EPPO Datasheet: *Liriomyza bryoniae*

Last updated: 2024-01-04

IDENTITY

Preferred name: *Liriomyza bryoniae*
Authority: (Kaltenbach)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Diptera: Agromyzidae
Other scientific names: *Agromyza bryoniae* Kaltenbach, *Liriomyza citrulli* Rodendorf, *Liriomyza hydrocotylae* Hering, *Liriomyza mercurialis* Hering, *Liriomyza nipponallia* Sasakawa, *Liriomyza solani* Hering, *Liriomyza triton* Frey
Common names: potato leaf miner, potato leafminer, tomato leaf miner, tomato leafminer
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EU Categorization: PZ Quarantine pest (Annex III)
EPPO Code: LIRIBO

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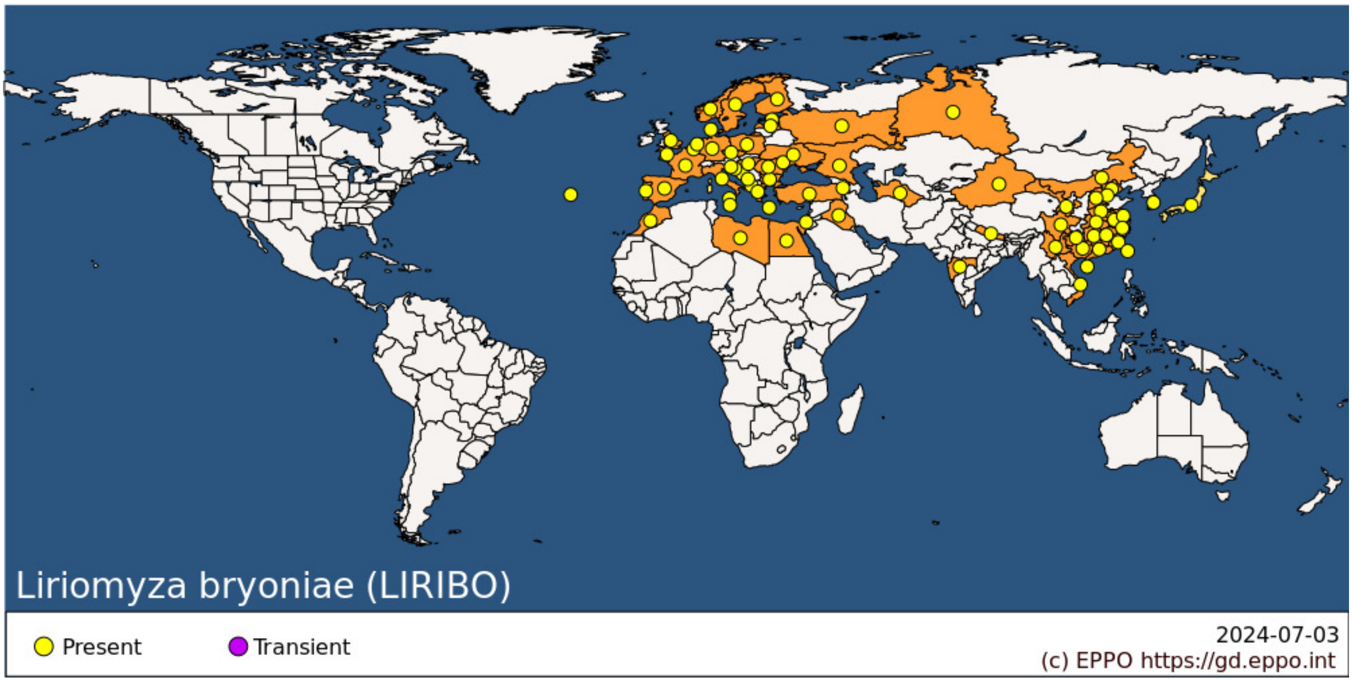
HOSTS

Agromyzidae are usually restricted to a limited number of host plants but a few species are highly polyphagous and have become important pests. *Liriomyza bryoniae* is one of those species and causes severe damage to open field and greenhouse tomatoes, cucurbits, cabbages and lettuces. In the pan-temperate region, *L. bryoniae* has been reported to complete its life cycle on plants from 16 families (Spencer, 1990).

Host list: *Brassica juncea*, *Brassica oleracea var. capitata*, *Brassica oleracea*, *Brassica rapa subsp. chinensis*, *Capsicum annuum*, *Citrullus lanatus*, *Cucumis melo*, *Cucumis sativus*, *Cucurbita pepo*, *Glebionis coronaria*, *Gypsophila paniculata*, *Lactuca sativa*, *Malva sylvestris*, *Nicotiana alata*, *Phaseolus vulgaris*, *Pisum sativum*, *Solanum lycopersicum*, *Solanum nigrum*, *Solanum torvum*, *Solanum tuberosum*, *Sonchus oleraceus*, *Vicia faba*

GEOGRAPHICAL DISTRIBUTION

L. bryoniae probably originates from Southern Europe but has now spread to Central and Northern Europe as well as North Africa and Asia. In Central and Northern Europe, it is primarily found in glasshouses. In the more southern parts of its distribution range, *L. bryoniae* attacks crops grown in open fields.



