

ALL ABOUT ALMONDS

ORCHARD MANAGEMENT



MANAGING CARPOPHILUS BEETLE IN ALMONDS

PRELIMINARY MONITORING GUIDELINES, ATTRACT & KILL GUIDELINES FOR 2016 - 2017 SEASON

KEY POINTS

- ▶ Almonds are most vulnerable to attack from Carpophilus Beetle during hull split.
- ▶ Pheromone and co-attractant are much less effective when used separately rather than in combination.
- ▶ High priority blocks to monitor are likely to include those that experience excessive moisture retention and humidity.
- ▶ It is suggested that growers start with at least one trap per orchard block (approx. 20 ha).
- ▶ Carpophilus starts to become active and able to fly to traps as temperatures increase in late winter/early spring.

INTRODUCTION

CARPOPHILUS BEETLES ARE SERIOUS PESTS OF ORCHARD CROPS IN AUSTRALIA.

In stonefruits, two species (*C. davidsoni* and *C. hemipterus*) attack fruit and can result in annual losses of up to 30% of the crop. Damage by Carpophilus beetle is most severe as the fruit ripens/matures, with beetles penetrating the fruit and also causing indirect damage by serving as a vector for brown rot (*Monilinia*), which frequently develops at the sites of beetle entry. Carpophilus are highly active pests that can spread rapidly from fruit to fruit and between neighbouring orchards, leading to populations quickly escalating out of control.

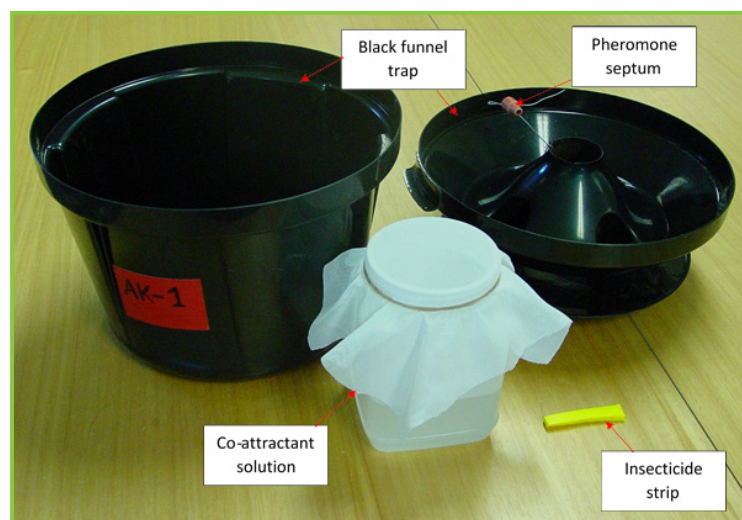
An effective lure has been developed for monitoring Carpophilus in stonefruit, with potential to control this pest through a mass trapping program ("Attract and Kill"). The lure combines the beetle's aggregation pheromones with a synthetic blend of fruit odours, and is highly attractive to the male and female beetles. The lure was developed through Victorian Government (DEDJTR) research in collaboration with Horticulture Innovation Australia Ltd (Hort Innovation), and together with a suitable trap (funnel trap) it is used by the stonefruit industry to effectively control Carpophilus before fruit crops ripen.

CARPOPHILUS IN ALMONDS

Carpophilus beetles comprise many species with different preferences for fruit type and fruit ripening/ maturing stage. In recent years, almond growers have indicated significant crop losses due to Carpophilus, and there is an urgent need for an Attract and Kill (A&K) system that can control these pests, particularly in the 'hull-split' development stage when almonds are most vulnerable to attack. During the 2014/15 and 2015/16 seasons, five species of Carpophilus were detected in samples from traps in almond orchards, and concerns that beetle populations could escalate over coming years has led to a research project "Management of Carpophilus beetles in almonds" to look specifically at this problem. The

project includes research on the distribution of different Carpophilus species throughout orchards and in different almond growing regions, testing whether the "stonefruit" lure is effective in almonds and how its potency might be improved, and determining the most effective spacing of A&K traps to achieve control.

