

# Survey on the control methods of *Bactrocera oleae* (Gmelin) in organic olive groves producing oil and table olives in Sicily

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## Abstract

*In Sicily there are several organic farms producing olive oil and the number of farms has grown in the last years. The control methods of Bactrocera oleae (Gmelin) used by Sicilian organic farms were surveyed in 2004 and 2005. After a bibliographic search, on search engines on internet and by personal contacts, a sample of 30 organic farms in Sicily was chosen; 23 farms produce bottled extra-virgin oil and 7 produce table olives. Then farms were contacted by phone, some of them visited and olive growers were interviewed. For each farm were put together data about: interventions vs. the olive fruit fly, altitude, surface of the olive grove, olive cultivar, irrigation method, harvesting period, milling procedure, product destination and production results in 2005 and in the previous years.*

*From collected data we can say that to obtain oils of excellent quality and table olives of good quality in organic farming is surely possible; the early harvesting and a quick milling (for the oil) let to obtain good results.*

*The most used interventions are: mass trapping with ammonium carbonate, pheromone and pyrethroids, bottled-traps baited with sardines, yellow sticky traps, sprays with kaolin, Bordeaux mixture or pyrethrum, but there is more than one third of sampled oil producers not using any control method except early harvesting and a quick milling.*

*Unfortunately the organic farms producing table olives in Sicily are very few, perhaps because, differently from olive oil producers, table olive plantings are almost all young and the experience of growers in such organic cultivation is not strong. Also these growers prefer to use mass trapping to control olive fruit fly, but best results were achieved by farmers spraying kaolin, rotenone or copper hydroxide.*

**Keywords:** organic olive growing, *Bactrocera oleae*, control methods.

## Introduction

In the last years the organic olive growing has been in expansion, particularly for the olive oil production; the number of farms and the surface of the olive groves increased and the products of these farms have had always more success on the market.

Consumers prefer healthy and more controlled products and farmers understood that agriculture should be more respectful of environment and less productive, but of excellent quality.

In Sicily there are about 1,482 organic olive farms and their total surface is about 9,634 ha (ISMEA 2004). The favourite pedoclimatic conditions, the possibility of valorise the product and the consequent development of the farms encourage the conversion to the organic olive growing. Unfortunately in Sicily also the commercial net of organic products is not efficient and this point of weakness sometimes discourage the farmers.

*Bactrocera oleae* (Gmelin) is the key insect in olive growing and in organic farming, because of the ban of synthetic insecticides use, the larvicide control of *B. oleae* is almost impossible.

At the moment no data are available on the control methods vs. *B. oleae* used in organic farming in Sicily.

The aim of this paper is to provide the first data on the control of the olive fruit fly in Sicilian organic olive groves producing quality olive oil and table olives.

## Material and Methods

### *Organic farms producing extra-virgin olive oil*

The survey on the control methods of *B. oleae* used in organic olive groves producing oil was carried out in 2005 and 2006, addressed to methods used in 2005 and in the previous years.

After a bibliographic search, on search engines on internet, by personal contacts and thanks to technicians of the University of Palermo and of the Agriculture Department of the Sicily Region (Assessorato Agricoltura e Foreste, Regione Siciliana) a sample of 23 organic farms in Sicily was chosen; these farms produce bottled extra-virgin oil (23 oil producers in Sicily out of about 1482 organic olive oil growers); 21 out of 23 participated to the International Biol Prize in the last editions. Then farms were contacted by phone, some of them visited and olive growers were interviewed. We interviewed 5 farmers in Agrigento, 1 in Caltanissetta, 1 in Catania, 2 in Enna, 1 in Messina, 6 in Palermo, 2 in Ragusa, 2 in Siracusa and 3 in Trapani Provinces. For each farm were collected data about: control methods of the olive fly, altitude, surface of the olive grove, olive cultivar, harvesting period, milling procedure, product destination and production results in 2005 and in the previous years (see questionnaire no. 1 in Fig. 1).

### *Organic farms producing table olives*

Also in these farms the survey on the control methods of *B. oleae* used was carried out in 2005 and 2006, addressed to practices used in 2005 and in the previous years.

