Efficacy of products allowed in organic olive farming against *Bactrocera oleae* (Gmel.)

Iannotta N.[1*], Belfiore T.[2], Noce M.E.[1], Perri L.[1], Scalercio S.[1]

1) C.R.A. Experimental Institute for Olive Growing, Rende, Cosenza, Italy; 2) Dept. of Ecology, University of Calabria, Rende, Cosenza, Italy

*Corresponding Author: nino.iannotta@entecra.it

Abstract

In organic olive farming, one of the most problems is how to control the olive fly. The present study has been performed in two different Calabrian olive areas in order to test some active molecules allowed by regulation concerning organic farming. The tested compounds were Rotenone, Azadiractin, Copper, Kaolin and Propolis. The results showed that, at harvesting time (end of October), the lowest infestation has been registered in the theses treated with Propolis and Kaolin in both investigated fields. The obtained results display that the restraining of the active infestation of Bactrocera oleae within limits of 20%, compatible with a quality production, turns to be possible also in Southern olive areas.

Keywords: *Bactrocera oleae*, organic biocide, olive, infestation, Calabria.

Introduction

In the Southern olive areas, the olive fly (*Bactrocera oleae* Gmel.), the most dangerous and noxious parasite of the olive plant and key phytophagous of the olive ecosystem, grows up and reproduces more easily owing to the climatic conditions favourable to its life cycle. It causes quali-quantitative damages; consequently, the need to contain the infestation within limits compatible with the achievement of high quality oil is evident. If in traditional olive farming, the phytophagous control is almost based on use of chemical pesticides, in organic olive farming it becomes more difficult and onerous. In this ecocompatible cultivation, in fact, it is only allowed a list of product contained in the EC Reg. 2092/91 concerning organic farming, whose efficacy is only partially known. These products, almost all of plant extraction except for copper (chemical extraction), should have been tested in relation to their potential efficacy in olive fly control also in comparison to dimethoate, the most used conventional pesticide (Iannotta 2003). In this study, it has been tested the efficacy of some products with biocide action as rotenone, the bioregulator azadiractine, the bactericide or bacteriostatic products containing copper and propolis, the repellent kaolin which constitutes a mechanical obstacle to ovideposition, in comparison to the dimethoate and to a control plot. The investigation has been performed in Calabria where *B. oleae* is perfectly settled in the environment causing considerable damages every year.

Material and Methods

The trials have been performed in 2005 in two different olive areas characterized by very high infestation of olive fly. The first experimental field is located in the plain of Sibari (Terranova da Sibari) and it consists of a 30-years old orchard characterized by the presence of Calabrian cultivars (Carolea, Dolce di Rossano and Tondina). In this field, in the theses treated with kaolin and propolis, three treatments were performed (4th August, 8th September and 17th October). Treatments were performed by spraying kaolin (5 Kg/hl of water) (SURROUND), propolis (150 g/hl) (PROPOLI+) adding to both solutions 50 ml of wetting agent. The theses treated with rotenone and azadiractin were sprayed on 11th August and 17th October (300 ml/hl of ROTENA and DIRACTIN, plus 50 ml of wetting agent). The second field placed on the Cosenza ionic coast (Mirto-Crosia) was made up

by an orchard with 15-18 years old plants belonging to the cvs Carolea, Cassanese and Dolce di Rossano in which kaolin and propolis were sprayed on 4th August, 7th September and 17th October. The thesis treated with rotenone, assisted by mass trapping to consist an integrated system allowed in organic olive growing (150 devices Attract and kill per hectare, placed on 5th July), and Azadiractin (200ml/hl) (DIRACTIN) were treated on 10th August, 7th September and 17th October. In the thesis treated according to conventional method, three dimethoate treatments (ROGOR 40, 150 ml/hl and 50 ml of wetting agent) were performed on 5th August, 2nd and 27th September. The plants belonging to the thesis used as control were treated only with water.

In both field, the flight trend of *B. oleae* were carried out by decadal reading of chromotropic traps (3/ha) (Raspi and Malfatti 1985) placed in July-December. Active and total infestation were determined by analysis of drupe samples (200/thesis) collected every ten days, on which different development stages (eggs, larvae, pupae, emergence holes and feeding tunnels) were registered. Climatic conditions concerning temperature and humidity, were monitored.

Results

The trend of adults, cumulatively captured by chromotropic traps in the experimental field of Terranova, is shown in figure 1. The demographical trend is referred to the different monitored theses; the data concerning the theses treated with kaolin and propolis were not registered owing to their reduced width. By examining this figure, it may be deduced that the plot treated with azadiractin registers the highest presence of adults in the field until the first decade of November, time considered as the best one for ripening. The other two theses, treated with copper and rotenone, display a trend comparable to that one exhibited by control thesis.

