

A Guide to the Major Pest Fruit Flies of the World





International Atomic Energy Agency



Food and Agriculture Organization of the United Nations



Scientific Advisory Services Pty Ltd

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Introduction

This guide aims to provide a general reference for those involved in plant quarantine activities including the surveillance and management of fruit flies, and the marketing of fresh fruits which may be infested with fruit flies.

This guide is not exhaustive and only includes the major pest fruit flies (Diptera: Tephritidae) in the world. The correct identification of fruit flies is a specialized task and specimens should be preserved properly and sent to fruit fly taxonomists in order to be identified to species level.

This guide has been jointly produced by Scientific Advisory Services and the Insect Pest Control Section, Joint FAO / IAEA Division of Nuclear Techniques in Food and Agriculture with the support of the Department of Technical Cooperation of IAEA through the technical cooperation regional Africa project RAF5061 and is aimed at supporting area-wide management programmes.

The maps show only approximate distributions of the various species, however, the responsible government agencies should be contacted in each country for more detailed information on their distribution and hosts.

The hosts presented are some of the major commercially important fruits and vegetable types, however for most species, there are other hosts. In the absence of any specific synthetic attractants for some species, proteins, ammonium compounds, sugar, vinegar and fruit-based attractants may be used for surveys.

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Life Cycle

The life cycle can be completed in 3-5 weeks for some species in warmer climates.

Tropical species can have many generations per year, while the trend in temperate species is towards fewer generations per year, in some cases, only one.



Mating

The female fruit fly generally requires a protein feed before eggs can be developed and bacteria present on fruit and leaf surfaces are an important source for some species. Other food sources for adults include dew, aphid honeydew, bird faeces and plant secretions.

A couple of days after mating, the female fruit fly commences egg laying. Adults may lay from 50 to more than 1000 eggs in their lifetime depending on the species.



Oviposition

Fruit flies belong to the family of flies called the Tephritidae. Female fruit flies possess a characteristic telescoping structure in the abdomen called the ovipositor.

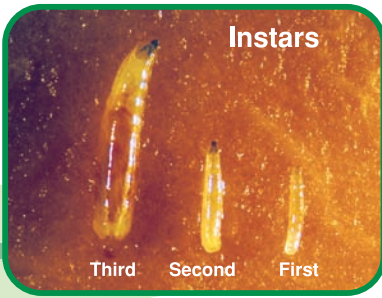
The female extends the ovipositor to pierce the skin and insert the eggs into the fruit. The resulting oviposition marks on the fruit are sometimes known as 'stings'.



Egg

Eggs are usually white or cream in colour, elongate and about 1-2mm long. Eggs may be laid singly or in bulk depending on the species.

Eggs usually hatch to produce first instar larva within 2 to 12 days depending on species and temperatures.



Larva

The larvae or maggots tunnel and feed inside the fruit. There are 3 instars (first, second and third) each separated by a moult. Third instars are usually 7-10mm but can be up to 15mm long in some species. Young larvae are almost translucent becoming cream to white in colour when mature.

The mature larvae usually emerge from the rotten fruit, drop to the ground, crawl or jump some distance and then burrow down into the soil where they change into puparia.

Larval stages can be completed in as little as 6 days for some species.



Puparium

Puparia (often called pupae) are found buried a few centimetres in the soil beneath the host plant, although some species pupariate in fruit.

Puparia can be white, brown or black in colour and may be 4-12mm long.

This stage may last from approximately 7 days to more than 100 days depending on temperatures and species.



Female ♀
Bactrocera dorsalis



Male ♂
Bactrocera dorsalis

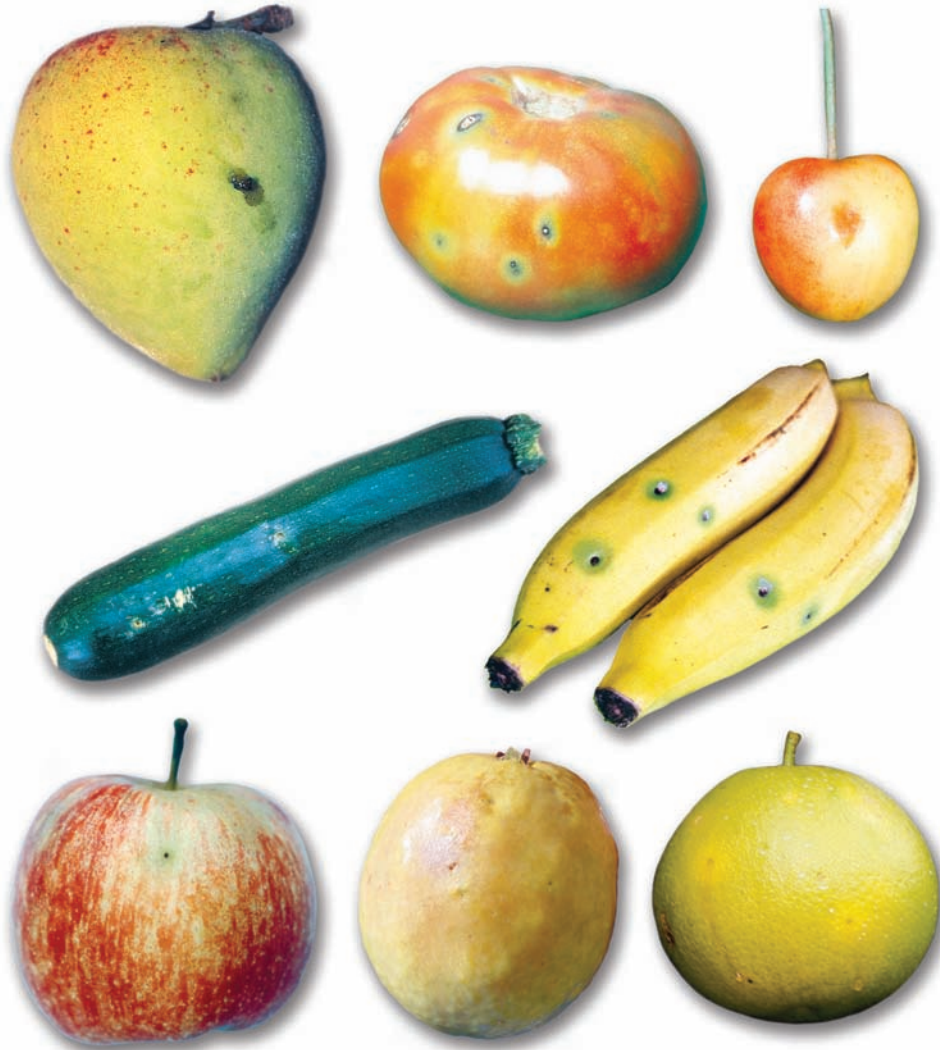
Adult

The abdomen of the female fly is pointed at the rear, in contrast with that of the male, which is evenly rounded.

Adult flies may live for up to one year. Adults vary in body size from 3mm to 26mm long including the ovipositor.

