

2023: The Year of the Fruit Fly

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California has seen an unusually high number of fruit fly detections in 2023. Currently, quarantines are in place for four species of fruit fly important to avocado growers. These include the Oriental Fruit Fly (OFF; *Bactrocera dorsalis*), the Mediterranean fruit fly (medfly; *Ceratitis capitata*), the Tau fruit fly (TFF; *Zeugodacus tau*) and the Queensland fruit fly (QFF; *Bactrocera tryoni*). Except for QFF, all these fruit flies have been previously detected in California numerous times and successfully eradicated; 2023 is only the third time QFF has been detected in California.

It is nearly impossible to determine exactly how any of these fruit flies arrive in California. However, it is very unlikely they arrive through commercial trade channels since very robust protocols exist within exporting countries as well as at U.S. ports of entry, whether land, air or seaports.

It is more likely that these incursions are a result of post-pandemic travel trends. The United Nations World Tourism Organization reports that 2023 international travel is predicted to be 90% of pre-pandemic levels. For the Americas specifically, international tourist travel from January through September 2023 was at 88% of 2019 levels. Many of those traveling to the U.S. may not have seen family and friends for several years due to COVID-19 travel restrictions and they may be anxious to bring a taste of home with them, and not all these exotic treats are intercepted by Customs and Border Protection officials.

Avocado Fruit Fly Host Status

Hass avocados are recognized by the U.S. Department of Agriculture and the California Department of Food and Agriculture as conditional non-hosts for OFF, medfly, QFF as well as the Mexican fruit fly (*Anastrepha ludens*, for which there are currently no quarantines in California). This means that officials acknowledge that mature, hard, green Hass avocados, like those normally commercially harvested and transported, are not a suitable host for these fruit fly pests. As such, commercial Hass avocados grown within quarantine areas for these four fruit fly species are not required to follow the quarantine treatment protocols prior to moving fruit.

Importantly, the above paragraph is specific to Hass avocados. All other avocado varieties grown within quarantine areas must follow the established treatment protocols (https://www.cdfa.ca.gov/plant/PE/InteriorExclusion/current_preharvest_treatment.html). Some avocado varieties (such as certain green skin varieties) are known to be good fruit fly hosts because they lack the thick, hard peel of the Hass variety. Others, such as GEM and Lamb Hass which have similar peel characteristics to Hass, are not exempted due to a lack of data to support their conditional non-host status. The California Avocado Commission is diligently working with their partners in the research community to uncover any existing data that supports the conditional non-host status of GEM and Lamb Hass and submit that data to the USDA Animal and Plant Health Inspection Service for their consideration.



Oriental Fruit Fly

Adult OFF is slightly larger than the common housefly. Their body color is variable, but usually dominated by bright yellow with a dark T-shaped mark on the abdomen. Females lay eggs under the skin of host fruit in groups of 3 to 30, and can lay up to 1,000 eggs in their lifetime. Maggots feed on fruit flesh and emerge in about 10 days. The larvae drop from the fruit and pupate in the top 1-inch of soil. Adults emerge in 10 to 12 days and newly emerged females are sexually mature in 8 to 12 days. OFF adults are strong flyers, capable of traveling up to 30 miles in search of food and host fruit.

OFF is widespread throughout the mainland of southern Asia as well as surrounding islands (e.g., Sri Lanka, Taiwan). OFF is known to attack over 230 crops including citrus, nuts, berries and vegetables. OFF became established in Hawaii in 1946 where it is a pest of nearly all commercial crops except pineapple. In California, OFF was first detected in 1960 and detections have been made every year since 1966 through the movement of infested fruits and vegetables. Fortunately, the rigorous monitoring and eradication efforts by CDFA and USDA have prevented the establishment of OFF in California. If OFF were to become established in California, the annual economic cost is estimated to be as high as \$176 million from direct crop loss, treatment costs and quarantine requirements.



Mediterranean Fruit Fly

The medfly is a small fly, about ¼ inch long. Its thorax is blackish in color with silver markings, a tan abdomen and clear wings. Like OFF, medfly females pierce host fruit skin and lay 1 to 10 eggs per fruit. Developing maggots feed on the fruit flesh, and decaying infested fruit usually fall to the ground where the maggots leave the fruit and pupate in the ground. Emerging adults mate and the cycle repeats.

Medfly has the widest known host range of any pest fruit fly, infesting over 300 crops. It is also the most widespread, being established throughout Africa, southern Europe, the Middle East, the Caribbean, Central and South America, Australia and Hawaii. Medfly will attack fruit, nut and vegetable crops of temperate, subtropical and tropical origin. The first detection in California was in 1975 and CDFA's monitoring and eradication program has successfully eradicated every incursion since then. Medfly's known hosts in California had an economic value in 2011 of over \$16.5 billion, and it is estimated that if medfly were to become established in California the annual economic impact would be \$1.3 to \$1.8 billion.



Tau Fruit Fly

TFF is similar in size to a housefly. Their body is yellow with brown to black markings, wings are clear with two dark stripes, one along the front wing margin and one running diagonally across the wing. As with other fruit flies, females lay eggs beneath the peel of host fruit and they may lay more than 400 eggs in their lifetime. Larval development can be as short as one week, depending on temperature. They pupate in the soil in about one week and newly emerged adults are sexually mature about 12 days after emergence.

TFF is native to southeast Asia and is not known to be established outside of this region. It has a much narrower known host range than other fruit flies, with only about 100 host species documented. It is a particularly aggressive pest of cucurbits (cucumbers, melons, squash). The first detection of TFF in California was in 2016. Since then, three more introductions have been discovered and eradicated.



Queensland Fruit Fly

Adult QFF are slightly smaller than a housefly. Their body is mostly brown with small yellow markings and clear wings, which are about twice the length of their body. Females lay up to seven eggs through fruit punctures. Development is temperature dependent, but eggs typically hatch in 2 to 3 days and larvae mature in 5 to 7 days, emerging from the fruit to pupate in the soil. The pupal stage lasts anywhere from one week to a month or more in cool conditions. The total lifecycle ranges from 2 to 3 weeks in summer to 2 months in fall. QFF are strong flyers and can infest new areas quickly.

QFF are native to Australia, being found in the states of New South Wales, Queensland, South Australia and Victoria. Prior to 2023, QFF had only been detected twice previously in California — in San Diego County in 1985 and in Orange County in 1991 — and was successfully eradicated both times.

Exotic fruit flies pose a tremendous risk to California agriculture. We are fortunate that the primary avocado variety has a tough, leathery peel that allows it to resist these pests. But if any of these fruit flies were to become established in California, they would no doubt become a burden for avocado growers. All current fruit fly quarantine maps can be found on the CDFA website (<https://www.cdfa.ca.gov/plant/pdep/treatment/>). If you suspect you have seen any of these fruit flies outside of the quarantine areas you are encouraged to call CDFA's pest hotline: 1-800-491-1899. 🍌