Serpentine leafminers (*Liriomyza huidobrensis*) could pose a serious threat to the potato industry if they were to establish in Australia.

Serpentine leafminer: A threat to the potato industry

Serpentine leafminers *(Liriomyza huidobrensis)* are small flies belonging to the family Agromyzidae. They seriously affect solanaceous crops (such as potato, tomato and eggplant), as well as crops in the Asteraceae, Cucurbitaceae and Fabaceae families. Currently, Australia remains free of this species of leafminer, which is now well established in nearby countries, including Indonesia. If the pest establishes itself in Australia, it could threaten the local potato 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 and nursery 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.

Project partners have since identified *Liriomyza huidobrensis*, commonly known as serpentine leafminer, as a pest that requires immediate further research and development of preparedness in case it establishes in Australia.

The following article addresses the leafminer's distribution, effect on potatoes, ability to resist chemicals, and establishment potential in Australia.

MT16004 is a strategic levy investment under the Hort Innovation Nursery and Vegetable Funds.

Leafminer identification

Adult serpentine leafminers range from 1.3-2.3mm in length, and females are slightly larger than males. Distinctive features include dark bristles on the head, brownish-yellow antennae with dark end segments, and dark side walls of each body segment.

Serpentine leafminer eggs are slightly translucent and off-white and are barely visible to the naked eye. Colourless larvae hatch from the eggs and turn pale yellow-orange. During later instars, the larvae turn solid yellow-orange. Larvae develop inside the leaf tissue and vary in size but they can reach up to 3.2mm in length. The larvae form irregular serpentine mines which tend to be restricted by veins and are generally found towards the base of the leaf. The third (final) instar larvae exit the leaf and pupate externally to the leaf, usually in the soil below the plant.

Worldwide distribution

The serpentine leafminer originated in the highlands of South America and is better adapted to cooler climates than VLM. It is now established in Africa, Asia, Central America, Europe and North America (in glasshouses in Canada, but not in the United States). Australia remains free from the serpentine leafminer, which is now well established in Indonesia (since 1995) and has been recorded in West Timor.

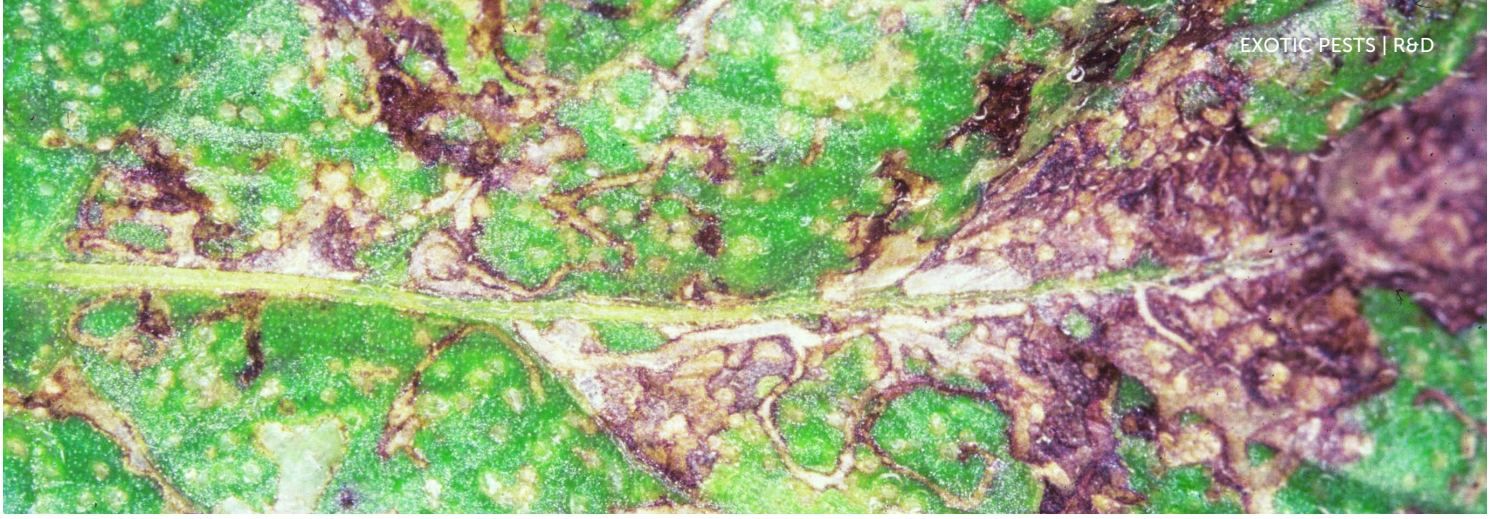
In California, *Liriomyza langei* was first described in 1951 and subsequently synonymised with *L. huidobrensis*. However, it was subsequently reinstated as a separate species in 2001. This polyphagous species can only be distinguished morphologically from *L. huidobrensis* with great difficulty, so molecular testing is required to differentiate the two species accurately.

