic olive groves.

Materials and methods

Eco-trap vs. bottle traps baited with diammonium phosphate (2003)

In 2003 the test on the effectiveness of Eco-trap, was carried out in an olive grove (cultivar Cerasuola) of 6.6 ha in Licata, Agrigento province (Sicily); the field was divided into 3 plots (Figure 1):

1. 2 ha with Eco-trap (one trap for each tree along the perimeter and one every 2 trees inside the plot);
2. 2.6 ha with bottle traps containing a 4% diammonium phosphate water solution (the same trap density of the preceding plot);
3. 2 ha untreated plot; initially, sprays of copper hydroxide should be done in a half of this plot, but the total infestation did not exceed the limit of 5% until the 17th October; so, there was no need to treat, and all the plot was untreated.

To survey the infestation level, olives were sampled (every two weeks) collecting 100 drupes from the trees of the central part of each plot (Figure 1).

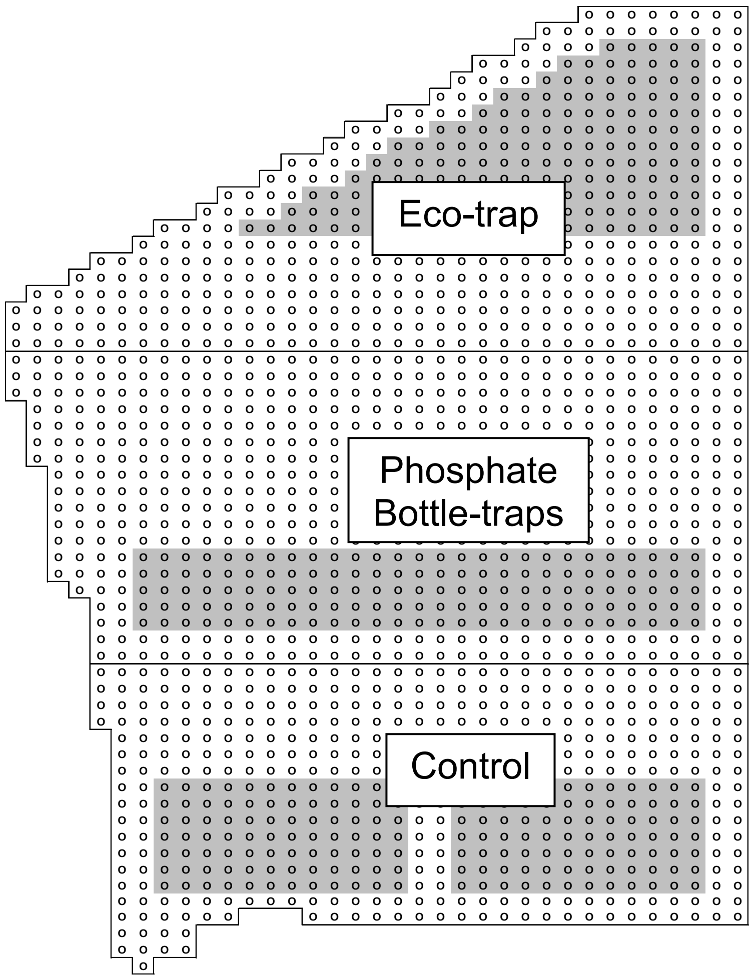

Figure 1. Licata olive grove (2003); grey area = sampled trees.

Assessment of the additional power of Eco-trap to others products permitted in organic olive groves (2004)

In 2004 tests on the effectiveness of Eco-trap, were carried out in an olive grove (cultivar Cerasuola) of about 2 ha in Trapani (Sicily); the field was divided into 2 parcels, one with Eco-trap and one without, each of them divided into four smaller plots (Figure 2):

1. the first one was unsprayed;
2. the second one was sprayed twice (7th September and 3rd October) with Surround WP (containing 95% of kaolin);

3. the third one was sprayed twice with BPLK kaolin;
4. the last one was sprayed twice with copper hydroxide.

To survey the infestation level, olive trees were weekly sampled collecting 60 drupes in each of the 8 plots (10 drupes from each of the six sampled trees). Collected drupes were examined at the stereoscopic microscope to pick out the preimmaginal stages of the fly, the exit holes and the empty tunnel.

