

Fiji fruit flies (170)

Common Name

There are seven fruit flies in Fiji: The species of economic importance are: (i) *Bactrocera kirki* (no common name), (ii) *Bactrocera xanthodes* (the Pacific fruit fly), (iii) *Bactrocera passiflorae* (Fijian fruit fly), (iv) *Bactrocera distincta*, and (v) *Bactrocera* species near *passiflorae*. *Bactrocera gnetum* and *Bactrocera obscura* are not of economic importance.

Scientific Name

Bactrocera distincta, *Bactrocera kirki*, *Bactrocera gnetum*, *Bactrocera obscura*, *Bactrocera passiflorae*, *Bactrocera* species near *passiflorae*, and *Bactrocera xanthodes*. *Bactrocera xanthodes* is closely related to three other species: *Bactrocera paraxanthodea* in New Caledonia, and *Bactrocera neoxanthodes* in Vanuatu, and a species not yet described from Samoa.

Distribution

The SPC Pacific Fruit Fly Project records seven species in Fiji (<http://www.spc.int/lrd/country-profiles/fiji>): Not that *Bactrocera kirki* is only recorded from Rotuma.

The distribution of the Fiji fruit flies elsewhere in the Pacific island region:

***Bactrocera kirki*:** American Samoa, French Polynesia (not Marquesas), Niue, Samoa, Tonga, and Wallis & Futuna.

***Bactrocera passiflorae* (Fiji fruit fly):** Fiji (excluding Rotuma), Niue, Tonga (Niua islands), and Wallis & Futuna.

***Bactrocera xanthodes* (Pacific fruit fly):** American Samoa, Cook Islands, Fiji, French Polynesia (Austral Islands), Niue, Samoa, Tonga, and Wallis & Futuna.

***Bactrocera* species near *passiflorae*:** It is a light coloured form of *Bactrocera passiflorae* which occurs in the northern interior of Viti Levu and the Lau group (but not Rotuma), and also in Tokelau, Tonga (Niua islands) and Tuvalu.

***Bactrocera distincta*:** American Samoa, Futuna, Samoa, Tonga.

***Bactrocera obscura*:** No information.

***Bactrocera gnetum*:** No information.

Hosts

The hosts of the species of economic importance are:

Bactrocera kirki infests: guava, mango, avocado, Pacific lychee (*Pometia pinnata*), and Indian or tropical almond (*Terminalia catappa*).

Bactrocera passiflorae infests: guava, Indian or tropical almond (*Terminalia catappa*), rose apple (*Syzygium jambos*), kumquat, orange, mandarin, pomelo, mango, Malay apple (*Syzygium malaccense*), Pacific lychee (*Pometia pinnata*), *Amaroria soulameiodes*, *Ochrosia oppositifolia*, *Cerbera manghas*, *Barringtonia edulis*, and Tahitian chestnut (*Inocarpus fagifer*).

Bactrocera xanthodes infests: breadfruit, jackfruit and papaya.

Bactrocera* species near *passiflorae infests: *Ochrosia oppositifolia*. Its economic impact has not been assessed.

Bactrocera distincta infests: sapodilla only.

Bactrocera gnetum infests: *Gnetum gnemon* (commonly called two-leaf; it is used as a cabbage).

Bactrocera obscura infests: not recorded.



Photo 1. *Bactrocera kirki*.



Photo 2. Fiji fruit fly, *Bactrocera passiflorae*.



Photo 3. Pacific fruit fly, *Bactrocera xanthodes*.



Photo 4. Pacific fruit fly, *Bactrocera xanthodes*, laying eggs.

Symptoms & Life Cycle

Bactrocera kirki is black with yellow markings near the head and wings (Photo 1). The abdomen is glossy black with orange-brown bands in the middle, from top to bottom. Mating occurs late morning or early afternoon.

Bactrocera passiflorae is native to Fiji. It is black, a little smaller than a house fly with yellow markings on each side of the thorax (the part of the body behind the head), and on a triangular area at the back of the thorax. The wings are clear except for the dark margin at the front of the wings (Photo 2).

Bactrocera xanthodes is a little larger than a house fly. It is brown-orange with three yellow stripes on the upper surface of the middle part, the thorax (Photos 3&4). This fruit fly is found in villages, towns and coastal areas, but not forests. Mating occurs at dusk.