EPPO Region: Albania, Armenia, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France (mainland), Germany, Greece (mainland, Kriti), Hungary, Israel, Italy (mainland, Sicilia), Latvia, Malta, Moldova, Montenegro, Morocco, Netherlands, Norway, Poland, Portugal (mainland, Azores), Romania, Russia (Central Russia, Southern Russia, Western Siberia), Slovenia, Spain (mainland), Sweden, Türkiye, Ukraine, United Kingdom (Channel Islands, England)
Africa: Egypt, Libya, Morocco
Asia: China (Anhui, Beijing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Neimenggu, Shanxi, Sichuan, Xinjiang, Yunnan, Zhejiang), India (Maharashtra), Iraq, Israel, Japan, Korea, Republic, Nepal, Taiwan, Turkmenistan, Vietnam

BIOLOGY

The principal biological characteristics which make certain *Liriomyza* spp. particularly successful pests are their rapid population growth and their ability to attack a wide range of different host plants (Reitz *et al*., 2013).

Details about the life history of *Liriomyza bryoniae* are summarized from Lee *et al.* (1990), Minkenberg & Lenteren (1986), Nedstam (1985), Parrella (1987), Spencer (1973) and Tokumaru & Abe 2005.

In some cases, males have been observed to emerge before females. Copulation takes place immediately after females have emerged; non-fertilized females are not able to oviposit. Females can live for a week or more but males only for up to 3 days. Female flies puncture the cotyledons or the young leaves of the host plants with their ovipositor causing wounds which serve as sites for feeding or oviposition. Males can also take advantage of these feeding sites as they are less well-equipped for puncturing plant tissue. Eggs are mostly inserted in the upper surface of leaves but also occasionally in the lower surfaces. Each egg puncture contains a single egg and the duration of this stage varies from 4 to 8 days at a mean temperature of 20.6°C. Females lay from one to ten eggs per day depending on the host plant.

There are three larval stages which, in total, last 7-13 days, depending on the temperature. The larva feeds rapidly and forms an irregular linear mine. If a leaf is not sufficient for its full development, then the larva can move up in the stem into a second leaf; larvae are unable to penetrate leaves from the outside. Just before pupation, mature larvae cut semi-circular exit slits in the upper surface of the leaves. After a short period, larvae drop to the ground and then burrow just below the surface of the soil or in crop debris before pupating. The duration of the pupal stage depends on the temperature but under glass in the spring and summer months in England, it averages 3 weeks. During winter, pupae enter into diapause or retarded development until the following spring.

DETECTION AND IDENTIFICATION

Symptoms

The most important damage caused by *Liriomyza* spp. is due to larval mining in the leaf tissue. As for the feeding and oviposition punctures, larval mining reduces the aesthetic value of ornamentals, decreases the photosynthetic capacity of leaves and can ultimately cause defoliation in severe cases (Spencer 1973). Mines are irregular linear structures in the leaf tissue. They are off-white with trails of dark frass in their margins.

Liriomyza spp. adults cause two main types of damage to their host plants, feeding and oviposition punctures (Minkeberg & van Lenteren, 1986; Reitz *et al*., 2013). Adult feeding and oviposition punctures reduce the aesthetic value of ornamental plants and can lead to death of young plants by reducing photosynthetic capacity. Punctures can also be invaded by fungi and bacteria causing additional damage to host plants. Feeding punctures appear as uneven rounded white speckles on the leaf surface whereas oviposition punctures are smaller and more rounded. These symptoms are not used as a diagnostic character as there is no variation between *Liriomyza* spp.

Morphology

Detailed description of the morphology of immature and adult *L. bryoniae* is given in Spencer (1973). The main diagnostic characters of the four regulated *Liriomyza* spp. (*L. bryoniae*, *L. huidobrensis*, *L. sativae* and *L. trifolii*) can be found in the IPPC diagnostic protocol for the genus *Liriomyza* (IPPC, 2017) and the EPPO Standard on diagnostics PM 7/53 (2) *Liriomyza* spp. (EPPO, 2022a). The following sections summarize this information.

Eggs

Oval and white, 0.25 mm long.

Larva

There are three larval stages that range from 0.5 mm in length for the first instar to 3.0 mm for the last one. Their shape is cylindrical and tapering towards the head. The anterior and posterior spiracles are located on projections and the posterior spiracles are composed of an ellipse of 7 to 12 pores. The mouth-hooks comprise two strongly alternating teeth. *L. bryoniae* larvae are cream-coloured except in the last stage where a yellow-orange patch appears dorsally at the anterior end.

Puparium

Oval cylinder in shape of about 2.0 mm, -pale yellowish-brown. The spiracles are still visible in the pupal stage.

Adult

Small 1-3 mm long mostly black flies, with a yellow frons and scutellum. The orbital setulae are reclinate, the costa extends to vein M_{1+2} and the femora are predominantly yellow. Male genitalia are characteristic of the genus.