This article contains information on how best to apply an A&K strategy to monitor and control Carpophilus in almonds using the current stonefruit lure. We consider this an interim guide for interested growers, and as we continue our research we aim to provide growers with more detailed guidelines specific to almonds, and hopefully more effective lures.



Carpophilus Catcha Trap Kit

HOW DO THE TRAPS WORK?

Pheromone from the rubber button combined with odours from the co-attractant solution are released from the traps and disperse into the orchard. *Carpophilus* can detect the pheromone from over 100 metres and respond to it by flying towards the odour. When the beetles are closer to the pheromone source, they become less responsive to it and more attracted to the fruit odours emitted from the co-attractant solution. Beetles enter the trap and find it difficult to escape because of the funnel design, and are subsequently killed by the insecticide strip.

A crucial factor for the effectiveness of A&K traps is the combination of odours that attract *Carpophilus* over long distances (pheromone) and short distances (co-attractant). Both the pheromone and co-attractant are much less effective when used separately rather than in combination.

To simply detect and monitor *Carpophilus* activity in orchard blocks, the traps are used without the pheromone buttons. This ensures that the traps attract beetles only from the local area, and do not draw more beetles in from outside the blocks being monitored.

WHAT IS A CARPOPHILUS TRAP COMPRISED OF?

A plastic funnel trap containing:

- A tub of liquid co-attractant (fruit odour) covered with mesh to keep insects out of the solution
- A rubber button (septum) containing *Carpophilus* aggregation pheromone
- A piece of insecticide strip to kill beetles that enter the trap

The only difference between traps used for monitoring vs A&K is that:

- A&K traps include the co-attractant solution, insecticide strip and pheromone button.

- Monitoring traps include the co-attractant solution and insecticide strip but no pheromone button.

HOW SHOULD THE TRAP COMPONENTS BE STORED?

- Pheromone buttons should be stored frozen to maximise their shelf life. If this is not practical, they should at least be stored in a fridge until they are used in traps.
- Synthetic co-attractant must be stored refrigerated (around 4°C) to prevent the rapid breakdown of critical volatile compounds.
- Insecticide strips should be stored in a sealed bag in a cool dark place.
- During field trips for trap maintenance, the co-attractant and pheromone buttons should ideally be carried in a cold esky or car fridge.
- For safety, the co-attractant and insecticide strips should not be kept in fridges that are used to store food or drinks.

HOW ARE THE TRAPS USED FOR MONITORING?

Considering the limited information regarding *Carpophilus* in almonds, we recommend growers begin to monitor this pest using the synthetic co-attractant and insecticide strip without pheromone, and manage traps with weekly servicing as detailed below.

Carpophilus have been found in spring in almond mummies on the ground near dripper lines where the nuts are kept moist. Inspection of these nuts

may help producers to identify infested blocks and highlight areas where monitoring traps should be installed.

High priority blocks to monitor are likely to include those that experience excessive moisture retention and humidity such as low lying areas and sites near dams and other water sources. In addition, blocks with a history of insect damage, hull rot and orchard hygiene issues should be given attention.

HOW ARE THE TRAPS USED FOR ATTRACT AND KILL?

Growers who are concerned by the numbers they catch in monitoring traps and choose to employ the current A&K system, must understand that it has not yet been fully evaluated or adapted for almonds and has not been registered for that purpose. Remember - the only difference between the two systems is that A&K traps include the long-range aggregation pheromone as well as the synthetic co-attractant solution and insecticide strip.

Once *Carpophilus* beetles infest and start to feed on stone fruit, they emit their own pheromone which competes with the pheromone used in A&K traps. In addition, ripening fruit and nuts at hull split or beyond also emit odours that attract the beetles and compete against the traps. Therefore, to be effective, A&K traps need to be installed early enough to kill the maximum number of beetles before the fruit or nuts become susceptible to *Carpophilus* damage. The aim is to prevent fruit or nut infestation by the beetles. As suggested earlier, successful use of A&K to protect stone fruit relies on reducing beetle populations to below a threshold level before fruit becomes susceptible to damage, i.e. before ripening. This is likely to be equally important for almonds, although the threshold levels in the two crops may differ.