As for the extra-virgin olive oil, after a bibliographic search, on search engines on internet, by personal contacts and thanks to technicians of the University of Palermo and of the Agriculture Department of the Sicily Region (Assessorato Agricoltura e Foreste, Regione Siciliana), we sampled 7 olive groves producing table olives in Sicily; they are located in Agrigento (1), Catania (2), Palermo (1) and Trapani (3) Provinces. Then farms were contacted by phone, some of them visited and olive growers were interviewed. For each farm we collected almost the same kind of data of olive oil producers (see questionnaire no. 1 in Fig. 1), except production results: percentage in weight of table olives, percentage of high quality table olives production of fresh or processed olives.

## Results

### *Olive oil production*

The 23 sampled farms producing organic olive oil are at altitudes varying from 15 to 700 m a.s.l. (Fig. 2) and have a cultivated area between 1.5 and 53 ha (average 17.3 ha). The most planted olive cultivars are autochthonous ones of each area: Biancolilla, Cerasuola, Nocellara del Belice, Moresca, Nocellara Etna and Tonda Iblea.

In five farms two different interventions vs. the olive fruit fly were performed in two different parts of each farm, for this reason from here on they are considered as different farms, and their total is 28 instead of 23 (Figs. 3-5).

In 2005 10 farms did not perform any intervention vs. *B. oleae*; eight of these farms are located above 300 m a.s.l., representing more than half of those at these altitudes. The most used intervention was mass trapping (15 out of 28 farms). Two devices baited with ammonium salts and the sex pheromone, and a pyrethroid (deltamethrin or lambda-cyhalothrin) as insecticide were used: in one farm Attract and Kill, in 11 Eco-trap (in two of the last ones 2 copper hydroxide sprays were added); in 2 farms mass trapping was performed by bottle-traps baited with sardines, while in one yellow sticky traps were used; 3 farms sprayed repellent, antiovipositional products (kaolin, Bordeaux mixture or pyrethrum) (Figs. 3-5).

14 olive growers monitored the fly with pheromones traps, one with yellow traps; 11 farms analysed the olives to the naked eye and only one used the stereomicroscope to analyse the olives.

The olive oil extraction in 24 hours after the harvesting is practiced in all the olive groves except in one, where is done in 48 hours (13 farms out of 23 have their own mill); 17 farms practice the early harvesting (about 15 days before conventional olive groves, Fig. 4). In this year, 21 farms obtained extra-virgin olive oil of excellent quality and the other 2 extra-virgin olive oil; production was good for all the farms and only one farm had problems of fruit drop due to the olive fruit fly. The olive oil produced by these farms is almost totally bottled and sold in the national and foreign market (Germany, U.S.A., Japan, etc.).

Figure 1. Questionnaire 1: Interventions vs. *Bactrocera oleae* used by Sicilian organic farms producing olive oil.