The infestation pointed out on the drupes was subdivided in:

1. active infestation (eggs, alive first and second instar larvae);
2. harmful infestation (third instar larvae, pupae, exit holes and the empty tunnel);
3. total infestation (active infestation added to harmful infestation).

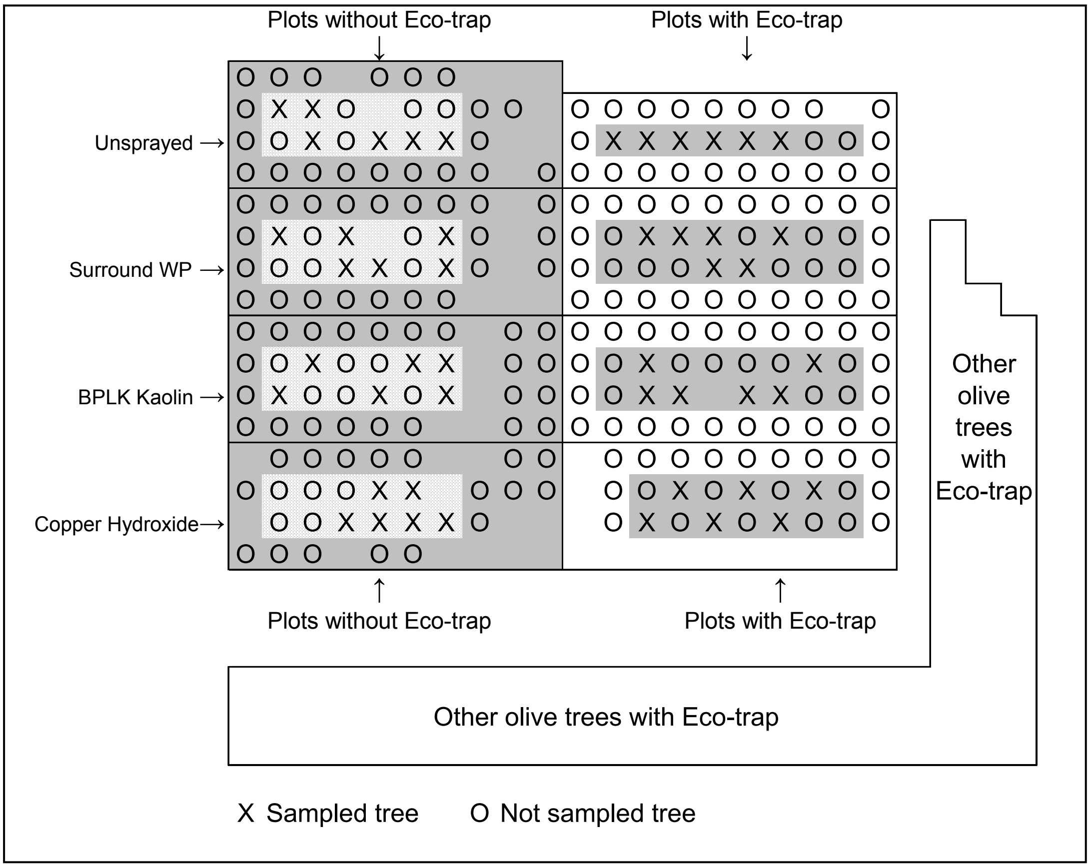

Figure 2. Trapani olive grove (2004).

Results and discussions

In 2003, year with low olive fly infestation, the three plots of Licata olive grove did not result statistically different in the whole period (Figure 3).

In 2004 *B. oleae* infestation reached high levels in Trapani olive grove. Comparing the total infestation of the whole period in the 8 theses, 5 theses (4 sprayed with kaolin products and one with Eco-trap and copper hydroxide) recorded the lowest infestation without statistically significant difference among them; the thesis sprayed with copper hydroxide reached a higher infestation level without statistically difference with the thesis sprayed with BPLK kaolin, while the two unsprayed plots (with or without Eco-trap) reached the highest infestation level without statistically difference between them (Table 1).

The two couples of plots unsprayed or treated with Surround WP did not show any statistically difference both in the total and harmful infestation analysing the whole period through repeated measurements ANOVA, while in the last sampling date plots with Eco-trap showed a significantly lower infestation (1-way ANOVA) (Figures 4 & 5).

