



Fruit Flies in Palau

There are over 4500 species of fruit flies (Family Tephritidae) in the world and more than 50 of these are classified as major pests. Of the 50 major pest species, 22 are found in the Pacific islands including four recorded from trapping and fruit collection programmes in Palau.

The fruit fly species in Palau include *Bactrocera occipitalis* Bezzi and *Bactrocera philippinensis* Drew & Hancock, both of which belong to the *dorsalis* complex, *Bactrocera umbrosa* Fabricius (breadfruit fly), *Bactrocera frauenfeldi* Schiner (mango fly) and a non-pest fruit fly species, *Bactrocera calophylli* Perkins & May (Calophyllum fruit fly).

The first detection of the *dorsalis* complex species was in September 1996, when the specimens were identified as *Bactrocera dorsalis* (Hendel) (oriental fruit fly). In 2001, after several specimens from host fruit surveys were examined, the two *dorsalis* complex species (*Bactrocera occipitalis* and *Bactrocera philippinensis*) were confirmed to be present in Palau. These species look very similar to oriental fruit fly and were identified using DNA analysis and morphological characters such as the lengths of the ovipositors. Most importantly, it was confirmed that oriental fruit fly does not occur in Palau.

BIOLOGY OF FRUIT FLIES

Fruit fly activity is centered on the host plant, which provides site for adult resting or shelter, feeding, mating and egg laying, larval and pupal development in the soil underneath the

plant. Using its egg-laying organ (ovipositor), the adult female lays its eggs in clutches under the skin of the fruit. In the process, bacteria are introduced into the fruit causing the fruit to break down and rot. Once in the fruit, the eggs hatch into larvae or maggots. It is the decaying flesh that provides food for the larvae or maggots. When fully grown, the larvae escape from the fruit, burrow into the soil or organic matter and transform into pupae. Twenty days after eggs are laid, the adult fly emerges from the puparium. Shortly after females emerge, they disperse in search of a protein meal, an essential requirement to produce viable eggs.

ECONOMICALLY IMPORTANT FRUIT FLY SPECIES

Bactrocera dorsalis complex

In the past, oriental fruit fly was thought to be the major pest fruit fly species in the Asia / Southeast Asia region. Studies showed that oriental

fruit fly belonged to a complex of sibling species made up of 52 species. Of these 52 species, 8 are of economic importance and two of the eight are present in Palau. To confirm the differences in sibling species, conventional morphological taxonomy is used together with scanning electron microscopy, chemical analyses of male pheromones, tissue enzyme electrophoresis, host plant data and responses to male attractants.

The two *dorsalis* complex species *B. occipitalis* and *B. philippinensis* have caused extensive damage to fruits and vegetables in Palau. Field control of fruit flies in Palau is necessary to reduce losses caused by these two species and by mango fly and breadfruit fly. Host fruit surveys have confirmed that the two *dorsalis* complex species cause 10%, 11% and 69% damage to banana, papaya and starfruit, respectively. An eradication program for the *dorsalis* complex



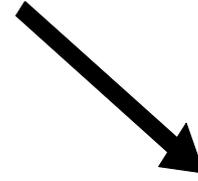
Oriental fruit fly, *B. dorsalis*, not present in Palau (Photo: USDA-ARS)

Life Cycle of Fruit Flies

Adult



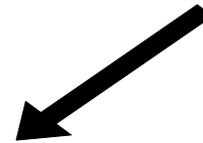
17 - 20 days



Eggs



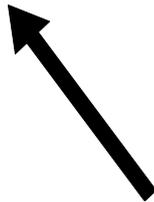
1-2 days



Larvae



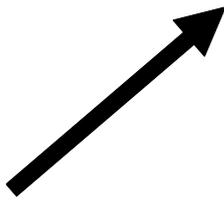
2 -8 days



Pupae



10 - 14 days



species was proposed for Palau, but funding support did not eventuate.

Bactrocera philippinensis

B. philippinensis, a sibling of both oriental fruit fly and *B. occipitalis*, is native to Philippines. It has been recorded from *Artocarpus communis*, papaya, mango, *Syzygium malaccensis*, and *Pouteria duklitan*. *B. philippinensis* is attracted to methyl eugenol. Host survey records of starfruit (*Averrhoa carambola*) show that 73% of the fruit are infested by *B. philippinensis* in Palau. In addition, *B. philippinensis* has caused 51% and 19% damage to guava and kumquat (*Citrofortunella mitis*), respectively.

Bactrocera occipitalis

B. occipitalis is an oriental fruit fly lookalike and is about the same size as a house fly. It is known to infest mango and guava. This species is present in the Philippines, Brunei, and Malaysia (Sabah). It is attracted to methyl eugenol.

***Bactrocera umbrosa* (breadfruit fly)**

Breadfruit fly is widely distributed throughout Southeast Asian countries where it is a major pest species of breadfruit, jackfruit and other *Artocarpus* species. It is present in Malaysia, Southern Thailand, Philippines, Indonesia, Vanuatu, New

Caledonia, Solomon Islands, Papua New Guinea and Palau.

