Department of Primary Industries
primefact

Fruit spotting bug in macadamia

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Fruit spotting bug (FSB) has become the most significant macadamia pest since an effective biological control option was established for macadamia nut borer. The macadamia industry benchmark report (Project MC18002) has continually shown that late FSB damage is consistently the primary reason for nuts being rejected at factory stage.

Risk period

Table 1. The peak risk period for fruit spotting bugs is from peak flowering to harvest.

Pre-flowering	Early flowering	Peak flowering	Nut set	Pea size nut and spring flush	Shell hardening to harvest	Harvest to pre-flowering

Two types of FSB are known in Australia; *Amblypelta nitida Stål* (*A. nitida*) and *Amblypelta lutescens lutescens* (*A. lutescens*). Both feed on macadamia fruit and flowers and have multiple host plant species (Table 2). *A. nitida* is prevalent in Northern NSW and South East Queensland, while *Amblypelta lutescens* can be found from the Queensland border through to Cape York (Figure 1).

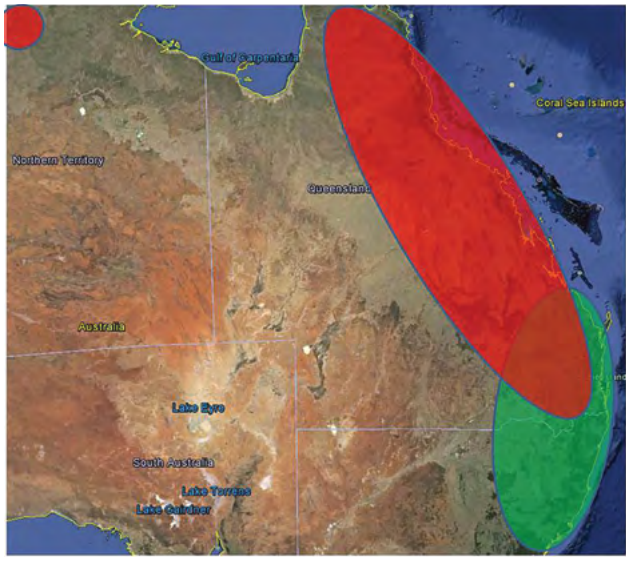

Figure 1. Fruit spotting bug distribution in Australia. Green shows where *A. nitida* is found and red *A. lutescens*.

Life cycle

Fruit spotting bugs pass through 3–4 generations a year; one in spring, one or two in summer and one in autumn (Figure 2–Figure 6). Adults from the autumn generation survive the winter to begin a new generation in spring.

Table 2. Types of fruit spotting bug in Australia.

Species	*Amblypelta nitida Stål*	*Amblypelta lutescens lutescens*
Distribution	From 17°S to 35°S (Figure 1)	From 11°S to 27°S (Figure 1)
Number of host plant species	56	111
Diet	Feeds only on fruit and flowers	Generally feeds on fruit, shoots and flowers, although rarely on macadamia shoots
Days to develop from egg to adult at 20 °C	63	79
Days to develop from egg to adult at 25 °C	45	50

Figure 2. *Amblypelta nitida* 1st instar stage.
Photo: Alana Govender.

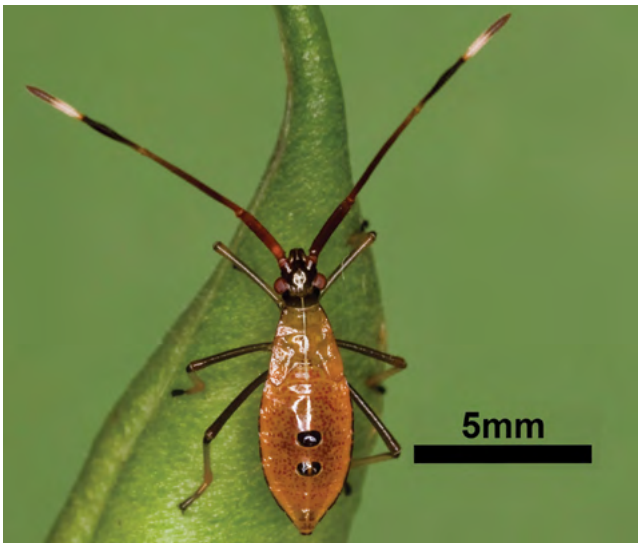

Figure 3. *Amblypelta nitida* 4th instar stage.
Photo: Alana Govender.

