

## *Anastrepha fraterculus*

### Introduction

*Anastrepha fraterculus* Weidman is one of the most significant neotropical pests occurring from Rio Grande valley of Northern Mexico to Central & South America and the Caribbean. It is considered to be the most important pest in all citrus growing areas.

### Identity

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Authority	: Wiedemann, (1830)
Classification	
Kingdom	: Animalia
Phylum	: Arthropoda
Class	: Insecta
Order	: Diptera
Family	: Tephritidae
Genus	: <i>Anastrepha</i>
Species	: <i>fraterculus</i>
Synonyms	: <i>Dacus fraterculus</i> (Wiedemann) 1830; <i>Tephritis mellea</i> (Walker), 1837; <i>Trypeta unicolor</i> (Loew), 1862; <i>Anthomyia frutalis</i> eyenbergh, 1874; <i>Anthomyia frutum</i> , (Erro), <i>Anastrepha soluta</i> (Bezzi), 1909: (var. <i>fraterculus</i> ); <i>A. peruviana</i> (Townsend), 1913; <i>A. peruana</i> (Erro); <i>A. distans</i> , (Greene), 1934; <i>A. distincta</i> (Greene), 1934; <i>A. braziliensis</i> , Greene, 1934; <i>A. trinidadensis</i> (Greene), 1934; <i>A. suspensa</i> , (Lima), 1934; <i>A. costarukmanii</i> (Capoor), 1954; <i>A. scholae</i> (Capoor), 1955; <i>A. pseudofraterculus</i> (Capoor), 1955.
Common name	: South American fruit fly
Role	: Pest

### Signs & symptoms

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#### Characteristic Damage

Damage begins when the ovipositing female punctures the fruit for egg laying. The larvae feed on the internal tissues causing breakdown and premature fruit drop. The oviposition punctures often heal over and become invisible in mature hosts. Sometimes, sap exudation and discolored spots are present. The larvae feed in immature, ripening or ripe fruits. Usually, this feeding is in the pulp and occasionally on immature seeds. A single larva can render a fruit worthless (Anonymous, 1982).

Oviposition may occur throughout the day and at dusk. The relationship between fruit phenology and infestation was studied for two species only, apple and peach. In peach, infestation occurs only at fruit ripening stage. In apple, (Gala cultivar) larvae are rarely seen in the fruit. Larval development is usually observed in overripe fruits that have dropped to

the ground. Apple fruits 1-2 cm in diameter are already damaged if no treatment was used. The damage is irreversible, producing skin deformation. Internal damage occurs just under and around the puncture site and the tissue becomes like a corky tissue (Salles, 1999).

Average number of pupae per fruit varied from 0.7 to 9.9.

Another study stated that the average number of larvae per fruit was between 1 - 5 in large fruits (guava, peach and loquat) and fewer in smaller fruits (e.g. Suriname cherry).

## Morphology

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Field description (Anon., 1982):

**Adults:** About 12 mm long (not including ovipositor of female). Wing expansion about 25 mm. Body rust-yellow or brownish-yellow, with three sulfur-yellow longitudinal stripes on thorax. Wings clear except for characteristic but variable yellow-brown pattern. Inverted V of wing separated from main pattern (Fig 2).



Fig 1. *Anastrepha fraterculus*  
Picture by: H. Negri de Oliveira  
(Malavasi *et al*, 2000)

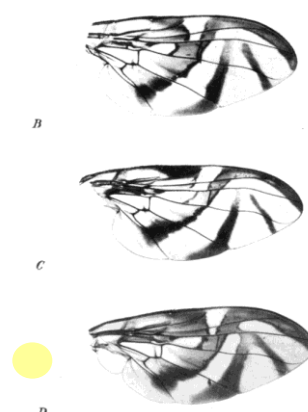


Fig 2.  
Wings: *Anastrepha fraterculus*  
B. from Peru  
C. from Brazil  
D. from Panama  
Stone, 1942

Ovipositor stout and shorter than abdomen, tapered regularly toward tip and covered with coarse, black hairs.

### Technical description

**Adults:** Small to rather small, yellow-brown. Mesonotum 2.75 mm - 3.3 mm long, yellow - brown; the humerus, median stripe widened posteriorly, anterior to acrostichal bristles and barely includes these bristles; lateral stripe from transverse suture to scutellum bright yellow; pleura yellow and yellow brown; metanotum and postscutellum rather broadly blackened laterally. Macrochaetae yellow-brown to black; pile yellow-brown. Sternopleural bristle slender. Wing 5.35 - 7.2 mm long, bands yellow, orange and brown. Costal band typically separated from S-band, wing pattern with considerable variation.