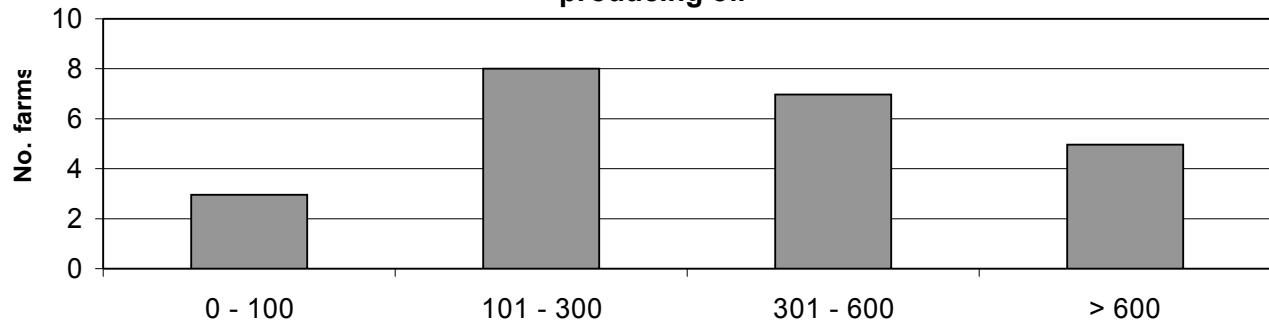
<b>UNIVERSITÀ' DEGLI STUDI DI PALERMO DIPARTIMENTO SENFIMIZO</b> <b>SEZIONE DI ENTOMOLOGIA, ACAROLOGIA E ZOOLOGIA</b> Viale delle Scienze – 90128 Palermo (ITALIA) Tel. (0039) 091/7028812 – Fax (0039) 091/7028882 Codice Fiscale 80023730825 – Partita IVA 00605880822	
<b>Questionnaire on interventions vs. <i>Bactrocera oleae</i> (Gmelin), in organic farms producing olive oil in Sicily</b>	
<b>Farm</b>	
<b>Owner</b>	
<b>Site</b>	
<b>Province</b>	
<b>Phone</b>	
<b>Fax</b>	
<b>E-mail</b>	
<b>Web site</b>	
<b>Interventions vs. the olive fruit fly (2005)</b>	
None	
Mass trapping with yellow sticky traps (How many traps?)	
Mass trapping with traps baited with ammonium carbonate, pheromone and pyrethroids (How many traps?)	
Mass trapping with bottle-traps baited with ... (How many traps?)	
Sprays with copper hydroxide	
Sprays with rotenone	
Sprays with...	
No. sprays	
Other methods	
Monitoring of the fly with pheromone traps	
Monitoring of the fly with yellow traps	
Analysis of fruit infestation to the naked eye	
Analysis of fruit infestation to stereomicroscope	
Intervention threshold	
<b>Intervention vs. the olive fly (previous years)</b>	
None	
Mass trapping with yellow sticky traps (How many traps?)	
Mass trapping with traps baited with ammonium carbonate, pheromone and pyrethroids (How many traps?)	
Mass trapping with bottle-traps baited with ... (How many traps?)	
Sprays with copper hydroxide	
Sprays with rotenone	
Sprays with...	
No. sprays	
Other methods	

Continued overleaf

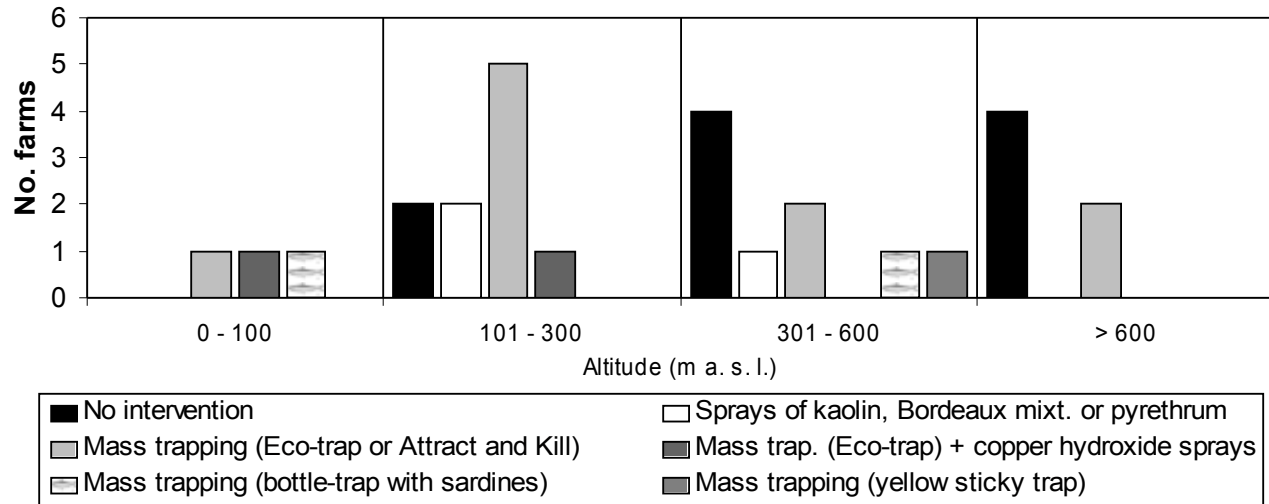
Continuation of "Questionnaire 1: Interventions vs. *Bactrocera oleae* used by Sicilian organic farms producing olive oil."

