

SIGASTUS WEEVIL UPDATE

Part I: Life cycle and monitoring keys to control

Jeremy Bright, NSW Department of Primary Industries

This information sheet by Jeremy Bright outlines what we know about *Sigastus* weevil and how to control it.

***Sigastus* weevil, sometimes called macadamia seed weevil, is a pest that infests macadamia orchards.**

So far, serious infestations of *Sigastus* weevil have been confined to the NSW Northern Rivers and North Queensland. This article outlines the latest information on monitoring and controlling *Sigastus* and how to prevent its spread to other macadamia-growing regions.

Life cycle

Calendar sprays and poorly timed cultural practices to reduce carryover populations are unlikely to be effective. The key to control is better understanding the *Sigastus* life cycle. Armed with this knowledge, growers can manage the pest with just two strategic spray applications per season.

Two features of the *Sigastus* life cycle that need to be considered in timing control measures are:

- Females lay about 20 eggs per week. This is the equivalent of 280 eggs in a lifetime.
- Half of the emerging adult weevils will survive for around 100 days. Some have been known to live for over a year.

Monitoring *Sigastus* weevil

Understanding the life cycle of the weevil in your orchard is the key to identifying when to spray to eliminate the residual egg lay in fallen nut. It is best

to do this in consultation with a professional pest scout, who will help you establish where your *Sigastus* population is at. This assumes that you spray when there are signs of *Sigastus* lay and fruit spotting bug damage at pea size nut drop (typically November in the Northern Rivers of NSW). This also assumes that you achieve good spray coverage of your crop.

The recommended procedure for monitoring *Sigastus* population growth is as follows:

1. After spraying for *Sigastus* weevil, collect freshly fallen nuts (up to two weeks after application).
2. Place nuts in a plastic container in the shade with mosquito netting or gauze on top.
3. Watch for the emergence of weevils.

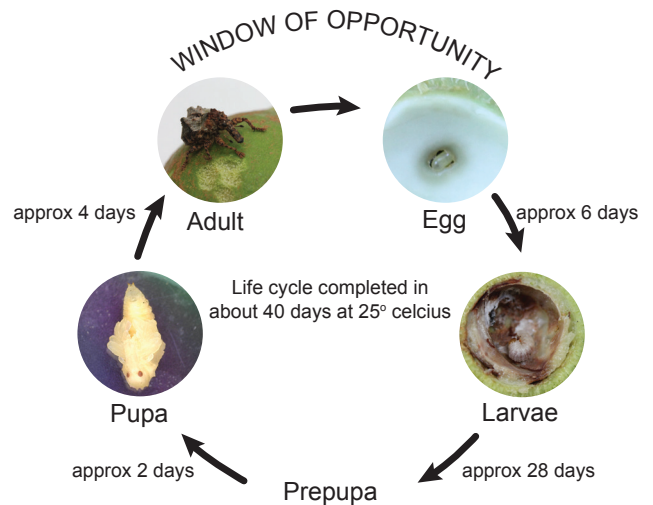


Figure 1. Estimated life-cycle for *Sigastus* weevil. The window of opportunity depicts critical stages of the weevil's lifecycle where growers have control over reducing population numbers through correctly timed chemical and cultural practices.



Sigastus lays its egg on chewed patch of husk.



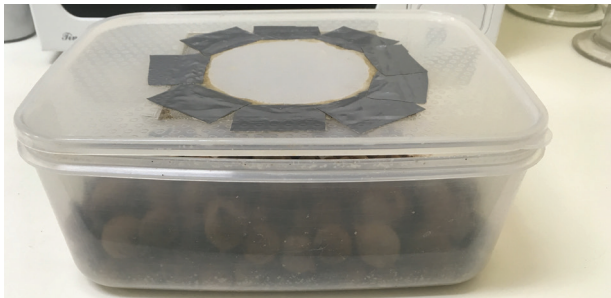
Typical mark left by *Sigastus* weevil indicates egg laying.

4. Check the rate of emergence each day and record the proportion of weevils that hatch and how many days it takes them to develop (this proportion matches the stage of development of the pest in the orchard). When hatchings in the container reach a peak, that is, when a high percentage of the weevils emerge within a 24-hour period, this signals it is time to spray the orchard.

When you clean up the orchard is also important. Remove and destroy fallen infested nuts within two weeks of spray application.

You should then spray again about 40 days later to control any weevils that escaped the clean-up (see Figure 2). Note that this is not a prescription and that peak emergence from the lunchbox is what you should use to guide timing of the second spray.

Coverage is key for this system to work at its best. Also, note the critical time for pre-generation clean-up, pre-harvest clean up and spray applications.