Oviposition Damage

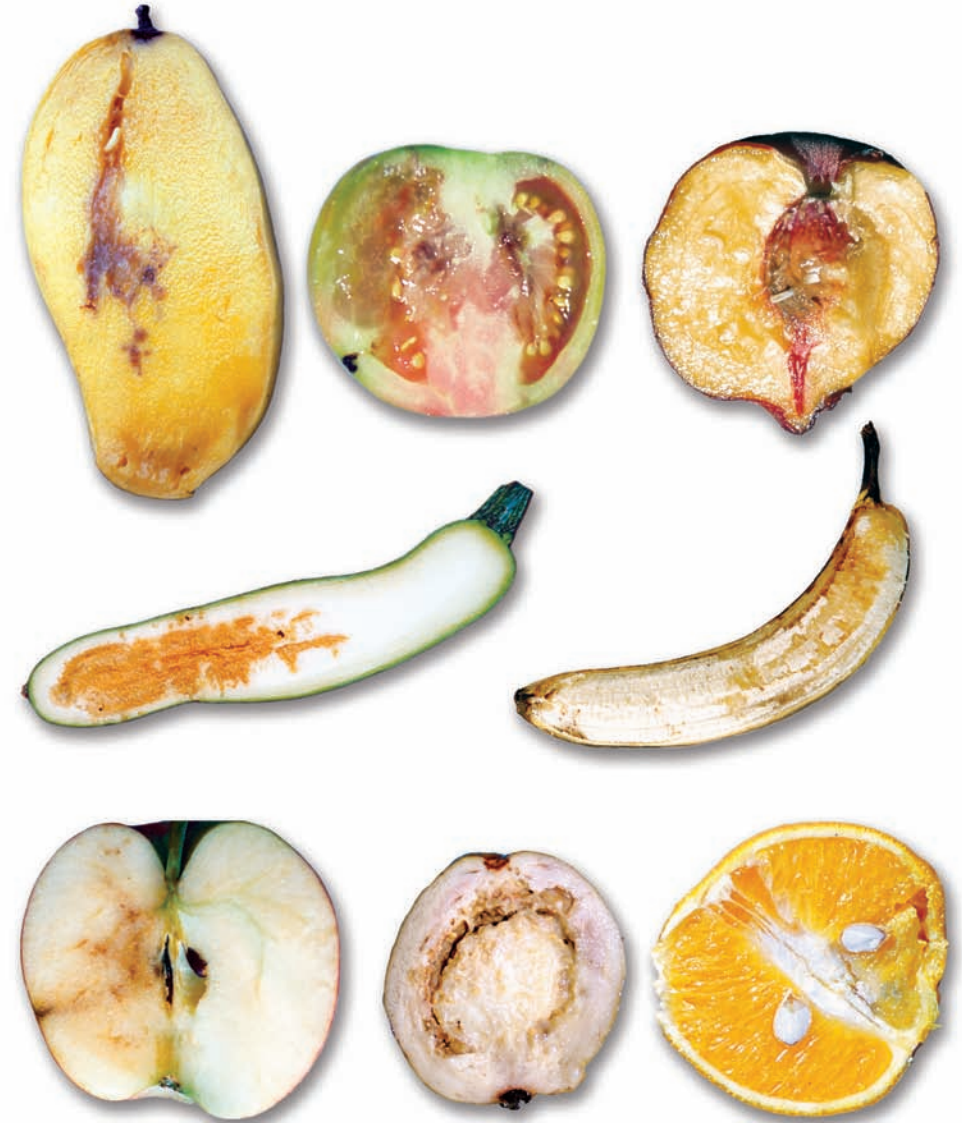
Damage occurs when the female's ovipositor penetrates the skin of the fruit or vegetable. This also allows the entry of secondary micro-organisms such as bacteria and fungi that cause rotting.



Clockwise from top left: mango, tomato, cherry, banana, grapefruit, common guava, apple, zucchini.

Larval Damage

Larval feeding and tunnelling damages the fruit or vegetable and is associated with secondary rotting from micro-organisms.



Clockwise from top left: mango, tomato, peach, banana, orange, common guava, apple, zucchini.

Anastrepha distincta

Greene

Inga Fruit Fly



Lures: Protein baits (♀♂).

Hosts: *Inga* species, mango, star apple + others.



Anastrepha fraterculus

(Wiedemann)

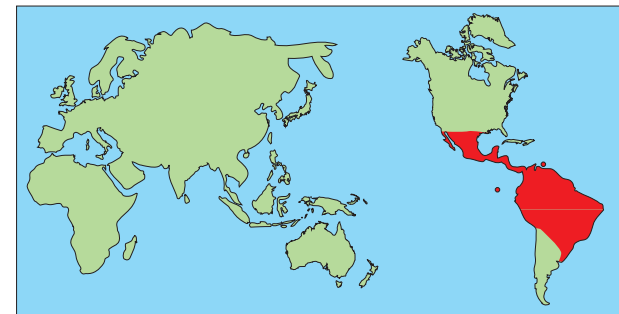
South American Fruit Fly

Scientific evidence indicates that this species is a complex of about seven species with different hosts and behaviours.



Lures: Protein baits (♀♂).

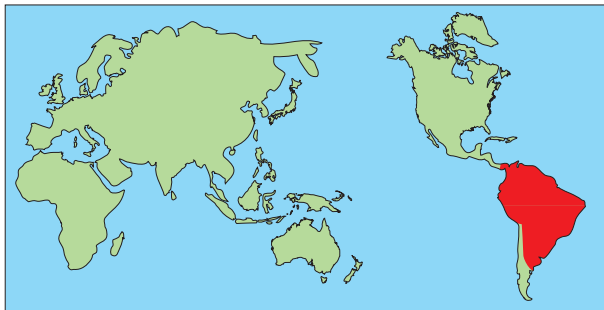
Hosts: Apple, coffee, carambola, citrus (some) common guava, peach, pear + others.



Anastrepha grandis
(Macquart)
South American Cucurbit Fruit Fly



Lures: Protein baits (♀♂).
Hosts: Cucurbits including pumpkin.



Anastrepha ludens
(Loew)
Mexican Fruit Fly



Lures: Protein baits (♀♂).
Hosts: Peach, citrus (some), mango, pear + others.



Anastrepha obliqua

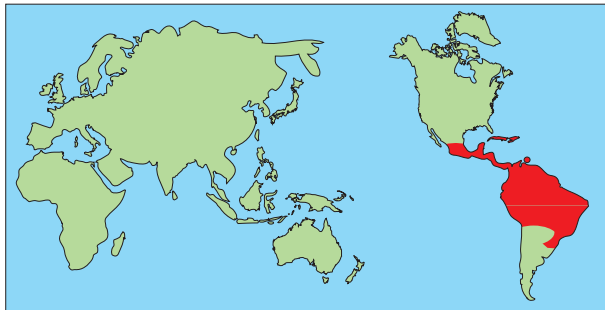
(Macquart)

West Indian Fruit Fly , Antillean Fruit Fly



Lures: Protein baits (♀♂).

Hosts: Carambola, hog plum, mango, red mombin + others.



Anastrepha serpentina

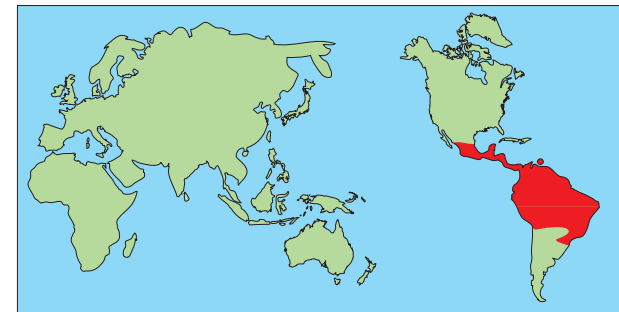
(Wiedemann)

Serpentine Fruit Fly, Sapote Fruit Fly



Lures: Protein baits (♀♂).

Hosts: Black sapote, mango, peach, sapodilla + others.



Anastrepha striata

Schiner

Guava Fruit Fly



Lures: Protein baits (♀♂).

Hosts: Brazilian guava, common guava, strawberry guava + others.



Anastrepha suspensa

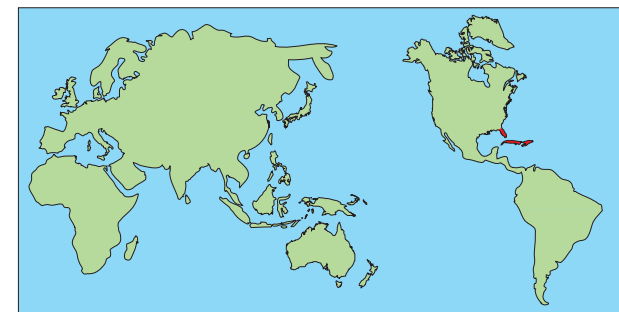
(Loew)

Caribbean Fruit Fly, Greater Antillean Fruit Fly



Lures: Protein baits (♀♂).

