The Benefits of Insecticide Use: Olives

Olive Fruit Fly

Olive Fruit Fly Pupa Inside Olive

Internal Decay and Feeding Damage From Olive Fruit Fly

Spraying Insecticide for Olive Fruit Fly

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Leonard Gianessi
Key Points

- The olive fruit fly was first noticed in California in 1998 and has spread to most locations where olives are grown.
- Olive processors enforce a zero standard for olive fruit fly.
- Up to 87% of the olives in an orchard can be damaged by the olive fruit fly.
- California olive growers spray an insecticide bait (approved for organic growers) to control populations of the olive fruit fly.

Technical Summary

The olive tree has been a part of Mediterranean civilization since before recorded history. As early as 3000 BC, Syrians cultivated olives and traded in its oil. Olives were dispersed by the explorers and colonists. In 1560, olive cuttings were carried to Peru by Spanish explorers. The first California mission was founded at San Diego in 1769. Olives were soon grown there. By 1855, 503 olive trees were growing in the state. A renewed interest in olive oil production led to significant expansion of the industry between 1870 and 1900. The number of trees went from 5,600 in 1876 to 539,000 by 1901 [5]. California growers found that they could not compete with the less expensive European olive oil. Shortly thereafter, the industry shifted its emphasis to the production of pickled olives, the mainstay of the California industry ever since.

Over 99% of the olives grown in the U.S. are grown in California. California is primarily a table olive industry producing the “California Black Ripe” table olive. This is a product unique to California and is unlike the Mediterranean styles. California grows almost 11% of the total world production of table olives and .1% of the olive oil [4]. California growers harvest about 254 million pounds of table olives from 31,000 acres, representing a value of $84 million at the producer level and about $350 million in processed value. The majority of olive acreage in California (65%) is located in the San Joaquin Valley. The other production area is the Sacramento Valley. There is a small but developing acreage in the coastal areas of California to exclusively produce gourmet olive oil. An additional 3-4,000 acres have been planted for olive oil with an estimated value of $18 million. All olives destined for the “California Black Ripe” process are picked green and immature. Following harvest, the fruit are soaked in an aerated lye solution that eliminates the bitterness contained in the fresh fruit and turns the fruit black [4].

In the decade prior to 2000 California olive orchards were infrequently treated with insecticides for any arthropod pests. Of the most significant pests, black scale could be managed by pruning of the interior tree canopy to increase the temperature in the summer, and olive scale was under good biological control [2].

The olive fly was first detected in California on October 19, 1998. It has now spread to most locations where olives grow within the state. The olive fruit fly spread throughout California at a rate of about 100 miles a year, indicating great mobility [3]. This pest colonized the state of California more quickly than any other pest in the last 25 years.
The olive fruit fly is the most serious insect pest of olive fruit in the world. A native of East Africa, it is known primarily from the Mediterranean area of southern Europe, and it is also found in North Africa, the Middle East, and along the east coast of Africa to South Africa. There are records of olive fly infestations in fruit three centuries BC in the eastern Mediterranean. In areas of the world where olive fruit fly is not controlled, its damage has been responsible for losses of up to 80% of oil value because of lower quantity and quality. In some varieties of table olives, this pest is capable of destroying 100% of the crop [6]. The adult fly is about 3/16 inch long (about the size of a housefly), reddish brown in color with large reddish eyes and small antennae.

Fruits in the plant genus *Olea* are the only known natural hosts for the olive fruit fly. The fly lives all of its life stages solely in the olive fruit and emerges as a winged adult. The fly attacks both cultivated and wild olives. In nature, this insect only reproduces in olive fruit. Although the olive is the only natural breeding host for the fly, flies have been found in other plants as they search for food, or for protection and refuge [1]. They are strong flyers and have been observed flying up to six miles to find an olive tree.

In California, it is believed that at least three and perhaps as many as five or six generations of olive fly can develop in the olive production areas of the San Joaquin Valley. In milder parts of the state such as San Diego County, olive fly development can be continuous throughout the year. In summer, olive flies can complete a generation in as little as 30 to 35 days. When the new olive crop reaches a stage where the pit begins to harden, it gives off chemicals which trigger the development of eggs in the olive fruit fly. Olive fly females can lay from 50-400 eggs in her lifetime, usually one in each fruit [1]. She also introduces bacteria which break down the flesh of the fruit enabling her offspring to feed better. The developing larval stages (maggots) feed upon the internal fruit tissues. While feeding, they tunnel throughout the fruit, destroying the pulp and allowing secondary infestations of bacteria and fungi that rot the fruit [3]. This cell destruction greatly increases the free fatty acid level (acidity) of the olive oil and causes off flavors. The egglaying stings, caused by the female laying eggs inside the olive, destroy the value of table fruit. Not all egglaying stings result in a maggot. Stings cause holes and a moon shaped depression on the olive. Stings alone, without eggs or larval feeding, will lower the value of table fruit [1]. After emerging as an adult, males seek out females to mate. Females attract males by emitting a pheromone. Adult flies can live from 2 to 7 months.

As the season progresses, an increasing proportion of the larvae leave the fruit, pupate and overwinter in the soil.

Although some generalist natural enemies have been reported attacking the olive fruit fly in California, these have not suppressed olive fruit fly to sub-economic levels [2]. Efforts are underway to locate, import, introduce and establish new species of parasitoids that are highly-specific to olive fruit fly [10]. The olive fly has few natural enemies in Europe.

Olive processors will not risk olive fruit fly infested fruit in their products and cannot readily separate them during processing. The processors that purchase olives for curing
enforce a zero tolerance of olive fruit fly. Thus, table olive growers must keep their olive crops free of olive fruit fly infestations. The tolerance for olive fruit fly in oil olives depends on the individual processor, but is usually around 10% damage [2]. California’s canning olive industry reports that even a 1% infestation translates into 1 maggot per every other can. And 0.1% infestation translates into one maggot per every 50 cans of olives. To guarantee that fruit will be free from olive fruit fly injury, prophylactic applications of insecticide are required to control egglaying females [2].

Currently, GF-120 NF Naturalyte Fruit Fly Bait (containing the active ingredient spinosad) is the only product registered as a sprayable insecticidal material [2]. It is approved for organically-grown olives. The bait is a formulation of hydrolyzed protein. Female fruit flies need protein for egg production and are attracted to ammonia, a volatile compound associated with protein decomposition [7]. There is no need to cover the whole tree, because the adult flies are attracted to the bait, feed on it and die. In order for the bait to be effective, it needs to remain moist to attract the fly. Once it dries out, the effectiveness of the chemical is reduced [8]. In order to achieve adequate control in heavily infested orchards, most growers apply the material every week from late spring to harvest. GF-120 provided very good control in trials, with damage levels averaging around 3% compared to untreated controls with 87% damage [3].

The cost of olive fruit fly control is estimated at $73/A, which represents about 2% of the cost of production [12].

Since the introduction of the olive fruit fly, insecticide use in California olive orchards has increased dramatically (Figure 1).

The virulence of six species of entomopathogenic nematodes against the olive fruit fly was compared under laboratory conditions; all species induced >65% mortality with one species causing mortality >95% [11].

The EPA has concluded that, left uncontrolled, the olive fruit fly may wipe out the olive industry in California [9].

References


6. UC Management Guidelines for Olive Fruit Fly, University of California, Agricultural and Natural Resources, Available at http://www.ipm.ucdavis.edu/PMG/r583301311.html


Figure 1. Olives: California Insecticide Use