Olive Fruit Fly

June 2005 • Paul Vossen, Lucia Varela and Alexandra Devarenne

University of California Cooperative Extension

133 Aviation Blvd, Suite 109 • Santa Rosa, CA 95403 • 707-565-2621

Olive fruit fly *(Bactrocera oleae)* was introduced from the Mediterranean region where there are records of infestations dating back to the third century BC. It is also found in eastern and southern Africa where native wild olive trees are found, and where there are more natural enemies. It was identified for the first time in the US in October 1998 in Los Angeles. Since then, it has spread to most of California.

Fly deposits egg in olive

Economic importance and damage

The adult female can lay 50-400 eggs in her lifetime, usually one in each fruit. These hatch into tiny larvae (maggots) that are very difficult to see until they feed for a while and get larger. While feeding, they tunnel throughout the fruit, destroying the pulp and allowing secondary infestations of bacteria and fungi that rot the fruit. This damage greatly increases the free fatty acid level (acidity) of the olive oil and causes off flavors. Feeding damage may cause premature fruit drop. Oviposition stings, caused by the female laying eggs inside the olive, destroy the value of table fruit.

Description

The adult fly is about 3/16 inch long (4-5 mm), reddish-brown in color with large reddish eyes and small antennae. The top of the thorax (trunk) is dark brown with gray or black longitudinal stripes and a white crescent-shaped spot (scutellum) located to the rear of where the wings are attached. There are also several yellow-white patches on each side of the thorax. The abdomen is brown with darker variable areas on the sides of each segment. The wings are clear with a small dark spot near the tip and can be distinguished from those of other fruit flies (e.g. walnut husk fly) that have dark wing bands or patterns. The females have a point at the tip of the abdomen (ovipositor). The larvae are white-yellow legless maggots with a point on one end (head).

Adult female olive fruit fly

Olive fruit fly larva

Life cycle and biology

The olive fruit fly has three to five generations per year depending upon local conditions. It overwinters either as an adult, or as a pupa in the soil or fallen fruit. Overwintered adult populations decline to low levels by February or March, but under ideal conditions adult flies can live for over six months. In mild climates there can be continuous adult emergence throughout the whole year, but larger numbers of new adults from overwintered pupae begin to emerge in March and April. These females can lay eggs inside last year's fruit left on the tree, or wait until new fruit is large enough for oviposition. The ability of the fruit to sustain larval development begins around the time of pit hardening. High populations can develop very rapidly when ideal temperature favors rapid development. In most cases, the greatest damage occurs from September to November.

The second generation appears in mid summer. The olive fly can complete a generation in as little as 30 to 35 days at optimum temperatures (from 68° to 86° F). Eggs hatch in 2 to 3 days, larvae develop in approximately 20 days, and pupae in 8 to 10 days. The maggots feed throughout the olive and pupate in a hollow area just beneath the outer skin, or can exit the fruit and pupate in the soil. Adult flies can live from 2 to 7 months depending on the temperature and availability of food (honeydew, fruit juices, bird feces, etc.). Additional generations of flies are produced through the late summer and fall months into December, depending upon fruit availability. Olives left on trees after harvest can produce high populations of flies from late fall to early spring. Most of the last generation larvae abandon the fruit to pupate in the ground for several months. Adults can overwinter in protected areas, especially in locations with mild winter temperatures. Olives are the only breeding host plants. The larger olive varieties are preferred for oviposition, however, smaller oil olive cultivars are also susceptible. Flies have been trapped in other crop orchards or plants where the adults search for food or refuge.

Olive fly pupa inside fruit

Olive flies survive best in cooler coastal climates, but are also found in hot, dry regions of Greece, Italy, Spain, Mexico, and California. Temperatures above 95° are detrimental to adult flies and to maggots in the fruit. The flies, however, can travel to seek out cooler areas where water is available. Reports of fly movement range from 600 ft in the presence of an olive host to several miles. The olive fruit fly spread throughout California at a rate of about 100 miles a year, indicating great mobility. During rainy winter weather the number of flies caught in traps usually drops off significantly, but stings and damage can continue.

Damaged fruit–note exit holes where adult flies have emerged

Damage thresholds

In Europe, the damage threshold for commercial table fruit orchards is 1%, but California table fruit processors have zero tolerance for olive fruit fly damage. The backyard table olive producer may be willing to accept higher levels of olive fly damage since the damaged fruit can be sorted out by hand.

The most commonly cited European damage threshold level for olive oil production is 10%. However, research has shown that even with 100% of the fruit sustaining olive fly damage, extra virgin olive oil can be produced as long as the fruit shows no signs of rot. The real problem occurs when larval feeding introduces fruit rotting organisms that create off flavors. Since this is more likely to happen toward the end of the larval feeding cycle when the maggots get quite large; earlier harvest may be one of the options for dealing with this pest. It is also important to note that when olives are damaged by olive fruit fly, the fruit is more sensitive to oxidative and microbial breakdown, therefore the time from harvest to milling should be kept as short as possible. Research is being conducted in California to establish specific damage threshold levels.

