



SASKATCHEWAN  
ALFALFA SEED  
PRODUCERS  
ASSOCIATION

## CHALKBROOD DISEASE IN ALFALFA LEAF-CUTTING BEE POPULATIONS

ISBN 0-88656-728-9

Chalkbrood disease (*Ascosphaera aggregata*) is a serious limiting factor in the use of alfalfa leafcutting bees for alfalfa seed production. Chalkbrood-related bee losses in excess of 50% have been reported in some areas of the northwestern United States. The disease has also caused significant levels of mortality in southern Alberta alfalfa leafcutting bee populations, and has occurred sporadically at low levels in alfalfa leafcutting bee populations elsewhere in Canada.

Chalkbrood spores are ingested by alfalfa leafcutting bee larvae as they feed on contaminated nectar and pollen provisions placed in the cell by the adult female bee. These spores germinate and grow rapidly within the body of the larvae. As the disease progresses, cysts containing spores are generally formed beneath the intact cuticle of the larval cadaver. In larval cadavers infected with chalkbrood, the fungus may or may not form spores. The result is two distinct chalkbrood cadaver phenotypes, commonly referred to as "sporulating" and "non-sporulating" chalkbrood.

Research undertaken by SASPA in collaboration with researchers at the University of Saskatchewan has demonstrated through DNA analysis that despite the morphological differences between leafcutting bee larval cadavers exhibiting the "sporulating" and "non-sporulating" forms of chalkbrood, both forms of the disease are caused by *A. aggregata*. Illustrations of chalkbrood cadavers are given in figures 1 - 4.

An individual "sporulating" chalkbrood cadaver may contain millions of chalkbrood spores. These spores are spread within leafcutting bee populations as emerging adult bees chew through cells containing chalkbrood cadavers. The chalkbrood spores carried on the bodies of adult bees contaminate leafcutting bee cell surfaces, nest material, and field shelters. Research carried out by SASPA in order to prevent the disease from becoming a problem in Saskatchewan alfalfa leafcutting bee populations has led to the development of a paraformaldehyde fumigation process which effectively decontaminates leafcutting bee cells and nest material.

Several native *Ascosphaera* species may also occur in alfalfa leafcutting bee populations. Among these species is the fungus *A. larvis*, which causes chalkbrood-like symptoms in developing leafcutting bee larvae and eventually produces spores within the larval cadaver and on the cadaver surface as well (figures 5 - 7). Leafcutting bee cadavers infected by *A. larvis* can be easily distinguished from those infected by chalkbrood (*A. aggregata*) because *A. larvis* sporulates on the surface of the cadavers.

A final note on alfalfa leafcutting bee larval mortality concerns the occurrence of dead discoloured larvae, which are commonly found at levels in the 2.5 - 5.0 % range in leafcutting bee populations. There is often no sign of fungal growth on the surface of these cadavers and their colour may vary from light brown through red or black (figures 8 - 10). The causes of dead discoloured larvae may be related to fungal, bacterial, or viral infections, and may also include interaction with environmental or other factors.

As noted previously, chalkbrood disease may be spread through movement of alfalfa leafcutting bee cells and nest material contaminated with chalkbrood spores. Methods available for decontamination of leafcutting bee cells and nest material include paraformaldehyde fumigation and chlorine bleach treatment. Wood nest material may also be decontaminated through a heat treatment process.

Important considerations involved in maintaining chalkbrood-free alfalfa leafcutting bee populations include utilizing the loose cell management system, effectively decontaminating bee cells, nest material, and other equipment annually, and regularly sampling alfalfa leafcutting bee cell quality.

---

D.W. Goerzen, Biologist  
Saskatchewan Alfalfa Seed Producers Association  
107 Science Place, Saskatoon, SK S7N 0X2  
SASPA Extension Publ. No. 2001 - 02  
May, 2001



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

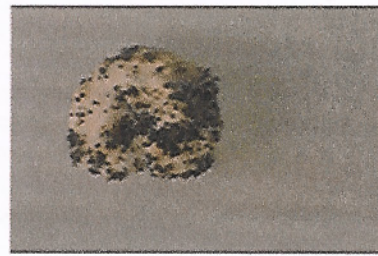


Figure 6



Figure 7



Figure 8



Figure 9



Figure 10

- Figure 1. Sporulating chalkbrood cadaver (*Ascospaera aggregata*) - external view.  
Figure 2. Sporulating chalkbrood cadaver (*Ascospaera aggregata*) - cross section.  
Figure 3. Non-sporulating chalkbrood cadaver (*Ascospaera aggregata*) - external view.  
Figure 4. Non-sporulating chalkbrood cadaver (*Ascospaera aggregata*) - cross section.  
Figure 5. Alfalfa leafcutting bee larval cadaver infected with *Ascospaera larvis*.  
Figure 6. Alfalfa leafcutting bee larval cadaver infected with *Ascospaera larvis*.  
Figure 7. Alfalfa leafcutting bee larval cadaver infected with *Ascospaera larvis*.  
Figure 8. Dead discoloured alfalfa leafcutting bee larva.  
Figure 9. Dead discoloured alfalfa leafcutting bee larva.  
Figure 10. Dead discoloured alfalfa leafcutting bee larva.

This chalkbrood control research and extension program has been funded by the Canada-Saskatchewan Agriculture & Agri-Food Innovation Fund (AFIF) and the National Research Council (NRC-IRAP), and is also supported by Agriculture & Agri-Food Canada (AAFC), the Saskatchewan Alfalfa Seed Producers Association (SASPA), and the Saskatchewan Alfalfa Seed Producers Development Commission (SASPDC).