# OLIVE FRUIT FLY

*Integrated Pest Management for Home Gardeners and Landscape Professionals*

The olive fruit fly, *Bactrocera oleae* (Diptera, Tephritidae) first was recorded in California in October 1998 when a single female fly was captured in west Los Angeles. By fall 1999, olive fruit flies had been captured in seven additional counties including Tulare County, in the San Joaquin Valley, the leading producer of table olives in California. Presently, the olive fruit fly occurs in all olive growing areas of California and threatens virtually all commercial and fruit-bearing ornamental olive plantings.

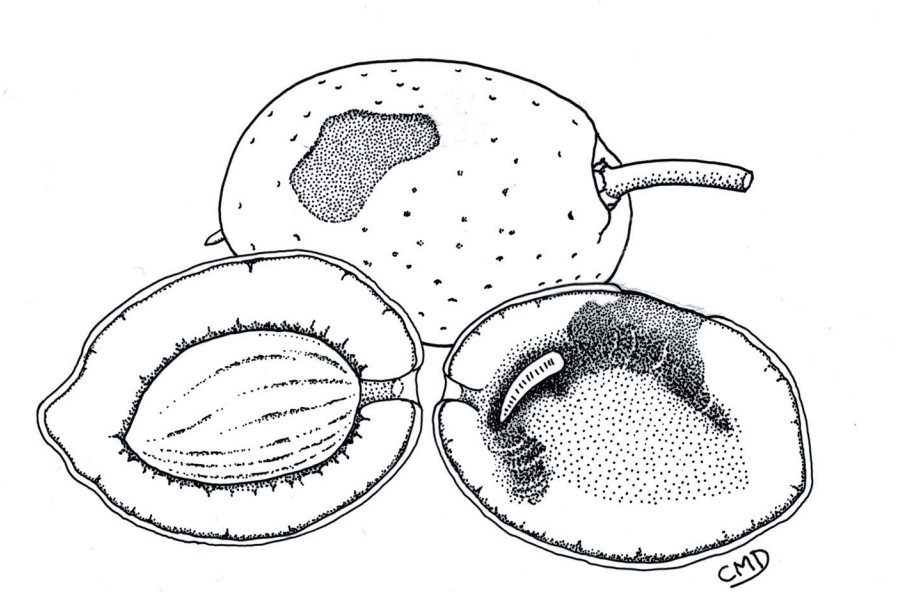


**Figure 1. External appearance of fruit infested with olive fruit fly (top), and larva and internal damage caused by feeding of larva (bottom right).**

## IMPACT

The olive fruit fly poses a severe economic threat for the state's commercial olive growers. The larvae (maggots) of the olive fruit fly feed inside the fruit, destroying the pulp and allowing the entry of secondary bacteria and fungi that rot the fruit and degrade the quality of the oil. Feeding damage can cause premature fruit drop and reduce fruit quality for both table olive and olive oil production. Large numbers of rotting fruit on the ground can create an unwelcome mess, especially in landscaped situations.

In areas of the world where the olive fruit fly is well established, it has been responsible for crop losses of 100% of some table cultivars and up to 80% of oil value. It is considered the most devastating insect pest of olives in the Mediterranean region, where it has occurred for more than 2,000 years. For table olive growers, the presence of even a few infested fruit can lead to rejection of an entire crop. Some infestation can be tolerated in olive fruit used for oil production as long as the fruit are not rotten. Harvesting early and pressing infested fruit quickly after harvest will reduce off-flavor changes caused by olive fruit fly injury. Ornamental olive trees can serve as a source of olive fruit flies infestating commercial plantings, especially as adult flies are capable of flying long distances.

## IDENTIFICATION

The adult olive fruit fly is about 1/4 inch long. The head, thorax, and abdomen are brown with darker markings and several white or yellow patches on the top and sides of the thorax. Its wings are positioned horizontally and are held away from the body. Olive fruit flies may be distinguished from related fruit flies by the presence of black spots on the wing tips and the lack of banding across the wings that occurs in most other related species such as the walnut husk fly, apple maggot, and Mediterranean fruit fly.

Females can be distinguished from males by the presence of an ovipositor, a dark-colored pointed structure at the end of the abdomen, which is used to pierce olive fruit and lay eggs. Usually only one egg is laid per fruit. However, multiple eggs may be laid in olive varieties that produce large fruit; females prefer large-fruited varieties to smaller-fruited ones for egg laying.

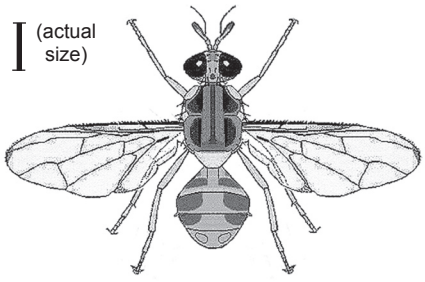


**Figure 2. Olive fruit fly adult.**


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Larvae are yellowish white, legless maggots with pointed heads. When first hatched, they are immediately below the surface, tiny and difficult to see. After they have been feeding for a while, they are easier to locate, especially when the fruit has begun to rot.

