# EPPO Datasheet: *Anastrepha suspensa*

Last updated: 2021-01-08

## IDENTITY

**Preferred name:** *Anastrepha suspensa*
**Authority:** (Loew)
**Taxonomic position:** Animalia: Arthropoda: Hexapoda: Insecta: Diptera: Tephritidae
**Other scientific names:** *Acrotoxa suspensa* (Loew), *Anastrepha longimacula* Greene, *Anastrepha unipuncta* Sein, *Trypeta suspensa* Loew
**Common names:** Caribbean fruit fly, greater Antillean fruit fly
view more common names online...
**EPPO Categorization:** A1 list
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**EU Categorization:** Quarantine pest ((EU) 2019/2072 Annex II A)
**EPPO Code:** ANSTSU

### Notes on taxonomy and nomenclature

This species was first described by Loew (1862) as *Trypeta suspensa*. The current combination was proposed by Schiner (1868). The names *Anastrepha unipuncta* Seín (1933) and *Anastrepha longimacula* Greene (1934) are recognized as synonyms. Name, host plant, and distribution data for this species and other fruit flies are available under Fruit Fly Databases on the USDA Compendium of Fruit Fly Host Information.

## HOSTS

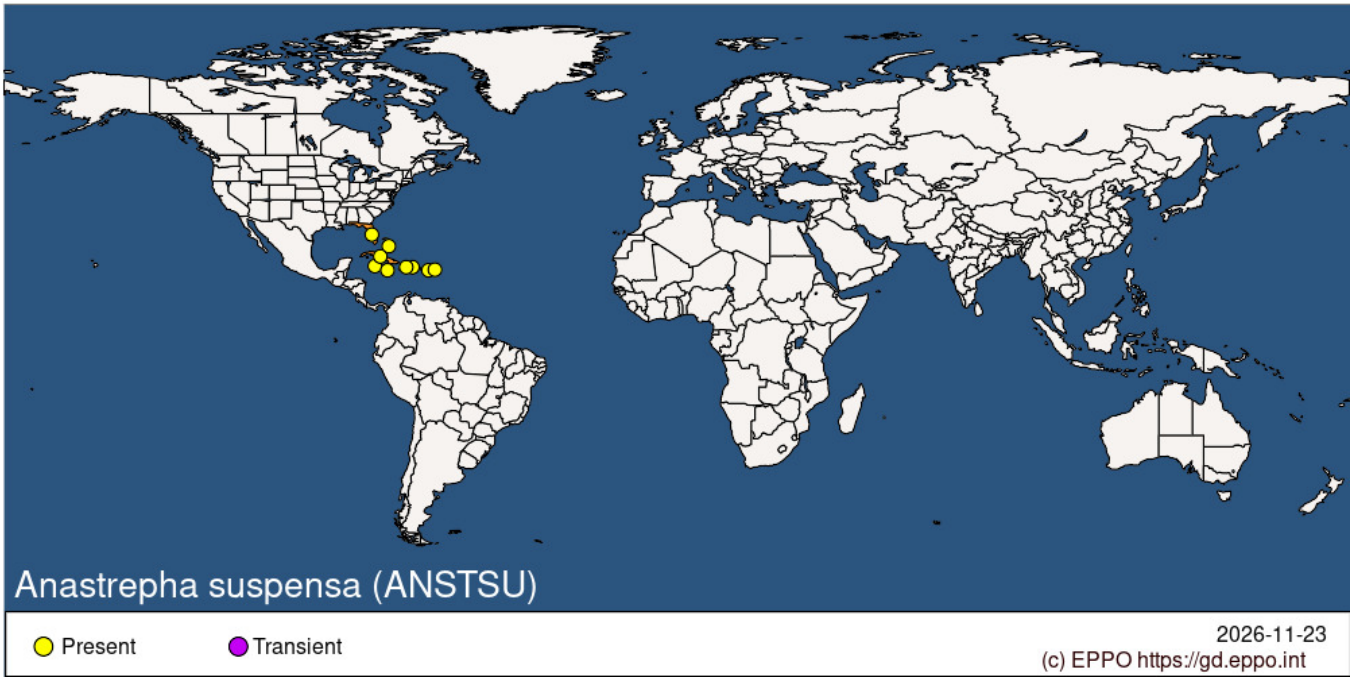
The preferred hosts of *Anastrepha suspensa* are Myrtaceae, especially *Eugenia uniflora* and other *Eugenia* species, guavas (*Psidium guajava* and other *Psidium* species), and *Syzygium* species. Tropical almond (*Terminalia catappa*) and calamondin (*Citrofortunella microcarpa*), which are primarily planted as ornamentals, and loquat, kumquat, and sapodilla, are also important hosts, and a variety of other fruits are occasionally infested. *Citrus* spp. are not normally significant hosts (Whervin, 1974; Enkerlin *et al*., 1989), but at least in Puerto Rico and USA (Florida) *A. suspensa* can attack ripe citrus fruits, especially grapefruit and oranges, and is of quarantine importance. As is the case for several other pest species of *Anastrepha*, *A. suspensa* has been recorded on a wide range of fruits, both tropical and temperate, but many of these records may be incidental occurrences or need verification (Norrbom, 2004).

