

Bactrocera carambolae

Introduction

Carambola fruit fly, *Bactrocera carambolae* (Drew & Hancock), belongs to the species complex of *Bactrocera* (*Bactrocera*). This pest is native to Indonesia, Malaysia & Thailand and was first collected in South America in 1975 in Paramaribo, Suriname. It is now present in French Guiana and Brazil.

B. carambolae is of phytosanitary significance to the Caribbean.

Identity

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Authority	: Drew and Hancock
Classification	:
Kingdom	: Animalia
Phylum	: Arthropoda
Class	: Insecta
Order	: Diptera
Family	: Tephritidae
Genus	: <i>Bactrocera</i>
Species	: <i>carambolae</i>
Synonyms:	: <i>Dacus dorsalis</i> , <i>Bactrocera</i> sp. (Carambola fruit fly), van Sauers-Muller, 1991: 432; <i>Bactrocera</i> sp. nr <i>B. dorsalis</i> (A), White & Elson Harris, 1992: 192.
Common name	: Carambola fruit fly
Role	: Pest

Signs & symptoms

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Characteristic damage: A puncture mark, which develops some necrosis around the spot after some time especially visible on carambola fruits (Fig.1).



Fig. 1. Infested carambola fruit.
Photo credit:
(A. van Sauers-Muller)

Egg- Curved (banana-shaped), 1 mm long, shining white, milky when ready to hatch.

Pupa- Cylindrical, about 4 mm long, dark reddish-brown, resembling a swollen grain of unhusked rice.

Larva- Elongated and pointed at head. Length from 1 mm just after hatching to 7 - 8 mm just before pupation.

The colour is white or the same color as the fruit pulp. If larvae of the third instar are confronted with an unfavorable microclimate, they are able to jump repeatedly about 10 cm or more and move to more suitable conditions. This is especially visible when they are placed on a dry surface. White *et al.* 1992.

Adult:

Drew and Hancock, 1994, distinguish the *B. dorsalis* species complex as follows: *Bactrocera* (*Bactrocera*) spp. with a clear wing membrane, except for a narrow costal band (not reaching R4+5); cells bc and c colorless (except in a few non-pests with a very pale tint) and devoid of microtrichia. Scutum mostly black, with lateral but no medial vittae; yellow scutellum, except for basal band which is usually very narrow; abdomen with a medial dark stripe on T3-T5, dark laterally but form of marking varies from species to species (Fig. 2).

Additional characters (including those of the subgenus) are that the narrow part of cell br has microtrichia; anterior supra-alar setae are present; pre-scutellar acrostichal setae are present (except in a few non-pest spp.); male abdomen with pecten on each side of T3; male sternite 56 with a V-shaped posterior margin.



Fig. 2: Adult male carambola fruit fly
(Photo credit: E. Neering)

The following key was based partly on Drew and Hancock, 1994, and partly on a study being carried by I.M. White and K. Mahmood (I.M. White, IIE, personal communication, 1996), in which the variability of each character is being quantified, so as to establish the relative reliability of each character. The keys presented here include all eight members of the complex, which are known to attack commercial fruit crops (the additional species being *B. caryeae*, *B. kandiensis* and *B. pyrifoliae*). These eight species fall into three groups, as follows:

- 1) Species with a dark mark on the post-pronotal lobe, narrow lateral vittae and extensively marked femora. Only two pest species belong to this group, and both are from the south Indian subcontinent area, namely *Bactrocera caryeae* in southern India and *B. kandiensis* in Sri Lanka. White and Elson-Harris (1992) gave notes on these species, with *B. kandiensis* referred to as sp. D as it was not formally named at that time. These two species differ markedly in body patterning and there is little reason to doubt that they are separate species.
- 2) Species with yellow post-pronotal lobes, tapered lateral vittae, and femora not extensively marked. Only one pest species belongs to the large section of the complex

that is characterized by tapered lateral vittae. *Bactrocera pyrifoliae* is only known from northern Thailand where it has been reported as a pest of pear.

- 3) Species with yellow post-pronotal lobes parallel lateral vittae, and femora not extensively marked. The remaining five pest species are *B. carambolae*, *B. dorsalis*, *B. occipitalis*, *B. papayae* and *B. philippinensis*.

The following list summarizes the differences between these species:

B. carambolae: short aculeus/aedeagus; tomentum with no gap; deep costal band; intermediate abdominal markings.

B. dorsalis: short aculeus/aedeagus; tomentum with no gap; narrow costal band; wide abdominal markings.

B. occipitalis: short aculeus/aedeagus; tomentum with gap; deep costal band; with abdominal markings.

B. papayae: long aculeus/aedeagus; tomentum with no gap; narrow costal band; narrow abdominal markings.

B. philippinensis: long aculeus/aedeagus; tomentum with no gap; costal band variable; narrow abdominal markings.

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Eggs are laid below the skin of the fruit, usually in groups of 4-5. The eggs develop in two days under tropical conditions (24-27°C, 70% RH). The larvae develop in the fruit in approximately 6-9 days after which the larvae burrow into the soil to pupate, when the mature fruits drop to the ground. Up to a hundred larvae per carambola fruit have been found. Pupation takes generally 8 - 10 days (Operations Manual, 1998). The majority of the adults emerge in the morning hours, between 9 am – 12 noon.

(Adults begin to mate at a later stage than *B. dorsalis*, usually after being three weeks old.)

