Compendium of Apple and Pear Diseases and Pests

SECOND EDITION

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introductions have been eradicated. Its expansion has been mainly linked to human activities, such as trade and traveling.

Life History and Description

The adult medfly is about 4.0 mm long and has very characteristic pattern designs on the thorax and wings (Fig. 201). The male's head bears one pair of rhomboid-shaped setae (the cephalic palettes). Eggs are elongate and white. The three larval instars, 8 mm long when fully grown, are white or yellowish white, acephalic but with chewing mandibles, and legless (Fig. 202). The pupa is confined within a brown puparium.

The number of generations per year depends mainly on temperature and host availability. When temperature allows it, development does not stop in the winter. In temperate climates, it overwinters in the soil, mainly as a pupa. Newly emerged adults fly to search for food, since carbohydrate and nitrogen consumption is necessary for egg maturation. Flying distances vary from a few hundred meters to longer distances, depending on food availability. Males attract and court females for mating. Mated females lay eggs beneath the skin of nearly mature fruit, more than one egg being laid by the same or different females in the same fruit. Egg and larval development takes place within the fruit in about 140–150 degree days above 10°C, in temperate regions. Fully grown larvae exit from the fruit and drop to the soil to pupate.

Damage

Females damage the fruit when they lay eggs, producing very tiny holes that are difficult to detect. The larvae feed on fruit flesh and facilitate their invasion by promoting the growth of rot-inducing microorganisms.

Fig. 201. Mediterranean fruit fly adult female (left) and male (right). (Courtesy J. Avilla)

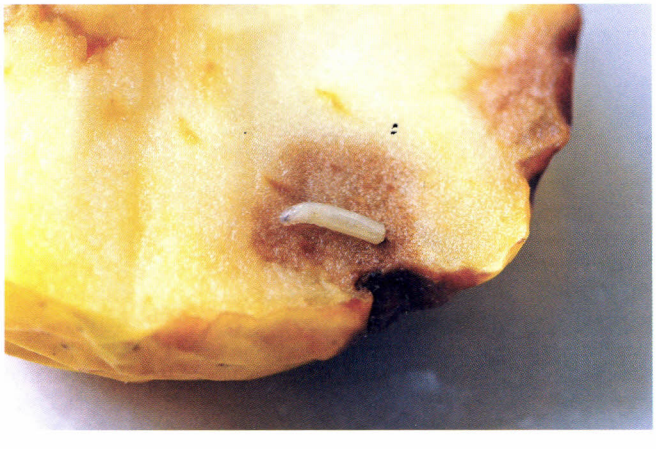

Fig. 202. Mediterranean fruit fly larva in an infested fruit. (Courtesy J. Avilla)

Management

Quarantine measures are the main control method in areas where the medfly is not established, such as the U.S. mainland. Once established, medfly control may be considered either on an areawide or single-orchard scale. Areawide control, appropriate because of this species' polyphagy and dispersion capacity, is accomplished by means of Sterile Insect Technique programs, alone or in combination with mass trapping, attract and kill, attract and sterilize, and chemical control. Population monitoring is done by using traps baited with trimedlure, which attracts only males, or with other attractants, such as ammonium salts, 1,4-diaminobutane, and trimethylamine, which attract females and males, and by visually counting infested fruits. At the orchard scale, mass trapping is carried out with traps baited with feeding attractants and hung on the sunny side of the trees. Some organophosphates, pyrethroids, and spinosyns show good activity against this pest. Medfly natural enemies (i.e., predators, parasitoids, and pathogens) may be an important mortality factor in some areas.

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(Prepared by J. Avilla)

South American Fruit Fly

This fruit fly, *Anastrepha fraterculus* (Wiedemann), is native to South America but is widely distributed from South America to Mexico and southern Texas (United States). In some locations it does not cause economic damage, but in southern Brazil, it can cause significant losses. For many years, this fruit fly has been considered one of the most important and difficult pests to control in apple and other temperate fruits grown in this region. The large number of alternative hosts in native areas, conditions favorable for its reproduction, and lack of effective tools for its control give this fruit fly a high level of economic importance.

