EPPO Datasheet: *Prodiplosis longifila*

Last updated: 2022-01-17

IDENTITY

Preferred name: *Prodiplosis longifila*
Authority: Gagné
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Diptera: Cecidomyiidae
Common names: bud midge, citrus gall midge
view more common names online...
EPPO Categorization: A1 list
view more categorizations online...
EU Categorization: A1 Quarantine pest (Annex II A)
EPPO Code: PRDILO

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Notes on taxonomy and nomenclature

According to Gagné (1986) *P. longifila* was reported on wild cotton in the USA (Florida) by Rainwater (1934) probably as *Contarinia gossypii* Felt. Dhileepan *et al.* (2017) and Duque-Gamboa *et al.* (2018a) suggest that populations collected from different hosts might correspond to a complex of cryptic species rather than a single polyphagous species. The species initially reported as *P. longifila* in Bolivia in galls of *Jatropha clavuligera* (Dhileepan *et al.*, 2017) was later confirmed as a separate new species, *Prodiplosis hirsuta* Kolesik sp. nov. (Kolesik *et al*., 2022)

HOSTS

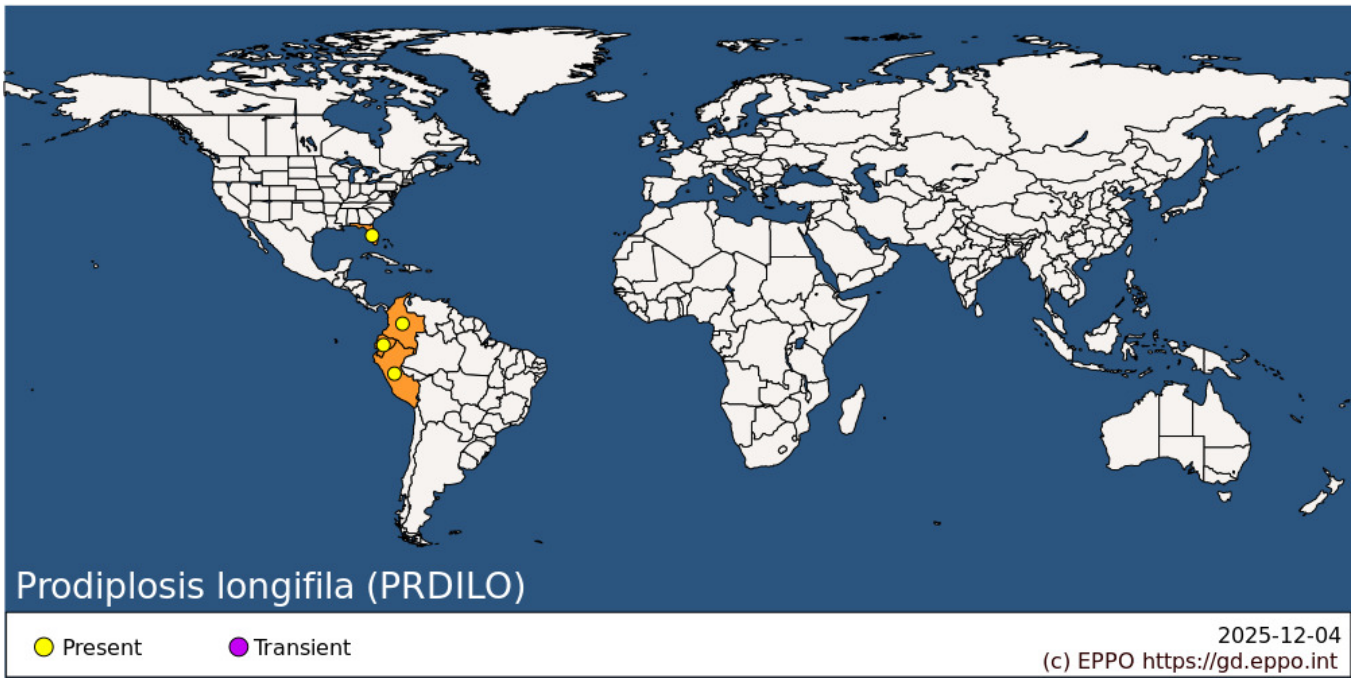
The most important host crops belong to Rutaceae and Solanaceae, however *P. longifila* has also been reported in many non-cultivated plants. Valarezo *et al.* (2003) report that *P. longifila* causes economic damage only on tomato (*Solanum lycopersicum*) crops in Ecuador, but it is also found in other crops, non-cultivated plants and weeds. In Peru it is found mainly in asparagus (*Asparagus officinalis*), tomato, potato (*Solanum tuberosum*), sweet pepper (*Capsicum annuum)* and the ornamental plant *Tagetes erecta* but also in other crops and non-cultivated plants (Diaz-Silva, 2011). In Colombia it is found in tomato, sweet pepper and Tahiti lime *Citrus* x *latifolia* (Hernandez *et al.*, 2015). In the USA, it is found in Tahiti lime (Peña *et al.*, 1987). In Colombia both *P. longifila* and *Prodiplosis floricola* larvae coexist on Tahiti lime and are indistinguishable to the naked eye (Duque-Gamboa *et al.*, 2018b).