A lunchbox with gauze over a hole in the lid is used to monitor *Sigastus weevil* populations collected from the field.

Follow recommended control programs

The APVMA has issued a permit for acephate (PER81463) for *Sigastus weevil* in macadamias.

It is important that growers use acephate at a time when it is most effective against fruit spotting bug and *Sigastus weevil* when nuts have developed to pea size (10 mm in diameter).

Before this, it is crucial that you have completed an orchard floor clean up. Once the orchard floor is cleaned and spray applied, it will be about 40 days until the next spray is required (note that this is not a prescription and that peak emergence from the lunchbox is what you should use to guide timing of the second spray). After this time, the shell has hardened and the weevil can no longer enter the shell.

Always monitor

The window of opportunity to control *Sigastus* will change from season to season so it is crucial to monitor and collect populations.

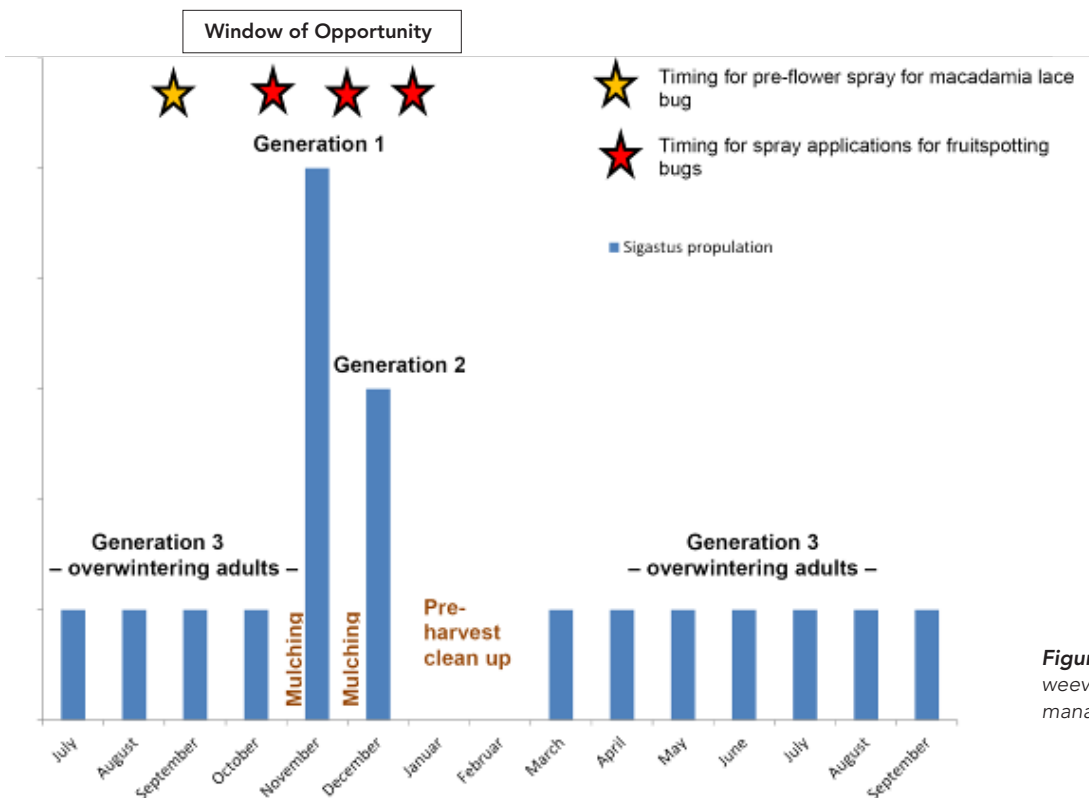


Figure 2. Seasonal *Sigastus weevil* presence and management approaches

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Part 2: Orchard management for Sigastus weevil

An integrated approach to Sigastus weevil control is the most effective way to manage the pest in the long term. The timely use of cultural controls to minimise the population at the beginning of the season can reduce the reliance on chemicals at a later stage. Also important is knowing the key factors that contribute to high Sigastus populations. At least five have been identified, as follows:

1. Out-of-season flowering and nut set
2. Inadequate spray coverage
3. Neglected orchards
4. Poor management of orchard floor
5. Alternate host (not yet known).

While growers do not have control over some aspects of these factors, it is important to identify and put into place actions that can help reduce the potential for high Sigastus populations developing. Key actions are as follows:

Factor. Out-of-season flowering and nut set (limited control)

Sigastus weevil populations appear to become high when flowering season is extended, resulting in out-of-season nut set. Small, soft shell, out-of-season nuts allow the weevil to lay its eggs and build up in numbers. Continual out-of-season flowering can create a very high base population of Sigastus weevil.