In the apple production region, natural host species, such as Rio Grande cherry (*Eugenia involucrata* DC.), guabiroba (*Campomanesia corymbosa* (Cambess.) O. Berg), and feijoa (*Feijoa sellowiana* (O. Berg) O. Berg), are of great importance. Rio Grande cherry ripens in the spring, with production dependent on seasonal climatic conditions. Guabiroba starts ripening in early December and continues throughout the month. Fruit flies reproducing in the fruit of this species are able to attack 'Gala' apples during the preharvest and harvest periods. Feijoa is responsible for the multiplication of the fruit fly population in March and April. As the temperature drops, the larval and (especially) pupal stages are longer; the pupa remains in the soil during the winter, emerging as an adult in early spring (September). This means that a high production of feijoa fruit and a long and demanding winter will result in a strong infestation of fruit flies at the beginning of the apple fruiting period.

For years, control based on the application of organophosphate insecticides was adopted and gave excellent results. However, recent global changes in pesticide tolerances have impacted these uses for fruit fly control, and consequently, many growers have had to completely change their pest control

strategies in response to more stringent residue and quarantine requirements.

Life History and Description

The eggs are oblong, white, and laid under the skin of the ripening fruit. After hatching, the larvae pass through three instars while feeding on the fruit flesh. They are elongate maggots without legs or a head capsule (Fig. 203). The egg-shaped puparium is brown, segmented, and about 2 × 5 mm. The adults are generally yellowish brown and their wings are patterned with brown S- and V-shaped bands (Fig. 204).

The fruit fly is present in apple orchards from October to April, with the population size dependent on an alternative host presence during the autumn and winter periods. There are no resident fly populations in commercial apple orchards, probably because of the inadequacy of apples as larval hosts and the extensive use of organophosphate insecticides.

Population growth is greatest outside the orchards, in wooded or native forest areas and backyards, where primary hosts in the Myrtaceae family are found. After emerging and becoming sexually mature, the adults fly into the orchards and females lay their eggs in the fruit, which explains the preponderance of damage and captures in the traps at the edges of the orchards.

Damage

Gala and Fuji, the major apple cultivars planted in Brazil, are inadequate hosts for larval development up to the period of maturation, and all the adults captured in orchards are from wooded or native forest areas where there are wild hosts. The fruit fly attacks apple fruit from 1.5 cm in diameter through harvest. However, the fly can lay eggs in fruit at any stage of growth. The oviposition site is initially undetectable, but soon the surrounding tissue cells die, forming a depression at the point of injury and causing deformations in the fruit. This symptom does not appear in fruit that are no longer growing. The larvae cause corky stains and improper development in green fruit. Larvae can develop normally only in fruit that are mature or nearly so. Upon completing development, the larvae exit the fruit and fall to the soil to pupate. Intense attack of small fruit can cause premature drop. The greatest damage usually occurs at points where the flies enter the orchard. There are three types of damage in apples: superficial oviposition puncture, internal larval feeding gallery, and destroyed pulp or presence of live larvae.

Fig. 203. South American fruit fly larva and external feeding damage on an apple. (Courtesy A. Kovaleski)

Fig. 204. South American fruit fly adult female. (Courtesy A. Kovaleski)

Management

Monitoring is conducted using McPhail traps containing a 25% grape juice solution, deployed in the orchard immediately after bloom, at a density of one trap per 2 ha. Despite its being nonspecific and somewhat impractical, grape juice is a cheap and efficient attractant. Flies are counted twice weekly by sieving the trap contents.

The treatment threshold is 0.5 flies per trap per day; however, care must be exercised in using this threshold since the pest's distribution in the orchard is not homogeneous, being concentrated on the edges in proximity to alternative hosts. Control is achieved through periodic cover sprays of organophosphate insecticides, for control of the immature stages, in combination with molasses bait sprays, applied in selective orchard locations against immigrating adults, one to two times a week. Larvae escaping control at or before harvest can be treated by storing fruit at 0°C for at least 14 days.

The main parasitoid species associated with *A. fraterculus* are *Utetes anastrephae* (Viereck), *Doryctobracon areolatus* (Szépligeti), and *Doryctobracon brasiliensis* (Szépligeti). Surveys in unmanaged plantings show a parasitism rate of 24% in Rio Grande cherry, 29.3% in guabiroba, and only 1.6% in feijoa, this latter being one of the main alternative hosts. The high parasitism in Rio Grande cherry and guabiroba is due to the reduced size of the fruit, which allows the parasite to easily find the larva and deposit its eggs. Parasitism in feijoa can be affected by climatic conditions (low temperatures) and its thick skin. Increased parasitism in feijoa would result in lowered pest pressure the following spring.

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