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Carpophilus Beetle: Preliminary Monitoring Guidelines Monitoring and Attract and Kill - 2015-16 Season

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Introduction

Carpophilus beetles are serious pests of ripening stone fruit in Australia. *Carpophilus davidsoni* Dobson, *C. mutilatus* Erichson and *C. hemipterus* (L) cause the greatest economic damage in ripening fruit. Carpophilus are attracted to and penetrate ripening fruit, causing rapid breakdown, which can result in substantial fruit losses. Growers have reported annual losses of up to 30% of the crop. The beetles also can cause indirect damage by serving as a vector for brown rot inoculum (*Monilinia* spp.), which frequently develops at the sites of beetle entry.

Carpophilus are highly active pests and can quickly move between blocks and from fruit to fruit within a crop. Damage by Carpophilus beetle is most severe as the fruit ripens. *Carpophilus* spp. are gradually expanding their choice of host fruits and have become pests of new crops. In recent years growers have indicated substantial crop losses due to Carpophilus beetles in almond.

The use of synthetic aggregation pheromones to attract and kill (A&K) Carpophilus beetles has shown considerable potential for management of this pest. A synthetic blend of food attractant which was highly attractive to the beetles was developed by DEPI. It also proved a funnel trap is the most promising trap design for use as an A&K trap. Stone fruit industries deployed A&K traps to successfully control Carpophilus.

Based on the experience in stone fruit, there might be great potential to use the A&K system to control Carpophilus which is causing serious damage to almonds. However, it is necessary to understand the following to make this system sustainable:

1. Spatial distribution of the Carpophilus beetles in the orchard (from trapping).
2. Species composition and succession of species over the crop cycle (from analysis of trap catches).
3. Season long study to understand population fluctuations throughout the season (from season-long trap data).

Note: During the 2014/15 season we received very limited samples of Carpophilus from traps in almonds and so can draw only limited conclusions regarding the mix of species and effectiveness of traps. Observations from that season need to be confirmed with further studies. To date, four species have been identified from the trap samples, these being *Carpophilus davidsoni*, *C. hemipterus*, *Urophorus humeralis* and *C. near dimidiatus*. The latter species has yet to be confirmed by specialised taxonomists.

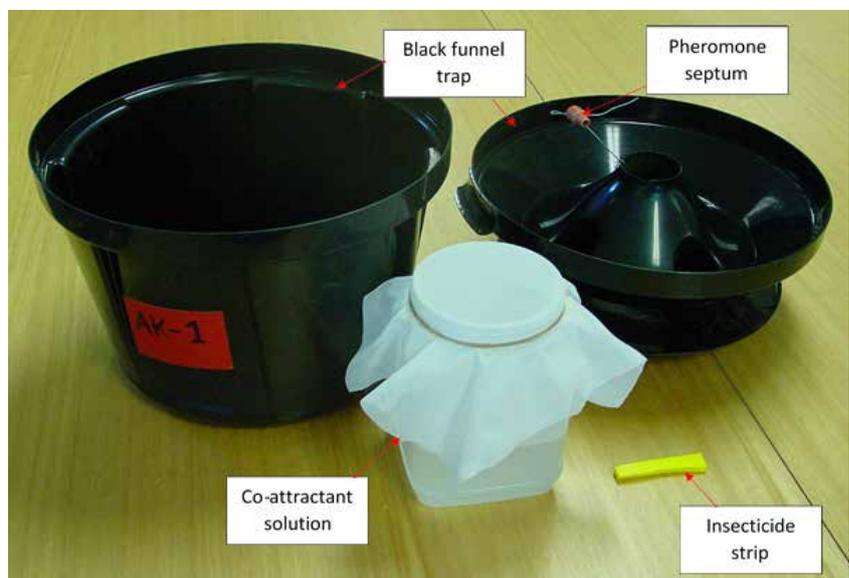
Although the A&K system currently in use did attract and kill all four species listed above, DEDJTR is not in a position to

confirm that this system is effective against all the species occurring in almonds, or that it will provide sufficient protection to almond crops.

Until we develop more information and understanding about the current monitoring and A&K systems, beetle behaviour and their interaction with the attractants in this new environment (almonds) it is difficult to formulate detailed guidelines regarding management of this pest in almonds. The following points are provided as an interim guide for interested growers.

Definitions & Equipment

- **Monitoring Trap:** A trap that contains synthetic co-attractant solution or fermented apple juice (FAJ) and insecticide strip. No pheromone.
- **Attract and Kill Trap:** A trap that contains pheromone, synthetic co-attractant solution and insecticide strip.
- **Treated blocks:** Blocks that have A&K stations deployed in them.



Carpophilus monitoring and management in almonds

Monitoring methodology

Considering the limited information regarding *Carpophilus* in almonds, we recommend growers begin to monitor this pest using the synthetic co-attractant and managing traps with weekly servicing as detailed below.

