

# Macadamia Seed Weevil



## Key Points

- Most of the Macadamia Seed Weevil (MSW) lifecycle occurs inside the developing nutlet where the MSW larvae are protected from pesticides and predators.
- Monitoring for MSW activity and timing of control is critical to stop adults laying.
- Nutlets are most susceptible to MSW from pea size (7-10 mm) until the shell hardens around 10-12 weeks from nut set.
- MSW causes two types of husk damage.
- Egg-laying is distinguished by triangular chew marks on the husk.
- Feeding damage is round, resembles golf ball dimpling but does not affect kernel quality.
- Indoxacarb disrupts adult egg laying, so timing of application before egg laying is critical.

## Introduction

Macadamia Seed Weevil (MSW) is a native species and was initially found in the mid-1990s infesting macadamia orchards on the Atherton Tablelands in far north Queensland. Around 2010, MSW was reported in orchards around the Clunes/Eureka area of the Northern Rivers region of NSW and is now a major pest across this region. MSW has not been recorded in the NSW Mid North Coast and the Central and Southeast QLD growing regions.

The most susceptible time for nut damage is from pea-size (7-10 mm) until shell hardening, with larvae consuming the developing kernel. Crop loss estimates vary from 15-30% in unsprayed orchards.

Initially described as a *Sigastus* species, in 2018 MSW was reclassified as *Kuschelorhynchus macadamiae* with the common name of Macadamia Seed Weevil.



*Figure 1. Macadamia seed weevil adult (K. Griffin)*



*Figure 2. Macadamia seed weevil adult on a macadamia nut showing scarified areas in the husk from feeding (NSW DPI).*

## What does macadamia seed weevil look like and what is its lifecycle?

Adult MSW are 6-10 mm long and have a robust body. They range in colour from grey to brown-red and have long, nose-like mouthparts. A hard forewing (the elytra) covers their wings, and they have small spines on their head and back (Figures 1 and 2).

The life cycle of the MSW has four distinct phases: egg, larva, pupa, and adult. At 25°C the lifecycle takes approximately 40 days (Figure 3).



Figure 3. Lifecycle of Macadamia seed weevil (NSW DPI)

The female MSW bores a hole in the husk, inserts its ovipositor and lays an egg onto the surface of the developing nut, typically just above the unformed shell (Figure 4A). It then covers the egg with chewed husk pieces. The female weevil then chews into the nut stalk (Figure 4B), which usually causes the nut to fall from the tree about three days later.

The egg hatches in the developing nut in 5-7 days and the larva eat the kernel (Figure 5) before pupating and emerging as an adult. The MSW adult then flies into the orchard to mate.

