EPPO Datasheet: *Bactrocera carambolae*

Last updated: 2020-09-23

IDENTITY

Preferred name: *Bactrocera carambolae*
Authority: Drew & Hancock
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Diptera: Tephritidae
Other scientific names: *Bactrocera species A*
Common names: carambola fruit fly
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EPPO Categorization: A1 list
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EPPO Code: BCTRCB

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Notes on taxonomy and nomenclature

Bactrocera carambolae belongs to the *B. dorsalis* species complex (see Drew & Hancock, 1994). Schutze *et al.* (2014) showed that despite the high morphological and genetic similarity between *B. carambolae* and *B. dorsalis*, they are considered two valid species.

HOSTS

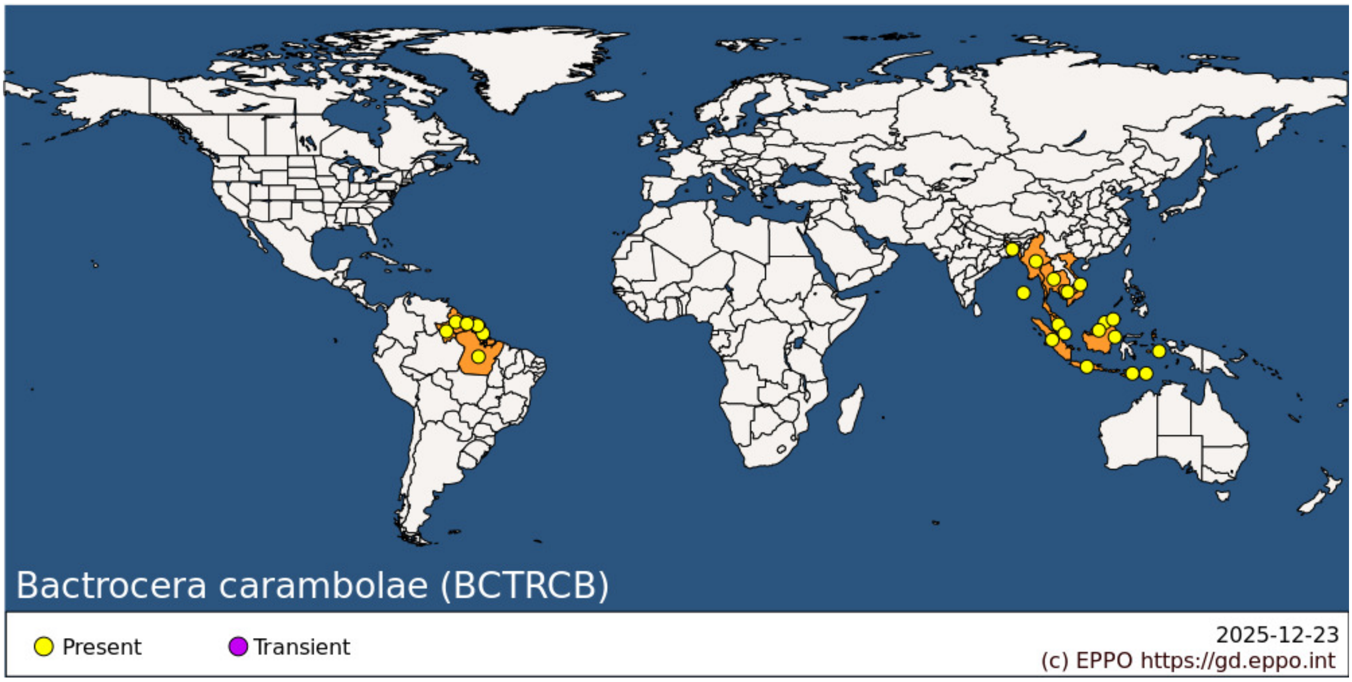
This pest species utilizes a wide range of hosts. It has been reported from over 100 different host plants belonging to more than 30 different families of which the adventive populations in South America are recorded from 11 different plant families and close to 30 hosts (Sauers-Muller, 2005; Malavasi *et al.*, 2013; Adaime *et al.*, 2016). The USDA Compendium of Fruit Fly Host Information (CoFFHI) (Liquido *et al.*, 2016) provides an extensive host list with detailed references. While *Garcinia mangostana* is listed as a host by Allwood *et al.* (1999), it was shown by Unahawutti *et al.* (2014) that *B. carambolae* females cannot oviposit in undamaged fruits of this species.