<b>Results 2005</b>	
Extra-virgin olive oil of excellent quality ( acidity < 0.3 - peroxide number < 6)	
Extra-virgin olive oil	
Virgin or lamp oil	
Amount of production	
Fruit drop	
<b>Results previous years</b>	
Extra-virgin olive oil of excellent quality ( acidity < 0,3 - peroxide number < 6)	
Extra-virgin olive oil	
Virgin or lamp oil	
Amount of production	
Fruit drop	
<b>Harvesting period</b>	
2005	
Previous years	
<b>Milling procedure</b>	
In 24-48 hours	
After 48 hours	
In your own mill?	
<b>Farm data</b>	
Altitude (m a.s.l.)	
Surface of the olive grove (ha)	
Cultivars	
<b>Products</b>	
Bottled oil (%)	
Unbottled oil (%)	
Table olives (%)	
Other	
<b>Market of destination (percentage of the product; total = 100)</b>	
<i>% direct sales in situ</i>	
<i>% regional</i>	
<i>% national</i>	
<i>% European Community</i>	
<i>% on the foreign market</i>	

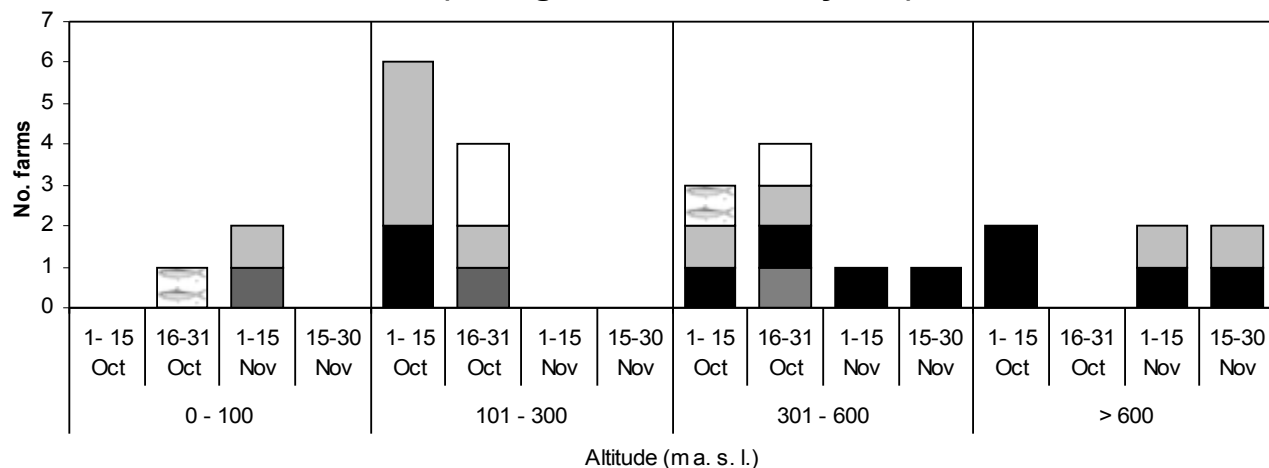
**Fig. 2 - Altitude (m a. s. l.) of sampled Sicilian organic olive groves producing oil**