Bactrocera species near ***passiflorae*** is similar to *Bactrocera passiflorae* except that the abdomen has many pale markings.

Adult flies pierce the fruits with their ovipositors to lay eggs under the skin (Photos 4&5). As the eggs are laid, bacteria are also inserted into the fruit; these rot the fruit and provide the larvae or maggots (Photo 6) with the food that they need.

The eggs hatch in about 2 days, and fruits start to rot about 3 days later. At 5 to 7 days after egg laying, rots are obvious. When completely rotted, the fruits fall to the ground, and the maggots enter the soil and pupate (Photo 7) until the adults emerge. Emergence is 18 to 20 days after the eggs were laid.

Fruit flies find the fruits to lay in by their colour, shape and the smell of the fruit, leaves and the bacteria on them.

The fruit flies feed on the juices from fruit, nectar from flowers, honeydew from insects, bird faeces and bacteria. Young females need protein foods before they become sexually mature and able to lay viable eggs.

Impact

Three species are of major economic importance: *Bactrocera passiflorae*, *Bactrocera xanthodes*, and *Bactrocera kirki*. They lay eggs in a wide range of fruits which subsequently develop bacterial rots upon which the larvae or maggots feed. The rotting causes the fruits to fall.

Bactrocera kirki is present only on Rotuma, but is a major threat to the fresh fruit and vegetable industry of other Fiji islands.

Damage assessment on *Bactrocera passiflorae* in Viti Levu shows that it infests 60% of ripe kumquats, 40-90% of ripe guavas, 62% of ripe kavikas (*Syzygium malaccense*), and 20-25% of ripe mangoes. Fleshy vegetables are virtually free from fruit fly infestation.

Detection & inspection

Look for a black fly with yellow markings on each side of the thorax, closest to the head and wings and orange-brown longitudinal bands in the middle of the abdomen (*Bactrocera kirki*); a black fly with yellow markings on each side of the thorax near the wings, and a triangular area at the rear of the thorax (*Bactrocera passiflorae*); and a slender, almost translucent, light brown-orange fly with three yellow stripes (*Bactrocera xanthodes*). Male *Bactrocera kirki* and *Bactrocera passiflorae* are attracted to Cue-lure. Male *Bactrocera xanthodes* are attracted to methyl eugenol. Males of the light coloured form of *Bactrocera passiflorae* - are also attracted to Cue-lure.

Management

QUARANTINE

There is need for vigilance and public awareness programs to prevent *Bactrocera kirki* spreading from Rotuma to Viti Levu and Vanua Levu, as well as the entry of exotic fruit fly species. Routinely, traps should be placed in villages, airports and seaports, some baited with Cue-lure, others with methyl eugenol plus insecticides, and checked monthly.

NATURAL ENEMIES

In general, predators (spiders, ants, assassin bugs and carabid beetles) have had little effect on populations of fruit flies. Parasitoids, too, have only been found at low levels in Pacific island countries, and introducing others is probably not worthwhile. The egg/larval parasite, *Opius oophilus*, was introduced into Fiji from Hawaii in 1951 (with three other *Opius* species), but it is not as effective as it was in Hawaii where it was introduced against the Oriental fruit fly, *Bactrocera dorsalis*. In Fiji, rates of parasitism rarely exceed 25% except in cherry guava, and according to Swaine (1971)¹ infestations of *Bactrocera passiflorae* and *Bactrocera xanthodes*, still occur in native fruits and guava.

CULTURAL CONTROL

An integrated approach to fruit fly management is needed which combines bagging of fruit, fruit production during times of low fruit fly populations, the use of less susceptible varieties, hygiene measures, and protein bait sprays.

Before planting:

- Consider growing crops in the cooler months when fruit fly populations are at their lowest. For instance, during the cooler months of May to August the damage caused to capsicums in, e.g., Tonga falls to about 10%.