**Female terminalia:** Ovipositor sheath 1.65 - 2.1 mm long, stout, tapering apically, spiracles about 0.7 mm from base. Rasper rather small patch of hooks in four or five rows. Ovipositor 1.5 - 1.95 mm long, stout, base distinctly widened, tip narrower beyond end of oviduct and before serrate portion, serrations blunt and rounded, extending over half length of tip, sometimes less (Fig 3).

**Male terminalia:** Tergal ratio about 0.87; clasper about 0.35 mm long, moderately stout basally, greatly flattened apically, apical

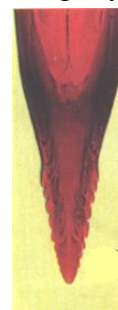


Fig 3.  
*Anastrepha fraterculus*  
Ovipositor  
(Picture by Elton L. Araujo)  
(Malavasi *et al*, 2000)

portion somewhat narrowed, with rather blunt apex, teeth slightly basad of middle (Stone, 1942).

**Eggs:** Creamy white, elongated, tapered at end. About 1.4 mm long, 0.2 mm wide at midpoint.

**Larvae:** When mature about 8 - 10 mm long, 1.0 mm wide, pale yellowish-white, tapered slightly toward cephalic end.

**Pupae:** About 4.5 - 6.0 mm long, 2.0 - 2.5 mm wide, cylindrical, dull luteous to reddish-yellow or dark red.

Fruit fly larvae and pupae are difficult to identify to species level, and much more research is needed. Adult identification is usually based on the female since; in most cases, males are still indeterminable (Weems, 1980).

### **Taxonomy:**

The taxonomy of *A. fraterculus* is based mainly on wing pattern and characters of the female genitalia. Certain characters in male genitalia were found (Norrbon, in press) useful for identification. Studies on immature stages are limited. However, *A. fraterculus* displays considerable morphological variability, e.g. in wing pattern, thoracic coloration, the size of the dark spot on the scuto-sutellar sutur, aculeus variation in length and shape of the tip. There are also variations at genetic and biochemical levels: karyotype, isozyme, mitochondria DNA and cuticular hydrocarbons. These data indicate that populations regarded as *A. fraterculus* may comprise more than one cryptic species, henceforth termed the *A. fraterculus* complex.

## **Biology and Ecology**

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In general, for complete life cycle development, temperatures must range between 15° to 27°C. This is the range of effective temperatures that promote development of *A. fraterculus*. Cumulative heat development or degree days (D°), and the number of hours above 10.7°C, necessary for development of *A. fraterculus* phases and life cycle was determined.

Degree-days necessary for development of *A. fraterculus* are given in Table 1.

	<b>Degree-days D°</b>
<b>Eggs</b>	<b>52.2</b>
<b>Larvae</b>	<b>161.4</b>
<b>Pupae</b>	<b>227.7</b>
<b>Life cycle</b>	<b>430.6</b>

Table 1: Degree-days required for complete development of *A. fraterculus*

*A. fraterculus* has a sexual behavior in sharp contrast to many other tephritids reported to date. Male-male and male-female encounters in *A. fraterculus* occurred on leaf-nodes or the

undersurface of leaves, but all mating pairs moved to the bottom surface of leaves. Male displays began at about 0700 hrs in the summer at 18°C and 800-lux light intensity and ceased about 10.30 hrs. Males often displayed from a site for about 30 minutes before leaving. Aggregations or leks of 3 - 8 males within about 50 cm of each other were common. Male display behavior included puffing of lateral, abdominal and anal pouches, and bursts of wing fanning. Copulation was initiated at sites other than the undersurface of leaves, but a copulating female immediately walked to the underside of a leaf (Nation, 1989). Sexual behavior occurs exclusively from 1 hour after dawn till midmorning. Oviposition peaks at midday (Smith, 1989). Females lay about 200-400 eggs each in laboratory studies. This is considerably less than under field conditions (Fletcher, 1989).

## Dispersal/vectors

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According to Salles (1999), *Anastrepha fraterculus* was captured from 1.5 to 10 m above the ground. No studies of horizontal flight distance or dispersion capacity (migration patterns) of *A. fraterculus* were conducted. Only colonization and dispersion of adults in peach and apple orchards were investigated in correlation with fruit presence.

Artificial spread of the pest is caused by the movement of any article that may harbor the fly ( as eggs, larvae, pupae, adults) from infested to uninfested areas. These articles include all *Anastrepha fraterculus* host fruits and vegetables. *A. fraterculus* enters uninfested areas when persons bring in prohibited exotic fruits infested with maggots, or when infested fruits and vegetables are shipped or mailed from areas where *A. fraterculus* is established.