Hosts: Black sapote, mango, peach, sapodilla + others.

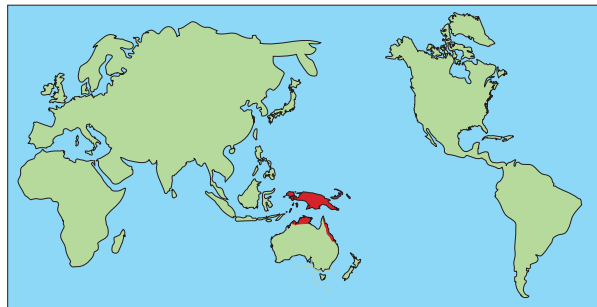


Bactrocera bryoniae
(Tryon)



Lures: Cue-lure (♂).

Hosts: A variety of fruit including banana, chilli and tomato.

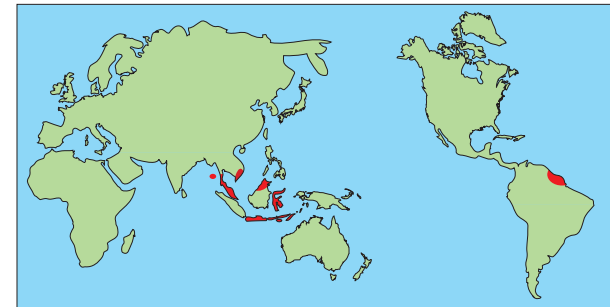


Bactrocera carambolae
Drew & Hancock
Carambola Fruit Fly



Lures: Methyl eugenol (♂), protein baits (♀♂).

Hosts: Carambola, common guava, mango, *Syzygium* species (including rose, water and watery rose apple) + others.



Bactrocera caryeae
(Kapoor)



Lures: Methyl eugenol (♂), protein baits (♀♂).
Hosts: Citrus (some), common guava, mango + others.



Bactrocera correcta
(Bezzi)
Guava Fruit Fly



Lures: Methyl eugenol (♂), protein baits (♀♂).
Hosts: Common jujube, common guava, mango, peach, tropical almond + others.



Bactrocera curvipennis
(Froggatt)



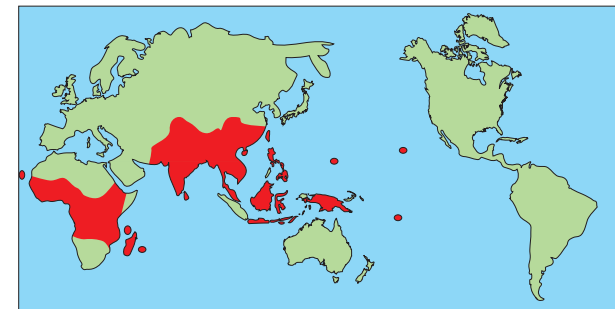
Lures: Cue-lure (♂).
Hosts: Bell pepper, cashew, citrus (including grapefruit and mandarin), common guava, mango + others.



Bactrocera dorsalis
(Hendel)
Oriental Fruit Fly



Lures: Methyl eugenol (♂), protein baits (♀♂).
Hosts: Apple, common guava, mango, papaya, peach, pear + others.

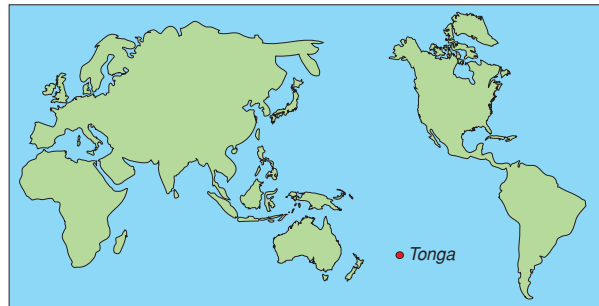


Bactrocera facialis
(Coquillett)



Lures: Cue-lure (♂).

Hosts: Avocado, bell pepper, common guava, mango, peach, tomato + others.



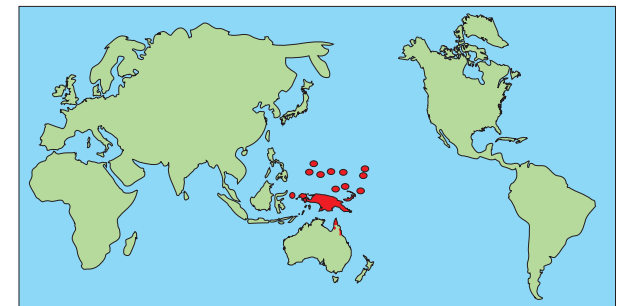
Bactrocera frauenfeldi
(Schiner)
Mango Fruit Fly, Mango Fly



Lures: Cue-lure (♂).

Hosts: Breadfruit, carambola, common guava, mango, papaya + others.

Inset: Variation of scutellum (arrows).



Bactrocera jarvisi

(Tryon)

Jarvis' Fruit Fly



Lures: Zingerone (♂).

Hosts: Common guava, Japanese persimmon, mango, papaya, peach, pear + others.



Bactrocera kandiensis

Drew & Hancock



Lures: Methyl eugenol (♂).

Hosts: Mango + others.



Bactrocera kirki
(Froggatt)



Lures: Cue-lure (♂).

Hosts: Bell pepper, common guava, mango, orange, passionfruit, peach + others.

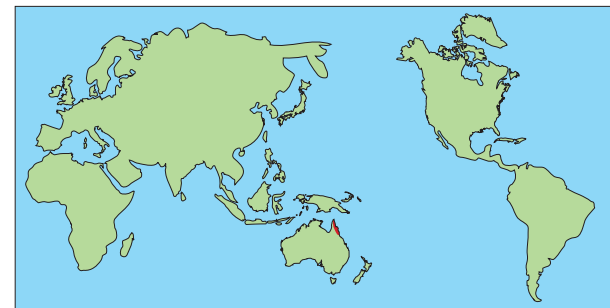


Bactrocera kraussi
(Hardy)
Krauss's Fruit Fly



Lures: Cue lure (♂).

Hosts: Banana, carambola, citrus, common guava, mango, peach + others.



Bactrocera latifrons

(Hendel)

Malaysian Fruit Fly, Solanum Fruit Fly



Lures: Latilure (♂), latilure/cade oil mixture (♂), protein baits (♀♂).

Hosts: Bell pepper, eggplant, tomato + others.



Bactrocera melanotus

(Coquillett)



Lures: Cue-lure (♂).

Hosts: Avocado, citrus (including grapefruit, orange and pummelo), common guava, mango, papaya + others.



Bactrocera minax

(Enderlein)

Chinese Citrus Fly



Lures: Protein baits (♀♂).

Hosts: Citrus including grapefruit, kumquat, lemon and orange.

Inset: Live teneral male adult.



Bactrocera musae

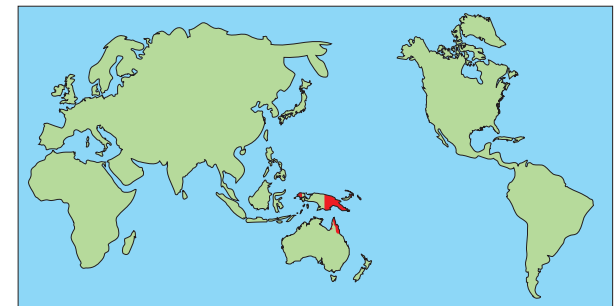
(Tryon)

Banana Fruit Fly



Lures: Methyl eugenol (♂).

