

OLIVE FRUIT FLY

Integrated Pest Management for Home Gardeners and Landscape Professionals

The olive fruit fly, *Bactrocera oleae* (Diptera; Tephritidae) was first 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 table olive-producing county in California. Presently, the olive fruit fly occurs in at least 41 counties in California and threatens virtually all commercial and fruit-bearing ornamental olive plantings.

IMPACT

The rapid invasion of California by the olive fruit fly poses a severe economic threat for the state's commercial olive growers. The olive fruit fly is considered the most devastating insect pest of olives in the Mediterranean region, where it has occurred for over 2000 years. The larvae (maggots) of the olive fruit fly feed inside the fruit (Fig. 1), destroying the pulp and allowing the entry of secondary bacteria and fungi that rot the fruit and impair quality or flavor 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 landscape and backyard trees.

In areas of the world where the olive fruit fly is well established, it has been responsible for losses of 100% of some table cultivars and up to 80% of oil value. 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.

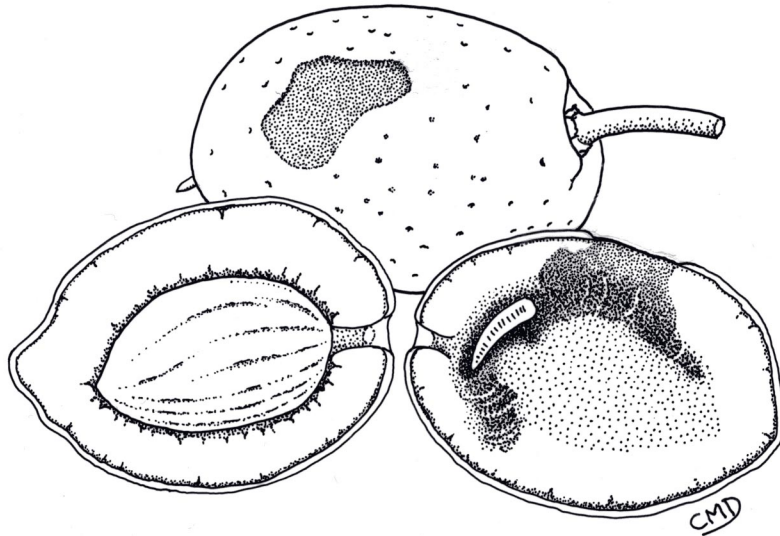


Figure 1. External appearance of fruit infested with olive fruit fly (*top*), and larva and internal damage caused by feeding of larva (*bottom right*).

IDENTIFICATION

The adult olive fruit fly is about ¼ inch (6 mm) long (Fig. 2). 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 varieties for egg laying. Larvae are yellowish white, legless maggots with pointed heads. When first hatched, they are tiny and hard to see; after they have been feeding for a while, they are easier to locate, especially when fruit have begun to rot. The larval stage is spent entirely within the fruit.

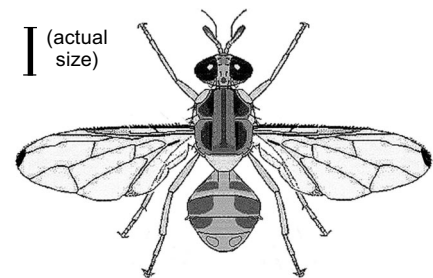


Figure 2. Olive fruit fly adult.

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 europaea*), and to the local climate. In mild coastal areas of California, adult flies remain active year-round and the eggs and maggots can be found throughout the year in unharvested fruit.

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 enter a state of reproductive diapause (rest) in which few or no eggs are produced. Although few eggs are produced at this time, the adults remain active, and it is believed that they may disperse to new locations during this period. By late June to the beginning of July as the new olive crop develops, females begin to produce eggs and are attracted to the fruit. Eggs are laid in the ripening fruit when the pits of the olives begin to harden; they 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 summer pupate in the fruit and emerge later in the season. Larvae produced during late fall pupate in the soil where they spend the winter; however, some maggots overwinter in fruit 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 86°F).

The activity threshold for the adult olive fruit fly is about 60°F; below this temperature 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 105°F), dry conditions reduce the buildup of olive fruit fly populations. Fruit fly maggots can experience relatively high mortality

during hot, dry weather, which may explain why population densities in cool, humid coastal areas are higher than in hot, dry, inland areas.