## Management

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### Bait Spray:

Bait sprays, using attractants such as hydrolyzed proteins and an insecticide, can be applied as spot applications. Compared with the usual cover sprays with insecticides, these are preferable, as the cover sprays can induce other insects to develop into pests.

### Physical Control:

Physical control can be done by wrapping or bagging individual fruits on the tree with paper bags to prevent oviposition and thereby produce fruit fly-free even in the presence of high adult fly populations. This method is especially applied in Asia.

### Cultural Control:

**Sanitation:** Collection and destruction of all unwanted fruit on the tree and on the ground contributes significantly towards reducing damaging fly populations (Vijaysegaran, 1993). While it is realized that sanitation is important, it is somewhat difficult to implement and enforce **Early Harvesting:** Development of fruit flies does not appear to occur in certain fruits such as papaya, sapodilla and banana when they are 100% green, although (tree) ripe fruits are good hosts. Thus, early harvesting is an important technique in the production of these fruits

**Resistant Varieties/Non-host Status:** Some tropical fruits such as mangosteen (*Garcinia mangostana*), rambutan (*Nephelium lappaceum*) and duku/langsat (*Lansium domesticum*) are not normally attacked by fruit flies.

**Sterile Insect Technique:** This technique is especially known for Oriental, Mediterranean and Melon fly, but work is done on many more species. Apart from being an eradication technique, it can – if deemed economically viable- also be used as a control technique

**Behavioral control:** Lures can be used to suppress fly populations over large areas either alone or in combination with other methods such as bait sprays.

## Biological control

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The following Braconids were recorded for *Anastrepha fraterculus* for Brazil (Malavasi and Zucchi, 2000) or Mexico (Aluja, 2000):

- *Doryctobracon areolatus* (Szépligeti, 1911) (in Brazil and Mexico)
- *Doryctobracon brasiliensis* (Szépligeti, 1911) (in Brazil)
- *Doryctobracon crawfordi* (in Mexico)
- *Doryctobracon fluminensis* (Lima, 1938) (in Brazil)
- *Opius bellus* (Gahan, 1930) (in Brazil)
- *Utetes anastrephae* (Viereck, 1913) (in Brazil and Mexico)
- *Diachasmimorpha longicaudata* (Ashmead) (in Mexico) (introduced)

Also Eucoilinid (Figitidae) parasitoids were recorded in the Neotropical region (Malavasi and Zucchi, 2000):

- *Aganaspis pelleranoi* (Brèthes, 1924) Brazil
- *Lopheucoila anastrephae*
- *Odontosema anastrephae* (Borgmeier, 1935) Brazil
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## Host Notes

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## Economic importance

*Anastrepha fraterculus* is a serious pest of cultivated fruits in many parts of South America, and apparently the most injurious species of the genus *Anastrepha*. In Argentina, it is considered to be the most important pest in all citrus areas

**Hosts include-** Anacardiaceae: *Anacardium occidentale* L. (cashew); *Mangifera indica* L. (mango); *Spondias* spp.; *Annona* spp.; *Carica papaya* (papaya); *Terminalia catappa* L. (tropical almond); *Persea americana* Miller (avocado).

*Eugenia* spp., *Myrcia jaboticaba* ; *Psidium guajava* L. (guava); *Averrhoa carambola* L. (carambola), *Passiflora edulis* (Simms) (passion fruit); *Coffea arabica* L. (coffee); *Citrus* spp.; *Manilkara zapota* L. (Van Royen) (sapodilla); *Lycopersicon esculentum* (tomato).

As for the medfly, it seems that the host preference of

*A. fraterculus* changes according to the geographical area.

## Distribution

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*Anastrepha fraterculus* is one of the most significant neotropical pests occurring from Rio Grande Valley of northern Mexico to Central and South America, between latitudes 27°N and 38°S, Pollard, (1982), Steck, Stone, (1942), USDA.APHIS.PPQ, Biological Assessment Support Staff (1982), Van Whervin, (1974), Zucchi *et al.*, 1999 (Fig. 4).

The occurrence of *A. fraterculus* has been mentioned for the following countries/islands: Argentina to the 37-38°S in the west (Buenos Aires province), Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador (including Galapagos islands), El Salvador, Guatemala, Guyana, Honduras, Mexico (from Rio Grande Valley, eastern Mexico, Yucatan), Nicaragua, Panama, Peru, Trinidad & Tobago, Uruguay, Venezuela.



Fig 4. Distribution  
*Anastrepha fraterculus*  
(Malavasi and Zucchi, 2000)

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## **WEB RESOURCE -**

[http://creatures.ifas.ufl.edu/fruit/tropical/southamerican\\_fruit\\_fly](http://creatures.ifas.ufl.edu/fruit/tropical/southamerican_fruit_fly)