

Watermelon (American serpentine) leafminer (259)

Common Name

American serpentine leafminer, serpentine leafminer, broad bean leafminer, celery leafminer, chrysanthemum leafminer.

Scientific Name

Liriomyza trifolii. See other fact sheets for accounts on separate species (**Fact Sheet nos. 262, 377**) and, for a general account, (**see Fact Sheet no. 110**).

Distribution

Asia, Africa, North, South and Central America, the Caribbean, Europe, Oceania. It is recorded from American Samoa, Guam, Federated States of Micronesia, Northern Mariana Islands, Samoa, Solomon Islands, and Tonga.

Hosts

Wide. CABI records over 400 species in 28 families, on vegetables and ornamentals. The main families are the potato family (Solonaceae), legume family (Fabaceae), cucumber family, (Cucurbitaceae), cabbage family (Brassicaceae), and the daisy (lettuce, *Gerbera*, *Chrysanthemim*) family (Asteraceae), but also on onions. In Samoa, it is recorded on head (English) cabbage; in Tonga, it is recorded from brassicas, beans, cucurbits (including watermelon), eggplant, lettuce, pea, potato, and tomato, and in Fiji, the following crops are hosts from border interceptions in New Zealand: Oregano, *Amaranthus*, basil, chives, sage, mint, rocket.

Symptoms & Life Cycle

White specks (about 0.15 diameter) occur on the top surface of leaves - easily seen when populations are high - caused by females as they pierce the leaf to lay eggs and also to feed on plant sap. Both males and females feed on flowers. Mines are white or greenish, snake-like, increasing in width as the larvae (maggots) grow inside. The frass or faeces of the maggots leave distinctive black marks on both sides of the mine, first on one side and then the other. On larger leaves, the mines are irregularly U-shaped. Seedlings may wilt due to the mining of the leaves.

Many eggs are laid on the same leaf just below the surface; they are oval, creamy-white, up to 0.3 mm long and 0.15 mm wide, and hatch in 2-5 days. The maggots are legless, yellowish-green as they mature, up to 3 mm long. There are three stages over about 10 days. When the maggots are ready to pupate they leave the mines and fall to the ground. The pupae are reddish-brown. After 7-14 days the adults emerge; males are about 1.3 mm long and females about 1.5 mm; wingspan is 1.3-1.7 mm. The adult is a small yellow and black fly, similar to other *Liriomyza* species (except that the eye is almost completely surrounded by yellow). From egg to adult is 2-3 weeks, depending on temperature.

Impact

The American serpentine leafminer is a major pest, causing much damage and loss of yield in vegetable crops and ornamentals. It has a wider host range compared to *Liriomyza sativae*. In the USA, considerable losses in celery have occurred as well as onion, and in Kenya it has become a major problem on chrysanthemums, with losses of overseas markets because of biosecurity concerns of importing countries.

Waterhouse and Norris mention that in Hawaii, *Liriomyza trifolii* has replaced *Liriomyza sativae* as a major pest, after its introduction in 1978, particularly on celery, chrysanthemum, lettuce and watermelon, possibly because it is less sensitive to spray programs.

Detection & inspection

Look for the white punctures on the top of the leaf, but especially look for the whitish mines. Look, too, for the frass which occurs at intervals on the inside of the mines, first on one side and then the other. Collect leaves or parts of leaves containing mines with maggots inside and place in plastic bags; breath into the bags to keep them full of air, and seal the opening. Remove the pupae to separate tubes containing sand or filter paper to await the emergence of the adults. All species of *Liriomyza* look similar and need to be examined by a taxonomist.



Photo 1. Characteristic white mines or trails of the vegetable leafminer, *Liriomyza sativae*, on the upper surface of watermelon leaves.

Management

The American serpentine leafminer is not usually a serious pest unless pesticides are used routinely for the control of other pests, which kill the natural enemies of the leafminer. When that happens, large populations of the leafminer occur, with serious consequences.

