Fact sheet

MANAGING MACADAMIA SEED WEEVIL

AUSTRALIAN MACADAMIA SOCIETY

This factsheet outlines the latest information on an integrated approach for controlling macadamia seed weevil (MSW), a serious pest of macadamia orchards.

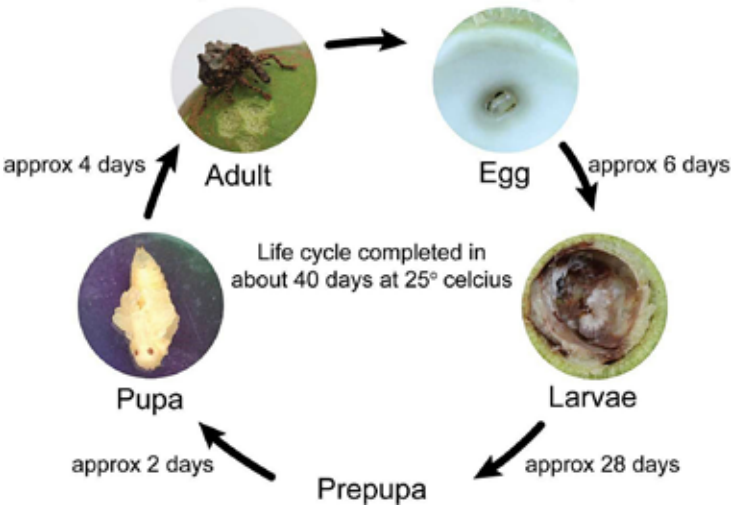
Infestations of MSW (previously referred to as *Sigastus* weevil) have been confined to the NSW Northern Rivers and North Queensland, so far. It is important that the pest is managed to reduce populations and the damage it does in these two areas as well as to stop it spreading to other growing regions.

An integrated approach

The use of insecticides alone is not an effective control for this adaptable native pest, rather it must be part of an integrated pest management strategy. Understanding the weevil's life cycle, monitoring the orchard regularly to identify critical times for control activities and practising good orchard hygiene are all fundamental elements of a control program.

Life cycle

The MSW life cycle lasts about 40 days at 25° C. Damage is done by the female who scarifies a 3 to 4 mm triangular shaped area on the husk and lays her eggs between the husk and soft developing shell. After egg laying the female chews on the nut stalk to induce nut drop, although in some cases the nut will remain in the tree. The larvae hatches after about six days and feeds on the kernel before pupating and then eating its way out of the nut as an adult.



An adult macadamia seed weevil chewing a macadamia husk in preparation for egg laying. Photo: Jessica Thurman.

Adult macadamia seed weevil laying its egg on chewed patch of husk. Eggs have been exposed for the purpose of highlighting what they look like. Photo: Craig Maddox, NSW DPI.

Figure. *The life cycle of the macadamia seed weevil is 40 days. The important period for control using indoxacarb is when nuts are at matchhead size. This is well before the weevil will start to lay, at 8 to 10 mm stage but ensures adequate protection for 13 weeks which will allow for nuts to develop to maturity. Source NSW DPI*

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Permitted/registered chemical control

Minor use permits have been issued by APVMA for two insecticides for their use in macadamia – indoxacarb *(PER86827)* and acephate *(PER81463)*, but in 2020 the permit for acephate was surrendered and use for MSW is no longer permitted. Tetraniliprole is a new registered control option. Discuss the best use of these products with your pest consultant.

It is important that you read the labels before application and adhere to their requirements, especially to do with spray timing and conditions, application rates and safety around non-target species.

The current permissible controls are newer generation pesticides that have a different mode of action and a number of benefits over older generation controls. They are more targeted, and softer on beneficials than acephate and for indoxacarb, only one application is usually required.

What we have learnt about applying indoxacarb

Research recommendation for using indoxacarb is based on stage of nut development, i.e. when nuts are at matchhead size. When applied to matchhead-size to pea-size nutlets it will eliminate egg laying from the adult female weevil for up to 13 weeks. One application will be enough. If problems persist, check your coverage.

Orchard clean-up before application is essential. No more than two applications of indoxacarb can be made per season, and it will easily be within the 6-week withholding period if it is applied as directed.

Livestock cannot be allowed to graze treated orchards during the season of application, and as with all chemicals used, it is important to avoid spray drift beyond the boundary of the orchard.

If indoxacarb is used as recommended there will be no issues with affecting bees foraging as it is applied after nut set. Growers should strictly adhere to permit instructions.