**Host list:** *Annona glabra*, *Annona reticulata*, *Annona squamosa*, *Atalantia buxifolia*, *Atalantia citroides*, *Averrhoa carambola*, *Bischofia javanica*, *Blighia sapida*, *Canella winterana*, *Capsicum annuum*, *Capsicum frutescens*, *Carica papaya*, *Carissa macrocarpa*, *Casearia hirsuta*, *Casimiroa edulis*, *Chrysobalanus icaco*, *Chrysophyllum cainito*, *Chrysophyllum oliviforme*, *Citrus maxima*, *Citrus reticulata*, *Citrus x aurantiifolia*, *Citrus x aurantium var. paradisi*, *Citrus x aurantium var. sinensis*, *Citrus x aurantium*, *Citrus x limon var. limetta*, *Citrus x limonia*, *Citrus x nobilis*, *Citrus x tangelo*, *Clausena lansium*, *Coccoloba uvifera*, *Dimocarpus longan*, *Diospyros discolor*, *Diospyros kaki*, *Diospyros virginiana*, *Dovyalis afra*, *Dovyalis hebecarpa*, *Drypetes lateriflora*, *Eriobotrya japonica*, *Eugenia cerasiflora*, *Eugenia coronata*, *Eugenia dombeyi*, *Eugenia ligustrina*, *Eugenia luschnathiana*, *Eugenia pyriformis*, *Eugenia umbellulifera*, *Eugenia uniflora*, *Ficus altissima*, *Ficus carica*, *Flacourtia indica*, *Fortunella crassifolia*, *Fortunella margarita*, *Garcinia aristata*, *Garcinia livingstonei*, *Garcinia xanthochymus*, *Malpighia emarginata*, *Malpighia glabra*, *Malus domestica*, *Mangifera indica*, *Manilkara jaimiqui subsp. emarginata*, *Manilkara roxburghiana*, *Manilkara zapota*, *Momordica balsamina*, *Muntingia calabura*, *Murraya paniculata*, *Myrcianthes fragrans*, *Myrciaria glomerata*, *Persea americana*, *Phoenix dactylifera*, *Pimenta dioica*, *Plinia cauliflora*, *Pouteria campechiana*, *Prunus persica var. nucipersica*, *Prunus persica*, *Psidium acutangulum*, *Psidium cattleyanum* , *Psidium friedrichsthalianum*, *Psidium guajava*, *Psidium guineense*, *Punica granatum*, *Pyrus communis*, *Pyrus pyrifolia*, *Pyrus x lecontei*, *Rubus idaeus*, *Rubus sp.*, *Solanum lycopersicum*, *Spondias dulcis*, *Spondias mombin*, *Swietenia mahagoni*, *Synsepalum dulcificum*, *Syzygium cumini*, *Syzygium jambos*, *Syzygium malaccense*, *Syzygium samarangense*

*, Terminalia catappa, Terminalia muelleri, Trevesia palmata, Triphasia trifolia, Ximenia americana, x Citrofortunella floridana, x Citrofortunella microcarpa, x Citrofortunella sp.*

## GEOGRAPHICAL DISTRIBUTION

*Anastrepha suspensa* occurs in the Greater Antilles, Bahamas, Cayman Islands, and Virgin Islands. It is invasive in the USA (Florida) (Weems, 1965, 1966). The record from French Guiana (CABI/EPPO, 2002) is doubtful. It has been trapped in California (USA) but is not established there (Foote *et al*., 1993).