During growth:

- Bag the fruit with double layers of newspaper or use brown paper bags. On three sides, fold over the edge of the newspaper for 2 cm, and staple the folds in place (Photo 8). Place the fruit in the bags as shown. This is a suitable method for protecting starfruit (*Averrhoa carambola*), mangoes and also snake gourd (*Trichosanthes cucumerina*).
- Alternately, use leaves of coconut, *Pandanus*, betel nut, or sago palm instead of paper to cover the fruit. Cover fruits of banana with leaves (Photo 9) to protect against banana fruit fly, birds, and also to improve appearance.
- Collect fallen and overripe fruit, and destroy by burning, burying or putting them in a plastic bag left in the sun for a day. Control by sanitation is best if all growers do it routinely over as wide an area as possible.
- Harvest early before the fruit is susceptible to fruit fly attack. This method is used for bananas and papaya. Bananas are harvested green, and papayas at colour break.

After harvest:

- Collect all discarded fruit and destroy them using the methods listed above.

RESISTANT VARIETIES

Some fruit varieties have been tested and found to be 'non-hosts' for fruit flies, for instance, the chilli varieties 'Hot Rod' and 'Red Fire' in Fiji. Also, pineapples are non-hosts for fruit flies in Fiji at any stage. Other crops that may be non-hosts or low risk are squash, pumpkin, zucchini, cucumber, and some varieties of watermelon, rockmelon, limes and papaya at colour break. Check with the agriculture authorities for the latest tests that have been done, and lists of appropriate varieties.

CHEMICAL CONTROL

Female fruit flies need protein for their eggs to mature properly. Protein bait sprays make use of this need by combining a protein source with an insecticide. In Pacific island countries, the protein is either a commercial autolysed yeast product (*MPPIL*, *Mauri's Pinnacle Protein Insect Lure*) - broken up yeast cells in which the proteins have been converted into simpler compounds using enzymes - or protein autolysate from brewery yeast waste. In Tonga, the product is known as *Royal Tongalure*.

If *MPPIL* is used, place 50 ml *MPPIL* concentrate and 4 ml malathion 50% emulsifiable concentrate into a bottle and make it up to 1 litre with water. If *Royal Tongalure* is used, replace the *MPPIL*, with 100 ml of *Royal Tongalure* in the *MPPIL* recipe above.

The bait solutions are sprayed at a rate of 50 ml per m² on each tree in the orchard, and on surrounding trees. On capsicum, chillies and cucurbits, 20-25 litres per hectare are applied as a spray to every third row.

A third product called *Bactrogeel* has been developed; this is a powder containing fipronil. Add 50 g *Bactrogeel* to 9.7 litres water, stir to dissolve, and add 300 ml protein bait concentrate, and again stir to dissolve. Much smaller amounts are needed compared to the other two. Apply 10 ml to lower surface of leaves on each tree. For vegetables, spray 5-10 ml at 4 m intervals along rows, and every 2-3 rows, depending on spacing. Small, hand-held sprayers can be used which deliver a coarse straight jet of liquid.

When using a pesticide, always wear protective clothing and follow the instructions on the product label, such as dosage, timing of application, and pre-harvest interval. Recommendations will vary with the crop and system of cultivation. Expert advice on the most appropriate pesticide to use should always be sought from local agricultural authorities.



Photo 5. Fruit fly eggs.



Photo 6. Fruit fly larvae or maggots.



Photo 7. Fruit fly pupae.



Photo 8. Newspaper with edges folded and stapled to form a bag in which to insert fruit to protect it from fruit flies.



Photo 9. Banana leaves used to wrap a fruit bunch to prevent attack by fruit flies, other pests, and to promote uniform ripening, in Papua New Guinea.

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¹Information from Swaine G (1971) *Agricultural Zoology in Fiji*. Her Majesty's Stationery Office, London; and (information and photos) *Fruit flies in Fiji Islands* (2000), SPC Pest Advisory Leaflet 28. (<https://lrd.spc.int/pest-advisory-leaflet?start=15>); and from *Fruit fly control methods for Pacific island countries and territories* (2001), SPC Pest Advisory Leaflet 40. (https://lrd.spc.int/pubs/cat_view/469-pest-advisory-leaflets).

Produced with support from the Australian Centre for International Agricultural Research under project PC/2010/090: *Strengthening integrated crop management research in the Pacific Islands in support of sustainable intensification of high-value crop production*, implemented by the University of Queensland and the Secretariat of the Pacific Community.



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