Host list: *Alangium uniloculare*, *Anacardium occidentale*, *Annona montana*, *Annona muricata*, *Annona squamosa*, *Arenga pinnata*, *Artocarpus altilis*, *Artocarpus elasticus*, *Artocarpus gomezianus*, *Artocarpus heterophyllus*, *Artocarpus integer*, *Artocarpus lacucha*, *Artocarpus odoratissimus*, *Artocarpus rigidus*, *Averrhoa bilimbi*, *Averrhoa carambola*, *Baccaurea motleyana*, *Bouea oppositifolia*, *Byrsonima crassifolia*, *Canarium odontophyllum*, *Capparis micracantha*, *Capsicum annuum*, *Capsicum chinense*, *Carica papaya*, *Cascabela thevetia*, *Chrysobalanus icaco*, *Chrysophyllum cainito*, *Citrus reticulata*, *Citrus swinglei*, *Citrus x aurantiifolia*, *Citrus x aurantium var. paradisi*, *Citrus x aurantium var. sinensis*, *Citrus x aurantium*, *Citrus x limon*, *Citrus x limonia*, *Diospyros wallichii*, *Drypetes longifolia*, *Dysoxylum parasiticum*, *Eugenia ligustrina*, *Eugenia patrisii*, *Eugenia stipitata*, *Eugenia uniflora*, *Fagraea ceilanica*, *Ficus grossularioides*, *Ficus hispida*, *Fortunella japonica*, *Fortunella margarita*, *Garcinia atroviridis*, *Garcinia cowa*, *Garcinia dulcis*, *Garcinia griffithii*, *Garcinia mangostana*, *Genipa americana*, *Gnetum macrostachyum*, *Gnetum montanum*, *Irvingia malayana*, *Knema angustifolia*, *Lansium domesticum*, *Lepisanthes alata*, *Licania sp.*, *Malpighia emarginata*, *Malpighia glabra*, *Malus domestica*, *Mammea americana*, *Mangifera indica*, *Manilkara zapota*, *Melientha suavis*, *Mimusops elengi*, *Ochanostachys amentacea*, *Paramignya andamanica*, *Passiflora quadrangularis*, *Pellacalyx saccardianus*, *Persea americana*, *Phaleria macrocarpa*, *Planchonella longipetiolata*, *Pouteria caimito*, *Pouteria campechiana*, *Pouteria macrophylla*, *Psidium cattleyanum*, *Psidium guajava*, *Psidium guineense*, *Punica granatum*, *Rhizophora sp.*, *Rhodomyrtus tomentosa*, *Rollinia mucosa*, *Salacca zalacca*, *Sandoricum koetjape*, *Shirakiopsis indica*, *Solanum lasiocarpum*, *Solanum lycopersicum*, *Solanum melongena*, *Spondias dulcis*, *Spondias mombin*, *Spondias purpurea*, *Symplocos cochinchinensis*, *Syzygium aqueum*, *Syzygium cumini*, *Syzygium grande*, *Syzygium jambos*, *Syzygium malaccense*, *Syzygium samarangense*, *Terminalia catappa*, *Terminalia citrina*, *Terminalia procera*, *Tetractomia majus*, *Triphasia trifolia*, *Uvaria grandiflora*, *Xanthophyllum amoenum*, *Ziziphus mauritiana*, *x Citrofortunella microcarpa*

GEOGRAPHICAL DISTRIBUTION

This species is found throughout large parts of Southeast Asia, from Bangladesh, eastwards to parts of Indonesia. Also present on the Andaman Islands (India) (David *et al.*, 2017).

It was introduced into South America, and is present in French Guyana, Guyana, Brazil (Amapa, Para and Roraima), and Surinam.