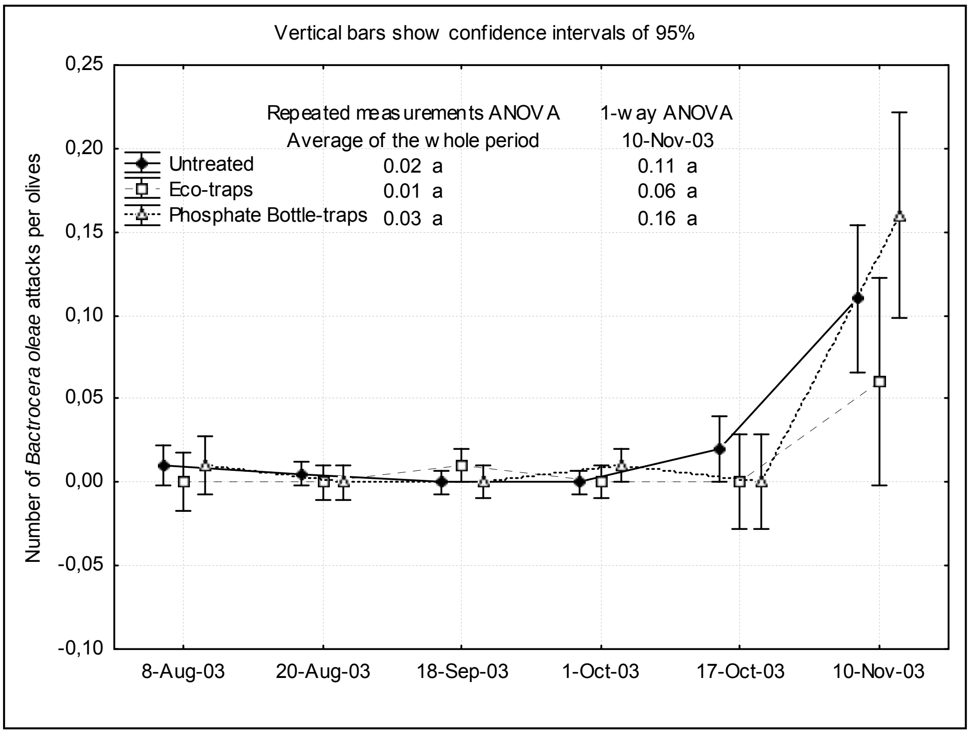

Figure 3. Trend of *B. oleae* total infestation in Licata olive grove in 2003.

Table 1. Total infestation (no. attacks per olive), in Trapani olive grove in 2004 (1-way ANOVA within each column; different letters denote statistically significant differences)

Theses	**25th Aug**	**7th Sept**	**21st Sept**	**2nd Oct**	**9th Oct**	**16th Oct**	**23rd Oct**	**30th Oct**	**6th Nov**	**ANOVA repeated measurement (for the whole period)**
Untreated	0.00	0.00 a	0.10 a	0.47 a	0,45 ab	0.98 a	1.57 a	1.60 ab	2.78 a	0.88 a
Eco-trap unsprayed	0.00	0.00 a	0.07 ab	0.33 ab	0,58 a	0.88 a	1.40 a	1.95 a	2.00 b	0.80 a
Surround WP	0.00	0.02 a	0.00 b	0.13 bc	0,23 bc	0.10 c	0.38 bc	0.48 e	1.07 c	0.27 c
Eco-trap + Surround WP	0.00	0.00 a	0.02 ab	0.12 c	0,22 c	0.10 c	0.18 c	0.28 e	0.7 c	0.18 c
BPLK kaolin	0.00	0.00 a	0.03 ab	0.06 c	0,13 c	0.37 b	0.38 bc	0.97 cd	0.97 c	0.32 bc
Eco-trap + BPLK kaolin	0.00	0.02 a	0.00 b	0.12 c	0,12 c	0.23 bc	0.17 c	0.63 de	1.08 c	0.26 c
Copper hydroxide	0.00	0.02 a	0.02 ab	0.10 c	0,13 c	0.28 bc	0.52 b	1.22 bc	2.02 b	0.48 b
Eco-trap + copper hydroxide	0.00	0.02 a	0.00 b	0.06 c	0,02 c	0.07 c	0.17 a	0.55 e	0.7 c	0.17 c

