

Chalcid Parasite Control in Alfalfa Leafcutting Bee Populations - 2021

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The chalcid parasite, *Pteromalus venustus*, is a persistent problem in alfalfa leafcutting bee populations. The female chalcid parasite first stings the alfalfa leafcutting bee prepupa and then lays eggs on the surface of the bee prepupa, leaving an intact cell containing a number of chalcid parasite prepupae instead of one healthy alfalfa leafcutting bee prepupa. Occurrence of the chalcid parasite is a cause for concern because it has the potential to parasitize a large number of alfalfa leafcutting bee prepupae in a relatively short period of time. Opportunities for controlling chalcid parasites are limited, and the presence of the parasite can be a drawback in the marketing of alfalfa leafcutting bee cells. This article contains information on the biology and control of the chalcid parasite, *Pteromalus venustus*.

Chalcid Parasite Life-cycle

Pteromalus venustus is an obligate parasite, which means that it is obliged to parasitize other species in order to reproduce. Adult female parasites search for completed cells containing bee prepupae which have finished feeding and have spun their cocoons. The female parasite pierces the leaf and cocoon layers of the bee cell with her ovipositor (a sting-like apparatus modified for laying eggs) and stings the bee prepupa, thus paralyzing it. The female parasite then lays eggs on the surface of the paralysed bee prepupa.

The parasite eggs hatch within 24 - 48 hours, and the young parasite larvae begin to feed upon the paralysed bee prepupa. Upon completion of feeding, the parasite larvae then either pupate and develop into adults, or enter a prepupal diapause stage which requires a cold temperature period similar to their alfalfa leafcutting bee host prior to development. Once temperatures rise sufficiently, development resumes, and the parasites pupate and emerge as adults from a small hole chewed through the alfalfa leafcutting bee cell.

In the incubator, chalcid parasites usually emerge from day 8 - 13 of incubation at 30°C, although they may emerge earlier. The time required for development of one generation depends on temperature; at 30°C chalcid parasites can develop from the egg to adult stage in 12 days. Thus, a second generation of chalcid parasites can complete development and emerge during the alfalfa leafcutting bee incubation period.

Prevention and Control of Chalcid Re-parasitism

Sampling of alfalfa leafcutting bee cells

An important step in controlling chalcid parasites in an alfalfa leafcutting bee population is to thoroughly sample the bee cells prior to spring incubation in order to determine the number of parasitized cells present. If necessary, heavily parasitized lots of bee cells may then be incubated separately from lots of bee cells which are parasite-free.

Parasite-proof alfalfa leafcutting bee nest material

An important step in preventing re-parasitism in the field is ensuring tight alfalfa leafcutting bee nest construction. Nests must be "parasite-proof". The nest backing material should be tightly strapped to the block, with a bonded polyester fill layer inserted between block and nest backing. Nest corners can be used to stabilize the tightly-strapped nest block, and various types of nest surrounds can also be utilized.

Chalcid parasite control measures

Control measures are generally aimed at the adult parasites, since parasite larvae and pupae are difficult to control while they are developing within bee cells. Black lights which emit light in the ultraviolet spectrum attract adult chalcid parasites. If these lights are placed over trays of water (containing a small amount of surfactant), the parasites will be attracted into the water-traps. Ultraviolet lights and water-traps can be utilized in the incubator throughout the incubation period. The water should be changed frequently in order to keep the surface free of insects.

It is recommended that dichlorvos resin strips be utilized for chalcid parasite control in the incubator at the rate of 0.75 strip / 1000 cubic feet of incubator space, from day 7 to 13 of incubation. Ideally, bee cells should be no deeper than one inch in incubation trays with solid bottoms (up to two inches in trays with screened bottoms), so that dichlorvos vapour can penetrate into air space surrounding the bee cells. Incubation trays should be stacked a minimum of four inches apart to allow for adequate air movement, and fans should be utilized to distribute dichlorvos vapour evenly throughout the incubator.

Research has indicated that under certain conditions, a significant increase in dichlorvos-related alfalfa leafcutting bee mortality during incubation may be related to increased dichlorvos rate, increased dichlorvos treatment time, number of bee cells treated per unit area, bee cell position in the incubator, and relative humidity in the incubator.

Vapour from dichlorvos resin strips readily adheres to surfaces such as wooden racks, incubation trays, and leaf pieces. For this reason, the incubator should be opened up and fresh air circulated for 24 - 48 hours after the strips are removed. Ventilation after using dichlorvos should be active - opening the door and turning on a ceiling fan may not be adequate. The air in the incubation trays must be exchanged many times in order to remove all traces of dichlorvos vapour. Adequate ventilation may involve removing incubation racks from the incubator for a 24 - 48 hour period while the air is repeatedly exchanged, as well as moving air through the racks and over the bee cells.

Chalcid parasites found on alfalfa leafcutting bee nest blocks during the fall storage period are likely the second generation, or emergent offspring, of the field parasite population. These parasites can represent a threat to the alfalfa leafcutting bee population since they will mate and attempt to parasitize bee prepupae, causing a decrease in live count and an increase in numbers of parasitized bee cells.

Use of water-traps under ultraviolet lights will help to control parasites during the fall storage period. As well, studies on the use of dichlorvos resin strips during the fall storage period have indicated that exposure of nest blocks to dichlorvos at a rate of 0.75 strip / 1000 cubic feet for up to seven days will not harm the alfalfa leafcutting bee prepupae within the nest blocks.

SUMMARY - *The chalcid parasite, Pteromalus venustus, can re-parasitize alfalfa leafcutting bee populations during the incubation period and during the field season, causing significant bee losses. Current chalcid parasite control measures include use of well-built, parasite-proof nest material in the field, use of ultraviolet lights and water-traps in the incubator, and use of dichlorvos resin strips at a rate of 0.75 strip / 1000 cubic feet of incubator space during day 7 to 13 of the alfalfa leafcutting bee incubation period, with fans utilized to distribute dichlorvos vapour evenly throughout the incubator. The incubator should be actively ventilated for 24 - 48 hours following the parasite control period in order eliminate dichlorvos residue, which may cause mortality in emerging alfalfa leafcutting bees.*