**North America:** United States of America (Florida)
**Central America and Caribbean:** Bahamas, Cayman Islands, Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, Virgin Islands (British)

## BIOLOGY

As in *Anastrepha* species generally, eggs are laid in the host fruit. Larvae pass through three instars that feed in the flesh of the fruit. Mature larvae exit the fruit and pupariate in the soil. Adult males produce a pheromone and lek to attract females for mating. Calling occurs mainly in the early afternoon (Aluja *et al*., 1999).

## 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

#### *Immature stages*

The identification of larvae of *Anastrepha* species, like those of most fruit flies, is extremely difficult. Larvae have

been described for only 9% of the species of *Anastrepha* (Steck *et al*., 2019). *Anastrepha suspensa* is included in the key of Steck *et al*. (1990) and the interactive key of Carroll *et al.* (2004) to third stage larvae, but it cannot be reliably distinguished from similar species such as *A. fraterculus* and *A. obliqua*. Lawrence (1979), Heppner (1984), Steck *et al.* (1990), White & Elson-Harris (1992), and Carroll *et al.* (2004) provided descriptive information on the third instar.

As in other *Anastrepha* species, the larva is whitish, up to 12 mm in length, lacking an external head capsule. The two mandibles, or mouthhooks, are strongly developed and equal in size. The body is tapered anteriorly and truncate posteriorly. Posterior spiracular plate weak, unpigmented, without peritreme, with three openings or slits arranged with their medial ends converging, the dorsal and ventral slits subparallel or oriented at less than 90°.

The following diagnostic description of the third instar is based on Steck *et al.* (1990), Carroll *et al.* (2004) and White and Elson-Harris (1994): Length 6.7-9.0 mm. Head: 8-13 oral ridges, 3-4 small accessory plates; mandible moderately sclerotized, with single large slender curved apical tooth. Thoracic and abdominal segments: T1-T3 middorsally with 5-10, 3-5, and 3-5 rows of spinules, respectively; A1-A8 without dorsal spinules medially; caudal segment with tubercles and sensilla small but obvious. Anterior spiracle with 8-15 tubules. Posterior spiracle with dorsal and ventral bundles of 9-16 hairs. Anal lobes large, protuberant, entire or bifid.

The egg is 1.02-1.40 mm long, 0.25-0.30 mm wide; white; posteriorly gradually tapered; anteriorly abruptly tapered, without lobe, micropyle near tip, with rim almost imperceptible; with strong chorion ornamentation covering about 11% of egg length comprising irregular polygons with aeropyles in polygon walls (Figueiredo *et al.*, 2013).

***Adult***

Like other *Anastrepha* species, *A. suspensa* is easily separated from other tephritids by a simple wing venation character; vein $M_1$, the longitudinal vein that reaches the wing margin just behind the wing apex, curves strongly forward before meeting the costa on the wing margin without a visible angle. Furthermore, as is the case for most *Anastrepha* species, *A. suspensa* has a characteristic wing pattern composed of 3 orange and brown bands: the 'C-band' on the anterior margin from the base to near midlength; the 'S-band', a sideways S-shaped band from the wing base, curving forward across the middle of the wing (in *A. suspensa* usually narrowly connected to the C-band, but with a triangular marginal hyaline area between them), then running along the anterior margin to the wing apex; and the 'V-band', an inverted V-shaped band on the posterior apical half of the wing.

