

Mediterranean fruit fly



Ceratitidis capitata

Common names: medfly, Mediterreense vrugtevlieg

Higher taxon: Insecta: Diptera: Tephritidae

EPPO code: CERTCA

The Mediterranean fruit fly is one of the most destructive fruit pests in the world. It is native to sub-Saharan Africa and has established in most regions of the world, but those regions that do not yet have it, East Asia and mainland USA in particular, regulate this pest in the strictest terms in order to deter its colonization and establishment.

Medfly is among the most polyphagous pests, with over 260 known host plants which include almost all known crops grown in South Africa. In the Western Cape, all deciduous fruits, wine and table grapes are hosts, as well as many other cultivated and wild plants.

The larvae are the damage-causing stage of medfly. They hatch from eggs laid just under the surface of the fruit skin and feed while tunnelling towards the centre of the fruit. This further exposes the fruit to secondary infestation by pests and pathogens, often leading to rotten, pulpy fruit.

Because of the very low economic thresholds for medfly damage, the success of control measures is difficult to measure in economic returns. Effective medfly control must be applied on an area-wide basis and include a variety of actions including monitoring of baited traps, augmentation of parasitoids, sterile insect technique, bait sprays and “attract and kill” bait stations.



A. Malan

Medfly adult female.



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BIOLOGY

Number of generations per year: normally 3-6, but can be as many as 15

Length of generation: 3 weeks to 6 months

Threshold for development: 10.2° C (lower); 30.0° C (upper)

Adult fruit flies emerge from soil in large numbers early in the morning during warm weather. They can fly short distances or be carried longer distances by the wind. Male adult medfly are sexually mature four days after emergence. Reproduction is sexual and mating takes place throughout the day. Female fruit flies become sexually mature and begin to mate and lay eggs as early as five days after emergence if weather is warm, or 10 days after emergence in lower temperatures. Females are attracted to ripe fruits, where they feed by sucking fruit juice and honeydew from aphids, mealybugs, and scale insects from the surface of fruit, without puncturing the fruit.

To lay eggs, females pierce fruit skins shallowly with their small ovipositor and deposit eggs in shallow cavities beneath fruit skins. Each female may lay up to 10 eggs within one cavity, but many females can lay eggs in the same place, leading to aggregations of up to 50 eggs within one cavity. Each female may lay up to 22 eggs per day for the entire course of her lifetime, only ceasing to oviposit shortly before death. Females do not oviposit when temperatures fall below 16°C.

After larvae hatch from the eggs, they begin to feed on flesh of the fruit and tunnel towards the interior of the fruit. Larvae undergo three instars within fruit before emerging, dropping to the ground and pupating in the top layer of the soil.

Development times of eggs, larvae, and pupae are dependent on nutrient availability and climatic conditions. Larval development is heavily influenced by the fruit type itself, with more favourable fruits having more generations of medfly each year than unfavourable fruits. Medfly prefers hotter and drier climatic conditions, and the life cycle is faster under these conditions.

Fruit fly generation times can vary from as little as 3-4 weeks or as much as 2-6 months depending on favourability of conditions and availability of food. Fruit flies are present year-round, and move from one host to the next as they mature in turn. Population sizes peak in late summer and autumn.

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IDENTIFICATION

Egg

Size: 1 mm long

Duration: 1.5-3 days

Slender, curved, shiny and white. Laid under the skin of fruit.

Larva

Number of instars: 3

Final instar size: 7-9 mm long

Duration: 6-30 days

White, cylindrical and elongate. Legs absent. Anterior end (head) is narrowed, pointed and slightly curved. Black mouth hooks are visible. Larvae of several fruit fly species appear quite similar so identification is easiest by rearing larvae to adults.



Medfly larvae.

Pupa

Size: 4-4.3 mm long

Duration: 6-19 days

Dark reddish-brown and regularly cylindrical.

Adult

Size: 3.5-5 mm long (slightly smaller than a housefly)

Duration: 2-6 months

Number of eggs laid by single female: 800 eggs

Thorax yellowish with a characteristic pattern of black markings. Forewings broad with dark characteristic markings and a yellow stripe across the middle of the wing. At rest, wings are held in a drooping position. Head with large iridescent reddish-purple eyes. Male has a pair of bristles with enlarged spatulate tips next to the inner margin of the eyes. Abdomen and legs yellowish with brown accents. Females can easily be identified by the presence of a dark ovipositor at the end of the abdomen.



Medfly pupae.



Medfly adult female.



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ECONOMIC IMPORTANCE

Larvae of the medfly cause the most damage although probing damage by adult females searching for oviposition sites may also lead to secondary infections.

Larvae hatch from eggs deposited just under the skin of fruit. Larvae then feed on fruit tissue while tunnelling towards the centre of the fruit. This damage makes the fruit vulnerable to secondary infection by bacteria or pathogens and also to infestation by secondary pests, which can turn fruit into pulpy rot.

In uncontrolled conditions, medfly can lead to 100% crop losses on a very wide variety of fruit. For example, in home gardens where no controls are applied, it is common for 80% of fruit to be damaged.

In citrus, it is common for adult female medfly to probe fruit in search of appropriate oviposition sites without laying eggs. Most of the damage in citrus is due to secondary fungal infections in the probing wounds.



Medfly larva feeding in a plum.



Medfly larvae feeding in a grape.

HOST PLANTS

Medfly is known to infest over 260 different fruits, flowers, vegetables and even nuts. Thin-skinned, ripe, succulent fruits and berries are the preferred hosts. In the Western Cape all deciduous fruits, wine and table grapes are included in the host list. Below is a very partial list of the most important host plants.