Breadfruit fly is a medium sized, attractive fly and is easily recognised by its three broad red-brown transverse bands across the wings; the thorax is black with yellow sections on the sides and lower end of the thorax. The abdomen has a broad orange-brown T-shaped mark at the center with a dark thin stripe at the center of the broad T-shape. Adults mate at dusk and are attracted to methyl eugenol lure.

***Bactrocera frauenfeldi* (mango fruit fly)**

Mango fly is widely distributed in Papua New Guinea, Palau, Solomon Islands, Federated States of Micronesia, Marshall Islands, Nauru, Kiribati and Australia (northern Queensland). Throughout its geographic range, it is a major pest known to attack guava, papaya, citrus, breadfruit, Surinam cherry (*Eugenia uniflora*), mountain apple (*Syzygium malaccense*), wax apple (*S. javannica*), Tahitian chestnut (*Inocarpus fagifer*), tropical almond (*Terminalia* sp.) and many other fruits.

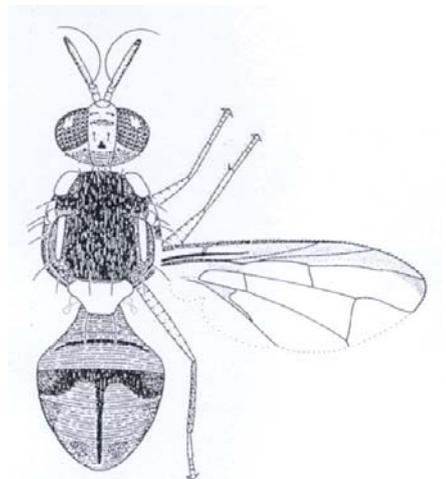
It is recorded from 72 host plant species belonging to 45 plant genera and 29 plant families. Male flies are attracted to cue-lure.

Mango fly is characteristically medium sized and is generally black in colour with yellow sections on the sides and lower end of the thorax. The rear end of the thorax has a yellowish coloured triangle with black markings at the lower part of the triangle. The wings are clear with broad dark bands in the lower parts of the wings. Host fruit surveys show 95% damage to *Terminalia catappa* (Pacific almond), 83% damage in Malay apple (*Syzygium malaccense*) and 69% in guava in Palau.

NON – PEST FRUIT FLY SPECIES

***Bactrocera calophylli* (Calophyllum fruit fly)**

Calophyllum fly is native to Palau and was first recorded by Hardy and Hadachi in 1956. It is not economically important and its only known host is *Calophyllum inophyllum*. This species has not been recorded during the recent surveys and, consequently, its occurrence needs to be confirmed by more intensive fruit sampling of *C. inophyllum*. Calophyllum fly is not attracted to any lure. It is important, therefore, that host fruit collections are carried out.



QUARANTINE SURVEILLANCE

The fruit fly surveillance program in Palau, like in other Pacific Island countries and territories, involves maintaining a network of pairs of modified Steiner traps baited with either cue-lure or methyl eugenol mixed with an insecticide (Malathion). These fruit fly traps are installed at strategic sites like rubbish dumps, farms, backyard gardens in urban



Bactrocera philippinensis (Photo: Anthony O'toole)



Bactrocera occipitalis (Photo: Anthony O'toole)



Bactrocera umbrosa Breadfruit fly (Photo: Steve Wilson)



Bactrocera frauenfeldi Mango fruit fly (Photo: Steve Wilson)

areas, villages, hotels/resorts, ports of entry, and residential areas of foreign diplomats. This monitoring system serves as an early detection method for any unwanted exotic fruit fly species that may be newly introduced into Palau.

There are two types of lures that are currently used in Palau to trap four of the five species present. The *dorsalis* complex species (*Bactrocera occipitalis* and *Bactrocera philippinensis*) and breadfruit fly are attracted to methyl eugenol lure, while mango fly is attracted to cue-lure.

The flies in the traps are collected every 2 weeks and the traps are re-baited and serviced after 12 weeks. Host fruit surveys are also carried out to complement the trapping program. Host fruit surveys provide vital information on the host fruit range of fruit flies, geographical distribution, seasonal abundance, levels of attack by natural enemies including parasites, and levels of damage to host fruits and



also detect the presence of fruit flies that are not attracted to male lures.

It is very important that a continuous quarantine surveillance program is maintained for early detection of exotic fruit fly species. The information derived from quarantine surveillance of fruit flies provides the basis for trade negotiations on export of fresh fruit and vegetables. In addition to the surveillance program, an on-going public awareness program targeting the traveling and the general public should be on-going.

The presence of the *dorsalis* complex species in Palau necessitates extra vigilance by plant protection staff and farmers in other Pacific Island countries and territories, particularly in neighbouring territories that do not have these species.

This leaflet was prepared by Fernando Sengebau, Nacanieli Waqa and Ema Tora Vueti

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