### *Life Cycle*

The life cycle of the olive fruit fly is closely linked to the seasonal development of its main host, the cultivated olive *(Olea europea),* and to the local climate. In mild coastal areas of California, adult flies remain active yearround, and the eggs and maggots can be found throughout the year in fruit left on the ground or on the trees.

In inland areas of California, adult flies emerge from March to May and attack olives remaining on trees from the previous season. During early summer (June) as temperatures and day length increase and few mature fruit remain on trees, female flies do not lay eggs. Although few olives are present from the previous crop to host the egg laying, the adults remain active, and they may disperse to new locations such as citrus orchards or vineyards.

By late June to the beginning of July as the new olive crop develops, females begin to lay eggs and are attracted to the fruit. Although eggs may be laid in small fruit, the larvae do not successfully develop until the ripening fruit grows to sufficient size. Eggs are laid just under the fruit's skin, often creating a dimple or brown spot. Under laboratory conditions, an individual female olive fruit fly may lay 10 to 40 eggs per day and from 200 to 500 eggs in her lifetime.

Larvae that develop during early to midsummer pupate in the fruit and emerge later in the season as adults. Larvae produced during fall leave the fruit and pupate in the soil where they spend the winter; however, some maggots overwinter in fruit left on trees and pupate in spring.

Multiple generations occur throughout summer and fall. In summer the flies can complete a generation in as little as 30 to 35 days, given optimum temperatures (68° to 86ºF). The olive fruit fly has no true period of dormancy, and all stages of the insect can occur during winter.

The lower and upper activity thresholds for the adult olive fruit fly are about 60ºF and 95ºF, respectively. Below and above these thresholds they are not very active. Eggs hatch in 2 to 3 days, and larvae develop in about 20 days during summer and fall. Pupal development requires 8 to 10 days during summer but may take as long as 6 months in winter. Hot (95° to 105ºF), dry conditions reduce the buildup of olive fruit fly populations. Fruit fly eggs and first instar maggots can experience relatively high mortality during hot, dry weather. Adult flies also may die during periods of high temperatures if adequate water and food are not available. High olive fruit fly populations have been observed in both coastal and inland areas.

### *Detection and Monitoring*

The most efficient trap for monitoring the olive fruit fly is the glass or plastic McPhail-type trap baited with torula yeast lures. Yellow sticky traps baited with spiroketal sex-pheromone lures (attractive to male flies) and/or ammonium carbonate, ammonium bicarbonate, or diammonium phosphate food bait (attractive to both sexes) also are commonly used to monitor olive fruit fly populations, but these generally are less efficient than McPhail traps. Traps are discussed in detail in Management.

## MANAGEMENT

The best method for controlling the olive fruit fly depends on if the tree is to be harvested and where it is located (backyard, landscape, or commercial grove). When planting olive trees that will not be harvested, consider the several varieties of fruitless olives that can be grown successfully in California including the full-size varieties Majestic Beauty, Swan Hill, and Wilsoni and the dwarf Little Ollie. They can be ordered through home and garden stores or retail nurseries. Fruitless olive varieties have the additional advantage of producing less pollen than fruiting varieties. Fruitless varieties are less likely to aggravate allergies and are more desirable for ornamental plantings. On existing trees, prevent fruit formation with a plant growth regulator or high-pressure water sprays during bloom. If you plan to harvest fruit, follow good sanitation and consider using traps, bait sprays, or barrier films.

### *Plant Growth Regulators for Trees Grown as Ornamentals Only*

Use a plant growth regulator to prevent fruit formation in ornamental trees by applying it thoroughly to flowers during bloom. The chemical will cause the flowers to drop so that fruit will not be produced that year. Application timing is critical for effective fruit suppression. Growth regulators are available at home-and-garden stores including Florel (active ingredient–ethephon, manufacturer–Monterey Chemical). Another growth regulator, Embark (active ingredient–diethanolamine salt of mefluidide, manufacturer–PBI/Gordon), is available to licensed applicators only. When using any chemical, be sure to follow the label directions to prevent personal injury and tree damage.

Any fruit that develops on the tree after applying a growth regulator spray should be removed and destroyed.

### *Trees Grown for Fruit*

Management of olive fruit fly on trees with a crop to be harvested depends on a combination of tactics, especially mass trapping and cleaning up fruit after harvest. The few sprays currently available for home and landscape use include Surround at Home Crop Protectant. GF-120 NF Naturalyte Fruit Fly Bait is another product that can be used by homeowners and may be purchased through farm supply dealers.

