



Fruit Flies in Cook Islands

Fruit flies belong to the Family Tephritidae in the insect Order Diptera, the true flies. There are over 4000 species of fruit flies, of which 35% attack soft fruits including many that are commercial or edible. Most of the other species infest flowers, leaves, stems or root tissue of plants.

Fruit flies should be distinguished from the small flies Drosophilidae or vinegar flies that infest damaged, fallen, or rotting fruits. They do not attack sound fruit unless it is over-ripe and so are not a problem in fruit production.

Pest fruit flies occur in all regions of the world, except Antarctica. They cause losses in fruit and vegetable production, increase the production cost due to the need to control them, and they have the ability to spread to and colonize new areas. Their presence in countries results in the imposition of restrictions to trade and forces the farmer and exporter to carry out expensive field control and post-harvest disinfestation treatments before commodities can be exported.

Throughout the Pacific, countries have their own fruit fly fauna. The exception to this rule is New Zealand, which is fortunate in not having any fruit flies. In Cook Islands, two species of fruit flies occur: *Bactrocera melanotus* and *Bactrocera xanthodes*.

Bactrocera melanotus

Distribution

Bactrocera melanotus (Figure 1) is the only endemic fruit fly of economic importance in the Cook Islands and has not been reported from any other country in the world. It has been recorded from the islands of Atiu, Aitutaki, Mangaia, Mauke, Mitiaro and Rarotonga.

Description

This fly is about the same size as a house fly. The dorsal (back) surface of the thorax and the abdomen is black. The sides of the thorax have three white-yellow markings, which in the sunlight appear greenish. The under surface of the abdomen is creamy coloured with six brown plates along the mid-line. The abdomen of the male is rounded while that of the female is pointed. Emerging from the rear end of the female fly is a pointed egg-laying mechanism, called an ovipositor, which pierces and deposits eggs under the skins of fruits. Its legs are black and its wings are basically clear.

Host fruits

B. melanotus attacks a wide range of commercial and edible fruits, such as avocado, breadfruit, carambola, grapefruit (*Citrus x paradisi*), guava, mandarin (*Citrus reticulata*), mango, orange (*C. sinensis*), pacific almond (*Terminalia catappa*), pawpaw, pomelo (*C. grandis*), rose apple (*Syzygium jambos*), surinam cherry (*Eugenia uniflora*), Tahitian chestnut (*Inocarpus fagifer*) and tomato. It also infests a number of wild hosts, such as indian laurel (*Calophyllum inophyllum*), noni (*Morinda citrifolia*), pistarich (*Syzygium cumini*) and *Guettarda speciosa*. It infests more than 30 host fruits, but it has not been recorded from fleshy vegetables in the field.



Figure 1: *Bactrocera melanotus* male

Pacific fruit fly- *Bactrocera xanthodes*

Distribution

Pacific fruit fly (Figure 2) unlike *B. melanotus*, occurs in other countries in the Pacific and is probably the most widely distributed species in the South Pacific. It occurs in Cook Islands, Fiji Islands, Tonga, Niue, Samoa, American Samoa and Wallis and Futuna. It occurred previously on Nauru but was eradicated in early 2000, using a combination of male annihilation and protein bait spraying. It has been detected in French Polynesia on Rurutu and Raivavae Islands and its eradication is in process. Its distribution in the Cook Islands is the same as that for *B. melanotus*.

Description

It is similar in size to *B. melanotus*, but is more slender. It is light brown-orange in colour, with three yellow stripes on the upper surface of the thorax. When examined under a microscope, the thorax is translucent, which is not common in fruit flies. Its abdomen is basically light brown-orange, but has two darker spots towards the rear of the abdomen on the dorsal side. Its legs are orange-yellow, as opposed to the black legs of *B. melanotus*. Similar to *B. melanotus*, the male's abdomen is rounded and the female's is pointed and contains the ovipositor. The wings are basically clear, but have yellow-orange bands at the front and rear edges. After this fly has been dead for a relatively short time, the colour darkens to almost a light brown and the thorax appears to be more translucent.

Host fruits

B. xanthodes has a more restricted host range than that of *B. melanotus*. It infests mainly pawpaw, breadfruit, jackfruit, and, on occasions, avocado and mango.

BIOLOGY OF FRUIT FLIES

There are four stages in the life cycle of the fruit fly – egg, larva, pupa, and adult. The adult female stings the fruit by inserting its ovipositor into the skin of the fruit and lays eggs in batches just under the skin. The eggs can be laid in fruits on the tree or on the ground. The female prefers to lay eggs in ripe or mature fruits, but will lay eggs in fruit that are at the colour break stage, e.g. in pawpaws. The eggs are creamy white in colour and are spindle shaped (Figure 3). They hatch in about 2–3 days and the larvae (maggots) commence to burrow into the flesh of the fruit.