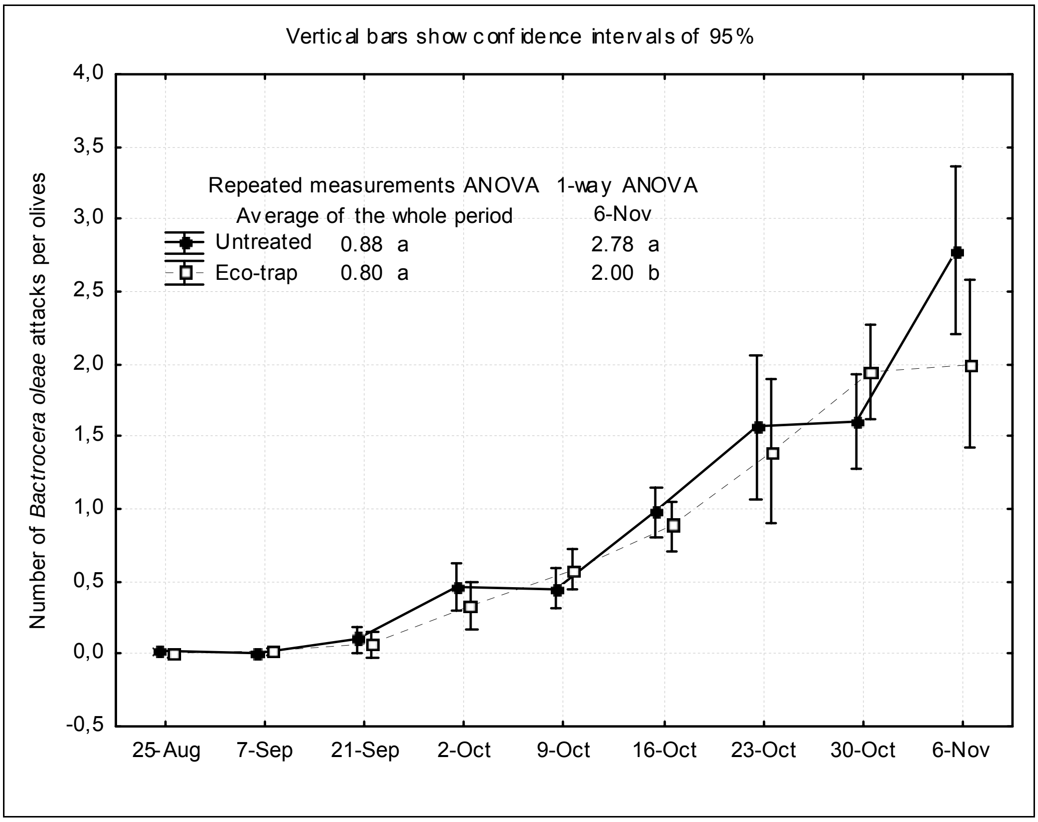

Figure 4. Trend of *B. oleae* total infestation in untreated and Eco-trap plots (Trapani, 2004).