- Monitoring should start in early October and continue until harvest.
- The high trapping densities used in small stone fruit orchards (e.g. 1 trap/ha) are likely to be not feasible in large almond orchards for economic and management reasons. Therefore, its suggested growers start with at least one trap per orchard block (approx. 20 ha) to gain some preliminary information on distribution of the pest within their orchard.
- Carpophilus* have been found in spring in almond mummies on the ground near dripper lines where the mummies are kept moist. Inspection of these mummies 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.
- Traps for monitoring should be located at least 15 metres inside the orchard block.
- Once *Carpophilus* activity is detected on a property, 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.
- Procedure for placing and servicing traps:
 - Install traps on the southern side of the tree in a shady position.
 - 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.
- Place the trap (containing jar with 250 ml co-attractant and insecticide strip) in the ring fitted on the metal star picket taking care not to spill co-attractant.
- For weekly servicing:
 - Wear latex gloves.
 - Carefully remove the trap from the ring.
 - Remove top part of the trap.
 - Remove container with co-attractant solution. Remove the net and pour used solution into a separate container (don't throw out in the block) and fill with 250 mL fresh co-attractant solution and replace the net.
 - Remove insecticide strip and retain. It's safer to use latex gloves when handling insecticide.
 - Follow the procedure below to estimate *Carpophilus* populations
 - Brush out the trap and make as clean as possible (use a damp kitchen-cloth if needed).
 - Reinstate the container with co-attractant solution and reinstall insecticide strip.
 - Reconnect the bottom of the trap to the top and make secure.
 - Place the trap in the ring.
- Procedure for estimating beetle number:
 - Use a small graduated tube for estimating beetle number less than 1000.
 - Use a large graduated tube where beetle number more than 1000.
 - Remove debris, big flies and other big insects as much as possible from the trap.
 - Use fine paint brush to collect the beetles.
 - Pour beetles carefully into the graduated tube using a funnel and avoid any beetle loss from spillage or wind.
 - 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.

Attract and kill methodology

- As the monitoring system is not designed to control *Carpophilus*, growers who are concerned by the numbers they catch in monitoring traps may choose to employ the current A&K system, on the understanding it has not yet been evaluated in almonds. The only difference between the two systems is the A&K traps include the long-range aggregation pheromone as well as the synthetic co-attractant solution and insecticide strip.

- From our experience we found that once the beetle established in the fruit crop, they emit their own pheromone, which makes the crop far more attractive than the traps. Therefore, we need to make sure the A&K traps are used well ahead and kill the maximum number of beetles before fruit becomes susceptible to *Carpophilus*. This should stop fruit infestation and beetle pheromone production.
- 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 be different. Preliminary observations indicate almonds become susceptible to damage by *Carpophilus* at hull split (typically early January), which suggests A&K should be implemented by early December.
- Traps for A&K should be placed in the appropriate corner of the orchard block, to allow for the most predominant wind to distribute the pheromone into the block. Assuming the predominant wind direction is south to south westerly, the trap should be located in the south-west corner.
- In high-value stone fruit crops two to three A&K traps are installed per hectare, but to do this in almonds would be very costly. Until A&K for *Carpophilus* is adapted and proven in almonds, it will be up to individual producers to determine the level of investment they are willing to commit to assessing this approach.
- Procedure for placing and servicing traps:
 - Install traps on the southern side of the tree in a shady position.
 - 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
 - Place the trap (containing jar with 250 ml co-attractant and insecticide strip) in the ring fitted on the metal star picket taking care not to spill co-attractant.
- For weekly servicing:
 - Wear latex gloves.
 - Carefully remove the trap from the ring.
 - Remove top part of the trap.
 - Remove container with co-attractant solution. Remove the net and pour used solution into a separate container (don't throw out in the block) and fill



with 250 mL of fresh co-attractant solution and replace the net.

- Remove insecticide strip and retain. It's safer to use latex gloves when handling insecticide.
- Follow the procedure below to estimate beetle attract and killed.
- Brush out the trap and make as clean as possible (use a damp kitchen-cloth if needed).
- Reinstall the container with co-attractant solution and reinstall insecticide strip.
- Every second week, add a new pheromone button, don't remove the old button.
- Reconnect the bottom of the trap to the top and make secure.
- Place the trap in the ring.
- Procedure for estimating beetle number:
 - Use a small graduated tube for estimating beetle number less than 1000.
 - Use a large graduated tube where beetle number more than 1000.
 - Remove debris, big flies and other big insects as much as possible from the trap.
 - Use fine paint brush to collect the beetles.
 - Pour beetles carefully into the graduated tube using a funnel and avoid any beetle loss from spillage or wind.
 - 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.

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. A cursory inspection has in fact found large numbers of *Carpophilus* 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 crops become susceptible to damage. Management of almond waste and mummies should be considered as an important aspect of the overall management of *Carpophilus*.

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