The Carambola fruit fly is known to feed compulsorily on the lure methyl eugenol (ME), a substance that is naturally found in plants. Investigations in Indonesia showed that adult Carambola fruit fly males start responding to ME at an age of 2 days (Iwahashi *et al.*, 1996). Most males start to respond to ME before they become sexually mature, whereas a very small percentage of newly emerged males (<1%) survived to mate with females during treatment with ME. If matings occur in a lek, a very low mating rate could be expected with the few flies that mate during the treatment.

Males respond to the lure mainly between 1100 hr and 1400 hrs; they never responded after 1600 hrs. Females however only responded to the lure after 1700 hrs, after the males began their mating activities. No females were caught in field traps (Iwahashi *et al.*, 1996).

In tests in Malaysia with *B. carambolae* and *B. papayae*, the response of *B. carambolae* males to methyl eugenol was observed to begin 10 days after emergence and increased with age (Wee *et al.*, 2000); this is in contrast to results obtained by Iwahashi in Indonesia. The attractancy peaked at 28 days and above after emergence. The amount of ME, which resulted in optimum response by the carambola fruit fly males, is 1 mg or more. Male response to ME peaked at 28 DAE (days after emergence) and above. Both sexes of *B. carambolae* began to mate much later and performed significantly fewer matings per

individual than *B. papayae* under the same laboratory conditions. Matings for *B. carambolae* began 2 weeks after emergence. Only 86.7% of the males and 71.7% of the females successfully mated during the 60 day post-emergence observation period. Mating experiments in Suriname also indicate mating at a later age. Results indicated that the attractancy to ME begins just before or at sexual maturity in the males of *B. papayae* and *B. carambolae*.

Mating in the Carambola fruit fly starts around 1830 hrs at a light intensity of approximately 300 lux, at about 30 minutes before darkness (McInnis *et al*, 1999).

The Carambola fruit fly is known in Asia to infest primarily carambola, where it can cause to 100 % damage in unprotected situations. It tends to predominate in orchard and urban areas and is rarely if ever found in undisturbed rain forests (Vijayasegaran, *et al.*, 1991). The experience in Suriname (traps, fruit collections) indicates a similar pattern (Annual Reports).

Dispersal/vectors

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Dispersal of the fly can occur through the fly moving to other areas, or by humans carrying produce to other areas/countries, as happened with the introduction into Suriname from its original area of distribution in Southeast Asia.

Management

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Bait spray Application of a protein hydrolysate and an insecticide, especially in host trees, reduces the fly population. Brewery yeast (a waste product from beer breweries) can be used as an attractant. This material might be very acidic; the pH has to be adjusted until it is between 5 and 7 (White and Elson-Harris, 1992). In Suriname, borax was found to be more suitable to adjust the pH compared to sodium hydroxide.

Destruction of host fruit is a valuable tool in decreasing the fly population, although it is labor intensive.

Male Annihilation Technique The attractancy of the male flies to the para-pheromone, methyl eugenol is used in control. Malathion 96% ULV is added to this lure, and the mixture (ME 3 : Ma 1) is applied in baits in Jackson traps and in fiberboard blocks which are distributed evenly in the field (van Sauers-Muller, 1993). The same technique can be applied as a spot treatment, through mixing of lure and insecticide in a powder (thickener) and applying this on electricity poles and trees. This last method is especially suitable for urban areas.

Phytosanitary importance

Considered as a pest with major risk of introduction, due to existence of several pathways for introduction.

Biological Control

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In Suriname, specific research on biological control has not been done. There is no indication that the locally present *Anastrepha* parasite (*Doryctobracon aereolatus*) parasitizes the Carambola fruit fly.

Many of the parasites imported into Hawaii have originated from Malaysia, and were recorded at that time as parasites of *Dacus dorsalis* (Clausen *et al.*, 1965). Since true *B. dorsalis* does not occur in Malaysia (Drew *et al.*, 1994), it is likely that some of these parasites are originally found on *B. carambolae*. No information is available yet on the present status of fruit fly parasites for the Carambola fruit fly.

Collections of *Dacus dorsalis* in carambola in Malaysia (Vijaysegaran, 1984)(Serit *et al.*, 1984) showed the presence of the braconid parasites *Biosteres arisanus* (egg-parasite); *B. vandenboschi* (misidentified as *B. persulcatus*; pers. comm.)(first instar), *B. longicaudatus* (now *Diachasmimorpha*)(second and third instar) and *Opius fletcheri*.

Host notes

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Some differences were found between hosts from Asia (Allwood *et al.*, 1999) (White and Elson-Harris, 1992) specific Malaysia (Yong, 1994), and South America (van Sauers-Muller, 1991 and Annual Reports). For many hosts, information on host preference is available (primary, secondary and occasional host).

Host Range

It has been recorded on more than 151 kinds of fruits and vegetables including cashew, mango, sugar palm, avocado, breadfruit, jackfruit, guava, carambola, lemon, grapefruit, mandarin, orange, tomato, sapodilla, West Indian cherry, bilimbi tropical almond and chilli pepper

B. carambolae is a serious pest of carambola, which can be attacked while the fruit is still very young. This is an unusual habit for any *Bactrocera* species, as most flies attack most hosts when fruits are ripe or even overripe. This phenomenon was also observed in Suriname, however, it occurs only if a high fly population exists. With low fly populations, the fly only oviposits in fruits, which are full-grown and are changing color from green to yellow. Acid varieties tend to be less infested than the sweet varieties.

Distribution

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Southeast Asia: Western Indonesia (Lombok, Sumbawa, prob. Kalimantan), Southern Thailand, peninsula and East Malaysia, Andaman Is. (India), Singapore, Brunei. (White, 1996)(Drew *et al.*, 1994).

South-America: Suriname, French Guiana, Brazil (State of Amapa). Guyana is declared free since October 2000.

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