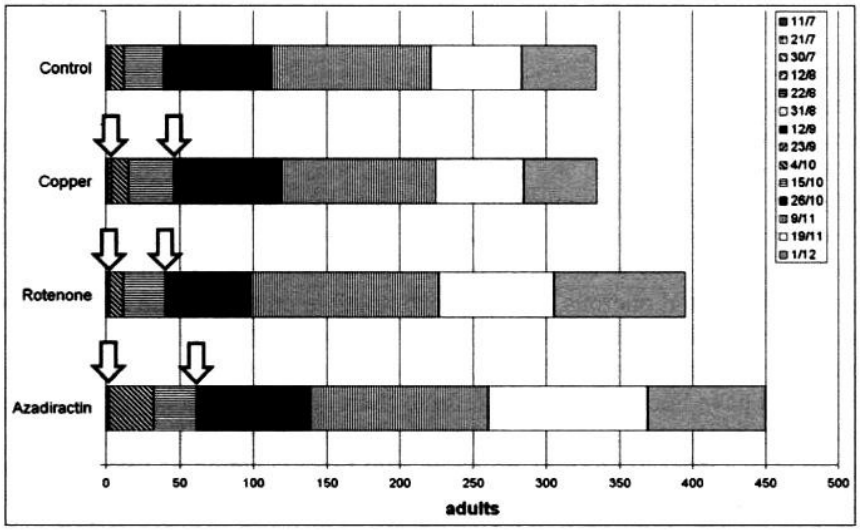

Figure 1. Demographical trend of *B. oleae* in Terranova da Sibari. Arrows indicate the treatment dates.

In table 1 results concerning active and total infestation registered in detailed times of observations are shown. These data display that, at harvesting time (first decade of November), in the thesis treated with kaolin it has been observed the lowest level of infestation. The infestation level appears progressively increasing in the theses treated with propolis, rotenone and copper. The plot treated with azadiractine shows a percentage of active infestation higher than all other treated theses and only slightly lower to that one registered in the control thesis. The Dipter pre-imago population trend is similar also in the times before harvesting, while in the course of time until December the theses appear to be equivalent. In all treated theses the infestation percentage does not exceed 20% until harvesting time (9th November), threshold still compatible with a quality production (Iannotta and Parlati 2002).

In figure 2 is shown the adult population trend registered in the field of Mirto-Crosia. The figure reports only two histograms concerning on the whole plots treated with product allowed

in organic farming and the plots treated with a conventional dimethoate, in order to put in evidence the comparison between two systems of control for the olive fly and, at the same time, to overcome the limit due to the reduced width of single plots for flights evaluation.

Table 1. Detailed data about weight, active (A.I.) and total (T.I.) infestation in the Terranova da Sibari.

	8/22	8/31	9/12	9/23	10/4	10/15	10/26	11/9	11/19	12/1	12/12	12/22
Azadiractin												
weight (g)	210.7	229.5	296.2	348.4	371.2	436.9	448.1	584.6	496.4	511.5	419.8	428.6
A.I. (T.I.)	0 (11)	- (-)	8 (20)	19 (27)	19 (39)	17 (30)	17 (30)	22 (45)	28 (52)	35 (60)	51 (73)	57 (70)
Kaolin												
weight (g)	207.3	274.3	315.9	344.3	325.1	377.4	435.4	523.2	507.7	432.6	531.7	467.4
A.I. (T.I.)	0 (6)	2 (14)	4 (22)	17 (29)	12 (36)	19 (35)	17 (32)	8 (27)	24 (31)	36 (42)	37 (59)	17 (38)
Copper												
weight (g)	254.5	309.9	359.4	363.6	394.2	424	508.7	582.4	524.8	553.4	418	510.6
A.I. (T.I.)	3 (17)	8 (26)	10 (36)	18 (32)	17 (36)	11 (26)	9 (20)	11 (36)	30 (50)	34 (54)	39 (57)	46 (63)
Propolis												
weight (g)	234.2	239.5	304.5	369.2	467.1	436.2	459.2	493.2	507.7	411.4	429.7	392.3
A.I. (T.I.)	6 (11)	6 (18)	13 (23)	7 (26)	6 (22)	17 (33)	10 (28)	17 (40)	32 (58)	42 (62)	51 (65)	34 (67)
Rotenone												
weight (g)	248.2	239	271.4	298.6	352.1	450.1	484.8	548.8	473.5	465.3	486.1	422.7
A.I. (T.I.)	0 (17)	5 (23)	14 (23)	13 (27)	12 (22)	19 (34)	9 (24)	13 (29)	34 (50)	42 (66)	29 (55)	34 (60)
Control												
weight (g)	299.4	318.8	399.6	402.2	464.7	447.8	538.6	569.9	529	523.5	492.7	490.5
A.I. (T.I.)	2 (16)	6 (23)	14 (29)	23 (35)	18 (36)	20 (41)	19 (43)	18 (43)	37 (58)	36 (56)	39 (65)	45 (64)

