High activity of noctuid caterpillars in Rubus

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This article provides an update on some of the work being carried out as part of the strategic levy investment project 'Integrated pest management approaches to address pest challenges in raspberry and blackberry (RB21000)' which is part of the Hort Innovation Raspberry and Blackberry Fund.

- During spring to late summer, noctuid caterpillars can cause substantial crop damage and are becoming more common across subtropical growing regions in eastern Australia
- The moth larvae can cause extensive feeding damage over a range of crop phenological stages, from vegetative growth to fruit ripening in berries
- Amongst the caterpillars impacting Rubus production in subtropical areas, *Helicoverpa armigera*, *Helicoverpa punctigera*, and *Spodoptera litura* remain the most challenging to manage

The cotton bollworm or corn earworm, *Helicoverpa armigera* (Lepidoptera: Noctuidae) is an Australia-wide pest of many field and horticultural crops including cotton, sorghum, maize, chickpea and fruiting vegetables. They are more prevalent in northern New South Wales Rubus growing areas from spring to late summer. Increased larval activity in spring and summer is triggered by warmer conditions as local populations that overwintered in surrounding winter crops or weeds surface.

Larvae has been documented to cause damage at all stages of Rubus growth. After hatching, the caterpillar crawls along the plant, feeding on tender tissues such as plant tips, buds, flowers, and fruit. Larvae are at their most economically damaging when they feed on reproductive parts of plants.

There can be substantial variations in larval colour including shades of brown, green and orange. Larvae have darkish stripes along the body with a darker pigment 'saddle' on the 4th body segment and have a sharp downward angling at the end of the body. Caterpillars have white hairs around the head (Figure 1).

Monitoring of adult moths in early spring can be performed using commercially available pheromone lure in bucket traps. In addition, routine scouting of eggs and larvae is required to assess the pest pressure throughout the growing season.

Given this species is known to have developed high levels of resistance to several groups of insecticides, integrated management incorporating biological and cultural options needs to be prioritised.

There are a wide range of predators and parasitoids that can manage immature stages of the *Helicoverpa* life cycle. *Helicoverpa armigera* adult population can also be managed deploying Attract-and-kill formulations such as Magnet® (currently NOT registered for use in berries at time of publication) in area-wide management programs.

The native budworm, *Helicoverpa punctigera* (Lepidoptera: Noctuidae) is a native and widespread lepidopteran pest of pulse and oilseed crops. While they are known to attack a wider range of broadleaf plants such as field peas, faba beans, lentils, chickpeas, lupins, soybeans, canola etc.,

Figure 1. *Helicoverpa* larvae feeding on vegetative and reproductive parts of raspberry crop. Note the variations in larval colour and the darker pigment 'saddle' on the 4th body segment on the example to the right
Photo credit: Costa Berries

over recent years they have become more common in raspberries during spring to summer. In winter, the migratory budworm moths undergo breeding on native flowering desert plants in arid inlands. As soon as the inland vegetations dry off in late winter or early spring, moths initiate their migratory flights into northerly or north-westerly warm winds and end up in nearby or distant cropping areas. As the weather warms up larval activity increases and ceases when temperatures drop below about 12°C. The impact of budworm damage becomes more significant as caterpillars start feeding on flower buds and young fruits.

Usually, female moths lay white spherical eggs singularly near the growth points of the plant. Similar to *Helicoverpa armigera*, *Helicoverpa punctigera* caterpillars can have variable shades of brown, green and orange as well as darkish stripes along the body. One distinguishing feature of Helicoverpa larvae is the sharp downward angling at the end of the body. Unlike Helicoverpa armigera, larvae of native budworm have black hairs around the head and do not have any pigmented saddle (Figure 2).

There is also a pheromone lure commercially available for *Helicoverpa punctigera* which attracts male moths. The use of this pheromone in a bucket trap can detect their migration from inland regions.

There are a wider range of natural enemies including Trichogramma ivalae, ladybird beetles, lacewings, shield bugs, damsel bugs, assassin bugs, and tachinid flies that can manage native budworm at early stages. Also, use of biological insecticides such Bt (*Bacillus thuringiensis*) and nuclear polyhedrosis virus (NPV) based commercial formulations can be effective in managing young larvae.

Cluster caterpillar, *Spodoptera litura* (Lepidoptera: Noctuidae) is an armyworm species prevalent in tropical and coastal regions with a wide host range including cotton, legumes, brassicas, diverse horticultural crops, and broadleaf weeds. Young larvae have been found to voraciously feed on the leaf surface whereas older larvae can cause significant damage to flowers, buds, and fruits in Rubus during early summer.