Identification to species is more difficult. It is essential to examine the aculeus (which is usually inside the oviscape, the basal tubelike part of the ovipositor) of a female specimen to achieve positive identification. The only comprehensive identification tool for *Anastrepha* is the online key by Norrbom *et al.* (2012). Adults, especially males, of *A. suspensa* are difficult to separate from those of *A. fraterculus* and various other similar species of the *fraterculus* group; if necessary, specimens should be referred to a specialist. Adult females of *A. suspensa* can be distinguished from those of other species of *Anastrepha* by the following combination of characters: Setae red brown to dark brown; mesopleuron and scutum without brown markings, except usually with distinct brown spot medially on scuto-scutellar suture (sometimes absent in Jamaican specimens); subscutellum entirely orange or with brown lateral mark; mediotergite entirely orange or narrowly brown laterally; S-band predominantly orange, including medial section, distal section broad, at apex of vein $R_{2+3}$ 0.8-1.0 times width of cell $r_{2+3}$ (both measured perpendicular to band), extended to or almost to apex of vein $M_1$; V-band with proximal arm extending along posterior wing margin more than 1/3 distance from apex of vein $M_4$ to apex of vein CuA+CuP; oviscape 1.45–1.95 mm long, 0.60–0.80 times mesonotum length; aculeus 1.4–1.6 mm long; tip 0.19–0.23 mm long, with distal 0.50–0.65 distinctly serrate and with lateral margin of serrate part not curved dorsally, 0.10–0.13 mm wide, 1.5-2.2 times as long as wide.

The adult of *A. suspensa* is very similar to that of *A. obliqua* and *A. fraterculus*, but differs from the former in the shape of the aculeus tip and in usually having a brown medial spot on the scuto-scutellar suture, and from the latter in having the apical section of the S-band broader.

**Molecular**

*Anastrepha suspensa* was included in the investigation by Barr *et al.* (2017a) of the DNA barcode region of the

cytochrome oxidase I gene for diagnosis of *Anastrepha* pest species. It cannot be distinguished from Mesoamerican populations of *Anastrepha fraterculus*, as these taxa share identical COI barcode sequences. However, *A. suspensa* can be distinguished from related taxa by small differences in the ITS2 DNA region (Barr *et al.*, 2017b). Boykin *et al.* (2006) examined variation in COI sequences in 107 individuals from throughout most of the range of *A. suspensa* and found no evidence of population segregation.

### Detection and inspection methods

No specialized male lures are available for *Anastrepha* species. Monitoring for adults utilizes traps with protein-based or other ammonia-emitting lures, which are much less effective than the male lures used for various dacine fruit flies (Diaz-Fleischer *et al.*, 2009). McPhail traps baited with torula yeast, hydrolyzed protein, or other fermenting protein lures, or Multilure traps baited with ammonium acetate and putrescine are typically used for the capture of *Anastrepha* species (Thomas *et al.*, 2001; Adaime *et al.*, 2011).

## PATHWAYS FOR MOVEMENT

*Anastrepha* adults are capable of long-distance dispersal, thus natural movement is an important means of spread (Aluja *et al*., 1999).

In international trade, the major means of fruit fly dispersal to previously uninfested areas is via transport of fruit containing live eggs or larvae. For the EPPO region, the most important imported fruits liable to carry *A. suspensa* are *Eugenia*, *Psidium* and *Syzygium* species, and to a lesser extent various other hosts, including *Citrus*. There is also a risk of the transport of fruit fly puparia in soil or packaging.

## PEST SIGNIFICANCE

### Economic impact

*Anastrepha* spp. are the most serious fruit fly pests in the tropical Americas (Norrbom & Foote, 1989), with the possible exception of the introduced *Ceratitis capitata* and *Bactrocera carambolae*. *A. suspensa* is primarily a pest of guavas and other Myrtaceae (White & Elson-Harris, 1992). It is recorded from *Citrus* spp., but only in some areas and there is evidence that only ripe fruits are attacked. The fact that the pest occurs in southern Florida, USA, a major center of tourism and agriculture, has given it particular quarantine importance (Greany *et al*., 1993).

