Managing Leaf Beetles in Production Nurseries

Leaf beetles (family Chrysomelidae) are one of the most commonly encountered beetles feeding on plants. Both adults and larvae feed externally on foliage, flowers, pollen and occasionally on or in seed pods. Larvae of some species feed on roots or internally within stems and leaves (leaf mines). There are over 30,000 species described worldwide, and over 2,000 species known in Australia that occur within 10 sub-families. Some of these have more specific common names including tortoise beetles, spiny leaf beetles, shining leaf beetles, cylindrical leaf beetles, leaf monkey beetles, kangaroo beetles and flea beetles. Across these groups there are a number of commonly known pests, e.g. elm leaf beetle, monolepta beetle, pumpkin beetle and orchid beetle.

Mating pumpkin beetles on zucchini

APPEARANCE

Adult leaf beetles are small to medium sized insects (4–15mm) with varied body shapes across the groups. The most common leaf beetles are circular to oval in shape with a strongly domed back. Other species have bodies that are relatively long and narrow; some species that jump have strongly developed hind legs. They can be brightly coloured with stripes or patterns of red, yellow, orange or green; adults can also be shades of white, grey or black and some species may be iridescent. Antennae are usually less than half the body length and are most often cylindrical, being the same narrow width from end to end, sometimes with slight broadening towards the apex (furthest away from the body). Like all beetles, leaf beetles have mandibles for chewing their food.

FURTHER READING:

Hangay G. and Zborowski P. (2010) *A Guide to the Beetles of Australia*. CSIRO Publishing. Collingwood, Victoria.

Brisbaneinsects.com has many pictures of leaf beetles and other insects.

Hort Innovation Strategic levy investment | NURSERY FUND

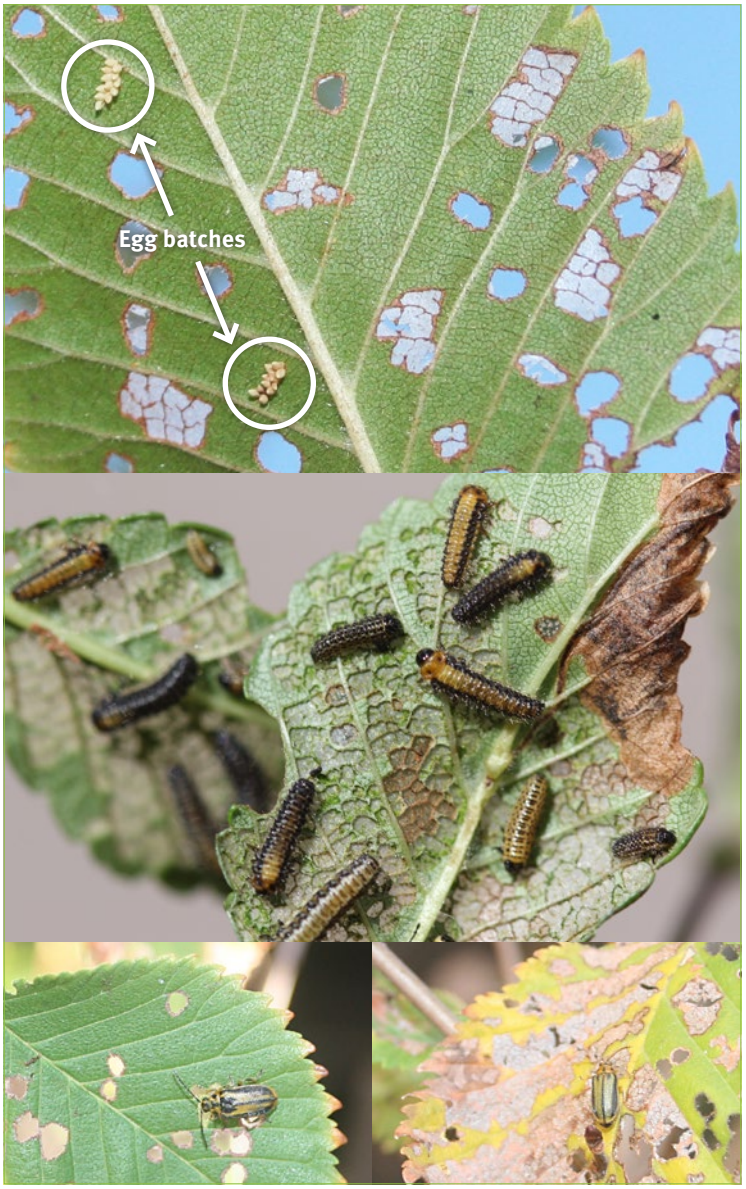
Nursery & Garden Industry Australia

Queensland Government

Eggs are laid singly or in groups, often on foliage or stems. Eggs may be laid flat or upright, loose or tightly packed or even appearing like a bunch of flowers. They are most often orange to yellow and ovoid in shape, similar in appearance to ladybird beetle eggs.