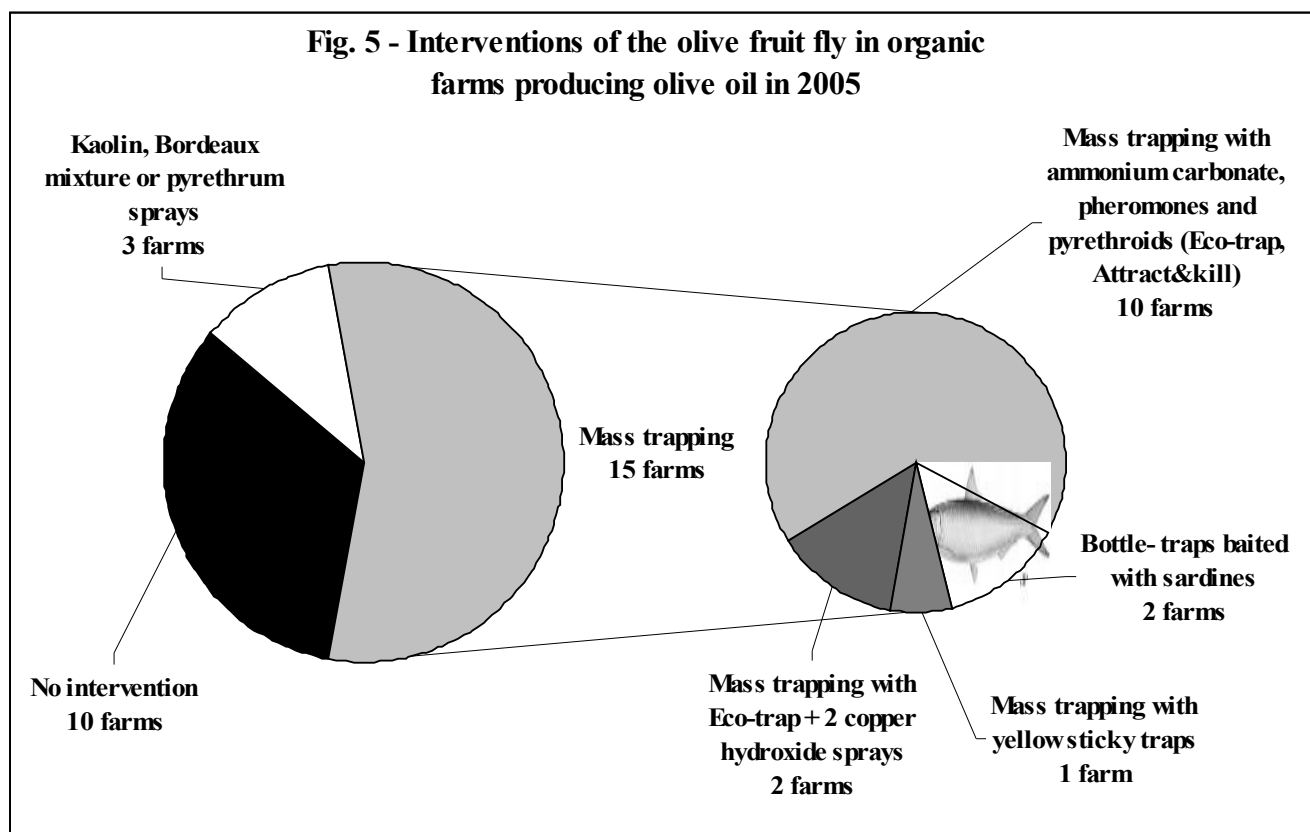
**Fig. 3 - Interventions vs. *Bactrocera oleae* used by Sicilian organic olive growers producing oil in 2005**



**Fig. 4 - Harvesting period in Sicilian organic farms producing olive oil (average of the last three years)**



**Fig. 5 - Interventions of the olive fruit fly in organic farms producing olive oil in 2005**



In the previous years control methods and production results differed from 2005 in few cases. Eight farms, instead of 10, did not use any tool to control *B. oleae*; four growers sprayed rotenone or pyrethrum or azadirachtin; the mass trapping by Eco-trap was performed in 8 farms. Each farm obtained extra-virgin olive oil, but only 10 were of excellent quality; in 2004 the production of two coastal olive groves was cut into halves by the fruit drop due to the high olive fly infestation added to a late harvesting.

21 out of 23 sampled farms participated to the last four editions of the Biol Prize, international awards for extra-virgin organic olive oil ([www.premiobiol.it](http://www.premiobiol.it)), and some of them won many awards: one of them won 4 times the 1<sup>st</sup> Place Biol Prize, one won one edition, three reached the 2<sup>nd</sup> Place, 12 of them had the award as Quality Olive Oil and 7 won the Sicily Biol Prize.

#### *Table olives production*

Our survey includes only 7 growers, but we assume that the total number of Sicilian organic olive growers clearly addressed to produce table olives is not higher than 15-20.

The 7 sampled farms producing table olives (tab. 1) are at altitudes between 60 and 300 m a.s.l. and have a cultivated area ranging from 1.3 to 17 ha (average 9 ha). Differently from olive oil producers, table olive plantings are almost all young and the experience of growers in such organic cultivation is not strong.