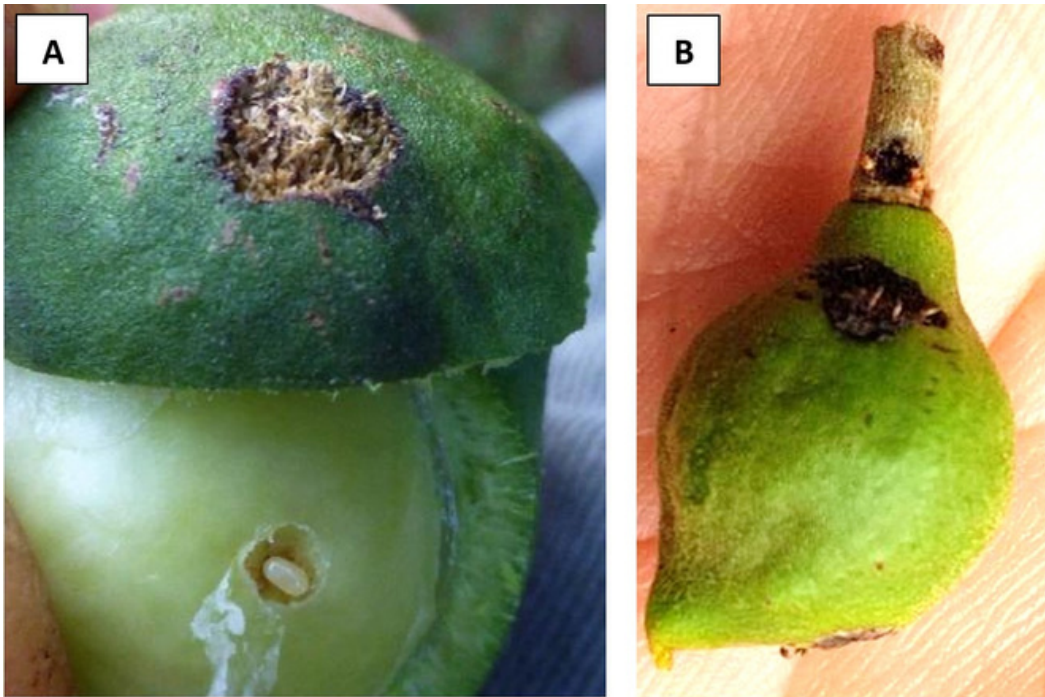


Figure 4. Cross section of egg laying point, the egg can be seen (BioResources); B- Female macadamia seed weevil chewing damage at egg insertion point and on nut stalk to make nut fall off tree (K. Griffin).

The minimum size that can support larval growth to adulthood is 7mm or greater. Larvae reach maturity quicker and grow larger in larger nuts. Once the shell hardens, the newly hatched larva can no longer penetrate the shell and egg laying ceases. Macadamia nuts are vulnerable to MSW for 10-12 weeks from nut set, typically from October until the end of December.



Figure 5. Larva of Macadamia seed weevil inside husk/shell (QDAF)



After shell hardening MSW adults continue to feed on the husk creating 'golf-ball' marks (Figure 2). This does not affect the shell or kernel. Adult MSW may live for more than a year and females can lay around 20 eggs per week.

Continual feeding and egg laying means multiple MSW generations may be present at the same time in the orchard. Out of season flowering and neglected orchards can also contribute to extended breeding and increased MSW populations.

## How do I control macadamia seed weevil?

The MSW eggs, larvae and pupae develop inside the macadamia nut where they are protected from pesticides and predators. Pesticide applications must therefore target the adult weevils to prevent or minimise egg laying and/or control weevils when they emerge from nuts.

Effective control of MSW requires an integrated approach involving regular monitoring, orchard hygiene (removal or mulching of infested nut) and insecticide applications. If any one of these is missing, control will be less effective.

Before you use any pesticide, it is important to check if they are registered or permitted by the APVMA (<https://portal.apvma.gov.au/pubcris>).

## Monitoring for MSW

Regular monitoring is a critical part of any successful IPM system and should be the basis of any pesticide applications. Collecting infested fallen nuts to monitor adult emergence is recommended. Regular monitoring is important to ensure that you to implement any control measures on the first breeding cycle of MSW, this will limit nut loss due to MSW. Full details are provided in the NSW DPI publication, 'Macadamia seed weevil (*Kuschelorrhynchus macadamiae*) orchard management'.

This video by NSW DPI, <https://www.youtube.com/watch?v=4QcO8oLh9hw>, shows you how to monitor for MSW.

## Registered Insecticides

Two pesticides are available for MSW control; a minor use permit for indoxacarb (PER86827 Sep 2018 – Sep 2026) and tetraniliprole (Vayego®).

Indoxacarb disrupts adult weevil egg laying. Grower's experience over the last few years shows that a well-timed indoxacarb application followed by mulching of fallen nut generally provides adequate control for the season. However, if continued weevil egg lay and feeding is observed, if there is a wide range of different nut stages in the orchard, a second application may be necessary.

Tetraniliprole is an insecticide that affects a pathway involved in mobility of adult weevils leading to death. Timing applications to when adult weevils are present in the orchard is critical. Because Tetraniliprole has only recently been registered for MSW control and there is limited grower experience with this product. One benefit of using Tetraniliprole is that it is from a different chemical group to indoxacarb, which is useful for pesticide resistance management.

## Are pesticides applications alone enough to control Macadamia seed weevil?

Research has shown that a combination of pesticide application and good orchard hygiene is critical for successful control. Orchard hygiene involves removing or destroying any fallen nut infested with MSW.

## Are there any viable organic options for macadamia seed weevil control?

MSW has proven difficult to control using only biological methods because it is long lived. NSW DPI and QDAF are currently investigating biological control of MSW using *Beauveria bassiana* and *Metarhizium anisopliae*. These are naturally occurring fungi that kill MSW. The research is promising; however, the strain type, environmental conditions (eg humidity and temperature) and impact of the application of fungicides are all factors in the research into these biological controls. Currently no commercial formulations of these are available.

## References

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