L. trifolii damage to chrysanthemum.

American serpentine leafminer: A threat to horticulture

The American serpentine leafminer *(Liriomyza trifolii)* is a small fly belonging to the family Agromyzidae. It infects plant species from 29 plant families including many vegetable, ornamental and legume crops. Currently, Australia remains free of this leafminer species but it is now well-established in nearby countries, including Indonesia. However, if the pest does establish in Australia, it could threaten our horticulture industry. AUSVEG Biosecurity Officer Madeleine Quirk reports.

The Research, Development and Extension program for control, eradication and preparedness for vegetable leafminer (MT16004) was developed in recognition of the extensive impact that vegetable leafminer (VLM; *Liriomyza sativae*) could have on the vegetable, nursery and melon industries if it were to move into production areas with no management plan in place. Project partners include Cesar, Plant Health Australia, Northern Australia Quarantine Strategy (NAQS), the University of Melbourne and AUSVEG.

The project has recently expanded to investigate two closely related leafminers, *Liriomyza trifolii* and *Liriomyza huidobrensis*. These pests have been recognised as potential threats to Australia's vegetable, nursery, melon, and potato industries, and neither species is present in Australia.

The following is an overview of *Liriomyza trifolii (L. trifolii)*, commonly known as the American serpentine leafminer, focusing on the pest's biology, distribution, effect on horticultural industries worldwide, and chemical and biological control strategies.

Pest overview

Adult *L. trifolii* can grow between 1-1.7 millimetres. The thorax and abdomen are grey/black with patchy yellow regions, while the head is completely yellow. Females will use their ovipositor (a tubular organ which can rasp through the leaf surface) to insert eggs just below the leaf surface that hatch between 2-5 days after being laid. Eggs are too small to be seen by the naked eye, so a seemingly healthy plant may be harbouring the pest without us knowing.

Inside the leaf tissue, colourless larvae grow to 3 mm, and as they move through three instar phases, the larvae become yellow-orange and exit the leaf at the third instar phase. Larvae pupate externally to the leaf, usually in the soil below the plant, from which adults emerge 7-14 days later.

The duration of *L. trifolii's* life cycle varies with temperature. At 28 degrees Celsius (°C), a single cycle can be achieved in 14-15 days. At lower temperatures, the cycle takes longer. Research has shown that adults will not feed or lay eggs at temperatures as low as 12°C.

L. trifolii larvae feeds internally on living plant tissue, particularly plant leaves, reducing photosynthetic activity and causing premature leaf drop. Unlike many other leafminers, the American serpentine leafminer is polyphagous (it has a broad host range from a number of families). It also has a high reproductive rate and has developed resistance to several classes of broad-spectrum insecticides.

Ornamental crops, legumes and vegetables are affected by the pest. Host families include Apiaceae (celery), Asteraceae (chrysanthemum, gerbera, lettuce), Brassicaceae (broccoli, cauliflower), Cucurbitaceae (cucumber, melon, pumpkin), Fabaceae (beans, lentils), and Solanaceae (potato, tomato, capsicum).

Damage from this pest reduces both marketability and crop yield, and has resulted in economic losses to growers globally. Examples include:

- Between US$18 and $21 million damage per year to Californian greenhouse ornamental growers in the early 1980s.
- $93 million in damage to the Californian chrysanthemum industry between 1981 and 1985.
- 80 per cent losses to celery growers in Florida in 1980, estimated at US$9 million.

Risk of spread and establishment in Australia

Major risk entry pathways for leafminers into Australia are by importation of infested ornamental host plants, cut

Adult American serpentine leafminer. Images courtesy of Central Science Laboratory, Harpenden, British Crown, Bugwood.org.

flowers, leafy vegetables and seedlings. Human-assisted entry can also occur, e.g. illegally on plant material.

Globally, *L. trifolii* dispersal and establishment has occurred rapidly, with populations found on most continents, including Europe, Asia, Africa, Central America, the Caribbean, North America, South America and Oceania (American Samoa, Guam, Fiji and Tonga). It has recently been identified in Indonesia. Movement of cut flowers and infested chrysanthemum cuttings have played a major role in the spread of *L. trifolii* from its original range in the Americas to other regions in the world.

While *L. trifolii* is not yet present in Australia, many horticultural production regions in Australia have climatic conditions similar to locations overseas where it has already established, and therefore could be at risk of establishment. It is a heat-tolerant species, meaning it will thrive in tropical locations, potentially tolerating temperatures near 35°C. It does not adapt as well to cool-climate regions as other leafminers, but it could maintain populations year-round in protected environments such as greenhouses.

Chemical and biological control

L. trifolii can rapidly develop resistance to various chemical groups, particularly organophosphates, carbamates, diamides and pyrethroids, which can make control difficult. Application of broad-spectrum insecticides often results in larger leafminer populations as these insecticides reduce the reservoir of natural enemies (parasitoid wasps as well as other generalist predators like spiders), which keep leafminer populations in check. Overseas, several insecticides are used for the control of *L. trifolii*, including but not limited to abamectin, azadirachtin, chlorantraniliprole, cyromyzine, indoxacarb, spinetoram and spinosad. Currently, Plant Health Australia (PHA) is seeking to obtain insecticide permits for control of *L. trifolii* and other *Liriomyza* leafminers in Australia as a preparedness measure for growers. PHA will be releasing a contingency plan in coming months, which includes further details on these applications.

Nevertheless, many species of parasitoid wasps have been recorded attacking the pest. MT16004 project partners from Cesar and the University of Melbourne are currently reviewing international literature to investigate the suite of parasitoids that attack *L. trifolii* worldwide, and they will cross-reference this list with those that already exist in Australia.

They have already identified possible parasitoid species for future control of *L. sativae* and have identified several wasp species attacking Torres Strait and Seisia populations. Some of these wasps are also found in other regions of Australia, which is promising for future management of vegetable leafminer. It is highly likely that the same, or similar, suite of parasitoids that might control *L. sativae* populations in Australia could also assist in potential control of *L. trifolii*.

Further Reading

- Capinera JL. 2017. American serpentine leafminer, *Liriomyza trifolii* (Burgess). University of Florida.

- Reitz SR, Gao Y & Lei Z. 2013. Insecticide use and the ecology of invasive Liriomyza leafminer management.

Find out more R&D

Any unusual plant pest should be reported immediately to the relevant state or territory agriculture agency through the Exotic Plant Pest Hotline (1800 084 881).

For further information, please contact AUSVEG's Extension and Engagement Team on 03 9882 0277 or email science@ausveg.com.au.

This project has been funded by Hort Innovation using the vegetable, nursery, melon and potato research and development levies and contributions from the Australian Government.

Project Number: MT16004

Hort Innovation