The prevailing olive cultivars planted in these farms are: Giarraffa, Moresca, Nocellara del Belice, Nocellara Etnea and Tonda Iblea; irrigation and early harvesting are practiced in all farms; 5 farmers sell their product as green fresh olives, while 2 transform it in brine and sell it in pots, packets or cans.

In 2005 most of the farms used mass trapping (with chromotropic traps with or without pheromone, or traps with proteinic attractants or Eco-trap); one grower placed just few yellow sticky traps (20 traps/ha), but this olive grove is located on the hills, at 300 m a.s.l. Two farmers sprayed kaolin, rotenone or copper hydroxide (1-2 sprays in the last 40-50 days before harvesting); these growers achieved the best productive results. In the other

farms results were different: 5 olive growers declared their product as good (> 50% of table olives), while 2 considered it of poor quality.

Table 1. Control methods vs. *Bactrocera oleae* used by Sicilian organic growers producing table olives.

Farm site, Province (Altitude, m a. s. l.)	No. tree (cultivar)	Product destination	Harvesting period	Interventions vs. <i>B. oleae</i>			
				2005		Previous years	
				Used methods	Results	Used methods	Results
Castelvetrano, Trapani (65)	300 (Nocellara del Belice, Giarraffa)	Processed table olives	End of September- beginning of October	Monitoring to the naked eye 1 spray with rotenone, kaolin or copper hydroxide	Good (100% table olives, but with different quality levels)	Monitoring since Sept. with yellow traps (1/tree). Sprays with rotenone or copper hydroxide every 6-8 days	Good (100% table olives, but with different quality levels)
Ribera, Agrigento (70)	500 (Tonda Iblea)	Fresh table olives/ olive oil	2 <sup>nd</sup> fifteen of September	Mass trapping with chromotropic traps	Second- rate (only olive oil)	As in 2005	Good
Gravina di Catania, Catania (100)	2600 (Nocellara etnea, Moresca )	Fresh table olives/ olive oil	Half September	Mass trapping with Eco-trap	Good	Mass trapping with yellow sticky traps	Good (50% table olives)
Partanna, Trapani (150)	1800 (Nocellara del Belice, Giarraffa, Gordales)	Fresh and processed table olives/ olive oil	End of September- beginning of October	Monitoring with pheromone traps Mass trapping with proteinic attractant	Good	Mass trapping with proteinic attractant + sprays with copper oxycloride	Second- rate (few table olives)
Lentini, Siracusa (150)	2000 (Nocellara Etnea, Tonda Iblea)	Fresh and processed table olives/ olive oil	End of September	Mass trapping with yellow, pheromone traps	Good	As in 2005	Good
Partanna and Castelvetrano, Trapani (150 / 200)	2500 (Nocellara del Belice)	Processed table olives/ olive oil	End of September- beginning of October	2 sprays with kaolin	Good	Mass trapping with Eco-trap	Often second- rate
Contessa Entellina, Palermo (300)	3700 (Nocellara del Belice, Giarraffa)	Fresh table olives/ olive oil	End of September	Monitoring with yellow traps	Second- rate	Trapping with few yellow sticky traps (20/ha)	Second- rate (few table olives; 10%)

## **Discussion**

The results of this survey show that Sicilian organic olive growers are able to produce an excellent oil and win awards for their oil quality, in spite of the ban of spraying synthetic insecticides. 10 out of the 23 sampled farms do not perform any intervention vs. *B. oleae*, also at altitudes lower than 600 m a.s.l. The olive oil quality do not seem strictly related to the intervention vs. the olive fruit fly. Sicilian growers not performing any intervention vs. *B. oleae*, or using mass trapping with bottle-traps baited with sardines, Eco-trap (with or without copper hydroxide sprays), sprays with kaolin, Bordeaux mixture or pyrethrum won Biol Prize awards.

The early harvesting and quick milling is to consider the most important method to minimize the damage caused by the olive fruit fly in the production of organic olive oil.

The production of organic table olives is more problematic because the appearance of the fruit is essential. We have recorded only few of these organic growers, with frequent poor production because of olive fly attacks. Most of them use mass trapping to control *B. oleae*, but the best results are achieved through a correct irrigation management, early harvesting and spraying allowed repellent antiovipositional products.

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