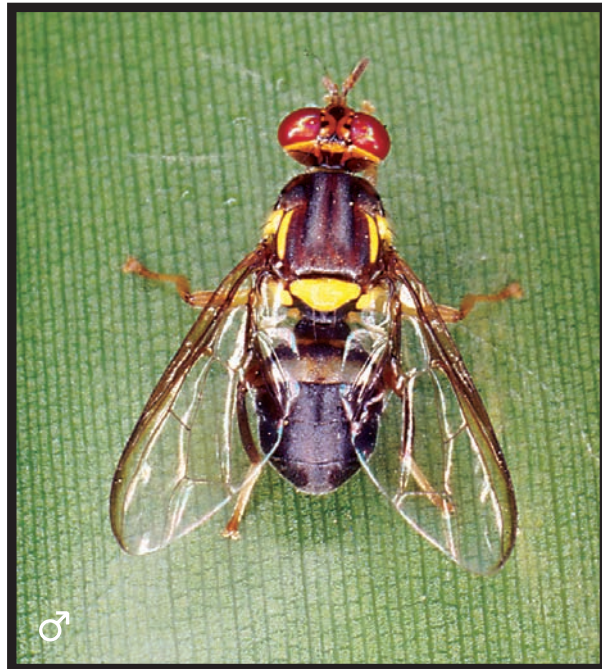
Hosts: Banana, common guava, papaya + others.



Bactrocera neohumeralis

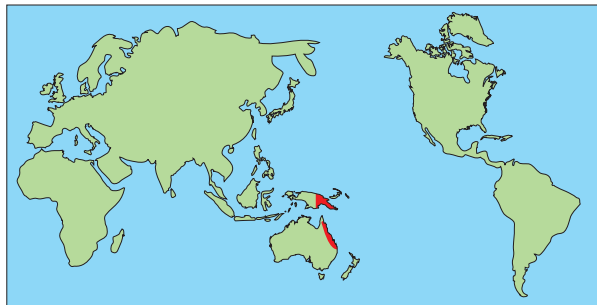
(Hardy)

Lesser Queensland Fruit Fly



Lures: Cue-lure (♂).

Hosts: Apple, citrus (most), arabica coffee, common guava, mango, peach, plum + others.



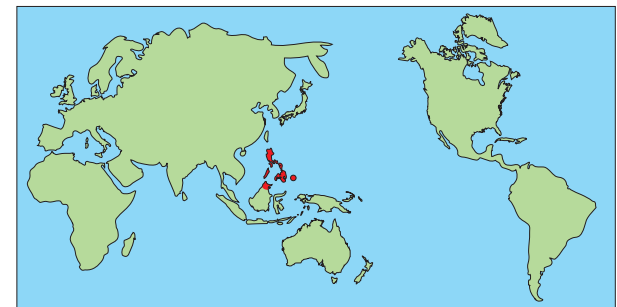
Bactrocera occipitalis

(Bezzi)



Lures: Methyl eugenol (♂), protein baits (♀♂).

Hosts: Common guava and mango.



Bactrocera oleae

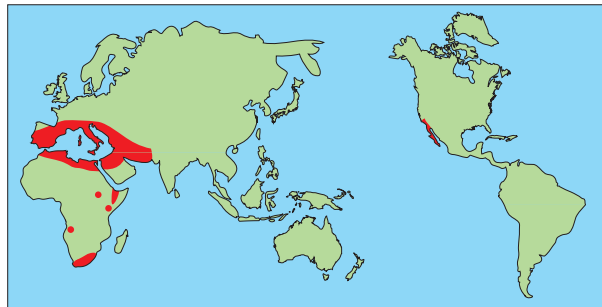
(Rossi)

Olive Fruit Fly



Lures: Ammonium bicarbonate (♀♂), spiroketal (♂), protein baits (♀♂)

Hosts: Cultivated olive and wild olives.



Bactrocera passiflorae

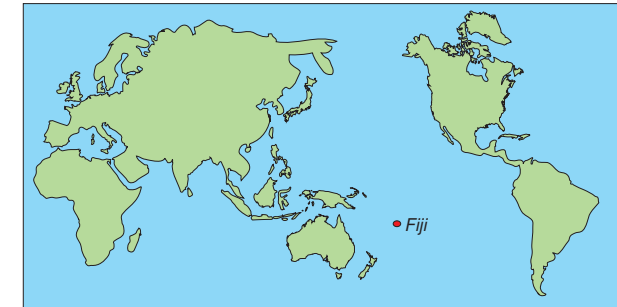
(Froggatt)

Fijian Fruit Fly



Lures: Cue-lure (♂).

Hosts: Avocado, common guava, eggplant, mango, papaya, passionfruit + others.



Bactrocera psidii
(Froggatt)



Lures: Cue-lure (♂).

Hosts: Cashew, custard apple, granadilla, common guava, Malay apple, mango, peach, pummelo + others.



Bactrocera pyrifoliae
Drew & Hancock



Lures: No known specific lures.

Hosts: Common guava, peach, sand pear + others.



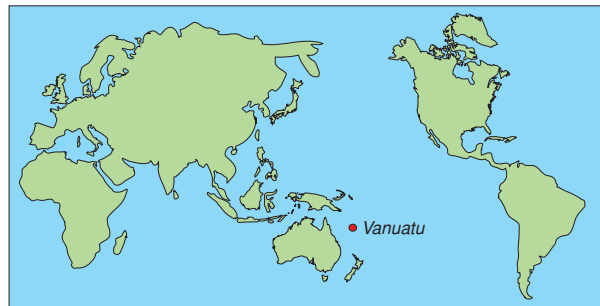
Bactrocera trilineola

Drew



Lures: Cue-lure (♂).

Hosts: Avocado, carambola, citrus (some), common guava, mango, papaya + others.



Bactrocera trivialis

(Drew)



Lures: Cue-lure (♂).

Hosts: Avocado, banana, common guava, Malay apple, mango, orange + others.



Bactrocera tryoni

(Froggatt)

Queensland Fruit Fly, Q Fly



Lures: Cue-lure (♂), protein baits (♀♂).

Hosts: Apple, citrus (most), common guava, Japanese persimmon, mango, olive, papaya, peach + others.



Bactrocera tsuneonis

(Miyake)

Japanese Orange Fly



Lures: Protein baits (♀♂).

Hosts: Citrus including kumquat, orange and tangerine.



Bactrocera tuberculata
(Bezzi)



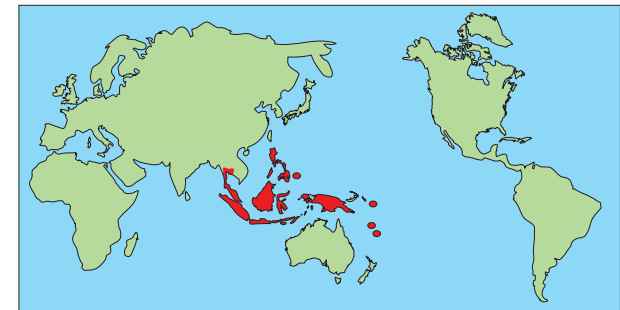
Lures: Methyl eugenol (♂).
Hosts: Mango, peach, sapodilla + others.



Bactrocera umbrosa
(Fabricius)
Breadfruit Fly



Lures: Methyl eugenol (♂), protein baits (♀♂).
Hosts: *Artocarpus* species including breadfruit, chempedak and jackfruit.



Bactrocera xanthodes

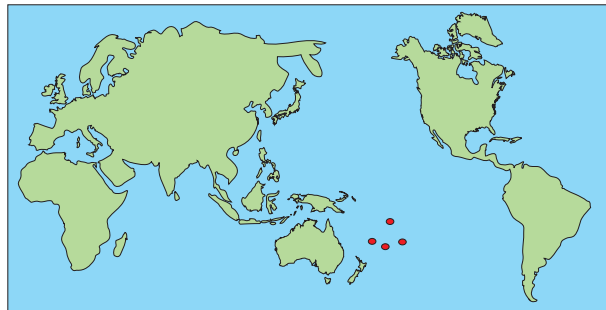
(Broun)

Pacific Fruit Fly



Lures: Methyl eugenol (♂).

Hosts: Breadfruit, granadilla, jackfruit, papaya + others.