Sanitation and fruit prevention

Anyone wishing to reduce or prevent olive fly should start with sanitation. Any olives that remain on the tree or the ground at the end of the season should be removed and either buried or sealed in a bag for landfill disposal. In situations where discing an orchard is practical, this may reduce the size of the spring generation by burying overwintering pupae too deep for emergence.

It is possible to spray the trees with a hormone that will stop the flowers from developing fruit. There are several registered materials for this use including: Florel (ethephon), Fruit Fix, and Olive Stop (Ammonium 1- naphthaleneacetate). Refer to the label for detailed use and safety information. If olive trees are planted purely for decorative purposes, fruitless varieties should be considered. Varieties such as 'Swan Hill,' 'Majestic Beauty,' 'Wilsoni' and the dwarf 'Little Ollie' have little or no fruit and will not harbor olive flies.

Trapping for monitoring and control

Using traps to check for the presence and activity level of olive flies can be a useful part of an olive fly control program, but caution should be used in interpreting the trap catches. Low trap catches do not necessarily correlate with low damage levels. If olive fly is present, it is prudent to inspect fruit frequently for stings and to initiate a control program. Yellow sticky traps are currently the monitoring standard in California, but McPhail trap catches tend to be higher and may be a better indicator of the fly population. Use at least two traps per block for monitoring. Traps should be checked weekly and the olive flies removed to avoid confusion when keeping the weekly tally.

Mass trapping is the use of traps for control. For mass trapping, traps are placed at a high density--up to one trap per tree. A few traps may be chosen to be monitored weekly, but the majority of the traps are just maintained in an effective condition. During recent field trials, when yellow sticky, McPhail and OLIPE traps were used at the rate of one per tree in small plantings, the damage levels averaged around 30% (compared to 87% in our untreated controls). The Attract and Kill trap averaged about 15% damage. Although mass trapping may not provide adequate control as a stand alone measure, the reduction in the fly population may improve the efficacy of bait sprays.

• Yellow sticky trap

Yellow sticky traps baited with a sex lure (spiroketal pheromone) and a food attractant (ammonium carbonate or bicarbonate) are used to capture both male and female adult flies. The bait packet and pheromone lure hang on the top edge of the trap. Hang the trap in the shade on the north side of a tree with fruit, inside the canopy with 8-10 inches of clearance from foliage. Traps can last from 1 to 8 weeks depending on how dirty they get (and thus how sticky they remain). Change the bait packets and lures according to the manufacturer's recommendations. Although most commonly used for monitoring, yellow sticky traps can also be used for mass trapping.

• Plastic McPhail-type trap

The McPhail trap is used extensively for monitoring and for mass trapping. They have a reservoir for liquid bait and use torula yeast as the bait attractant. Flies enter from below and drown in the solution. McPhail-type traps tend to have the highest catches of all the common traps. They also require the most maintenance because of their tendency to dry out in hot weather. Hang them in the shade and check the water level frequently. Use three torula yeast bait tablets per trap, and add water to the fill line. Change the solution at least once a month.

• OLIPE

A low-cost trap called the OLIPE (Olivarera los Pedroches) trap was developed in Spain for organic (ecological) production. It consists of a 1 to 2 liter plastic bottle with 5mm holes drilled or melted around the shoulder. It uses three torula yeast tablets to about one liter of water as an attractant and hangs in the shade. In recent research, a spiroketal pheromone lure hung on the bottle did not improve trap catches. The OLIPE requires much less maintenance than the McPhail because it does not dry out as quickly, but the yeast solution should still be changed periodically.

• Attract and Kill traps

The Attract and Kill olive fly target device is a trap that is used in Europe for olive fly control, especially in organic orchards. It consists of a shallow pyrethroid-impregnated cardboard cone with a bait and/or sex lure. The fly is attracted by the lures, encounters the pesticide and dies. The pesticide does not come in contact with the fruit or the environment. The trap lasts the entire season and requires no maintenance, making it very convenient. The trap is manufactured by AgriSense in the UK and will be distributed in the US through Monterey AgResources under the name Magnet OL. Very limited availability is expected for 2005, and wider distribution in 2006.

Bait Spray

GF-120 (Naturalyte) is a bait spray containing the active ingredient spinosad. Spinosad is a fermentation by-product of the actinomycete bacteria *Saccharopolyspora spinosa*. The bait is a formulation of hydrolyzed protein. The United States Department of Agriculture (USDA) - Organic Materials Review Institute (OMRI) standards board has approved spinosad for certified organic production. GF-120 is currently available to commercial olive growers under a Section 18 emergency exemption. The product is under review for a Section 3 classification which would make it available to homeowners. Call your local agricultural commissioner's office for current policies.