DETECTION AND MONITORING

In areas where the olive fruit fly is not well established, adult olive fruit fly populations are being monitored with yellow sticky traps containing a sex pheromone (spiroketal) and/or ammonium carbonate, ammonium bicarbonate, or diammonium phosphate bait. The sex pheromone attracts male flies and the ammonia volatile attracts female flies. Both sexes are attracted to the yellow color of the trap and are captured on the sticky trap surface. Olive fruit flies are also monitored effectively with glass or plastic McPhail traps that contain yeast hydrolysate plus the same ammonia-producing chemicals as the yellow sticky trap. County agricultural commissioners have been responsible for placing traps in many urban and suburban areas for detection purposes. Research has not been conducted to determine if these types of traps can be effective for control.

MANAGEMENT

The best method for controlling 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. Reduced pollen production makes fruitless varieties less likely to aggravate allergies and are more desirable for ornamental plantings. On existing trees, prevent fruit formation with a plant growth regulator. If you plan to harvest fruit, follow good sanitation and consider using attract-and-kill traps. Sprays are not yet available for home garden and landscape olives.

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 and include such brands as Florel (active ingredient—ethephon; manufacturer—Monterey Chemical) and Fruit Stop (active ingredient—naphthalene acetic acid [NAA]; manufacturer—United Horticultural Supply). When using any chemical, be sure to follow the label directions to prevent personal injury and tree damage. A third growth regulator, Embark (active ingredient—diethanolamine salt of mefluidide; manufacturer—PBI/Gordon), is available to licensed applicators only.

Any fruit that develops on the tree after a growth regulator spray should be removed from the tree, and all old fruit on the ground should be picked up and destroyed, or buried at least 4 inches deep.

Trees Grown for Fruit

Management of olive fruit fly on trees to be harvested depends on a combination of tactics, especially attract-and-kill traps and fruit sanitation after harvest. Sprays are not currently available for home and landscape use, and biological control agents are not currently effective in California.

Traps. Two types of traps have been devised to trap and kill adults. One trap, Olive Fruit Fly Attract and Kill (manufactured by Certis USA), is a cardboard panel treated with a pyrethroid insecticide and accompanied by dispensers containing either spiroketal pheromone or ammonium bicarbonate. Under its current registration (a Section 18 emergency exemption), this trap can be used in backyard and ornamental olive trees but not in commercial trees. Check with your county agricultural commissioner to find out if these traps are available to home gardeners in your county. The panels are hung as high as

possible in trees in the shade on the south side of the tree. Flies attracted to the panels die after they contact the pesticide-treated surface. One panel per tree is recommended in landscape areas, and the panel remains effective for 120 days. At the end of the season, the panels should be disposed of in a sanitary landfill, in accordance with local regulations.

A second 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 $\frac{1}{4}$ 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 on the south side of the tree and flies are attracted to the trap, crawl inside, and die. Ongoing research is being conducted to determine the effectiveness of these traps in California.

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 devel-

opment of the olive fruit fly. Knock down remaining fruit from trees with a wooden or fiberglass pole. Metal poles are dangerous when used 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 that are high enough to kill the maggots, but given that their mortality is greatly increased in hot weather, it may.

Bait Sprays. GF-120 NF Naturalyte Fruit Fly Bait (Dow Agrosiences), a bait containing the biologically produced insecticide spinosad, has recently received a Section 18 emergency exemption for agricultural use and is proving to be effective when applied frequently throughout the period of pit hardening to harvest. However, it is not yet available for home and landscape applications. Check with your county agricultural commissioner for updates regarding availability of this product.

Biological Control. In the Mediterranean area and also in sub-Saharan Africa, where it is believed to have originated, 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. At this time there are no biological control agents of this fly commercially available for release.

Researchers from the U.S. Department of Agriculture, University of California, and California Department of Food and Agriculture are currently working to identify and import natural enemies from Europe and Africa to control olive fruit fly. It is hoped that one or more parasite species will some day provide acceptable control, especially in non-commercial 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.

REFERENCES

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For more information contact the University of California Cooperative Extension or agricultural commissioner's office in your county. See your phone book for addresses and phone numbers.

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To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash nor pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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