Host list: *Acalypha virginica, Allium cepa, Amaranthus caudatus, Amaranthus hybridus, Asparagus officinalis, Brassica oleracea, Capsicum annuum, Capsicum baccatum, Capsicum chinense, Capsicum frutescens, Carica papaya, Chenopodiastrum murale, Chenopodium quinoa, Citrullus lanatus, Citrus x aurantiifolia, Citrus x aurantium var. sinensis, Citrus x latifolia, Coriandrum sativum, Cucumis melo, Cucumis sativus, Cucurbita pepo, Cynara cardunculus, Cynara scolymus, Datura stramonium, Desmodium sp., Desmodium tortuosum, Dysphania ambrosioides, Fragaria vesca, Gerbera jamesonii, Gliricidia sepium, Glycine max, Gossypium barbadense, Gossypium hirsutum, Laportea aestuans, Malus domestica, Medicago sativa, Melilotus albus, Merremia sp., Morus nigra, Nicandra physalodes, Persea americana, Petroselinum crispum, Phaseolus lunatus, Phaseolus vulgaris, Physalis angulata, Pisum sativum, Plukenetia volubilis, Pouteria lucuma, Richardia scabra, Ricinus communis, Salvia hispanica, Sida, Solanum carolinense, Solanum lycopersicum, Solanum nigrum, Solanum pimpinellifolium, Solanum tuberosum, Spinacia oleracea, Swinglea glutinosa, Tagetes erecta, Tagetes patula, Vicia faba, Vicia lens, Vitis vinifera*

GEOGRAPHICAL DISTRIBUTION

The native range of *Prodiplosis longifila* is probably the south of the USA (Florida) and South America (Colombia,

Ecuador, and Peru). According to Gagné (1986). *P. longifila* has been reported in the USA only in Florida; initially in wild cotton by Rainwater (1934) probably as *Contarinia gossypii* Felt (Gagné, 1986) and later in flower buds in Tahiti lime (Gagné, 1986). The first report in Ecuador was in 1986 in Arenillas, El Oro province, on the border with Peru; and it is believed that this was the pest's entry route to Ecuador since it was reported in Peru in 1979 (Valarezo *et al.*, 2003). In Ecuador it is found in tomato crops both on the coast and in the inter-Andean valleys between 1000 and 1700 meters above sea level (Valarezo *et al.*, 2003). In Peru, it was initially collected on the central coast, erroneously reported as *Contarinia medicaginis* (Kieffer) (Diaz, 1981; Diaz-Silva, 2011). Then it expanded its distribution to the entire Peruvian coast and in the Cañete, Moche and Virú valleys and in Chavimochic Irrigation (Diaz-Silva, 2011). In Colombia, *P. longifila* was initially reported as a pest in Valle del Cauca and the coffee region (Mena *et al.*, 2014), but it has spread causing concern to other areas of the country, principally to the Andean region and inter-Andean valleys (Hernández *et al.*, 2015).