Larvae are also variable in appearance but commonly appear similar to short, relatively squat caterpillars (without prolegs), i.e. they are roughly jelly bean to chipolata shaped. Most species that live on foliage have strongly developed legs, but species that live internally may have reduced legs or may be completely legless. Larvae are rarely brightly coloured and are often shades of white, cream, brown or black; some species may have orange or yellow colouration. Their bodies often have a speckled appearance with black dots on each segment down their body. Most species have a relatively dark, highly sclerotized head, which is most often black or brown in colour. Some species carry their excreta on their back in a liquid to slime-goo ball or amorphous glob that is often black to yellow in colour. This practice may assist in concealment from predators as larvae may not look like insects at all. Like adults, larvae have mandibles.

Pupae are similar in appearance to larvae, but are relatively short and stumpy compared to large larvae. Pupae are immobile and do not feed. Pupation may occur on foliage, within leaves or stems or in the soil.



Lifecycle of elm leaf beetle, *Xanthogaleruca luteola*. Egg batches (top image) and larvae (centre image). Natural variation in adult colouration (below), pupae not shown. Photo of larvae by Whitney Cranshaw, Colorado State University, Bugwood.org

DAMAGE

All leaf beetles have chewing mouthparts, most of which remove foliage. Small larvae feeding externally on foliage tend to skeletonise the leaf; the lamina remains giving a window-like effect. Relatively large larvae and adults remove foliage entirely. Small larvae tend to feed on young, soft foliage. When this is no longer available they move to older leaves. About 90% of damage caused by leaf beetles is done by large larvae (3rd or 4th instar). Large larvae may feed in groups or individually and can consume large amounts of foliage. When present in large numbers they can completely defoliate a plant and reduce growth substantially. A single defoliation event normally does not kill a tree, however successive defoliations can cause the death of established trees.

Species with leaf mining larvae may produce long windy mines, typical of many flies and other insects, or blotch mines, where larvae feed in a specific region that gets progressively larger as the individual gets bigger. Leaf mining species are relatively uncommon, making up about 1–2% of species in this family. Similarly, a small number of species have stem boring larvae that cause damage typical to that of other stem borers, i.e. wilting of stems. A relatively small proportion of larvae feed on roots and tubers, but can be common in some tropical forests. Root feeding species that build into large numbers on nursery stock are likely to reduce growth rates and generally, vigour, probably making plants more susceptible to root pathogen infection.

Adults tend to feed on mature foliage singly, scalloping the edges of leaves. Damage from adults is not as severe as from large larvae, but can cause plants to appear tattered and unthrifty.

HOST RANGE

Most leaf beetles feed on species from one plant genus or perhaps from a few genera within a family. Relatively few leaf beetles feed on plants from multiple families. The adults of many Australian species of leaf beetles feed on angiosperms, with a large number feeding on species of *Eucalyptus* and *Acacia*. Some species are severe and common forestry pests, such as *Paropsis* spp. and *Chrysophtharta* spp.

Seed feeding chrysomelids tend to feed on seeds or seed pods of Leguminosae, Palmaceae and Convolvulaceae. Tortoise beetles most often feed on Convolvulaceae. Spiny leaf beetles mainly feed on monocots and sometimes *Acacia*. Shining leaf beetles are most often associated with monocots (particularly grasses and orchids), but some feed on species of Solanaceae and Cycadaceae. Monolepta leaf beetles probably have the most diverse host range, potentially feeding on a wide range of fruit, vegetable and nursery stock plants, particularly *Syzygium* species.