Above: *Carpophilus hemipterus* (Driedfruit beetle)

Source of images: Walker, K. (2007) PaDIL - <http://www.padil.gov.au>



Above: *Carpophilus davidsoni* (Australian sap beetle)

Source of images: Walker, K. (2007) PaDIL - <http://www.padil.gov.au>

TRAPPING METHODOLOGY

HOW MANY TRAPS ARE REQUIRED?

- The high trapping densities used in high-value stone fruit orchards (e.g. 1 trap/ ha to monitor and 2-3 traps/ha for A&K) are not likely to be feasible in large almond orchards for economic and management reasons. For monitoring therefore, it is suggested that growers start with at least one trap per orchard block (approx. 20 ha) to gain some preliminary information on the distribution of the pest within their orchard.
- We cannot advise on the number or placement of A&K traps in almonds until the A&K system for *Carpophilus* is adapted and registered for use in almonds.

WHERE SHOULD TRAPS BE LOCATED?

- Given the very low trapping density likely to be used in almonds no specific recommendation can be made for locating traps for monitoring, other than placing them at least 15 metres inside the orchard blocks and taking block history into account (e.g. nut damage, mummy infestation as mentioned above).
- For A&K in stone fruit, traps should be placed specifically in the appropriate corner of orchard blocks to allow for the most predominant spring and summer winds to distribute the pheromone into the blocks. For example, if the predominant wind direction is from the south west, traps should be located in the south-west corner. This is also likely to apply in almonds.
- Once *Carpophilus* activity is detected on a property, monitoring or A&K traps that repeatedly catch zero beetles may be relocated to:
 - Other areas within the same block, to increase the chance of detecting *Carpophilus* 'hotspots' or;
 - Infested blocks to increase the trapping density around the infestation.

WHEN SHOULD TRAPS BE USED?

- *Carpophilus* starts to become active and able to fly to traps as temperatures increase in late winter/early spring. Monitoring from that time onwards will provide an indication of activity levels of the pest in the vicinity of the traps.
- If A&K is to be used, it should be implemented at least eight weeks before the crop becomes susceptible to infestation by *Carpophilus*.
- In stone fruit the crop becomes susceptible as the fruit colour begins to change in response to commencement of the maturity process.
- Almonds appear to be susceptible to attack at and beyond hull split
- Some growers commence A&K much earlier (e.g. late August/early September) in areas where significant *Carpophilus* populations or crop damage were detected during the previous season.

HOW ARE TRAPS INSTALLED?

- Install traps on the southern side of trees so they are in a shady position. Traps in the sun are likely to get very hot and repel any beetles that land on them. Also, the effective life of pheromone buttons and co-attractant is likely to be much shorter in hot traps.
- Ram a metal star picket into the ground in the designated place and fit the metal ring to the picket so the trap will be about 1.5 m above the ground.



Above: *Carpophilus mutilatus* (Confused sap beetle)

Source of images: Walker, K. (2007) PaDIL - <http://www.padil.gov.au>

- Insert the trap, containing the tub with 250 ml co-attractant, insecticide strip and pheromone button (for A&K only) into the metal ring, taking care not to spill the co-attractant.

HOW SHOULD TRAPS BE SERVICED?

- Service each trap routinely on the same day of the week, so that every trap is serviced every seven days.
- At the start of each day, shake the bottle of co-attractant to ensure it is well mixed.
- Wear latex gloves when handling the co-attractant and insecticide strip.
- Carefully remove the trap from the ring.
- Remove the top part of the trap.
- Remove the tub of co-attractant solution, remove its netting and pour the old solution into a separate container. Alternatively, leave the netting in place and pour the old solution out through the netting. Refill the tub with 250 mL of fresh co-attractant solution and replace the netting if necessary. It is vital to refill the tub only with fresh co-attractant. If the old solution is not removed, it will make the fresh co-attractant much less effective by diluting it. Dispose of the old solution away from the orchard – do not tip it out in the block or it may attract beetles away from the traps.
- Use forceps or gloves to remove the insecticide strip and retain.
- Follow the procedure below to estimate *Carpophilus* populations.
- Brush out the trap and make it as clean as possible (use a damp kitchen-cloth if needed).
- Reinstall the tub with fresh co-attractant solution and reinstall the insecticide strip.
- Every second week add a new pheromone button (for A&K only). Do not remove the old buttons as they can still release small amounts of pheromone over a long period.
- Reconnect the top of the trap to the bottom and make secure.
- Place the trap back in the ring carefully so as not to spill the co-attractant.