North America: United States of America (Florida)
South America: Colombia, Ecuador, Peru

BIOLOGY

Prodiplosis longifila eggs are deposited individually or in masses of approximately 13 eggs usually on stamens or styles on citrus (Peña *et al.* 1989). In tomatoes *P. longifila* oviposits on bud leaves (Duque *et al.* 2018), on thin branches, flowers or under the sepals of green tomatoes (Valarezo *et al.*, 2003). The eggs hatch in 1-2 days on citrus and on tomato (Duque *et al.*, 2018). There are three larval stages, which last approximately 2.5, 2.7 and 2.8 days respectively; the pre-pupal and pupal stages last about 1.5 and 6.3 days respectively (Valarezo *et al.*, 2003). The second stage larva is more mobile and feeds more than the first one (Valarezo *et al.*, 2003). The prepupal stage begins after the orange-coloured third stage larva, which presents jumping activity, stops feeding and leaves the leaf, propelling like an arc and reaching distances between 6-8 cm until it falls to the ground (Valarezo *et al.*, 2003). Once on the ground the larvae locate humid areas to penetrate the first millimetres of the soil and form the pupa with soil particles adhering to their body. This pupa is hardly visible to the human eye (Valarezo *et al.*, 2003). When the larva does not fall to the ground, it weaves a whitish cocoon and burrows in the foliage, branches or stems of the tomato (Valarezo *et al.*, 2003). The pupal stage lasts about 4-10 days (Diaz-Silva; Peña *et al.*, 1989), and the prepupae to pupae about 9-11 days in asparagus (Goldsmith et al., 2013).

The adult emerges in the late afternoon (Valarezo *et al.*, 2003). The adult stage lasts approximately 1.35 days (Valarezo *et al.*, 2003), and the high peaks of adult emergence appear from 17:00 to 23:00 with temperatures between 17-20°C and relative humidity between 69-98 % (Peña *et al.*, 1989). Sex ratio (female: male) of emerging adults reared on citrus fluctuated between 70:30 and 50:50 (Peña *et al.*, 1989). Sex ratio (male: female) of adults reared on tomato was 1: 1.03 (Duque *et al.*, 2018). The development time (first stage larva to adult) in tomato varies

between 14-17 days (Duque *et al.*, 2018, Valarezo *et al.*, 2003) while in Tahiti lime it was 7-10 days (Peña *et al.*, 1989). In tomato, feeding on flower seems to increase oviposition (Duque *et al.*, 2018) and sugar increases the longevity of adults from about 1 day to 3-4 days (Duque *et al.*, 2018). There are many generations in a year, up to 22 on asparagus in Peru (Diaz-Silva, 2011).

DETECTION AND IDENTIFICATION

Symptoms

The second larval stage of *P. longifila* is the one that causes the greatest damage; in tomato plants, it feeds on the base of the leaflets, directly affecting inflorescences and small fruits, causing deformation and creating necrotic lesions on them (Valarezo *et al.*, 2003; Hernandez *et al.* 2015). In tomato flowers the symptoms are very similar to those caused by *Botrytis cinerea* as the tissues become brown (Hernandez *et al.* 2018). Peña & Duncan (1992) mention that infections by *Colletotrichum gloeosporioides*, *Cladosporium herbarum* var. citricola and *Penicillium* sp. can occur at the feeding sites, causing the death of the flower. Tomato fruit necrotizes around the petiole, forming a spot known as 'caregato' (in Spanish) or scab (Hernandez *et al.*, 2018). On sweet pepper (*Capsicum annuum*), the small fruits (2 cm in length) affected by *P. longifila* larvae change from green to fuchsia and stop their growth (Hernández *et al.*, 2018). On asparagus new spears become distorted because of larval feeding (Diaz-Silva, 2011). On potato larval feeding causes bud abrasion, bud and leaf distortion and plant stunting (Diaz-Silva, 2011).

Morphology

Eggs

The eggs are transparent and elongated; they measure about 0.26 mm wide and 0.09 mm long (Peña *et al.*, 1989). Newly oviposited eggs are translucent or hyaline, with shiny chorion, smooth and in their external structure they are covered by a thin layer of a mucilaginous substance (Valarezo *et al.*, 2003).

Larva

The first larval stage is translucent when newly eclosed, turning white 1.2 days later; it ranges from 0.40-0.92 mm in length and its cephalic capsule measures 0.0450 ± 0.003 mm (Peña *et al.*, 1989). It only presents one pair of spiracles located in the eighth abdominal segment, and this differentiates it from the other instars (Peña *et al.*, 1989). The second larval instar measures 0.76 - 1.85 mm; the cephalic capsule measures 0.050 ± 0.005 mm wide, has a pair of spiracles in the first thoracic segment and one for each of the 8 abdominal segments (Peña *et al.*, 1989). The third larval instar measures between 1.15-1.90 mm in length and the cephalic capsule measures 0.050 ± 0.005 mm in width at the posterior end (Peña *et al.*, 1989). The distinguishing feature of this instar is the clove-shaped spatula on the venter of the first thoracic segment (Peña *et al.*, 1989). The third instar is orange (Duque *et al.*, 2018).