QUARANTINE

In general, once the vegetable leafminer has been introduced it is difficult to eradicate because of its wide host range, and the fact that it can survive on many weeds. In recent decades, the leafminer has become established in several Pacific island countries, associated with the trade in nursery plants, cut flowers and vegetables. However, there are some parts of the region yet free from the pest. These countries need to take special precautions to ensure that introduction of *Liriomyza trifolii* does not occur. *Liriomyza trifolii* is listed as an A2 quarantine pest by EPPO, the European Plant Protection Organisation - "a quarantine pest present in that area but not widely distributed there and being officially controlled".

NATURAL ENEMIES

There are a large number of natural enemies of leafminers, which under most situations provide effective control. However, many of the natural enemies have proved to be more susceptible to insecticides than leafminers. Consequently, when resistant strains of leafminers developed in response to over-use of insecticides natural enemies are insufficient to control them. The strategy, therefore, is to preserve natural enemies by monitoring leafminer numbers, knowing the numbers likely to cause damage, and by careful choice of insecticide, and the timing of applications.

The first step in any biological control program in a Pacific country with a *Liriomyza* problem is to find out the control that parasites can give in the absence of insecticides, then introduce parasitoids which are not present. A number of parasitoids, mainly minute species of wasps, are thought to have particular promise, these are: *Chrysocharis (parksii) oscinidis*, *Diglyphus begini* and *Diglyphus intermedius*. They have been introduced into Hawaii, and have established there.

Banacuniculus (Ganaspidium) utilis and *Chrysocharis oscinidis* were introduced into Tonga from Hawaii in 1988 after *Liriomyza trifolii* became an important pest of watermelon, pumpkin, tomato, bean and *Solanum* potato. More than 4000 individuals of both species were made at 11 locations from September to December that year. Both species became established.

CULTURAL CONTROL

A number of technologies have been used, often as part of IPM programs to control the leafminer, the most important of which is to restrict the use of pesticides. Do the following:

- Place yellow sticky traps above the crop to attract males, in particular, as they are more mobile and fly low between the plants.
- Clear weeds from around crops as the weeds act as alternative hosts of the leafminer.
- Make sure plants are not water stressed as healthy plants can better tolerate the leafminer.
- If practical, in screenhouses, sterilise the soil after outbreaks to destroy pupae.
- In commercial operations, use cold storage at 0°C for 1-2 weeks for crops undamaged by storage at low temperatures; this is not suitable for vegetables and ornamentals.

CHEMICAL CONTROL

The use of pesticides (organophosphates, carbamates and pyrethroids) for the control of leafminer pests that attack vegetables will kill their natural enemies, as well as selecting resistant leafminer strains. If used, they will make the situation worse. Instead, use these newly developed pesticides: cyromazine, an insect growth regulator, which affects the nervous system of larval stages; or abamectin, an insecticide containing chemicals from a soil bacterium.

When using a pesticide (or biopesticide), always wear protective clothing and follow the instructions on the product label, such as dosage, timing of application, and pre-harvest interval. Recommendations will vary with the crop and system of cultivation. Expert advice on the most appropriate pesticide to use should always be sought from local agricultural authorities.

AUTHOR Grahame Jackson

Information from Waterhouse DF, Norris KR (1987) *Biological Control Pacific Prospects*. Inkata Press, Melbourne; and CABI (2015) *Liriomyza trifolii (American serpentine leafminer)*. Crop Protection Compendium. (<https://www.cabi.org/cpc/datasheet/30965>); and Johnson MW (1993) Biological control of *Liriomyza* leafminers in the Pacific basin, Micronesia, Supplement 4, 81-92; and from Sooda A et al. (2017) Multiplex real-time PCR assay for the detection of three invasive leafminer species: *Liriomyza huidobrensis*, *L. sativae* and *L. trifolii* (Diptera: Agromyzidae). Photo 1 Sione Foliaki, Deputy Director and Head of Agricultural Research and Information Division, MAF, Tonga.

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