The larvae are creamy white (Figure 4) but, depending on the colour of the fruit's flesh, may appear to be pinkish if they feed on guava or yellow if they feed on pawpaw. The larvae pass through three stages (instars) inside the fruit and complete their development inside the fruit in 8–9

days. The first instar larvae feed close to the skin, with each successive instar burrowing deeper into the fruit in search of sound flesh. The larvae emerge from the fruit and enter the soil to pupate. They remain as pupae for 10–14 days, depending on the temperature.



Figure 3: Fruit fly eggs in pawpaw



Figure 2: *Bactrocera xanthodes* female laying eggs in breadfruit



Figure 4: Third instar larvae of fruit flies

The adult flies emerge from the pupae. The pupae of *B. xanthodes* are dark brown (Figure 5) while those of *B. melanotus* are light brown (Figure 6). The female fly requires a protein feed before it can lay viable eggs. Mating occurs in a host tree when they reach sexual maturity in about 6–7 days. Providing the female has fed on protein, it can commence laying eggs in about 10 days, with maximum egg-laying occurring after 28 days. An adult can lay as many as 300 eggs in its life. Adult flies can survive for long periods in the field and can be found at all times of the year.



Figure 5: Pupae of *Bactrocera xanthodes*



Figure 6: Pupae of *Bactrocera melanotus*

QUARANTINE SURVEILLANCE

The fruit fly surveillance program in Cook Islands has confirmed that there are two fruit fly species present. The surveillance program involves maintaining a network of a pair of modified Steiner or Lynfield fruit fly traps baited with either Cue-lure or methyl eugenol, and the insecticide, Malathion. The traps are located in areas such as backyards in residential areas of towns and villages, hotels and resorts, research stations and ports of entry. The flies in the traps are collected every two weeks and the traps are re-baited after 8 weeks. Host fruit survey is also carried out to complement the trapping program. Host fruit surveys determine for each fruit fly species: their geographical distribution and seasonal abundance, levels of attack by natural enemies including parasites, which plant species acts as hosts and the level of damage to host fruits. Such surveys are needed also to detect the presence of fruit fly species, not currently present in Cook Islands, that are not attracted to male lures. Information from quarantine surveillance of fruit flies provides the basis for trade negotiations for export of fresh fruit and vegetables. This information is subject to regular audits by the importing countries. For this reason it is important that a continuous quarantine surveillance program be maintained.

FURTHER READING

1. Allwood, A.J. and R.A.I. Drew. 1997. Management of fruit flies in the Pacific. Proceedings of a Regional Symposium held in Nadi, Fiji Islands, 27–31 October 1996. Australia Centre for International Agricultural Research Proceedings No. 76. 267p
2. Drew, R.A.I. 1989. The tropical fruit flies (Diptera: Tephritidae: Dacinae) of Australasian and Oceanic regions. *Memoirs of the Queensland Museum* 26:133–170.
3. Drew, R.A.I., G.H.S. Hooper, and M.A. Bateman. 1978. Economic fruit flies in the South Pacific Region. 55–70. Queensland Department of Primary Industries, Brisbane, Australia.
4. Waterhouse, D.F. 1993. Pest fruit flies in the Oceanic Pacific. 4– 47 In: Biological control. Pacific Prospects. supplement 2. Australia Centre for International Agricultural Research Monograph No 20. viiii.138p.

This leaflet was compiled under the Fruit Fly Projects in the Pacific. The FAO/AusAID/UNDP/SPC Project on Regional Management of Fruit Flies in the Pacific (RMFFP) commenced in 1990 and Phase 1 initially operated in Fiji Islands, Cook Islands, Tonga and Samoa. Phase 2 (1994-1997) included, besides the four original countries, Federated States of Micronesia (FSM), Solomon Islands and Vanuatu. The third phase (1997-2000) included all 22 Pacific Island countries and territories (PICTs). The RMFFP was funded by AusAID, UNDP and New Zealand Government (NZODA), implemented by FAO and executed by the Secretariat of the Pacific Community (SPC). The Australian Centre for International Agricultural Research (ACIAR) has also run a parallel fruit fly project in the seven countries during Phases 1 and 2, and in Papua New Guinea since 1998. Since January 2001, fruit fly activities have become Component 2, "Fruit Fly Management", of the Project on "Pest Management in the Pacific", executed by SPC and funded by the Australian (AusAID) and New Zealand (NZODA) governments. For more information on the Fruit Fly Project, consult the Web site: <http://www.pacifly.org>.



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