Bactrocera zonata

(Saunders)

Peach Fruit Fly



Lures: Methyl eugenol (♂), protein baits (♀♂).

Hosts: Date palm, common guava, mango, orange, papaya, peach + others.



Carpomya vesuviana

Costa

Ber Fly



Lures: No known specific lures.

Hosts: Various species of ber (*Zizyphus* sp.).

Inset: Dorsal view of thorax.



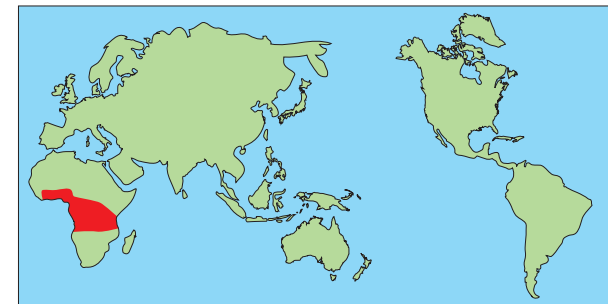
Ceratitis anonae

Graham



Lures: Trimedlure (♂), protein baits (♀♂).

Hosts: Mango, guava + others.



Ceratitis capitata

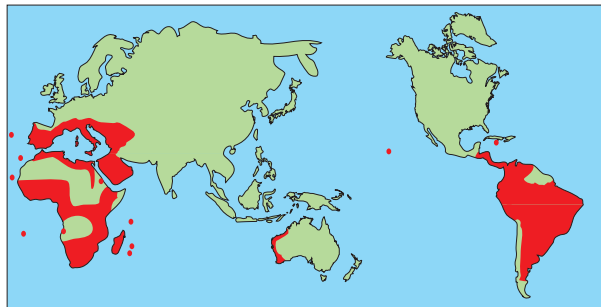
(Wiedemann)

Mediterranean Fruit Fly, Med Fly



Lures: Protein baits (♀♂), trimedlure (♂), enriched ginger oil (♂).

Hosts: Apple, apricots, citrus (most), common guava, mango, peach, pear + others.



Ceratitis catoirii

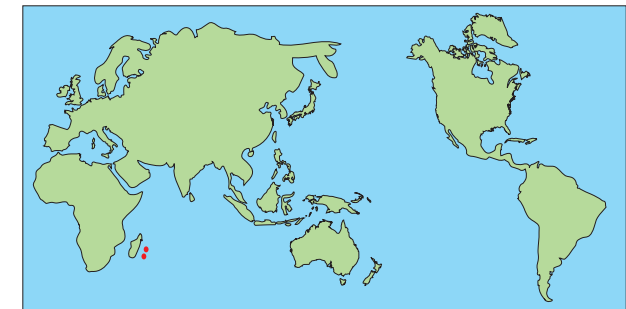
Guérin-Ménéville

Mascarene Fruit Fly



Lures: Trimedlure (♂).

Hosts: Avocado, bell pepper, common jujube, common guava, mango, peach, tomato + others.



Ceratitis cosyra

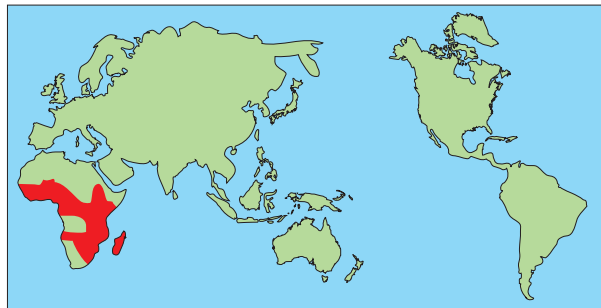
(Walker)

Mango Fruit Fly, Marula Fruit Fly, Marula Fly



Lures: Protein baits (♀♂), terpinyl acetate (♂), enriched ginger oil (♂).

Hosts: Avocado, guava, mango, marula plum, peach + others.



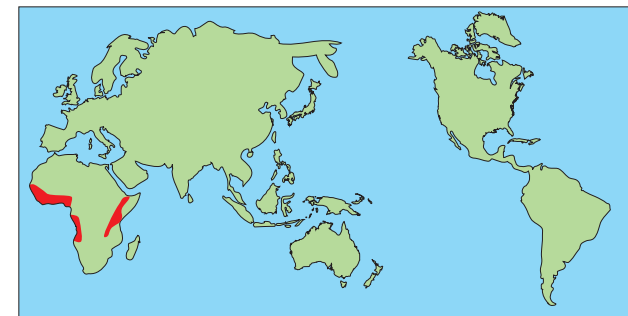
Ceratitis fasciventris

(Bezzi)



Lures: Protein baits (♀♂).

Hosts: Arabica coffee, common guava, mango + others.



Ceratitis quilicii

De Meyer, Mwatawala
& Virgilio

Cape Fruit Fly

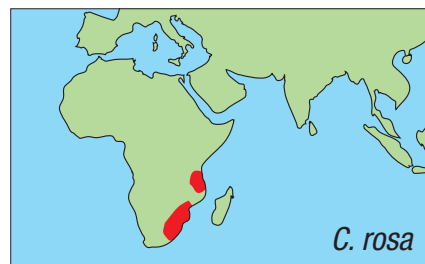
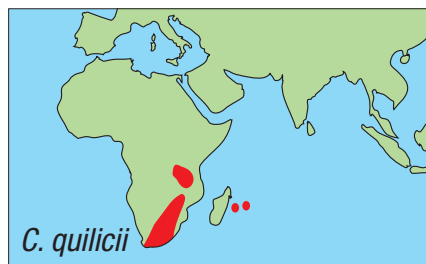
Ceratitis quilicii was formerly considered a subgroup of *Ceratitis rosa*. Females of these species cannot be distinguished morphologically.



Lures: (Both species): Protein baits (♀♂), enriched ginger oil (♂), trimedlure (♂).

Hosts: (Both species tentatively): Apple, avocado, guava, mango, papaya, peach + others.

Inset: Anterior views of male mid tibia (*C. quilicii* on left, *C. rosa* on right).



Ceratitis rosa

Karsch

Natal Fruit Fly

Ceratitis quinaria

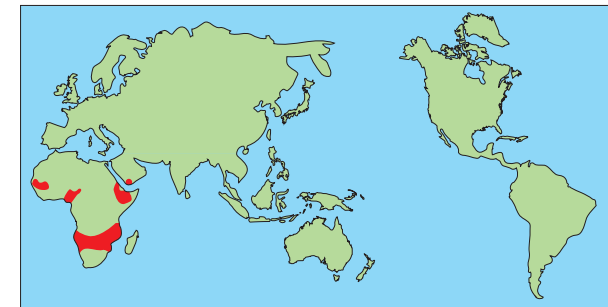
(Bezzi)

Five Spotted Fruit Fly



Lures: Protein baits (♀♂), enriched ginger oil (♂), terpinyl acetate (♂).

Hosts: Apricot, guava, mango, peach + others.



Dacus bivittatus

(Bigot)

Pumpkin Fly



Lures: Protein baits (♀♂).

Hosts: Cucurbits including bitter gourd, cucumber, melon, pumpkin and watermelon.



Dacus ciliatus

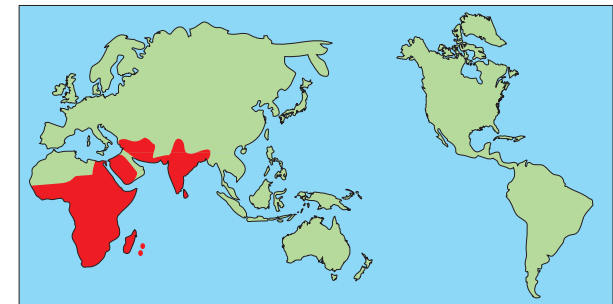
Loew

Ethiopian Fruit Fly, Lesser Pumpkin Fly, Cucurbit Fly



Lures: Ammonium acetate (♀♂), protein baits (♀♂).

Hosts: Cucurbits including cucumber, pumpkin, squash and watermelon.