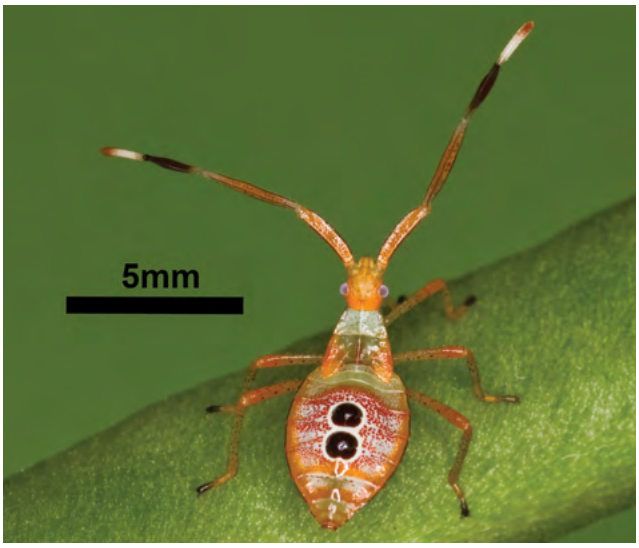

Figure 4. *Amblypelta lutescens* 4th instar stage.
Photo: Alana Govender.

Figure 5. *Amblypelta nitida* 5th instar stage.
Photo: Alana Govender.

Figure 6. *Amblypelta nitida* adult stage.
Photo: Alana Govender.

Damage to macadamia nuts

Very young fruit (generally up to pea size) falls within a few days of a FSB attack, some with visible external symptoms such as slightly sunken black spots. Dissecting the fruit will confirm the lesions are from FSB feeding. Fallen nutlet counts in October and November are the key monitoring tool crop scouts use to inform spray recommendations; the spray threshold being 3% of nuts falling.

As the nuts mature later in the season (December onwards), they are less likely to fall once stung, but they will be unmarketable. Nuts of all sizes and maturity levels can be damaged, although less frequently after shell hardening in January. Recent investigations by the NSW DPI entomology team has shown damage kernel from FSB feeding right up to May. Damage is visible as dark, slightly sunken spots on the husk, collapsed testa while it is soft, and misshapen, brown and shrivelled translucent kernels. Further damage can be caused by secondary disease from organisms spread by FSB (Ironside 1981; Fay 2002).

Monitoring

Regular FSB monitoring is essential but is not always easy because:

- they are very mobile, tending to move around in the top half of trees
- they are shy and do not congregate in large numbers
- a small number can cause significant damage
- they lay eggs singularly

Key steps in effective monitoring include:

- identifying FSB entry points and natural harbours
- monitoring bordering vegetation
- identifying hotspots in the crop (FSB often return to a damaged tree repeatedly)

Identifying hotspots in monitoring:

- check at least 10 trees in hotspots and 20 trees in other areas
- understand the timing and methods for monitoring, for example, when searching for fresh FSB damage:
  - start when small pea-size nuts start dropping in October
  - after the initial nutlet shedding, dissect 10 fresh green fallen nuts per tree and check for sting lesions in the husk and shell (Figure 7)
  - identify other insect damage e.g. macadamia nut borer, macadamia seed weevil (Figure 8), leptocoris and green vegetable bug
  - repeat fortnightly until nut drop stops in December
  - late damage is difficult to detect as the nuts remain in the trees.