Detection and inspection methods

There are more than 400 species of *Liriomyza* (GBIF, 2023) and their morphological identification relies on the male genitalia. Adult females can only be used for genus level identification. Likewise, there are no keys available for species level identification of the immature stages. *L. bryoniae* males can thus be separated from the very similar *L. huidobrensis*, *L. trifolii*, *L. sativae* and *L. strigata* by the structure of their distiphallus (terminal part of the intromittent organ) which is evenly sclerotized and has a pair of distal bulbs with circular rims (EPPO, 2022a; IPPC, 2017).

The mines caused by larval feeding can also be useful for detection, but this character should be used in combination with other characters as mine pattern is influenced by environmental factors (EPPO, 2022a). Other flies as well as some Lepidoptera are known to have leaf-mining larvae and can potentially be confused with Agromyzidae. Nonetheless, the characteristic feeding punctures of *Liriomyza* spp. allows diagnosticians to differentiate them from other leafminers.

In the absence of male adults for morphological identification, the following molecular tests can be used for *L. bryoniae* species identification: PCR RFLP targeting the COII gene (Kox *et al.,* 2005), conventional multiplex PCR targeting the COI gene (Nakamura *et al*., 2013) and DNA barcoding based on the COI gene (EPPO, 2021). These molecular techniques are summarized in the EPPO and the IPPC diagnostic protocols for regulated *Liriomyza* species. Recently, molecular identification based on next generation sequencing techniques are also being developed (Frey *et al*., 2022).

PATHWAYS FOR MOVEMENT

Adults are capable of limited flight and can be dispersed by wind currents (see Malipatil *et al.,* 2016 for references), but are unlikely to spread over long distances. The high degree of polyphagy of *L. bryoniae* as well as the concealed lifestyle of its larvae make its dissemination through the movement of plant material the most likely mean of colonizing new countries (EFSA, 2020; Parrella, 1987; Reitz *et al.,* 2013).

PEST SIGNIFICANCE

Economic impact

Liriomyza spp. are highly polyphagous and invasive and cause severe damage to vegetable crops and ornamentals through adult feeding, oviposition and larval mining. *L. bryoniae* is present throughout Europe as well as in North Africa and Asia. It is primarily a pest of open field and greenhouse tomatoes, cucurbits, cabbages and lettuces (EFSA, 2020, Spencer 1973). Tomato yield losses have been shown to reach 17% in highly infested greenhouses (Ledieu & Helyer, 1985).

Control

The most common control strategy against *Liriomyza* spp. is the extensive use of chemical control methods. However, *Liriomyza* spp. are known to readily develop insecticide resistance (Reitz *et al*., 2013), unlike their local parasitoids, thus causing serious leafminer outbreaks. Some insecticides are effective against *Liriomyza* spp. (Schuster & Everett, 1983). These are translaminar and target the larvae inside the leafmines. Biological control methods are increasingly being used in horticultural industries and commercial vegetable production (Liu *et al*., 2009). There are more than 140 described species of *Liriomyza* parasitoids and these are the primary agents used in biological control strategies. In open fields, integrated pest management strategies promoting local parasitoid diversity are commonly used to control *Liriomyza* spp. In the more controlled greenhouse environments, commercially available parasitoids, such as species in the genus *Diglyphus*, are also reported to successfully regulate *Liriomyza* infestations. Predators and entomopathogenic nematodes and fungi are also known but there are a limited number of species, and they are not considered as efficient control agents.

Phytosanitary risk

Liriomyza bryoniae is a highly polyphagous species present in the open field in Southern Europe as well as in greenhouses in the Northern parts of Europe. Within the EPPO region, this pest has the potential to spread to any areas where Asteraceae, Brassicaceae, Cucurbitaceae or Solanaceae are grown under glass.

The main dispersal mechanism is through the trade related movement of plant material hosting the immature stages of *L. bryoniae* (EFSA, 2020). The latter are cryptic and can easily go undetected in plants for planting, soil, fruit and vegetables, cut flowers and branches with foliage.

PHYTOSANITARY MEASURES

It can be recommended that host plants for planting from countries where *L. bryoniae* is present are inspected over three months at regular intervals before export can take place, to verify the absence of the pest itself or any signs of its presence. General guidance on how to conduct inspections of places producing vegetable plants for planting under protected conditions can be found in the EPPO Standard PM 3/77 (EPPO, 2022b).

Considering its probable Southern European origin and its wide distribution in the EPPO region, *L. bryoniae* is not listed on the EPPO A1 and A2 lists of pests recommended for regulation as quarantine pests. However, in the European Union, specific measures are taken to protect areas that are still free from *L. bryoniae* (Protected Zones), which means that plant material should respect a list of established rules (Commission implementing regulation (EU) 2021/2285) before being cleared for import into the Protected Zones.

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CABI resources used when preparing this datasheet

CABI Datasheet on *Liriomyza bryoniae.* https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.30950

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Datasheet history

This datasheet was first published in 1997 in the second edition of 'Quarantine Pests for Europe', and revised in 2024. 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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