Remove and destroy fallen infested nuts within two weeks of spray application.

MSW damage can be identified by the distinctive triangular mark on the husk. Photo: Craig Maddox, NSW DPI

Factors favouring MSW occurrence

Several factors will favour the occurrence of MSW. Most important are the following:

- Extended flowering and out-of-season nut set caused by events like prolonged rainfall and extreme wet weather. These can result in a build-up of insect pest populations, including MSW and macadamia lace bug. Importantly, MSW lays its eggs in the small, soft nut that can follow extended and out-of-season flowering. This will contribute to an increase in insect population in the orchard. In this scenario lace bug is your friend. Lacebug will generally take out most out of season flowering which will prevent development to 8-10 mm size.
- Neglected orchards are ideal breeding grounds for insect pests, including MSW. While MSW have the food resources they are likely to remain in these orchards, but if a crop is limited, they will migrate to others in their search for food. The benefit of spraying indoxacarb in this situation is that the seed weevil entering the orchard will not be laying eggs in the treated nutlets. This is not the case with a strategy based on applying acephate and will result in this incursion infesting developing nuts. This is one reason why it is crucial for growers to apply indoxacarb rather than acephate.
- Poor orchard floor hygiene, which is a significant factor in promoting population build-up. It is important to start early with cleaning up the orchard floor and mulching to destroy any nuts potentially infested with developing larvae.
- Poor orchard spray coverage. This is the primary cause for pest endurance. It is an expensive activity that will adversely affect beneficial insect populations and result in much less effective management of MSW in the orchard.

In line with good practice, it is recommended you calibrate spray equipment every year, which may also involve reducing sprayer operation speed. Checking coverage is key to all spray operations. This should be performed at least once a year, ideally by testing with water sensitive paper or kaolin clay.

An open, well-ventilated canopy with easily manageable tree height for effective coverage are essential. Where possible adjuvants will assist coverage. Check compatibility on permits and product labels before using them.

Biological controls

Research is underway to develop biological controls for MSW. This includes work being done on the effectiveness of entomopathogenic fungi and attractant/pheromone traps and identifying secondary hosting vegetation. For more information see page 12 of the *Macadamia plant protection guide 2019-20*. If you discover MSW on other vegetation or crops, please take a photo and submit the location and species to NSW DPI.

A host of beneficial insects that predate on MSW also occur in orchards, e.g. predatory bugs, parasitic wasps, predatory flies and larvae affecting parasitic mites. Establishing and maintaining a beneficial insect and spider population in the orchard is part of an integrated management plan.

Biosecurity

Farm biosecurity is an important part of an integrated program to stop the spread of MSW to other orchards and growing areas. Strategies include:

- preventing unessential vehicles from entering the orchard
- thorough cleaning to disinfest any equipment coming on farm
- ensuring any contractors and staff wash down machinery offsite before entering the property, particularly machinery coming from an area with MSW such as the NSW Northern Rivers and Atherton Tablelands in Queensland
- not removing plant material from areas with known infestation to other areas.

Growers can approach *NSW DPI Biosecurity* if they are keen to develop a biosecurity plan further.

Any integrated management program for MSW should include promoting the occurrence of naturally occurring beneficial insects, such as this robber fly which is attacking an adult MSW. Photo: Jarrah Coates

An assassin bug stalking two macadamia seed weevils. Photo Jarrah Coates

Orchard calendar: what to do when

Combining monitoring and good hygiene with targeted crop protection during spring should effectively manage MSW. The calendar is a guide to what to do when in the orchard.

Time	Task	Comments
July to October		
Pre-flowering to flowering Harvest/post-harvest	Main flowering season	Engage a professional pest scout to assist with orchard monitoring. Be aware of out-of-season pre-flowering, which supports populations for on-season flowering
September		
Flowering and post-harvest	Post-harvest clean-up to reduce latent population	Diligence at pre-flowering and ensuring good orchard hygiene are critical
October – November		
Nut set – match-head/pea size	Spray/mulch program	Applying newer generation chemistry such as indoxacarb at this stage will help relegate MSW to an insect pest of lesser importance
Late December to early January		
Pea to marble size	Program to remove infested nut	Use mulchers, mowers 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 into the next season	
Winter		
Harvest	March to June flowering will carry out-of-season nut and sustain MSW population	MSW are active during the middle of day and hide overnight

Information

This factsheet was developed by Leoni Kojetin from AMS in consultation with Ruth Huwer, Craig Maddox and Jeremy Bright from NSW DPI.

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