Fallen nuts need to be checked for fresh damage from early in the season until mid-December. However, this ceases to be an accurate indicator of recent activity the further into the season you measure. Activity after the shell hardens from January onwards, particularly on the thinner shelled varieties (e.g. A4, 849), is hard to detect from the ground and if unchecked, can be very costly.

When monitoring nut drop in spring, it is important to recognise and distinguish the common causes of nut drop, including macadamia seed weevil, macadamia nut borer and fruit spotting bug feeding (Figure 8).

Figure 7. Checking for sting lesions in husk and shell.

Figure 8. Common causes of nut drop include macadamia seed weevil (top left), macadamia nut borer (top right) and fruit spotting bug feeding (bottom).

Using a trap crop

Trap crop hedges are being used commercially for FSB monitoring. A trap crop is a species planted in a hedge next to the macadamia crop that also attracts FSB. One of the best trap crop species is *Murraya paniculata*, or mock orange. Other proven species include *Macadamia ternifolia* and *M. longan*. These species have been found to be very effective in predicting FSB movements.

Trap crop monitoring aims to predict when adult bugs start moving into an orchard. Ideally a grower can then time their spray accordingly, thus limiting production losses with well timed and informed spray decisions.

During spring, a FSB hotspot will appear in the trap crop before the macadamia crop. The FSB stay in the hedge once feeding starts and monitoring should detect a build-up of large 5th instar nymphs (Figure 5). These are almost adult size, with black antennae, black 'knees' and only wing buds rather than fully expanded wings.

Adult FSB (Figure 6) fly from the trap crop to the macadamia crop approximately 10–14 days after 30% of the bugs reach the 5th instar nymph stage. This is the optimal time to spray for the first FSB wave of the season. The hedge should be continually monitored for the next generation to emerge.

Control options

Cultural controls

To reduce the risk and damage from FSB:

- select appropriate varieties (avoiding thin-shelled macadamia varieties)
- reduce tree heights to improve spray coverage
- reduce canopy density by selective limb removal or new growing systems
- reduce tree density (tree removal)
- reduce out of season flowering effects
- use cover crops in the inter-row
- improve bordering alternate FSB host vegetation management.

Biological controls

Use cover crops in the inter-row to provide habitat for natural enemies of FSB, such as:

- egg parasitoids: *Anastatus* sp. near pentatomidivorus (Eupelmidae), *Ooencyrtus caurus* (Encyrtidae), *Gryon* sp. (Scelionidae) and *Centrodora darwini* (Aphelinidae)
- nymph and adult parasitoids include the tachinid fly, *Trichopoda giacomellii*
- predators: spiders, e.g. *Ocrusiona* sp., ants, e.g. green tree ant *Oecophylla smaragdina*, Pheidole sp., predatory bugs, e.g. assassin bug *Pristhesancus papuensis*, and lacewings, e.g. brown lacewing *Micromus tasmaniae*.

Chemical control

Future strategies will incorporate an integrated pest management (IPM) approach using cultural, biological and chemical controls based on monitoring using trap cropping, pheromone traps and potentially top of tree monitoring through drone images. Eventually area-wide management programs that reduce populations on a district basis will be developed.

The transition to IPM approaches will reshape chemical control practices through:

- using chemicals appropriately to reduce off-target effects
- using less broad-spectrum chemicals and having available more targeted pesticides that are safer on beneficial insects
- spraying hotspots to target problem areas
- leaving unsprayed refuges in the crop
- improving timing to minimise the need for repeat sprays.

References

Fay HAC. 2002. Fruit piercing moths and fruit spotting bugs: Intractable pests of tree fruits in a reduced-insecticide environment. Proceedings of the International Symposium on Tropical and Subtropical Fruits. *Acta Horticulturae* 575, 485–493.

Ironside DA. 1981. *Insect pests of macadamias in Queensland*, Queensland Department of Primary Industries, Brisbane.

Reference number: PUB20/776.