### Control

Bait sprays, typically a mixture of Spinosad, malathion, or other insecticides and a food-based attractant, such as hydrolyzed yeast, are the most common type of chemical control for *A. suspensa* (Bateman, 1982; Roessler, 1989). Cultural practices, such as destroying all fallen and infested fruits and removal of alternative hosts, are also used. Soil drenches around host plants with appropriate pesticides are used to kill larvae and pupae during eradication programs (Stark *et al*., 2014). Biological control with braconid wasps has been used with limited success in Florida and Puerto Rico (Baranowski *et al*., 1993, Sivinski *et al.*, 1996, Eitam *et al*., 2004, Garcia *et al*., 2020). Sterile insect technique (SIT) was evaluated for suppression and eradication in area-wide management programs to control *A. suspensa* in Florida (Holler *et al.*, 1999) but is not currently used. In Florida, the Caribbean Fruit Fly Protocol Program (https://www.fdacs.gov/Agriculture-Industry/Pests-and-Diseases/Plant-Pests-and-Diseases/Exotic-Fruit-Flies/Caribbean-Fruit-Fly-Protocol-Program) facilitates the export of fresh fruits (currently citrus, peach and carambola) to areas requiring regulatory safeguards (also see Simpson, 1993). Certification is based on the fruit being harvested from designated areas, following protocols including removal of preferred hosts, triggers for bait spray applications, and monitoring of traps, harvesting, packinghouses and bait spray applications during the harvest season.

### Phytosanitary risk

*A. suspensa* has a broad range of hosts and is a significant pest throughout its range, especially on *Eugenia*, *Psidium* and *Syzygium* species. It is invasive at least in Florida, USA (Weems, 1965, 1966) and has been trapped in California

(Foote *et al*., 1993). It occurs primarily in lowland, tropical or subtropical areas with hot climates, and is not capable of surviving the cold winters of the northern and central part of the EPPO region, thus the risk of establishment of *A. suspensa* is limited at most to the warmer southern parts of the EPPO region. Populations might enter and multiply during the summer months. In southern areas, some such populations might survive one or several winters, though in any case the direct losses from such introductions would probably not be high. The major risk for EPPO countries arises from the probable imposition of stricter phytosanitary restrictions on exported fruits (particularly to America and Japan) if any *Anastrepha* sp. enters and multiplies, even temporarily.

## PHYTOSANITARY MEASURES

Consignments of fruits of *Eugenia*, *Psidium* and *Syzygium* species as well as other hosts such as *Citrus*, *Eriobotrya japonica*, and *Fortunella* spp., from countries where *A. suspensa* occurs should be inspected for symptoms of infestation and those suspected should be cut open in order to look for larvae. EPPO recommends that such fruits should come from an area where *A. suspensa* does not occur, or from a place of production found to be free from the pest by regular inspection for 3 months before harvest. Fruits may also be treated in transit by cold treatment (e.g. 13, 15 or 17 days at 0.5, 1 or 1.5°C, respectively) or, for certain types of fruits, by vapour heat (e.g. keeping at 43°C for 4-6 h) (Hallman, 1990; USDA, 1994), or forced hot-air (Sharp & Hallman, 1992; Sharp, 1993), or hot-water immersion (Gould & Sharp, 1992). Temperature treatments specifically cited against *A. suspensa* include exposure to water or air >43°C and exposure to cold (0-2.22°C) (Sharp *et al*., 1993). Ethylene dibromide was previously widely used as a fumigant but is now generally withdrawn because of its carcinogenicity. Methyl bromide is approved on a very limited basis by the USA (e.g., 40 $g/m^3$ for 2 h at 21-29.5°C; Hallman & King, 1992; USDA, 2020). Gamma-ray irradiation has also been investigated as a quarantine treatment against *A. suspensa* (Gould & Windeguth, 1991), while use of heat-shrinkable film to wrap mangoes is not an adequate treatment (Gould & Sharp, 1990).

Plants of host species transported with roots from countries where *A. suspensa* occurs should be free from soil, or the soil should not contain fruits or be treated to kill any puparia.

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### Datasheet history

This datasheet was first published in the second edition of 'Quarantine Pests for Europe' in 1997 and revised in 2021. 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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