Pupa

Pupae are about 0.85-1.00 mm long and pale yellow when newly moulted; the head and thorax turn black 3-4 days later (Peña *et al.*, 1989).

Adult

Adults are midges of approximately 1.5 mm in length; the wing of the male measures 1.4 mm and of the female 1.5 mm (Peña *et al.*, 1989). They are white-yellow with a black head, black eyes, long legs, thin and delicate body, large wings with reduced venation, covered with small dark setae (Valarezo *et al.* 2003). *P. longifila* presents sexual dimorphism, since the female is larger and has a long and retractable ovipositor. The female's antennae are filiform with twenty-one segments, and those of the male are moniliform with twenty-three segments (Valarezo *et al.*, 2003). Male flagellomeres have irregular circumfila, some loops especially long on circumfila 1 and 3 (Gagné, 1986).

Detection and inspection methods

The easiest stages to recognize in the field in tomato crops are the white larvae in leaflets, in floral structures and under the calyx; also the orange pre-pupae on the ground. At high larval densities, tomato leaves appear black. In citrus it is necessary to open the flower buds when they are still closed; these buds are generally brown due to necrotic tissue but they can also contain larvae without this change in colour. In peppers (*Capsicum annuum*) affected small fruits (2 cm in length) change from green to fuchsia (Hernández *et al.*, 2018). In asparagus there are lesions on apical and lateral shoots and green shoots; shoot curvature and stunted plant development (Diaz-Silva, 2011). Symptoms in cultivated and non-cultivated plants are described mainly as lesions on tender tissues (Diaz-Silva, 2011). Larvae of *Prodiplosis longifila* can be confused with those of other genera of Cecidomyiidae such as *Dasineura* present in chili pepper *Capsicum frutescens* in Colombia (Hernandez *et al.* 2018) or *Contarinia* (Diaz, 1981). For molecular identification Duque-Gamboa et al (2018a) reported DNA sequences for DNA barcodes (cytochrome oxidase I gene) and a region of the ribosomal DNA (ITS2) that are available at the **GenBank**.

No specific traps are available. Sticky coloured traps may be used to monitor the pest in the country of export (Pena and Duncan, 1992; Chavez Vergara, 2002).

PATHWAYS FOR MOVEMENT

Flying adults of *P. longifila* are dispersed locally by the wind. Eggs and larvae can be present in different parts of host plants or in plant material, moving easily with trade because in the early stages of the infestation, symptoms may go unnoticed. In Colombia, it is considered that the populations of *P. longifila* on tomato are similar all over the country (Velasco-Cuervo *et al.*, 2016) due to movement of plant material between regions or by spread from nurseries. The soil attached to host plants can contain pupae. Possible pathways in trade are fruits, vegetables, plants for planting (except seeds), cut flowers of host plants, from countries where *P. longifila* is found. Eggs, larvae and pupae can survive transport. Potato tubers and bulbs of host plants are not considered as a likely pathway (EPPO, 2017b).

PEST SIGNIFICANCE

Economic impact

On tomato *P. longifila* has been reported to cause up to 100% loss in Colombia (Hernandez *et al.*, 2018) and up to 60% loss in Ecuador (Valarezo *et al.* 2003). Colombian farmers also expressed losses of up to 70% with the combination of *P. longifila* and the fruit borer *Neoleucinodes elegantalis* Guené (Lepidoptera: Crambidae) in tomato (Martin-Pabón & Salcedo-Martin, 2018). In Peru *P. longifila* causes economic losses on asparagus crops (Cedano & Cubas, 2012; Diaz-Silva, 2011) and potato with up to 16% of infested sprouts (Kroschel *et al.* 2012). In the coastal region of Peru, *P. longifila* reduces yields of asparagus and peppers by up to 80%, as it attacks the buds, flowers and fruits (Goldsmith *et al.*, 2013). In Florida it affected up to 25% of flowers buds on Tahiti lime (Peña *et al.*, 1987).