Asia: Bangladesh, Brunei Darussalam, Cambodia, East Timor, India (Andaman and Nicobar Islands), Indonesia (Java, Kalimantan, Maluku, Nusa Tenggara, Sumatra), Malaysia (Sabah, Sarawak, West), Myanmar, Singapore, Thailand, Vietnam
South America: Brazil (Amapa, Para, Roraima), French Guiana, Guyana, Suriname

BIOLOGY

The general life cycle is similar to those of other *Bactrocera* species infesting fruits: eggs are laid below the skin of the host fruit. Three larval stages develop inside the fruit, feeding on the plant tissue. Once mature the third instar larva will leave the fruit, dig down into the soil and turn into a pupa enclosed in a puparium. The adult fly will emerge from the puparium. Based on information from Latin America, completion of the life cycle (from egg to reproductive adult) takes 30-40 days. Adults flies can remain alive as long as 100-200 days, but this will depend on a number of variables including the host plant, and temperature (Malavasi *et al.*, 2013; Danjuma *et al.*, 2018; Castilho *et al.*, 2019). Further details on the biology of this species can be found in Danjuma *et al.* (2018) and Castilho *et al.* (2019), based on studies in, respectively, Thailand and Brazil.

DETECTION AND IDENTIFICATION

Symptoms

Attacked fruit have tiny oviposition punctures, but these and other symptoms of damage are often difficult to detect in the early stages of infestation. Considerable damage may occur inside the fruit before symptoms are visible externally, often as networks of tunnels accompanied by rotting.

Morphology

Larva

Fruit fly larvae in general have a typical shape, i.e., cylindrical maggot-shape, elongate, anterior end narrowed and somewhat recurved ventrally, with anterior mouth hooks, and flattened caudal end. Their length varies from 5 to 15 mm. Identification to species level is not possible based on larvae. The 3rd-instar larvae have been described by White & Elson- Harris (1992) under "*B.* (*B.*) *dorsalis* complex: *B.* (*B.*) sp. near *dorsalis* (A)" in detail. The same work provides a key to 3rd-instar larvae which is useful for an identification to genus level.

Adult (after diagnostic description given by Drew & Romig, 2013. Additional character states of the female after Drew & Hancock, 1994)

Male

Face fulvous with a pair of medium-sized oval black spots; postpronotal lobes and notopleura yellow; scutum dull black with brown behind lateral postsutural vittae, around notopleural suture and inside postpronotal lobes; broad parallel-sided lateral postsutural yellow vittae ending at or behind intra-alar seta; medial postsutural yellow vitta absent; mesopleural stripe reaching midway between anterior margin of notopleuron and anterior notopleural seta dorsally; scutellum yellow; legs with femora fulvous with a large elongate oval dark fuscous to black preapical spot on outer surfaces of fore femora in some specimens; tibiae dark fuscous (except mid tibiae paler apically); wing with cells bc and c colourless, microtrichia in outer corner of cell c only; a narrow fuscous costal band slightly overlapping R2+3 and expanding slightly beyond apex of R2+3 across apex of R4+5; a narrow fuscous anal streak; supernumerary lobe of medium development; abdominal terga III-V orange-brown with a 'T' pattern consisting of a narrow transverse black band across anterior margin of tergum III and widening to cover lateral margins, a medium-width medial longitudinal black band over all three terga, anterolateral corners of terga IV dark fuscous to black and rectangular in shape and anterolateral corners of tergum V dark fuscous, a pair of oval orange-brown shining spots on tergum V; abdominal sterna dark coloured.

Female

As for male in the general body colour patterns. Pecten absent from abdominal tergum III. Ovipositor basal segment orange-brown, dorsoventrally compressed and tapering posteriorly in dorsal view; ratio of length of oviscape to length of tergum V, 1:1; aculeus apex needle shaped.

Remark: differentiation between this species and closely related species within the *B. dorsalis* species complex (see Drew & Hancock, 1994) is difficult and needs expert confirmation. See ISPM 27 DP 29IPPC (2019) for details on how to differentiate between the main species of commercial importance belonging to the species complex.

