

Mexican fruit fly, *Anastrepha ludens* (Loew)

Introduction

Anastrepha ludens (Loew) (Diptera: Tephritidae), commonly known as the Mexican fruit fly, is a serious fruit pest on mango (*Mangifera indica*) and *Citrus* spp. However, more than 40 suitable host species have been recorded (EPPO 2022). Damage to crops is mainly caused by the larvae mining a network of tunnels throughout the fruit flesh accompanied by rotting.

Anastrepha ludens is native to all countries of Central America, except Panama where it is introduced. It is also frequently detected in the south of USA, having been formerly present but now absent in Arizona, and present but under eradication in California and Texas (CABI 2022; EPPO 2022).

Current distribution patterns suggest that *A. ludens* has the potential ability to establish in the southern Mediterranean area, particularly in Morocco, coastal North Africa, southern Portugal and Spain, small areas of Sicily and south Italy, Crete, and part of the Levant. When taking into account climate change the favourable areas would expand in western Portugal, central Spain and Crete, but contract in Morocco, along the north African coast and the Levant. In Central America, the area would contract, but correspondingly increase in Baja California and coastal California (Gutierrez et al. 2021).

History of classical biological control against *Anastrepha ludens*

In the 1950s, several parasitoids were imported into Mexico from Hawaii (USA) for the control of *A. ludens*. These parasitoid species originated from south-east Asia and West Africa and had previously been introduced into Hawaii for the control of fruit flies (Ovruski et al. 2000; Garcia et al. 2020). The imported species were *Fopius arisanus* (Sonan), *Fopius vandenboschi* (Fullaway), *Diachasmimorpha longicaudata* (Ashmead), *Psytalia incisi* (Silvestri) (Hymenoptera: Braconidae), *Aganaspis daci* (Weld) (Hymenoptera: Figitidae), *Aceratoneuromyia indica* (Silvestri) (Hymenoptera: Eulophidae), and *Dirhinus giffardii* (Silvestri) (Hymenoptera: Chalcididae), and in 1988, *Diachasmimorpha tryoni* (Cameron) (Hymenoptera: Braconidae) was also released; however, establishment was only shown for *D. longicaudata* and *A. indica* (Ovruski et al. 2000). In the 1990s, the Mexican government started a control programme against pestiferous *Anastrepha* species, including *A. ludens*. *Diachasmimorpha longicaudata*, *D. tryoni* and *F. arisanus* were mass-reared and released for augmentative pest control (Garcia et al. 2020).

Most promising natural enemies

Diachasmimorpha longicaudata was detected by Aluja et al. (1990) as the most abundant parasitoid in Mexico on *Anastrepha* species (among them *A. ludens*), with up to 29% parasitism in *Mangifera indica*. In a two year study addressing the influence of augmentative release of the exotic *D. longicaudata* on native parasitoids, Montoya et al. (2017) report up to 33% parasitism of *A. ludens* by *D. longicaudata* and detected a decrease in relative abundance of the native fruit fly parasitoid guild but no effects upon species richness and diversity.

Preparedness in biological control of priority biosecurity threats

Doryctobracon crawfordi (Viereck) (Hymenoptera: Braconidae) is a native parasite to Neotropical regions and is known to parasitize *A. ludens*. Parasitism rates of 12.5% are reported for *A. ludens* on the wild host *Casimiroa pubescens* in Mexico (Vanoye-Eligio et al. 2017; Aluja et al. 1990).

Coptera haywardii (Ogloblin) (Hymenoptera: Diapriidae) is native to Mexico and is a parasitoid of fruit flies. It was investigated in the 1990s by the Mexican government and determined to be a suitable candidate for combined area-wide augmentative releases together with *D. longicaudata* against *Anastrepha* spp. (Garcia et al. 2020). This parasitoid may therefore be a candidate for classical biological control release programmes against *A. ludens*.

Other natural enemies

There are several other hymenopteran parasitoid species, besides those discussed above, that are listed as able to parasitize *A. ludens*. These include *Doryctobracon areolatus* (Szépligeti), *Opius hirtus* (Fischer), *Utetes africanus* (Szépligeti), *Utetes anastrephae* (Viereck) (Braconidae); *Eurytoma sivinskii* Gates and Grissell (Eurytomidae); *Aganapis pelleranoi* (Brèthes) and *Odontosema anastrephae* Borgmeier (Figitidae); *Chromocryptus mesorufus* Cushman (Ichneumonidae); and *Pachycrepoideus vindemmiae* (Rondani) (Pteromalidae) (Stibick 2004; Garcia et al. 2020; EPPO 2022).

Several predators are also listed for *A. ludens*. In particular, predation by ants is the highest biotic mortality risk when the larvae are at their most vulnerable as they leave the fruit host to pupate in the soil (Aluja et al. 2005). Ant species include *Crematogaster* sp., *Pheidole gertrudae* and *Solenopsis geminata* (Hymenoptera: Formicidae), and other Arthropod predators include staphylinid beetles (*Belonochus rufipennis*, *Homaetarsus* sp. and *Xenopygus analis*), *Villa scylla* (Diptera: Bombyliidae), and the spiders *Paraphidippus aurantius*, *Phidippus audax*, *Phidippus bidentatus* and *Lyssomanes pescadero* (Araneae: Salticidae) (Stibick 2004; Garcia et al. 2020; EPPO 2022).

References

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