Dacus demmerezi
(Bezzi)



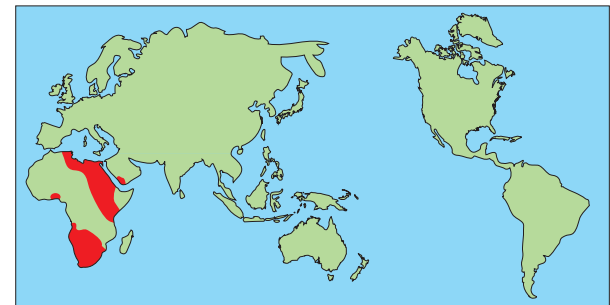
Lures: Cue-lure (♂).
Hosts: Cucurbits including bitter gourd, cucumber, angled luffa, pumpkin and watermelon.



Dacus frontalis
Becker



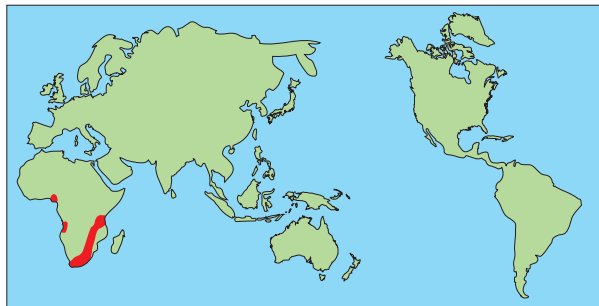
Lures: Zingerone (♂).
Hosts: Cucurbits including cucumber, pumpkin and watermelon.



Dacus lounsburyii
Coquillett



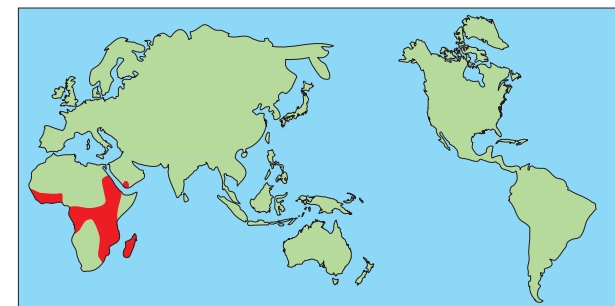
Lures: Cue-lure (♂).
Hosts: Cucurbits including melon, pumpkin and watermelon.



Dacus punctatifrons
Karsch



Lures: Cue-lure (♂).
Hosts: Cucurbits including cucumber and pumpkin.



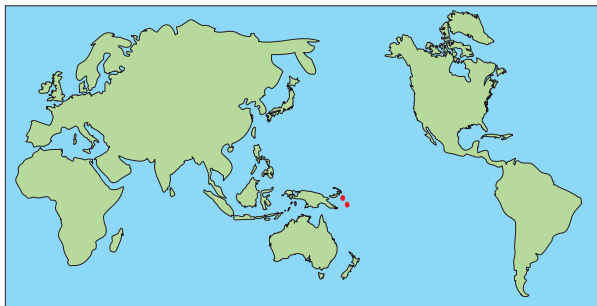
Dacus solomonensis

Malloch



Lures: Cue-lure (♂).

Hosts: Cucurbits including cucumber, pumpkin and snake gourd.



Euphranta canadensis

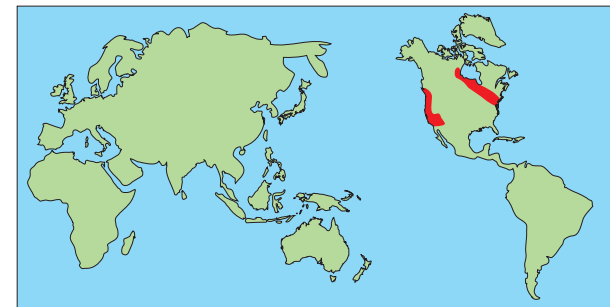
(Loew)

Currant Fruit Fly



Lures: No known specific lures.

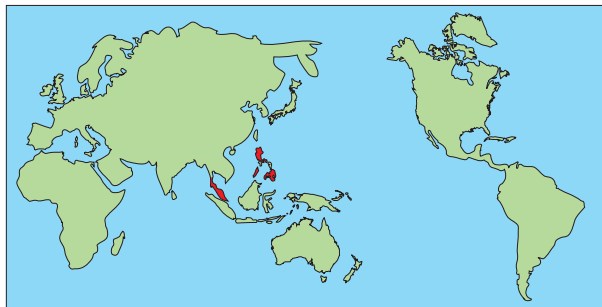
Hosts: Black, red and white currants and gooseberry.



Monacrostichus citricola
Bezzi



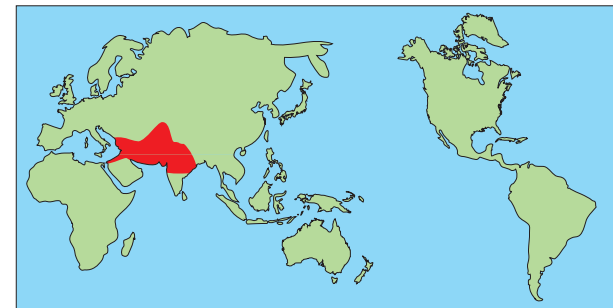
Lures: No known specific lures.
Hosts: Citrus including lemon, lime and pummelo.
Inset: Live male adult.



Myiopardalis pardalina
(Bigot)
Baluchistan Melon Fly



Lures: Cue-lure (♂).
Hosts: Cucurbits including cucumber, melon and watermelon.
Inset: Live male adult.



Neoceratitis cyanescens

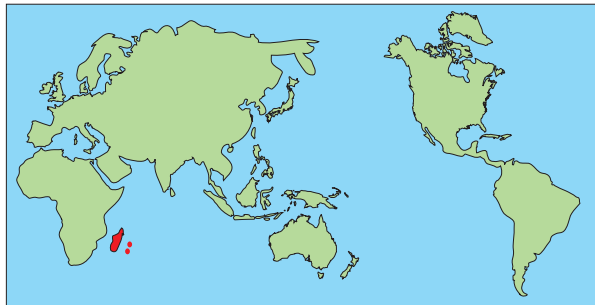
(Bezzi)

Tomato Fruit Fly



Lures: No known specific lures.

Hosts: Bell pepper, eggplant, tomato + others.



Rhagoletis cerasi

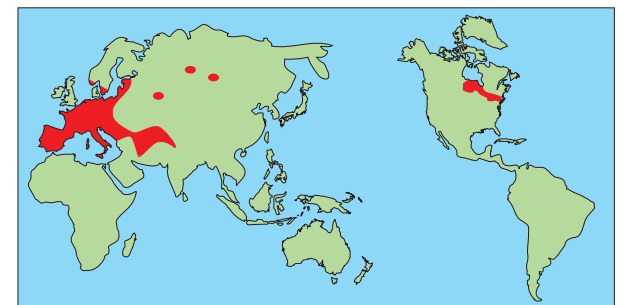
(Linnaeus)

European Cherry Fruit Fly



Lures: Ammonium acetate (♀♂), ammonium carbonate (♀♂).

Hosts: Cherries including black, mahaleb, sour and sweet cherry + others.



Rhagoletis cingulata

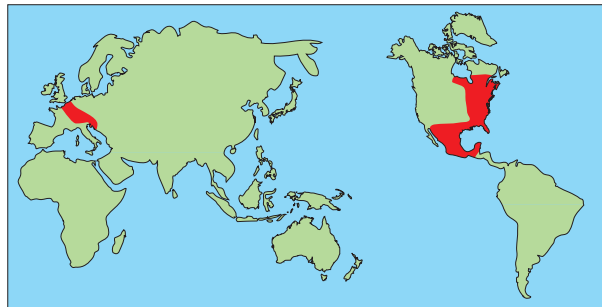
(Loew)

Eastern Cherry Fruit Fly



Lures: Ammonium acetate (♀♂), ammonium carbonate (♀♂).