Figure 2. Native budworm larva with black hairs around the head (no pigmented saddle)
Photo credit: Andrew Weeks, Cesar Australia

Spodoptera litura is named for the mass 'clustering' of its young larvae, which initially feed close to the hatched egg mass. Like other *Spodoptera*, cluster caterpillar has 3 distinct thin pale lines running along the body. Larger larvae have distinctive rows of dark half-moons and spots along the body. Medium cluster caterpillars often have darker pigment on the fourth segment behind the head, which disappears in the fully grown larvae.

Unlike *Helicoverpa*, cluster caterpillars are hairless and have an inverted pale 'Y' visible on their head capsule. Adult female lays eggs on leaf surfaces in a cluster usually containing several hundred eggs. Larvae emerge 2–3 days after egg laying. Younger larvae are mostly lighter green while older ones turn dark green or brown (Figure 3).

Adult *Spodoptera litura* moth can be monitored using commercially available cluster caterpillar pheromone lure in a plastic delta/bucket trap. In addition, scouting of egg masses and clusters of young larvae in crop is advisable prior to making pest management decisions. There are a range of generalist predators and parasitoids that are known to keep caterpillar population at low levels.

While commercially available biopesticide including NPVs can manage *Helicoverpa* efficiently, such impact is not applicable to *Spodoptera* species. There are synthetic products registered on the APVMA database for use against this caterpillar in Australia.

Fall armyworm (FAW) *Spodoptera frugiperda* (Lepidoptera: Noctuidae) is another highly polyphagous insect native to tropical and sub-tropical areas of the Americas that arrived on the Australian mainland in 2020. Following the initial detection in Far North Queensland, it was soon found infesting grass crops including corn throughout northern Australia and then began spreading southward.

The adult moths are a migratory pest capable of flying hundreds of kilometres on storm fronts. While FAW is expected to be present year-round in warmer areas, local populations may build up in other regions with seasonal warm weather. Young caterpillars feed on the leaf surface, creating pinholes and windows in leaf tissue, and thereby reduce leaf biomass significantly. Mature larvae can feed on roots and reproductive structures including flower buds.

Figure 3. Cluster caterpillar feeding on young raspberry crop in north coast NSW. Photo credit: Costa Berries

FAW is known to feed on a wide host range of more than 350 plant species including maize, cotton, rice, sorghum, sugarcane, wheat and many other vegetable and fruit crops. In the past four years after the initial invasion, the preferred hosts of fall armyworm have continued to be grass crops especially corn (maize and sweet corn). However, FAW larvae have been found in many other broadleaf horticultural crops. More importantly, during early autumn this year on the mid north coast, FAW larvae were observed to attack raspberry seedlings by feeding on the new shoot growth. The impact of FAW on berry industries has yet to be estimated (Figure 4).

Figure 4. FAW larvae found in Raspberry nursery in north coast NSW. Photo credit: Costa Berries

Figure 5. FAW egg mass (Left) FAW larvae head with an upside-down pale Y-shaped marking (Centre). Adult FAW trapping with bucket pheromone traps (Right). Photo credits: James Castner, University of Florida and Queensland Department of Agriculture and Fisheries

A female moth can lay up to 1,000 eggs. FAW eggs resemble those of other *Spodoptera* species, but newly hatched larvae disperse on silken threads (ballooning) whereas cluster caterpillar (*Spodoptera litura*) congregate near the hatched egg mass. Mature FAW larvae have a dark head with an upside-down pale Y-shaped marking as well as four black dots in a square pattern on the second last segment. Additionally, it has raised spots arranged in lines (end segments) and in trapeze (middle segments). Unlike *H. armigera*, the 'saddle' (dark marking behind the head) is absent in FAW.

Adult moths can be monitored with a delta pheromone trap that serves as an early warning for potential egg lays of FAW, and as an indication of pest pressure during the season. In-crop scouting is required to accurately assess the presence of FAW larvae (Figure 5).

Several natural enemies including egg parasitoids *Trichogramma pretiosum*, *Telenomus remus* and larval parasitoids Cotesia species have been reported to attack FAW.

Chemical treatment permits for FAW in berries are available through the Australian Pesticides and Veterinary Medicines Authority (APVMA). Complete a Permit search at portal.apvma.gov.au/pubcris for 'Fall armyworm' to identify permitted products for Minor Use in Rubus crops.

Further reading:

1. NSW Department of Primary Industries, Fall armywormavailable online via www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/fall-armyworm
2. Simpson M., Leongz G. (2023). Berry plant protection guide. NSW Department of Primary Industries available online via the Resource Library berries.net.au/resource-library/