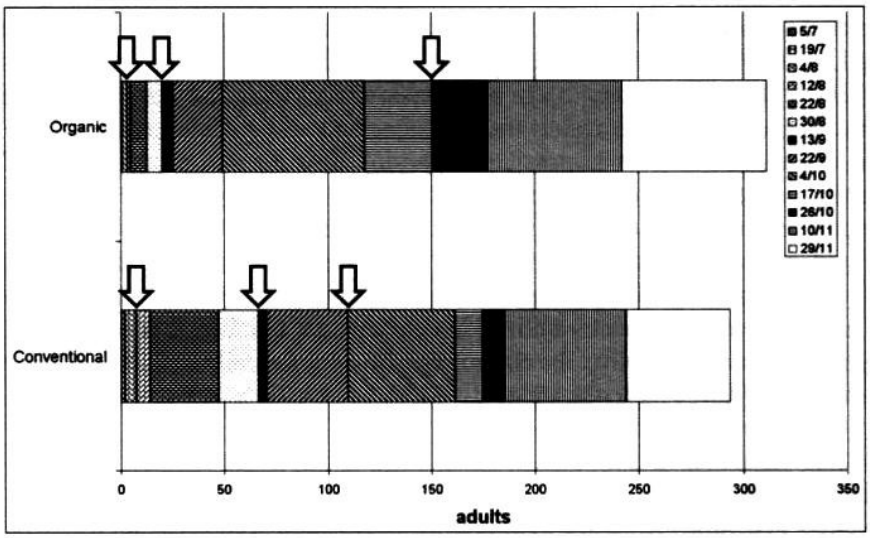

Figure 2. Demographical trend of *B. oleae* in Mirto-Crosia. Arrows indicate the treatment dates.

Table 2. Detailed data about weight, active (A.I.) and total (T.I.) infestation in the Mirto-Crosia field.

	8/22	8/30	9/13	9/22	10/4	10/17	10/26	11/9	11/29	12/16
Azadiractin										
weight (g)	161.7	208.1	223.8	255.4	242.3	271.4	397.9	291.7	386.8	237.6
A.I. (T.I.)	4 (14)	4 (30)	17 (48)	12 (33)	24 (50)	19 (38)	21 (63)	20 (54)	24 (65)	45 (79)
Kaolin										
weight (g)	176.5	235.9	206.2	281.3	284.7	302.8	338	292.3	374.5	277.6
A.I. (T.I.)	4 (14)	9 (21)	9 (25)	9 (26)	13 (34)	17 (29)	16 (38)	12 (31)	14 (35)	23 (30)
Propolis										
weight (g)	186.5	185.8	229	255.3	242.5	255.4	259.2	335.5	342.4	259.6
A.I. (T.I.)	6 (20)	8 (37)	20 (40)	12 (24)	26 (55)	18 (51)	17 (53)	19 (54)	21 (39)	46 (61)
Rotenone										
weight (g)	208.7	225.9	225.4	237.3	235.4	355.4	361.5	305	337.4	428.1
A.I. (T.I.)	2 (16)	6 (34)	10 (33)	12 (35)	20 (45)	24 (44)	42 (81)	20 (60)	27 (71)	37 (76)
Control										
weight (g)	188.5	207.6	227.9	266.5	286.7	276.7	212.6	368.9	391.4	258.7
A.I. (T.I.)	9 (27)	11 (37)	6 (31)	13 (34)	12 (29)	28 (55)	26 (60)	37 (76)	31 (74)	53 (90)

Obtained data display the same presence of the Dipter in the plots treated with products allowed in organic farming, at least until harvesting time (first decade of November).

In table 2 data concerning active and total infestation registered in the single observation times, are reported. Similarly to previous case, the thesis treated with kaolin turns out to be the less infested in all the observation times, including the harvesting time (first decade of November). All the other treated theses show values lower than those ones obtained for control thesis, comparing all observation times. The obtained data emphasize a particular efficacy of kaolin and propolis both in comparison of control thesis and all other treated theses, where often the percentage overcomes the threshold of 20% of active infestation before time considered as optimum for harvesting. The data display a total infestation trend similar to that one observed for active infestation.

Discussion

From on the whole obtained data some interesting conclusion, concerning active agents tested in the two Calabrian olive areas characterized by a very high olive fly infestation due to their bioenvironmental conditions, can be inferred. These suggestions turn out to be even more interesting considering the remarkable development of areas cultivated according organic farming method, where the high Dipter infestation problems turn out to be even more difficult that determining the economic convenience of the ecocultivation (Iannotta *et al.* in press, a).

The results showed an excellent efficacy of kaolin which allowed to restrain the infestation percentage within 20% and, consequently, to obtain a quality olive oil. These data confirm the results obtained in previous researches carried out by CRA Experimental Institute for Olive Growing concerning kaolin efficacy and its nearly null collateral effects on chemical and organoleptic quality of olive oil (Iannotta *et al.* in press, b). In both experimental fields, also propolis treatment turns out to be interesting providing better results than rotenone and azadiractine treatments, the most utilized products in organic farming. It is possible supposing also for this product, even if it is not yet experimentally proved, the low incidence of side-effects on environment and olive oil. Copper showed a quite large efficacy, comparable to that one exhibited by rotenone.

In the light of these considerations arising from the evidence that all products allowed by legislation concerning organic farming showed a good efficacy also in comparison with the traditional active agent (dimethoate) utilized in conventional farming, it is possible to conclude that the problems concerning the olive fly control can be optimistically tackled also in ecocompatible olive farming carried out in high risk areas.

Acknowledgements

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