Hosts: Cherries including black, chokecherry, mahaleb, pin, sour and sweet cherry.



Rhagoletis completa

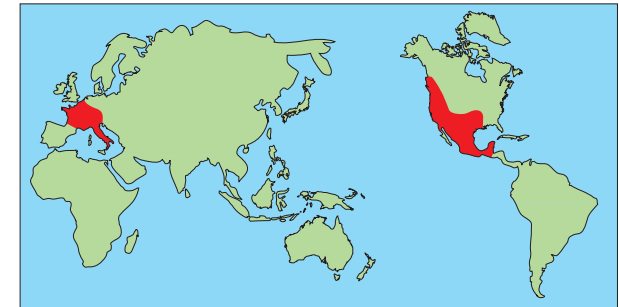
Cresson

Walnut Husk Fly



Lures: Ammonium acetate (♀♂).

Hosts: Walnuts (including black, Californian and Hinds' walnut), peach + others.



Rhagoletis fausta

(Osten Sacken)

Black Cherry Fruit Fly



Lures: Ammonium acetate (♀♂), ammonium carbonate (♀♂).

Hosts: Cherries including black, mahaleb, sour and sweet cherry.



Rhagoletis indifferens

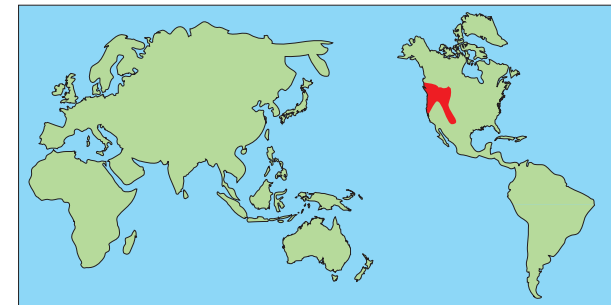
Curran

Western Cherry Fruit Fly



Lures: Ammonium acetate (♀♂), ammonium carbonate (♀♂).

Hosts: Chokecherry, Japanese plum, Klamath plum, sweet cherry + others.



Rhagoletis mendax

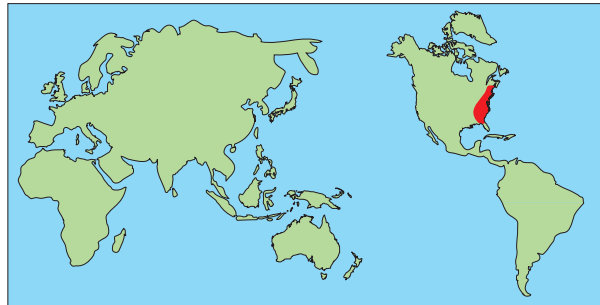
Curran

Blueberry Maggot Fly



Lures: Ammonium acetate (♀♂), protein baits (♀♂).

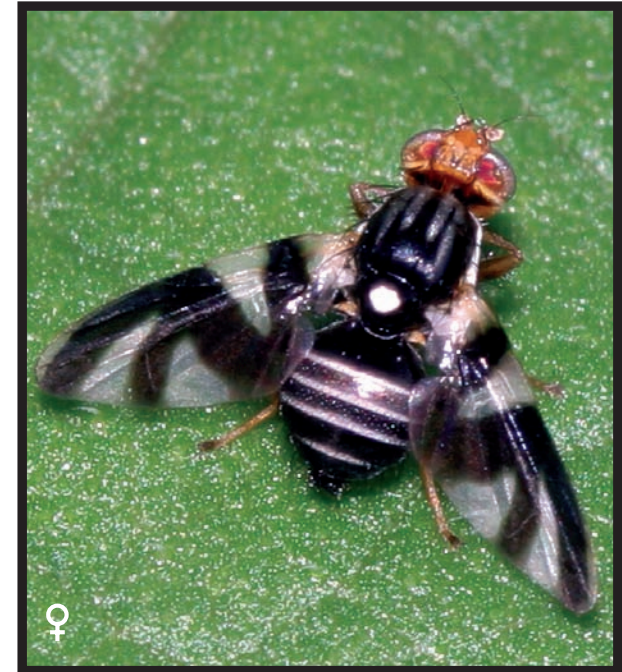
Hosts: Lowbush blueberry, highbush blueberry + others.



Rhagoletis pomonella

(Walsh)

Apple Fruit Fly, Apple Maggot



Lures: Ammonium bicarbonate (♀♂), butyl hexanoate (♀♂).

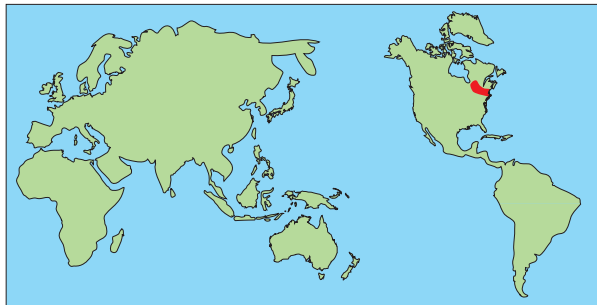
Hosts: Apple, peach, pear + others.



Rhagoletis suavis
(Loew)



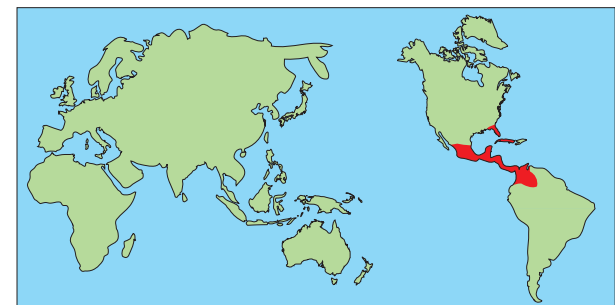
Lures: No known specific lures.
Hosts: Infests the husk of various species of walnut (*Juglans* sp.) + peach.



Toxotrypana curvicauda
Gerstaecker
Papaya Fruit Fly

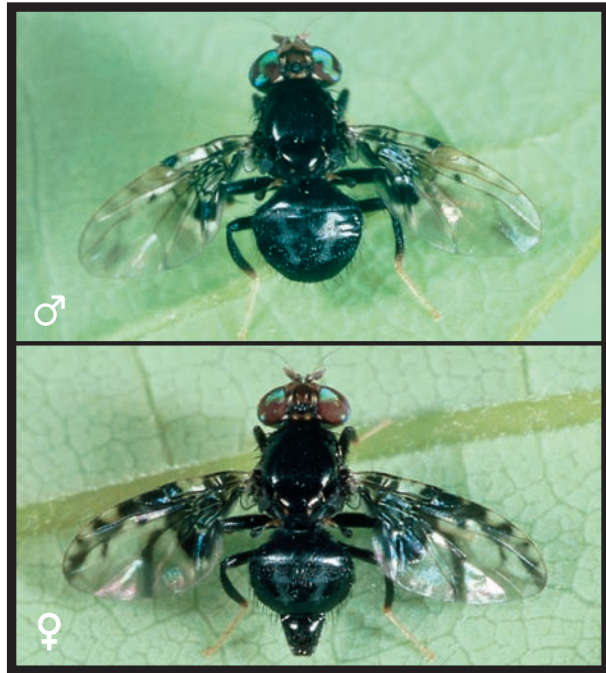


Lures: Papaya fruit fly pheromone (♀).
Hosts: Papaya.
Inset: Female ovipositing in green papaya.



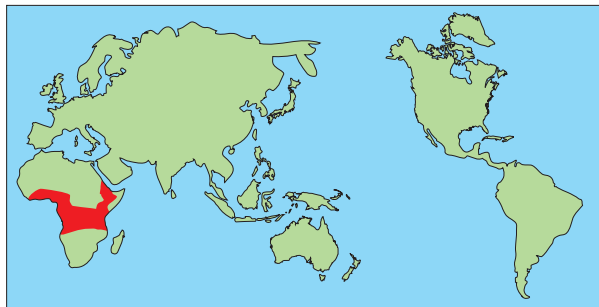
Trirhithrum coffeae

Bezzi



Lures: No known specific lures.