DNA barcoding

The molecular identification of *B. carambolae* through DNA barcoding (COI) proves to be problematic as this species cannot be properly resolved from a number of closely related species, including species from the *B. dorsalis* species complex (see ISPM 27 DP 29 - IPPC, 2019). Additionally, the presence of unidentified / possibly misidentified reference sequence in the Barcoding Index Number Systems (BINs) in which this species is represented, might also bias its molecular ID. Molecular identification by DNA sequencing, using internal transcribed spacer (ITS) nuclear DNA regions, has been proposed to distinguish *B. carambolae* from some other members of the *B. dorsalis* species complex (IPPC, 2019). Sequences are available in the Barcode of Life Data Systems (**BOLD**) and **EPPO-Q-bank**.

Detection and inspection methods

Males are attracted to methyl eugenol but require a much higher dose to elicit a response, compared to *B. dorsalis* (Wee *et al*., 2002). Both sexes can be monitored by traps baited with protein-based attractants. Detection is also possible by examination of fruit for oviposition punctures and then rearing the larvae through to the adult stage.

PATHWAYS FOR MOVEMENT

Transport of infested fruits is the main means of movement and dispersal to previously uninfested areas. Adult flight can also result in dispersal but previous citations of long (50-100 km) dispersal movements for *Bactrocera* spp. are unsubstantiated according to a recent review by Hicks *et al.* (2019). Dispersal up to 2 km is considered more typical.

PEST SIGNIFICANCE

Economic impact

In general, the species is considered a major pest of a number of commercial fruits. Adventive populations in South America are considered to have a serious economic impact, especially if the fly could expand its range throughout large parts of the continent (Malavasi *et al.*, 2013).

Control

Management for this species includes the general control measures for *Bactrocera* spp. (see Vargas *et al.* 2015 for an overview of management options). These include sanitation (to gather all fallen and infested host fruits and destroy them). Insecticidal protection is possible by using a cover spray or a bait spray. Bait sprays work on the principle that both male and female tephritids are strongly attracted to a protein source from which ammonia emanates. Bait sprays have the advantage over cover sprays in that they can be applied as a spot treatment so that the flies are attracted to the insecticide and there is minimal impact on natural enemies and other beneficials. Specific control methodologies conducted in Brazil comprises male annihilation technique (MAT) and foliage baiting (Malavasi *et al*., 2013), but MAT using methyl eugenol is deemed to be less effective for this species compared to *B. dorsalis* (Vargas *et al.*, 2014) probably because of weaker sensitivity to the attractant (Wee *et al*., 2002).

Phytosanitary risk

Bactrocera carambolae is a known pest of several commercial fruit crops in the area where it is present. It can be moved in trade with infested fruit. No detailed study has been made on climatic suitability of the EPPO region for this species, but a global potential distribution was proposed by Marchioro (2016). This publication points out that both the native and invaded ranges predominantly occur in tropical zones with extremely hot and moist regions. The prediction models show that the EPPO region is largely unsuitable for *B. carambolae.* However, even transient populations could impact export of host fruit from the EPPO region. The EFSA Panel on Plant Health, in their Pest Categorization of non-EU Tephritidae (EFSA, 2020) placed *B. carambolae* on the list of fruit flies that satisfy the criteria to be regarded as a potential Union quarantine pest for the EU.

PHYTOSANITARY MEASURES

Consignments of fruits from countries or regions where *B. carambolae* occurs should be inspected for symptoms of infestation and those suspected should be cut open in order to look for larvae. Possible measures include that such fruits should come from an area where *B. carambolae* does not occur, or from a place of production found free from the pest by regular inspection in the 3 months before harvest. Plants transported with roots from countries or regions where *B. carambolae* occurs should be free from soil, or the soil should be treated against puparia. The plants should not carry fruits.

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CABI resources used when preparing this datasheet

CABI Datasheet on Pest https://www.cabi.org/isc/datasheet/8700

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Datasheet history

This datasheet was first published in 1997 in the second edition of 'Quarantine Pests for Europe', as part of the *Bactrocera dorsalis* species complex, and revised in 2020. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', ‘Hosts’, and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

CABI/EPPO (1997) *Quarantine Pests for Europe (2nd edition).* CABI, Wallingford (GB).

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