



Management practices to reduce pests and disease in *Megachile rotundata* production systems



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OVERVIEW

The alfalfa leafcutting bee (*Megachile rotundata*) is the most intensively managed solitary bee in the world and is a vital pollinator of alfalfa and hybrid canola seed in western Canada and is used for blueberry pollination in Quebec.

This booklet focuses on management practices to reduce pest and disease risks in alfalfa leafcutting bee production

Alfalfa leafcutting bees are vulnerable to several pests and diseases, particularly chalkbrood and chalcid wasp infestations. By implementing good management practices, such as regular monitoring, timely interventions, and careful handling of cocoons and nesting material, farmers can help maintain healthy, productive bee populations.



Megachile rotundata (male) on a cocoon
Image credit: G. MacInnis



Image credit: G. MacInnis

PEST: *PTEROMALUS VENUSTUS*

Pteromalus venustus is a parasitoid wasp that parasitizes alfalfa leafcutting bees, posing a serious economic threat to bee producers. Even low infestation levels can lead to significant losses due to the parasite's rapid reproduction and limited control options.

Life cycle of the parasitoid *Pteromalus venustus*

Winter diapause: *P. venustus* overwinters in diapause at the prepupal stage inside the bee cocoon. This can last several months at low temperatures (below 5 °C), with development resuming as temperatures rise.

Emergence and mating: Adults emerge by piercing the cocoon. Mating occurs inside or shortly after emergence, typically between days 8 and 12 of incubation at 30 °C in commercial production.

Parasitism: At the bee's vulnerable prepupal stage, the parasitoid female lays up to 30 eggs in a cocoon after paralyzing the bee prepupa with her ovipositor.

Larval development: The parasitoid larvae consume the bee larva, then pupate inside the cocoon. Development is temperature-dependent and is optimal between 30 and 32 °C.

Second generation: A full cycle takes ~12 days. A second generation can therefore parasitize bee cells before their 30-day incubation period is complete.



P. venustus on a leafcutting bee cocoon
Image credit: N. Ganson

Parasitoid control through good management practices

Nest Design & Maintenance:

- Ensure tightly secured nest backs with bonded polyester lining.
- Inspect bee nesting blocks for cracks or holes that could allow parasite access.
- Replace partially filled or damaged nests mid-season to reduce infestation.

UV Light Traps:

- Install UV light traps over soapy water trays during incubation and fall storage.
- Parasites are attracted to UV light and drown.

Cocoon Analysis:

- Any purchased bees should be from populations that are low in parasites.
- This can be determined by having representative cocoons analysed at the [Canadian Cocoon Testing Centre](#) in Brooks, AB

DISEASE: *CHALKBROOD* *ASCOSPHAERA AGGREGATA*

Chalkbrood is a serious fungal disease caused by *Ascosphaera aggregata*. It infects alfalfa leafcutting bee larvae when they ingest pollen contaminated with fungal spores. Once inside the larva, the fungus grows and eventually kills it, usually before it becomes a pupa. Cadavers may be either 'sporulating' (producing infectious spores) or 'non-sporulating'. Adult bees can carry spores on their bodies when they emerge, spreading the disease to new cells.



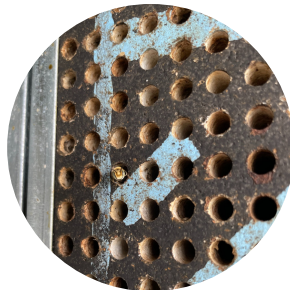
Image credits: J. Retzlaff

Healthy prepupa (top) vs. chalkbrood-infected prepupa (bottom)

Effective control of chalkbrood involves a multi-step approach

Analyse your cocoons

- Purchase cocoons from reputable sources and request quality analysis from the [Canadian Cocoon Testing Centre \(CCTC\)](#).



Loose-Cell Management

- Remove individual cocoons before cold storage, rather than leaving them in nest tunnels



Maintain clean field shelters

- Never discard old cocoons in the field



Sterilize nesting material

- Using a 3–5% bleach solution or paraformaldehyde fumigation on nesting material
- Sterilize cocoons before incubation to kill spores on their surface

Avoid sharing equipment

- Do not share equipment that comes in contact with alfalfa leafcutting bee cells unless it has been thoroughly disinfected

Image credits: J. Retzlaff

Non-Chemical Management Techniques for Reducing Pests and Diseases



Image credit: N. Ganson

FALL AND WINTER MANAGEMENT

Harvest and Tumbling

- The bee cells should be punched, tumbled, and placed in cold storage in sturdy containers (5°C) as soon as possible to avoid problems with mold, parasites and mice.
- Harvesting and tumbling should be done between November and March.
- Tumbling helps remove debris and pests

Timing and Environmental Control

- Adequate drying and ventilation are essential to prevent mold, especially in polystyrene blocks. Avoid stacking nests too tightly, and use dehumidifiers if needed.
- Maintain recommended temperatures and humidity levels at each stage of bee development and storage.
- Use dehumidifiers and air circulation to keep nesting and storage environments dry.
- Avoid sudden temperature changes in storage facilities that may cause mold or early emergence.



5°C

Cold storage temperature



15°C

Storage temperature should never exceed 15°C

- After removal from the field, nest blocks are stored for 3 weeks at approx. 20°C to allow bee larvae to develop to the prepupal stage for diapause. Exposing the back of the nesting block is not recommended until temperatures have been cooled to below 10°C.
- Temperature should not exceed 15°C for any length of time or bee energy reserves may be depleted, and parasite and predator activity will continue.
- Proper cocoon storage is cool, dry, and well-ventilated to prevent accidental bee/parasite development or mold buildup over winter.

Non-Chemical Management Techniques for Reducing Pests and Diseases (cont)



Image credit : Farmland legacies

FIELD SHELTER MANAGEMENT

- Place shelters in dry, sunny locations with good air circulation.
- Avoid over-crowding and reuse only shelters that have been cleaned and disinfected.
- Spray shelter interiors with a 3-5% bleach solution if needed and allow them to dry completely before reuse.

NEST HYGIENE AND ROTATION

- Avoid using the same nest blocks in consecutive years without proper treatment.
- Rotate blocks annually and clean all equipment thoroughly.
- Dry nest materials well before storage to prevent fungal issues.
- Moist polystyrene blocks are especially prone to mold growth.

SEPARATION OF RISKY STOCK

- Keep bee cells from different fields or shelters separate, especially if some are suspected of harboring disease or parasites.
- Incubate suspect lots in isolated areas to prevent contamination of healthy stock.



Image credit : J. Retzlaff

References: D. W. Goerzen. 1997. Alfalfa Leafcutting bee management and alfalfa seed production producer manual, Saskatchewan Alfalfa Seed Producers Association (SASPD). | Alfalfa leafcutting bee management guides: Saskatchewan Leafcutters Association/SASPD - <https://www.saspa.com/beeManagement.htm>

Province of Manitoba. Agriculture Parasites (Pteromalus venustus) of Alfalfa Leafcutting Bees - <https://www.gov.mb.ca/agriculture/crops/crop-management/print/parasites-of-alfalfa-leafcutting-bees.html>

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