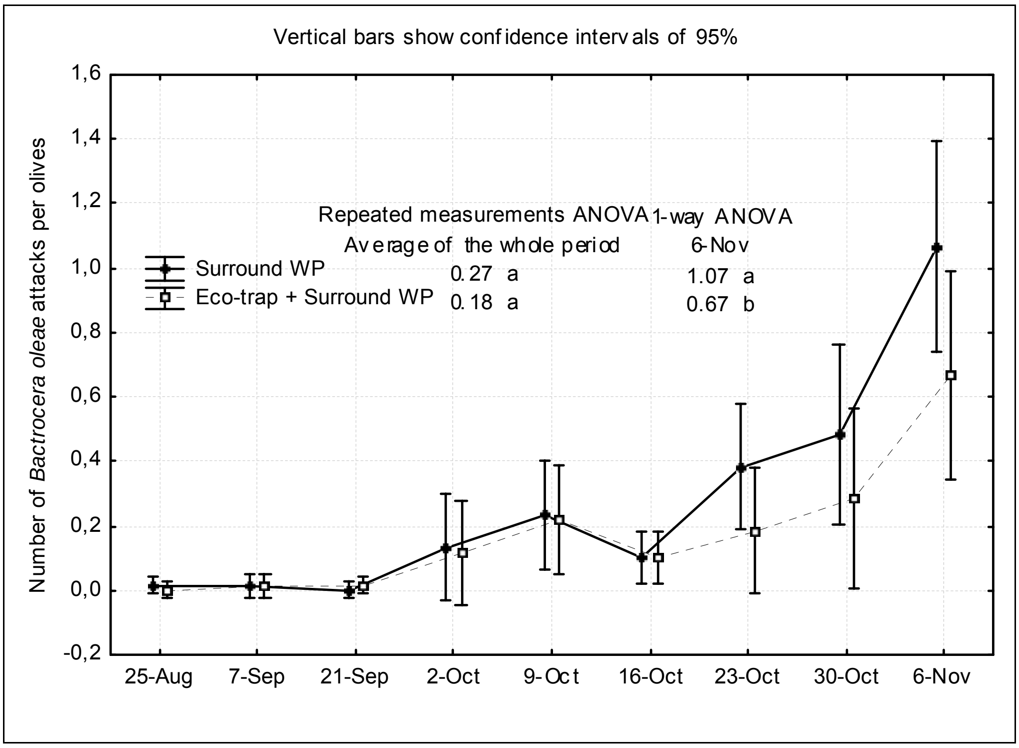

Figure 5. Trend of *B. oleae* total infestation in Surround WP and Eco-trap + Surround WP plots (Trapani, 2004).

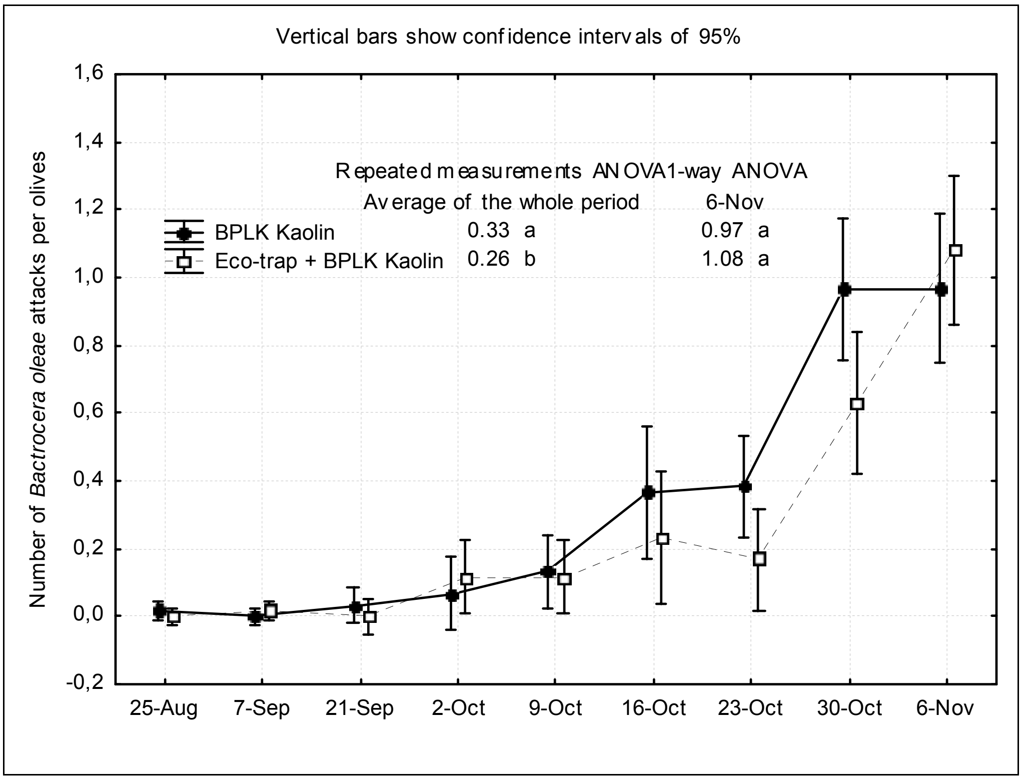

Figure 6. Trend of *B. oleae* total infestation in BPLK kaolin and Eco-trap + BPLK kaolin plots (Trapani, 2004).