Tortoise beetle adult (above) and larva with excreta carried on its back (below). Both photos by David Cappaert, Bugwood.org

BIOLOGY

The lifecycle of leaf beetles is quite varied. Some species may have only one or two generations per year, particularly in cooler climates. Other species may have three to four generations during warmer months and some species in the tropics may have continuous lifecycles. For species that have an inactive period over cooler months, the most common overwintering stages are as adults (e.g. elm leaf beetle) or as eggs. Eggs are normally laid on foliage, on stems or trunks of trees or in the soil. Eggs may only take 5–10 days to hatch. As indicated above, larvae feed on foliage, flowers, roots or within stems, depending on the species. Larvae normally have four stages to complete their development and this may take two to three weeks under good conditions. Some larvae remain on foliage their entire development period, others are nocturnal, feeding on foliage only at night and remaining in the soil or leaf litter during the day.

When larvae are ready to pupate they may burrow into the ground or remain on the foliage. Pupal development often only takes one to two weeks, depending upon the species and environmental conditions. Adults may take a few days before they become reproductively active. Adults may remain on foliage during the day or may be nocturnal. The entire lifecycle may take between one to three months, depending on the species and environmental conditions.

Given the diversity of lifecycles within this group of beetles it is often helpful to identify the species. This may assist in gathering information on when it is likely to be active, the number of generations per year and where each life stage occurs (i.e. where eggs are laid, pupation occurs, etc.). This information can help to break the lifecycle of the pest in a nursery setting.

Leaf beetle damage of *Syzygium* by *Monolepta* sp. (left), probably *M. rubrofasciata* (right).

MANAGEMENT

One or a small number of insects are unlikely to cause major problems, but increasing populations of larvae may require intervention to stop economic damage. Monitor plants during critical seasons that are known to receive economic damage, typically spring, summer and autumn. Look for eggs, larvae, adults and their damage to assess if populations are increasing or otherwise likely to cause significant damage. If possible, determine how individuals are likely to be entering the nursery. For example monolepta beetles can build up to large numbers in natural bushland and then enter the nursery in large numbers, defoliating plants in days or hours. Under these circumstances, there are few options except applying an insecticide immediately upon detecting the population.

A range of cultural practices may reduce damage in production nurseries including using varieties that are relatively resistant, moving susceptible varieties to an insect proof protected cropping environment, encouraging predators in the nursery that may feed on beetles, modifying the times that the plant is grown such that it does not overlap with the pest, remove overwintering sites that may serve as shelter and food for beetle populations and maintaining optimal growing conditions to promote strong plant health and growth. If required, unsightly growth can be pruned out.

Once a population is detected that is likely to cause damage to a crop line there are very few options to reduce the population other than applying pesticides. Commercially available biological control agents are not known to manage leaf beetle larvae. There are only a few active ingredients that are registered against leaf beetles suitable for use in production nurseries. These include dimethoate (1B), maldison (1B – on eucalypts, natives and cucurbits only), carbaryl (1A – pumpkin beetle only) and spinetoram (5 – against pyrgo beetle on melaleuca only). Group 1A and 1B products are very broad spectrum with a relatively long residual and will cause mortality to many insect pests and predatory species. Furthermore, some 1B products may become unavailable following a review of this group of insecticides by the APVMA.

Where the beetle larvae reside in the soil or growing media during the day and crawl up trunks at night to feed, it may be possible to apply the pesticide to the trunks of trees. This method uses less product and is more likely to preserve beneficial insects. It is recommended to test this approach for the species in question to ensure that it is economically viable.

BIOSECURITY

There are numerous leaf beetles that are exotic to Australia that are serious pests of particular plant species. In particular, Colorado potato beetle feeds on many solanaceous crops causing defoliation and leaving a sticky black excrement over the plant. Many other species do not occur in Australia. If you observe a beetle that you suspect is an exotic species, call the **Exotic Plant Pest Hotline** on **1800 084 881** and or submit a sample to a diagnostic laboratory for identification.

Colorado potato beetle adults (right individuals) and larva (left most individual). This species is not known to occur in Australia. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org

Flea beetle damage on baby beetroot (left) and close up of flea beetle (right).

This document was prepared by Andrew Manners (Agri-science Queensland, Department of Agriculture and Fisheries, Ecosciences Precinct, GPO Box 267, Brisbane QLD 4001) as part of the nursery levy and Hort. Innovation funded project Building the resilience and on-farm biosecurity capacity of the Australian production nursery industry (NY15002) in 2017. Thanks also go to John Duff and Lindy Coates for assistance in preparing this fact sheet. All photos by DAF, unless otherwise stated.