Common name	Scientific name	Family
Plum, peach, apricot	<i>Prunus</i> spp.	Rosaceae
Citrus	<i>Citrus</i> spp.	Rutaceae
Persimmon	<i>Diospyros kaki</i>	Ebanaceae
Pomegranate	<i>Punica granatum</i>	Punicaceae
Apple	<i>Malus domestica</i>	Rosaceae
Grape	<i>Vitis</i> spp.	Vitaceae



Medfly on an unripe peach.

Mediterranean fruit fly



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MANAGEMENT

Monitoring

Populations must be monitored using lure-baited traps. Several options of lures are available and these are most often loaded into yellow bucket traps, as medfly is attracted to the colour yellow. Delta traps with sticky cards can also be used. All control actions should be based on medfly trap counts.

Prevention

Orchard sanitation (removal and destruction of fallen fruits) and removal or fruit-stripping of host plants is crucial for prevention of medfly infestation.

Control measures

It has been well-established worldwide that optimal medfly control must be done on an area-wide integrated basis using as many control measures as possible. These measures include sterile insect technique (SIT), baiting in an “attract and kill” approach whereby fruit fly protein-based lure is mixed with insecticide, as well as bait sprays. Monitoring and augmentative release of parasitoids should also be conducted continuously.

In SIT, male pupae are irradiated to render them sexually sterile. Adult males which emerge from irradiated pupae are released from airplanes to mate with wild females. No fertile eggs are produced from this encounter, rendering the fruit fly population smaller in the next generation, although adult wild females may still cause probing damage.



J. De Waal

Medfly oviposition damage to a grape.



P. Addison

Medfly oviposition damage on a plum.



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MANAGEMENT

Natural enemies (biological control)

Many natural enemies of medfly are known. Entomopathogenic bacteria, nematodes and fungi are effective at killing all life stages, if they can be reached. Parasitoids, especially parasitic wasps, are the most effective natural enemy. Species of *Diachasmimorpha* and *Fopius* braconid wasps are mass-reared for augmentative release in some regions.

Attractants and trapping (pheromonal control)

Male adult medfly are strongly attracted to a synthetic sex attractant, trimedlure/capilure and terpinyl acetate. Males also produce a pheromone, one component of which, 3,4-dihydrop-2H-pyrrole, may attract virgin females too.

QUARANTINE REGULATIONS

Medfly is an EPPO A2 quarantine pest and is of quarantine significance throughout the world, especially in Japan and the USA. It is established and abundant in Hawaii but not in mainland USA, giving it high importance as a quarantine pest. If it is detected, even as an incidental non-established pest in a given country, this can have severe impacts for quarantine regulations for export of fruit from that country to uninfested countries. Therefore, medfly is seen as one of the most significant quarantine pests for tropical or warm temperate areas in regions where it is not yet established.



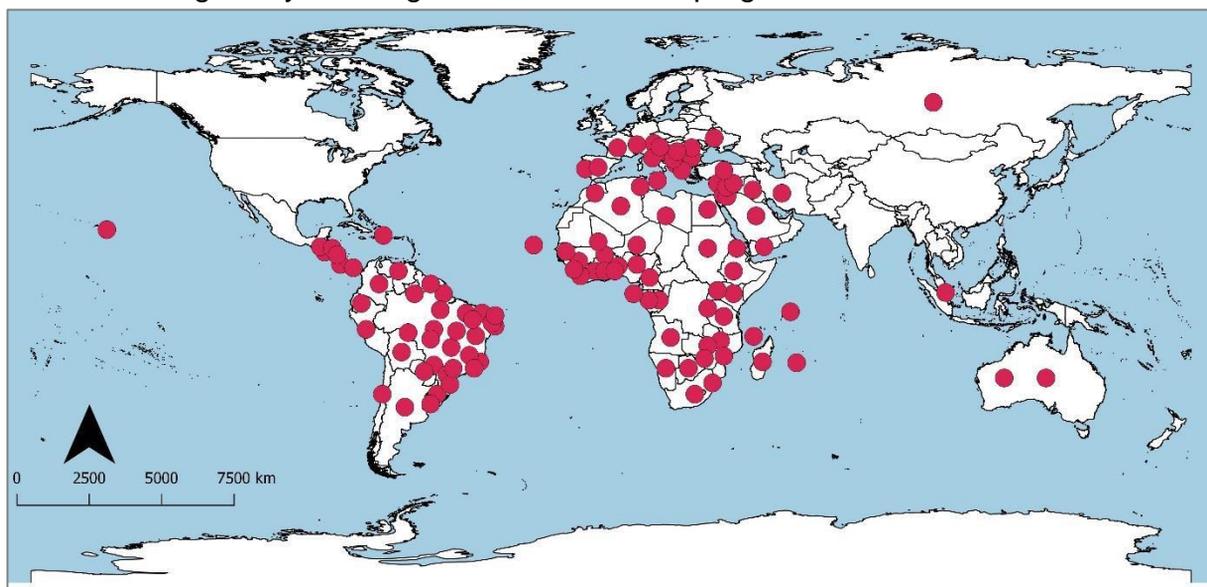


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DISTRIBUTION

Medfly originated in tropical sub-Saharan Africa but spread from there to the Mediterranean area and to parts of central and South America. It has been detected and eradicated in California, Texas and Florida (USA), and has not established in East Asia. It is abundant and established in most other temperate regions of the world and is known to invade North America relatively often, necessitating costly and large-scale eradication programs.



Mediterranean fruit fly, *Ceratitidis capitata*, distribution. Data from CABI (2017). Map drawn by C.S. Bazelet.

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