Hosts: Arabica coffee and robusta coffee.



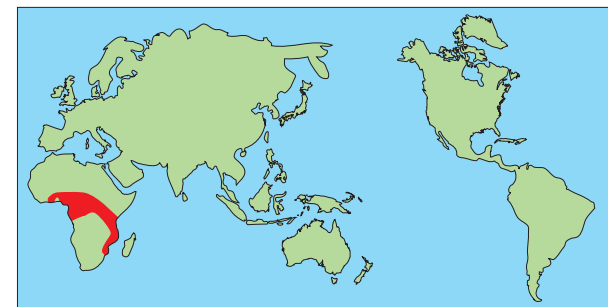
Trirhithrum nigerrimum

(Bezzi)



Lures: No known specific lures.

Hosts: Arabica coffee and robusta coffee.



Zeugodacus atrisetosus

Perkins

Formerly this species was known as *Bactrocera atrisetosa*.



Lures: No known specific lures.

Hosts: Cucurbits (including cucumber, pumpkin, watermelon and zucchini), tomato + others.



Zeugodacus cucumis

(French)

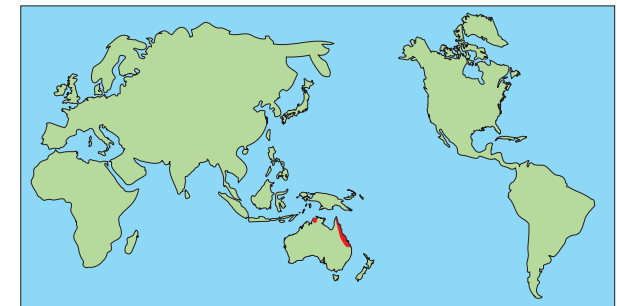
Formerly this species was known as *Bactrocera cucumis*.

Cucumber Fruit Fly



Lures: Protein baits (♀♂).

Hosts: Cucurbits (including cucumber, pumpkin, squash and zucchini), papaya, tomato + others.



Zeugodacus cucurbitae

(Coquillett)

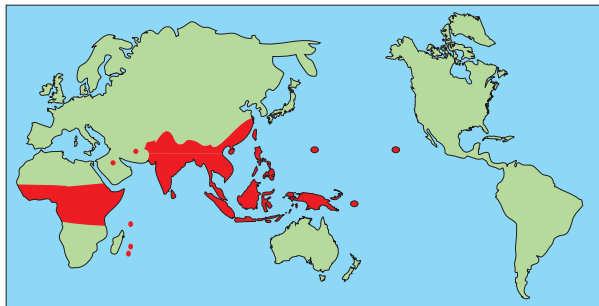
Formerly this species was known as
Bactrocera cucurbitae.

Melon Fly, Melon Fruit Fly



Lures: Cue-lure (♂), protein baits (♀♂).

Hosts: Cucurbits (including cucumber, pumpkin, squash and watermelon) + others.



Zeugodacus decipiens

(Drew)

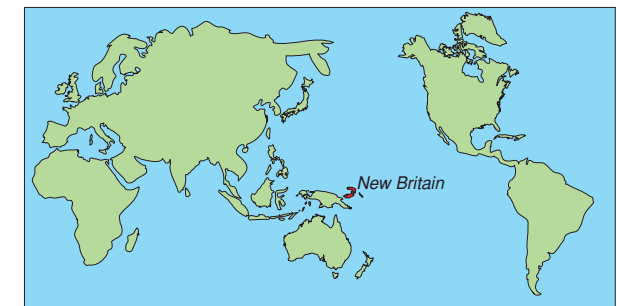
Formerly this species was known as
Bactrocera decipiens.

Pumpkin Fruit Fly



Lures: No known specific lures.

Hosts: Pumpkin.



Zeugodacus depressus

Shiraki

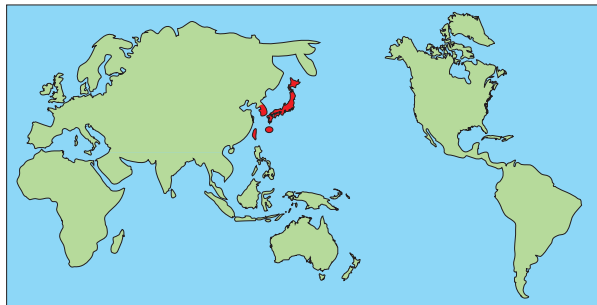
Formerly this species was known as *Bactrocera depressa*.



Lures: No known specific lures.

Hosts: Pumpkin + others.

Inset: Live female adult.



Zeugodacus tau

(Walker)

Formerly this species was known as *Bactrocera tau*.

Species complex.



Lures: Cue-lure (♂), protein baits (♀♂).

Hosts: Cucurbits (including angled luffa, cucumber and pumpkin), Malay apple + others.



Zonosemata electa

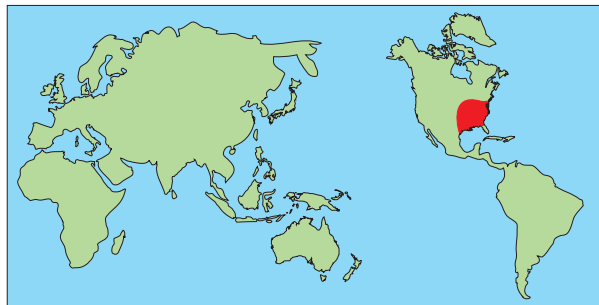
(Say)

Pepper Maggot



Lures: Ammonium acetate (♀♂).

Hosts: Bell pepper, eggplant, tomato + others.



Acknowledgements

Many people have kindly contributed information and photos for which we are very grateful. We particularly would like to thank A. Allwood, R. Drew, E. Hamacek, D. Hancock, A. Lloyd and A. Norrbom (Systematic Entomology Lab., USDA, ARS) for their assistance.

Photography Acknowledgements

R. Copeland, Kenya; R. Bull, C. Freebairn, R. Goebel, A. O'Toole, F. Page, J. Vitali, J. Watson and P. Zborowski, Australia; M. Davis, USDA, ARS, Texas, USA; M. Sueyoshi, Forestry and Forest Products Research Institute, Ibaraki, Japan; L. Luchoo provided by S. Permaloo, Ministry of Agriculture, Food Technology and Natural Resources, Reduit, Mauritius; L. Garcia, Winrock International; A. Franck, CIRAD- FLHOR, Reunion Island; K. de Jager, ARC- Institute for Tropical and Subtropical Crops, South Africa; R. Iwaizumi, Yohohama Plant Protection Station, Japan; L. Leblanc, SPC, Fiji Islands; C. Ooi formerly University of Malaya, Malaysia, R. Coutin, OPIE, France, J. Ogrodnick New York State Agricultural Experiment Station, USA; Ken Gray Collection, Oregon State University, USA; Mid Atlantic Orchard Monitoring Guide, USA; T. Murray, Massachusetts, USA; J. Dill, University of Maine, USA; E. Neering; H. Negri de Oliveira provided by L. de Salles, ESALQ, Brazil; Y. Penaloza, Ministry of Agricultural Development, Panama; K. Shellie, USDA, ARS, USA; K. Sorensen, North Carolina State University, USA; R. Wilson, SAGAR, Mexico; S. Wilson provided by SPC, Fiji Islands; G. McCormack, Cook Islands; K. David, National Bureau of Agriculturally Important Insects, India; J. Payne, USDA, ARS, Bugwood.org; J. Vayssieres, IITA, Benin; P. Ek-Amnuay, Siam Insect Zoo, Thailand; S. Marshall, Guelph, Canada; G. Goergen, IITA; <http://delta-intkey.com/ffa/>

IAEA



International Atomic Energy Agency

FAO



Food and Agriculture Organization of the United Nations

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