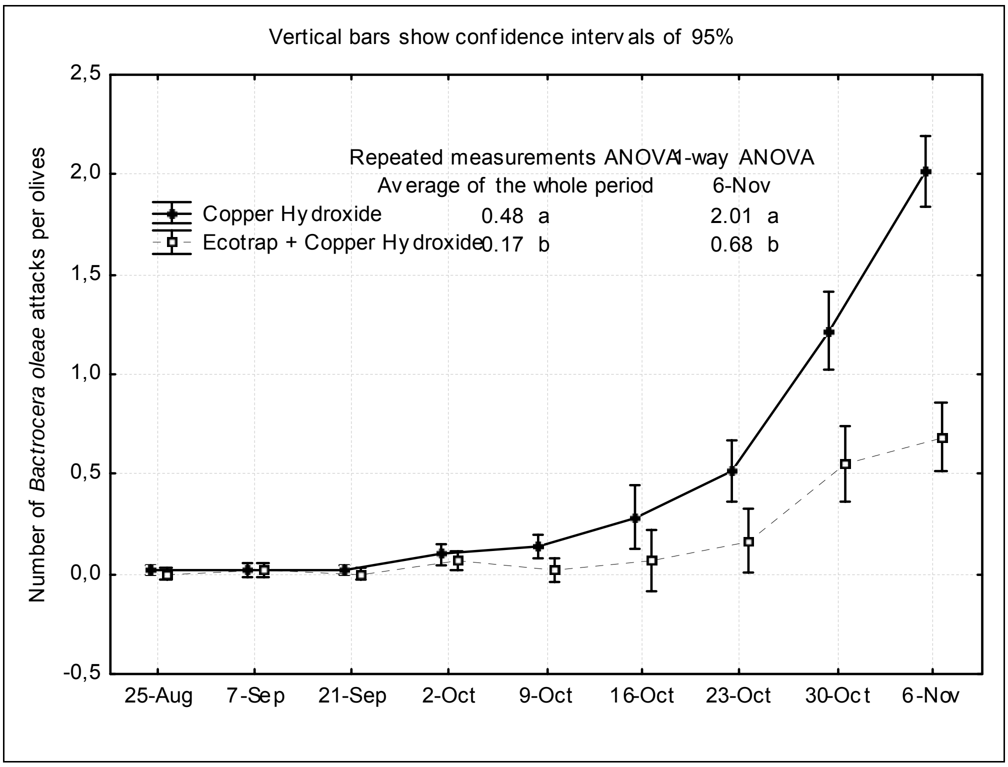

Figure 7. Trend of *B. oleae* total infestation in copper hydroxide and Eco-trap + copper hydroxide plots (Trapani, 2004).

In the two couples of plots treated with BPLK kaolin and copper hydroxide, the total infestation of the whole period was significantly lower in plots with Eco-trap (Figures 6 & 7). The statistical analysis of the total infestation on November 6th showed a significant lower level in the plot with copper hydroxide with Eco-trap vs. the plot copper hydroxide without Eco-trap (Figure 7); on the contrary, in the couple of plots sprayed with BPLK kaolin no difference resulted (Figure 6).

The additional power of Eco-trap in controlling *B. oleae* resulted very limited in plots sprayed with kaolin products and more consistent in the plot with copper hydroxide.

Results of this research confirm that the use of Eco-trap has not a clear effectiveness in reducing *B. oleae* infestation (Viggiani, 2001); in case of low pressure of the olive fly its use does not provide a significant reduction, and we confirm that the same happens, in any case, in the more external trees of the field or in small fields (Tsolakis & Ragusa, 2005); in case of high pressure of the tephritid the inner parts of the olive groves with Eco-traps, although some statistically significant differences, did not show so good results balancing their high cost.

Using Eco-traps their cost is every year the same, but in years with low level of *B. oleae* infestation their use will result unnecessary, while in years with high infestation levels, their use, also in organic olive groves, could be effectively replaced by a more flexible strategy consisting of 1-3 sprays with repellent products such as kaolin or copper products.

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