Effect on potato industries worldwide

Worldwide, the serpentine leafminer is a serious pest of arable crops, vegetables and ornamental crops grown in glasshouses or in the field. Larvae tunnel inside the leaf tissue and create visible 'mines' on the leaf surface. Leaf mining reduces photosynthetic activity and can result in premature leaf drop. Plant damage is also caused by female flies using their ovipositor (a tubular organ which can rasp through the leaf surface to allow eggs to be laid inside the leaf tissue) to make feeding punctures as well as depositing eggs.

Serpentine leafminer damage reduces crop marketability and yield, resulting in economic losses to growers. In potatoes, feeding punctures are visible all over the plant as it grows. Initial infestation begins in the lower third of the plant, which eventually leads to necrosis in the above-ground plant tissue and subsequent defoliation. Larval damage is worse in a fully grown plant than a developing plant.

When the pest first became established in Indonesia, yield losses up to 70 per cent were recorded as farmers struggled to control the pest with conventional insecticides. A research paper compiled by Plant Health Australia (2009) highlighted Indonesia as a high-risk entry pathway for serpentine leafminer to Australia.



Liriomyza huidobrensis damage to a potato leaf. Image courtesy of Merle Shepard, Gerald R.Carner and P.A.C Ooi, Insects and their Natural Enemies Associated with Vegetables and Soybean in Southeast Asia, Bugwood.org.

Potato growers in South America, particularly in Peru, Bolivia, Brazil, Chile and Argentina, have experienced substantial potato yield loss due to serpentine leafminer. In Peru, yield losses varied between potato varieties and greater yield losses were seen in earlier maturing potatoes (up to 60 per cent) than later maturing potatoes (up to 30 per cent). In Argentina, potatoes were severely damaged during tuber bulking but the severity of damage varied between provinces.

Chemical and biological control

Translaminar insecticides such as abamectin, cyromazine, neem, and spinosad, which penetrate the leaves and subsequently contact the larvae, are effective for control of the serpentine leafminer.

However, serpentine leafminers can rapidly develop resistance to a number of chemical groups, particularly synthetic pyrethroids and organophosphates, which can make control extremely difficult. Applications of broad-spectrum insecticides often result in larger leafminer populations as the pesticide reduces natural enemies such as parasitic wasps and spiders. This was experienced in Costa Rica, where farmers over-applied chemicals in an attempt to contain leafminer populations on snow peas, and in Indonesia, where the majority of potato farmers sprayed insecticides twice weekly but were dissatisfied with the results.

Worldwide, many species of parasitoid wasps have been recorded attacking the serpentine leafminer. MT16004 project partners are currently finding a number of endemic Australian parasitoids attacking non-pest species of leafminers, which should be effective biological control agents for VLM. It is highly likely that the same suite of parasitoids in Australia will assist in the control of the serpentine leafminer.

Risk of spread and establishment in Australia

Serpentine leafminer is most likely to enter Australia through importation of infested ornamental host plants, cut flowers, leafy vegetables and seedlings. Invasion could also occur via wind, assistance from humans or illegally on plant material. Unhatched eggs pose the most risk as they are difficult to detect in visual inspections.

Dispersal and establishment of leafminer species has occurred rapidly across the globe and the serpentine leafminer has become a destructive pest of potatoes in some, but not all potato growing areas where it is found. In China, the serpentine leafminer moved through 27 provinces over a six-year period, covering more than 394,000km². If the serpentine leafminer were to become established in Australia without control mechanisms in place, it would have a significant effect on horticultural production.

VLM was detected on multiple islands across the Torres Strait between 2008 and 2015. VLM was then detected on the most northerly point of the Australian mainland, Cape York Peninsula, in 2015.

Scientific literature suggests that this same pathway is a high-risk entry pathway for the serpentine leafminer, reaffirming the need to increase industry efforts to be aware of and to prepare for this pest.

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.

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Hort Innovation

Further reading

The invasive Liriomyza huidobrensis (Diptera: Agromyzidae): understanding its pest status and management globally – Weintraub PG et al. 2017. Journal of Insect Science 17 (1), 28 https://academic.oup.com/jinsectscience/article/17/1/28/3051723

Threat Specific Contingency Plan – Serpentine leafminer Liriomyza huidobrensis – Plant Health Australia (2009) http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Serpentine-leaf-miner-CP-2009.pdf