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IPM trials on attract-and-kill mixtures against the olive fly *Bactrocera oleae* (Diptera Tephritidae)

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Abstract

The key insect pest of the olive grove is the olive fly, *Bactrocera oleae* (Gmelin) because it affects the quantitative and qualitative production of olive oil. In order to first attract and then kill *B. oleae* adults before egg laying, thus limiting the infestation and avoiding treatments on the whole olive grove, we tested a mixture of the female sexual pheromone of the olive fly (1.7 dioxaspiro-5.5 undecane), the protein hydrolisate Buminal, and the insecticide Deltamethrin. We also tested different doses of the female sexual pheromone (1999: 1.212 ml/hl water and 2.424 ml/hl water; 2000: 2.424 ml/hl water and 4.848 ml/hl water). Both in 1999 and in 2000, treatments were applied when the gravity index Z exceeded the threshold level Z > 0.10. Irrespective of the general infestation level (high or low), the mixture successfully attracted and killed *B. oleae* adults. In both years, the mixture containing the pheromone at a dose of 2.424 ml/hl was the most effective.

Key words: *Bactrocera oleae*, IPM, olive, female sexual pheromone, Buminal, Deltamethrin, yellow sticky trap.

Introduction

The olive grove is an agroecosystem with integrated and biological control methods in constant evolution, and new integrated pest management (IPM) strategies aim at a reduced, targeted and, therefore, more selective use of agrochemicals.

The key phytophagous pest of the olive grove, *Bactrocera oleae* (Gmelin), shows the following characteristics: strict monophagism, direct association to areas with olive cultivation, likely disruption of the quantitative and qualitative production of olive oil (Del Rio, 1979; Michelakis and Neuenschwander, 1983; Belcari *et al.*, 1989; Ochando and Reyes, 2000). Traditional control techniques, usually used in Italy and other European countries, are based on agrochemical treatments, which are applied to the whole olive grove, against larval and adult stages of *B. oleae*. However, these treatments may also affect the useful entomofauna, and the olive oil quality due to the presence of residues (Spanedda and Terrosi, 2002a; 2002b).

In 1999 and 2000, in olive groves of Northern Lazio, the efficiency of a different *B. oleae* control method was investigated. We verified whether attract-and-kill treatments (mixtures including the sexual pheromone, a food attractant, and an insecticide) applied only to 6% of the trees within the olive grove, would attract and kill the adults before egg laying.

Materials and methods

The research was carried out at the specialized olive grove of the "Sugarella" Agriculture Farm, property of the Supreme Military Order of Malta in the town area of Canino (Viterbo, Italy) during the two-year period 1999-2000. The olive grove extends over a surface of approximately 14 ha, and has an altitude of 250 m above sea level. To the South and East it is surrounded by pastures, while to the North and West it borders with seed crop fields. It has a 6 x 6 tree spacing plantation layout with 35-40 year old trees. 'Canino' (87%) is the main cultivar; the other cultivars are 'Leccino', 'Frantoio', 'Maurino' and 'Pendolino' (13%). The experimental area was subdivided into three plots (plots A, B, and C). Plots A and B consisted each of approximately 185 trees, while plot C included approximately 300 trees.

In each plot, 12 plants of the main cultivar 'Canino' were selected and then exposed to the different treatments (see below). Both in 1999 and 2000, treatments were applied when the gravity index Z (Pucci, 1993) exceeded the threshold value Z > 0.10. This index allows an estimate of the development of *B. oleae* infestations (Pucci *et al*., 1979; Pucci, 1993) and is defined as:

$$Z = 0.039\ (Fm - 9.7) - 0.186\ (Tm - 22.1)$$

where:

- Fm is the mean number of females per yellow sticky trap, captured weekly;
- Tm is the mean of the daily mean temperatures recorded in that week.

Every year and in each plot, adults were monitored with three yellow traps placed on trees other than those exposed to treatments within the different plots. Traps were 15 x 20 cm in size, limed with Temocid glue (Kollant company), and oriented South. Traps were inspected weekly, and the number and sex of captured adults was recorded.

Once the threshold level Z > 0.10 was exceeded, the twelve target trees of plots A and B were treated with a mixture of the female sexual pheromone 1.7 dioxaspiro-5.5 undecane, the protein hydrolisate Buminal, and the insecticide Deltamethrin, diluted in 10 l of water. In both years and plots, Buminal was applied at a dose of 1,000 g/hl, and Deltamethrin at a dose of 1.67 mg/hl, but the doses of the female sexual pheromone varied