HOW ARE BEETLE NUMBERS ESTIMATED?

- **Remove any big insects and other debris (flies, spiders etc) as much as possible from the trap**, otherwise the estimate of beetle numbers will be much less accurate.
- Use a fine paint brush to collect the beetles together.
- Pour the beetles carefully into the graduated tube using a funnel, taking care to avoid any beetle loss from spillage or wind.
 - Use a small graduated tube for estimating beetle numbers less than 1000.
 - Use a large graduated tube where beetle numbers are more than 1000.
- Gently tap the tube containing beetles on a hard surface to settle the contents and record the beetle number corresponding to the volume of the beetles collected.

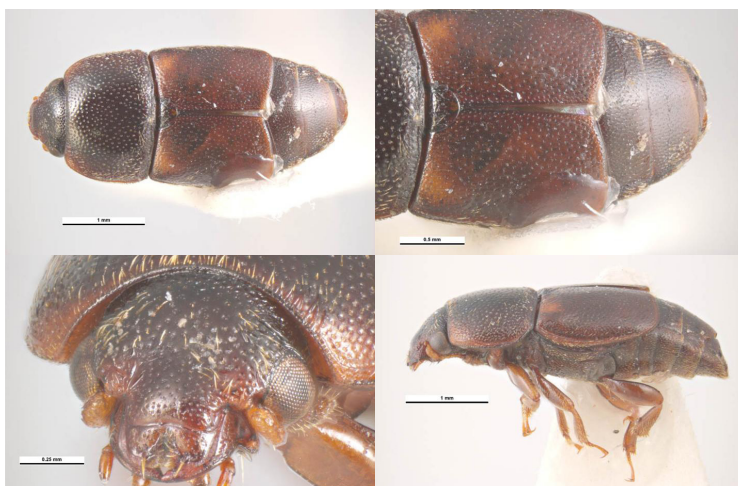
WHERE CAN TRAPS BE PURCHASED?

To obtain the traps, which are marketed as 'Carpophilus Catcha Trap Kits' and spare components, growers should approach their usual agricultural supplier. If difficulties in sourcing traps are encountered, please contact the Australian supplier 'Bugs for Bugs' via phone: 0459 974960, email: info@bugsforbugs.com.au or their website: bugsforbugs.com.au.

Graduated tubes are available from DEDJTR. To obtain a set of tubes, please email a request to mofakhar.hossain@ecodev.vic.gov.au.

SPECIAL NOTE ON ORCHARD HYGIENE

Some almond growers and processors dispose of rejected kernels, hulls etc. on their own property. These dumps, particularly in damp areas, can provide an important resource for *Carpophilus* during winter and early spring if they offer good protection and breeding sites. Similarly, fallen almond mummies, especially in the tree lines are suitable for these beetles to feed and breed and large numbers of *Carpophilus* have been found in these situations. These dumps and mummies might be the only widely available resources for the pest during early spring and it is likely the populations of *Carpophilus* they support could contribute significantly to levels of the pest in orchards as the new almond crop becomes susceptible to damage. Mummies retained on trees also harbour carob moth and are the major source of moths leading up to hull split. **Management of almond waste and mummies should be considered as an important aspect of the overall management of *Carpophilus* and carob moth.**



Above: *Carpophilus humeralis* (Pineapple Souring Beetle)

Source of images: Walker, K. (2007) PaDIL - <http://www.padil.gov.au>



Above: *Carpophilus dimidiatus*

Source of images: DEDJTR

USEFUL RESOURCES

Bugs for Bugs

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MORE INFORMATION

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PROJECT CODE

AL15004 - Control of *Carpophilus* Beetle in Almonds using attract and kill system

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02.Carpophilus Guidelines 2016-17

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