

Chalcid Parasite Control in Alfalfa Leafcutting Bee Populations - 2026

D.W. Goerzen
Research Scientist, SLA / SASPDC

The chalcid parasite, *Pteromalus venustus*, is a persistent problem in alfalfa leafcutting bee populations. The female chalcid parasites sting the alfalfa leafcutting bee prepupae and then lay eggs on the surface of the bee prepupae, leaving intact cells containing a number of chalcid parasite prepupae which feed on the alfalfa leafcutting bee prepupae. Occurrence of chalcid parasites is a cause for concern because these parasites have the potential to re-parasitize numerous alfalfa leafcutting bee prepupae within a relatively short period of time. Opportunities for controlling chalcid parasites are limited, and the presence of these parasites 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.

Chalcid Parasite Life-cycle

Pteromalus venustus is an obligate parasite, which means that it must parasitize other species in order to reproduce. Adult female parasites search for completed cells containing bee prepupae which have completed feeding and spinning their cocoons. The female parasite pierces the leaf and cocoon layers of the bee cell with its 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 the temperature rises sufficiently, parasite development resumes, and the parasites pupate and emerge as adults from a small hole chewed through the alfalfa leafcutting bee cell wall.

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 parasite generation depends on incubation 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 bee 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 the 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 period, number of bee cells treated per unit area, bee cell position in the incubation tray, and relative humidity in the incubator.

Vapour from dichlorvos resin strips readily adheres to surfaces such as wood tray racks, wood incubation trays, and leaf pieces. For this reason, the incubator should be opened up and fresh air circulated for 24 - 48 hours after the dichlorvos strips are removed. Ventilation following use of dichlorvos should be thorough - opening the door and turning on a ceiling fan may not be adequate. The air in and around the incubation trays must be exchanged many times in order to remove all traces of dichlorvos vapour. Adequate ventilation may involve removing incubation tray 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 parasite population from the field. These parasites can represent a threat to the alfalfa leafcutting bee population since they will mate and attempt to parasitize bee prepupae within the stored nest blocks, causing an increase in numbers of parasitized bee cells and subsequent reduction in live count and. Use of water-traps under ultraviolet lights will help to control parasites during the fall storage period. Studies on the use of dichlorvos resin strips during the fall storage period have indicated that exposure of alfalfa leafcutting bee 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.

Note to Producers: The Pest Management Regulatory Agency (PMRA) made the decision to cancel domestic registration of the dichlorvos resin strip product "Ortho Home Defense Max No-Pest Insecticide Strip" in 2022. Due to this decision, the product utilized for parasite control in alfalfa leafcutting bee populations for over 40 years is no longer available. Research to develop new parasite control technology is currently underway. The Saskatchewan Alfalfa Seed Producers Development Commission, in collaboration with the Alfalfa Seed Commission (Alberta) and the Manitoba Forage Seed Association, is supporting parasite control research being undertaken by Dr. Gail MacInnis. The focus of Gail's research involves testing the toxicity and repellent efficacy of bioactive compounds contained within plant essential oils. This work has included testing of these compounds for parasite control in commercial alfalfa leafcutting bee operations and results have been promising. To determine safety of the bioactive compound formulation for developing alfalfa leafcutting bees, extensive laboratory testing has been undertaken. Field-scale testing of the bioactive compound formulation for parasite control in commercial alfalfa leafcutting bee operations is continuing in the 2026 field season.