While growers have limited control over lace bugs, they can help by reducing out-of-season flower and not allowing nut to reach the minimal 10 mm for Sigastus larvae development.

Factor. Inadequate spray coverage (can control)

Gowers have total control over ensuring that spray coverage and application and rates are adequate by doing the following:

- calibrating your sprayer annually
- slowing down when applying chemicals
- timing your spray for maximum impact.

Coverage is essential in that it will eliminate adult populations and stop egg laying. It is then a matter of removing and/or destroying fallen nut to significantly reduce pressure for the season. Remember it is about population reduction as elimination is almost impossible.



Sigastus larvae and pupae overwintering in nuts.

Factor. Neglected orchards (limited control)

While you have control over managing your own orchard to reduce the potential for Sigastus numbers to build up, you don't over neighbouring ones, which might be neglected. Neglected orchards are breeding grounds for weevil. While the crop is there for the weevil, there is no reason for it to move into neighbouring orchards, however, when the crop is limited the weevil will migrate to other areas to sustain reproduction, and this could include your orchard.

Ideally growers should talk to their neighbours about the neglected orchard and perhaps come up with a solution such as removing trees.

Again, in this case lace bug help by reducing out-of-season flower and not allowing nut to reach minimal 10 mm for Sigastus larvae development.

Factor. Poor management of orchard floor (can control)

This is where we need to trust the life cycle chart. After spraying, it is important that you remove and destroy fallen nut. This will significantly reduce population pressure. If your spray coverage is good you will only need to do this twice, after each time you spray for Sigastus weevil (see Figure 2).

Remember that 100% clean up of the orchard floor is rarely achievable so the idea is to reduce the population to reduce the damage.

Factor. Alternate host (no control as none know yet)

An alternate host has not yet been identified. Work is continuing on developing biological controls for this pest.

The HIA-funded Macadamia IPM Program is working towards developing an attractant lure and further development of methods to control out-of-season nut. Biological controls such as the fungus *Beauveria bassiana* are also being investigated.

Orchard calendar: what to do when

Combining good hygiene (removing infested nuts) with targeted spraying during spring with the registered minor use permit chemical acephate should effectively manage *Sigastus* weevil. The calendar is a guide to what to do when in the orchard.



Golf ball husk as a result of Sigastus feeding on the green nut.

Time	Task	Comments
July to October Pre-flowering to flowering harvest/ post-harvest	Main flowering season	Pre-flower. Be aware of out-of-season flowering, which builds up populations of weevil for on-season flowering
September Flowering and post-harvest	Post-harvest clean up to reduce latent population	Diligence at pre-flowering for effective control is critical
November Nut set – pea size	Spray/mulch program Before fruit spotting bug nut drop, make sure the orchard floor is clean	November to February especially are months when floor management is crucial. Ensure the larva developing in nut is controlled by doing a clean-up of the floor that is similar to the pre-harvest orchard floor clean up
Late December to early January Pea size - marble	Spray and removal of infested nut program	Use mulcher, mower and, in some cases, harvesters to remove infested small nut
January to February Oil accumulation	Pre-harvest clean up to reduce residual population from current season passing over the next season	
Winter Harvest	March – June flowering will carry out-of-season nut and sustain <i>Sigastus</i> population	<i>Sigastus</i> are active during the middle of day and hide overnight

Stopping the spread of *Sigastus* weevil

This year (to June 2017) *Sigastus* weevil has only been found in:

- NSW Northern Rivers
- Atherton area of Far North Queensland.

If you see *Sigastus* weevil on other vegetation it would be useful to take a photograph, record the GPS location and report it to NSW DPI Development Officer Jeremy Bright (Ph 0427 213 059). So far, there have been no reports of *Sigastus* weevil breeding in any crop other than macadamia.

Biosecurity on farm for regions that do not have *Sigastus* weevil

Farm biosecurity helps with more than just limiting the chances of *Sigastus* incursion, it is a system put in place to ensure better protection for your property against pests and disease.

If you do not have *Sigastus* weevil, steps you can take to stay free include:

- Prevent unnecessary entry of vehicles on to your farm from other areas.
- If vehicles such as contract hedgers, sprayers and harvesters are entering your property from other regions, ensure that the operator has done a thorough wash-down off-site. This process is a standard biosecurity procedure enforced to avoid foreign contamination.

Information

For information about on-farm biosecurity go to the "NSW DPI Macadamia plant protection guide" under Farm Biosecurity or visit website www.farmbiosecurity.com.au.