Control

Valarezo *et al.* (2003) in Ecuador reported the use of chemical insecticides against *P. longifila* larvae in tomato (e.g. imidacloprid, pirimifos-methyl, thiamethoxam and abamectin). They also report the use of insecticides of botanical origin such as azadirachtin, neem complex and polysulfone-azadirachtin. Cardona *et al.* (2010) in Colombia recommended alternating active substances to reduce infestation (e.g. thiamethoxam and lambda-cyhalotrin followed by imidacloprid; imidacloprid followed by abamectin; abamectin followed by Bt). The spinetoram active substance was used for the control of larvae on tomato in Ecuador (Rendón Torres, 2015) but seems to have selected resistant genotypes of the pest in Colombia (Duque *et al.* 2018). Abamectin reduced the population of *P. longifila* larvae in quinoa (Soca-Flores, 2021). Sabando-García *et al.* (2020) noted that tomato producers generally apply 30-35 insecticide treatments per crop.

Bacillus thuringiensis strains *kurstaki* and *israelensis* did not reduce the average number of tomato fruits damaged by *P. longifila* (Delgado *et al.*, 1999). For biological control in Colombia, four species of parasitoids of the genus *Synopeas* were reported for *Prodiplosis longifila* and *P. floricola* (Hernandez *et al.*, 2018) but the most successful cases of biological control were achieved with natural biological control by *Synopeas* sp. in citrus in the USA (Peña *et al.*

1990) and by augmentative biological control through the release of *Synopeas* sp. in asparagus in Peru (Diaz-Silva, 2011). Natural parasitoidism is less than 20% in asparagus (Cisneros, 1995 cited by Kroschel *et al.* 2012). Several species of natural predators have been reported (Valarezo *et al.* 2003; Diaz-Silva 2011). Some species of nematodes are promising in the control of pupae under laboratory conditions (Pacheco-Chinchay, 2015) and several genera of entomopathogenic fungi have been tested (Reátegui *et al.*, 2019).

Wild tomato varieties were not affected by *P. longifila* while commercial varieties were in a field trial in Colombia (Mena *et al*., 2014).

Various mechanical control techniques have been tried, such as trapping adults using plastic materials coated with glue or oil, or pressure washing to kill adults (Diaz-Silva, 2011). White (Goldsmith *et al.*, 2013) or colour (Valarezo *et al.* 2003) sticky traps attract adults as do light traps with a sticky panel (Camborda *et al.*, 2015). Sticky traps show low capture but may be used for pest monitoring (Valarezo et al., 2003). Light traps in combination with a coloured plastic panel attract less than 25% of the adult population and are therefore not considered efficient to kill pest populations (Diaz-Silva, 2011). Pruning of infested plants, destruction of harvest residues and elimination of uncultivated host plants are recommended as cultural control to reduce pest population (Diaz-Silva, 2011). Using drip irrigation allowed the total number of insecticide treatments needed again *P. longifila* to be reduced on tomato (Sabando-García *et al.*, 2020).

Phytosanitary risk

P. longifila is polyphagous and is a damaging pest on crops that are important in the EPPO region (e.g. tomato). *P. longifila* could be introduced with imported host plants and become established in the hottest areas of the EPPO region (the Mediterranean region, Portugal and the southern Black Sea coasts) where tomato, asparagus and *Capsicum* are major crops, and where citrus are found. It could also cause outbreaks or transient populations under protected conditions in the rest of the EPPO region (EPPO, 2017a). *P. longifila* could expand in the same areas where *Tuta absoluta* (Lepidoptera: Gelechiidae) has established since both pests coexist in tomato crops in Colombia (Duque *et al.* 2018) but given *P. longifila*'s polyphagic nature it could also feed on non-cultivated plants.

PHYTOSANITARY MEASURES

Phytosanitary measures should be taken especially on the main cultivated host plants (tomato and *Capsicum*, asparagus).

Host plants for planting, fruit, and cut plant parts (e.g. asparagus or cut *Tagetes* flowers) should come from a pest-free area or a pest-free place of production under physical isolation. Host fruits may also be produced in a systems approach including treatment of the crop, removal of green parts and inspection at packing. Alternatively, they can be imported only in winter for direct consumption or immediate processing in countries where the pest cannot establish outdoors. All traded commodities should be transported in new packaging material and packaging destroyed or safely disposed of at import (EPPO, 2017a).

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Datasheet history

This datasheet was first published online in 2022. It is 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.

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