**Traps.** Traps baited with food lures can be used to reduce adult fly densities by mass trapping. One such trap

was developed in Spain and is called an OLIPE trap (See References for additional information.). It is a homemade trap used in Spain to suppress olive fruit fly populations in organic olive groves and in sensitive areas near homes and natural parks. The OLIPE trap is made from a 1- to 2-liter plastic bottle with 13⁄64 inch (5 mm) holes melted into the shoulder. Current research in California suggests that Torula yeast tablets dissolved in water are very effective as bait. Traps are hung in the shade, and flies are attracted to the trap, crawling inside and dying.

McPhail-type traps also can be used for mass trapping olive fruit flies. If used for this purpose, traps should be checked weekly during the summer to ensure that the water-based lure has not evaporated. The lure should be changed regularly to maintain maximum attraction. Several companies currently sell McPhail-type traps. Contact your local cooperative extension office for a source, or try a vendor such as Great Lakes IPM (www.greatlakesipm.com) or ISCA Technologies Inc. (www.iscatech.com). These and other mass trapping devices have been shown to reduce olive fly damage by 30% to as much as 100%. Mass trapping effectiveness also is quite variable and may not provide adequate control when used as the only control approach.

**Sanitation.** Before harvest, an ongoing effort to pick up and destroy fallen fruit can help reduce olive fruit fly populations. Remove fruit as soon as possible once it is ripe to prevent the maggots from leaving the fruit and entering the soil to pupate. Collect fallen olives and remove as much fruit as possible from trees during the harvest process. After harvest, olive fruit left on trees or on the ground can result in continuing development of the olive fruit fly. Knock down remaining fruit from trees with a wooden or fiberglass pole. Be cautious of using metal poles near overhead power lines. Unused or fallen fruit should be destroyed by mulching or mowing or buried at least 4 inches deep. It is not known if composting the fruit would produce temperatures high enough to kill the maggots, but hot weather does greatly increase their mortality rate.

**Bait Sprays.** GF-120 NF Naturalyte Fruit Fly Bait, an organically acceptable product containing the biologically produced insecticide spinosad, recently has received registration for use on olives in California. GF-120 can be purchased from a local farm chemical distributor. GF-120 attracts olive fruit fly adults, which feed on the bait, and causes adult mortality. GF-120 is concentrated and needs to be diluted with water at 1:1.5 to 1:4 (GF-120 NF: water) before application. Follow label instructions for methods of dilution. GF-120 applications should commence when olive fruit fly adults are captured on the monitoring traps or at least 2 to 3 weeks before pit hardening. Repeat applications every 7 days until harvest when flies are captured on monitoring traps. GF-120 should be applied at a 2.5 to 7.5 ounce dilute spray per tree using a 1:1.5 dilution or at a 5 to 15 ounce dilute spray per tree using a 1:4 dilution with very large droplet size. Droplets should be 5 millimeters or more in size and uniformly dispersed around the tree. The person applying the GF-120 is required to wear coveralls, waterproof gloves, shoes and socks, as well as follow all the requirements on the pesticide product label.

**Barrier Film Sprays.** Surround (active ingredient–kaolin clay, manufacturer-Engelhard Corp.), is a barrier film that can be used to protect the fruit from attack. When sprayed so that thorough coating of fruit is achieved, it can be quite effective in preventing olive fruit fly damage by preventing egg laying and damage. This material alters the ornamental look of olive trees as it leaves them covered with white residue.

**Combination Treatments.** A combination of mass trapping to reduce the olive fruit fly population together with one late season application of kaolin clay applied so that it thoroughly coats the fruit has been effective in research trials. The traps used for mass trapping should have their yeast bait changed every two weeks April through November. The barrier film spray should be applied as the fruit begins to be attacked in late summer or early fall.

**Biological Control.** In sub-Saharan Africa, where it is believed to have originated, and in the Mediterranean area, the olive fruit fly is attacked by a number of parasitic wasps. However, the parasites common in the Mediterranean area do not provide acceptable control in commercial situations. Some naturally occurring parasites are known to attack olive fruit fly in California, but they do not appear to provide adequate control.

Researchers from the U.S. Department of Agriculture, the University of California, and the California Department of Food and Agriculture currently are working to identify and import natural enemies from Europe, Africa, Guatamala, and Hawaii to control olive fruit fly. It is hoped that one or more parasite species will someday provide acceptable control, especially in noncommercial and ornamental olive plantings. It may not be cost-effective to use only biological controls in commercial olive groves because of the commercial requirements for very low olive fruit fly infestation levels. However, suppressing olive fruit fly populations with biological control agents on untreated landscape trees, which otherwise serve as a source of adult olive fruit flies that disperse into commercial groves, will help reduce overall fly densities and potentially reduce the number of treatments needed in commercial groves to achieve control.

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