GF-120 is diluted (from 1:1.5 to 1:4) and applied at a rate of 50-100 ounces of diluted material per acre or 1-3 fluid ounces per tree (26-52 fluid ounces actual ingredient per acre) in a course spray or stream to a small portion of the tree. There is no need to cover the whole tree; the adult flies are attracted to the bait, feed on it and die. It should stay wet as long as possible, so very early morning or very late afternoon application timing is best. One or two sprays as soon as fly catches in monitor traps show an increase in the late winter or early spring may help to reduce the population. In order to achieve adequate control in heavily infested orchards, most growers apply the material every week from late spring to harvest. The current recommendation is 14 oz./acre, treating alternate rows every 7 days. Light infestations might get by with applications every two weeks. GF-120 provided very good control in recent trials, with damage levels averaging around 3% compared to untreated controls with 87% damage.

Barrier spray

Kaolin clay (brand name Surround) is also approved for certified organic production. The product is mixed with water at a rate of 1/4 lb to 1/2 lb Surround to 1 gallon water. In order to get good coverage, a high pressure sprayer is required. The solution dries to a white powder which repels the olive flies. The first application should be a week or two before pit hardening, and it should be reapplied every five or six weeks. The control in our trials with Surround was comparable to GF-120, averaging around 3% damage.

More information is available from:

http://www.ipm.ucdavis.edu/PMG/r583301311.html
http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74112.html
http://www.cdfa.ca.gov/phpps/pdep/olive_ff_profile.htm
http://ceucdavis.edu/hortic/research_pubs.html

Sources

- “Bionomics of the Olive Fruit Fly Bactrocera (Dacus) oleae” by Dr. Richard Rice , UC Plant Protection Quarterly, 2000, Volume 10, Number 3
- “Olive Pest and Disease Management” by Manuel Civantos López-Villalta
- “Olive Fruit Fly” by F. G. Zalom, R. A. Van Steenwyk and H. J. Burrack, Pest Notes Publication 74112, University of California Agriculture and Natural Resources
- “Controlling Olive Fruit Fly at Home” by P. Vossen and A. Devarenne, UCCE Sonoma County.

Paul Vossen and Alexandra Kicenik Devarenne • University of California Cooperative Extension Sonoma County

pmvossen@ucdavis.edu akicenik@ucdavis.edu

Sources of Products for Olive Fly Control (Rev. 06/07/05)

Better World Manufacturing Inc.
5690 E. Dayton
Fresno, CA 93727
(599) 291-4276
bettertrap@aol.com
Multilure (McPhail-type) trap; torula yeast tablets (by the lb.)

Irv Boxer
ERA International Ltd.
PO Box 7329
Freeport, NY 11520
(516) 379-5579
torula yeast tablets (50 lb. Drum)

Gardens Alive!
(513) 354-1483
www.gardensalive.com
Surround At Home in 5, 10 & 25 lb. packages

Scentry Biologicals
610 Central Avenue
Billings, MT 59102
(406) 248-5856
www.scentry.com
Pheromone/bait lures

ISCA Technologies Inc.
2060 Chicago Avenue, Suite C2
Riverside, CA 92507
(951) 686-5008
www.iscatech.com
McPhail traps, yellow sticky traps, torula yeast tablets (by the lb.)

Monterey AgResources
3654 South Willow Avenue
Fresno, CA 93725
(559) 499-2100
www.montereyagresources.com
Magnet OL attract and kill trap

Suterra
213 SW Columbia St.
Bend, OR 97702
(541) 388-3688
www.suterra.com
Yellow sticky traps (sold in cases of 100).

Dow AgroSciences
http://www.dowagro.com/prod/index.htm
Sources for GF-120 Naturalyte

Trécé Inc.
P.O. Box 129,
Adair, Oklahoma 74330
(866) 785-1313
www.trece.com
Yellow sticky traps

AgriSense BCS Ltd
www.agrisense.co.uk
Info on Magnet OL

Engelhard Corporation
www.engelhard.com
Surround WP crop protectant

Great Lakes IPM
10220 Church Rd.
Vestaburg, MI 48891
(989) 268-5693
www.greatlakesipm.com
Liquibator (McPhail-type) fruit fly trap; torula yeast tablets (sold individually); yellow sticky traps

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 their original labeled containers in a locked cabinet or shed, away from foods or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.
Confine pesticides to the property being treated. Avoid drift onto neighboring properties or gardens containing fruits and/or vegetables ready to be picked.
Dispose of empty containers carefully. Follow label instructions for disposal. Never reuse the containers. Make sure empty containers are not accessible to children or animals. Never dispose of containers where they may contaminate water supplies or natural waterways. Do not pour down sink or toilet. Consult your county agricultural commissioner for correct ways of disposing of excess pesticides. **Never burn pesticide containers.**
PHYTOTOXICITY: Certain chemicals may cause plant injury if used at the wrong stage of plant development or when temperatures are too high. Injury may also result from excessive amounts or the wrong formulation or from mixing incompatible materials. Inert ingredients, such as wetters, spreaders, emulsifiers, diluents, and solvents, can cause plant injury. Since formulations are often changed by manufacturers, it is possible that plant injury may occur, even though no injury was noted in previous seasons.