

The following control measures have been adopted resulting in different degrees of success. Black lights in combination with drown baths are used to attract and drown adults after emergence. This in combination with vacuuming helps to eliminate the adult population. However, since mating occurs soon after emergence, the mated females have already done considerable damage by reparasitising other non-infected cells before they leave the incubation trays, thereby fostering a second generation of chalcids. The use of insecticide vapour strips (Yapona No-Pest Strip, 19.2% dichlorvos) at one strip per  $(28.3 \text{ m}^3)$  1000 ft<sup>3</sup> during days 8 to 10 of incubation is most effective. Yapona should be used with extreme caution. After the vapour strips are removed, the incubation room should be aired thoroughly with circulating fans for at least 24 hours before resuming incubation. These fumes are very toxic to adult leafcutting bees.

The cuckoo bee, Coelioxys is not a serious pest in most seed growing areas in northwest Canada. They occasionally appear in some populations and are usually rapidly phased out. Except for physically removing this parasite, there is no known control measure. Cuckoo bees and leafcutting bees belong to the same family and are very similar in appearance. Female cuckoo bees lack pollen-collecting hairs on the underside of the abdomen and have a longer, more sharply pointed abdomen than the leafcutting bee. Males are smaller than females and have a broader abdomen. The female cuckoo bee lays its egg in the pollen and nectar provisions of a leafcutting bee cell. This egg gradually develops into a larva and in its advanced stages of development it usually kills the leafcutting bee larva

in the same cell. After development is completed, the mature larva spins a cocoon in which it overwinters. In the following spring during incubation, adults usually emerge a few days before leafcutting bees.

The checkered flower beetle, Trichodes ornatus is a predator that actively searches for leafcutting bee cells to consume two or more bee larvae before reaching maturity. It occurs sporadically and is not usually a serious problem in the region. Adult beetles are (6 to 12 mm) (1/4 to 1/2") long and shiny metallic blue with either bright red or yellow markings on the wing covers. They lay their eggs between leaf pieces in the tunnel plug or between cracks in the nesting material. The newly hatched larva is bright red with a black head. They enter the bee cells, and feed on the pollen stores and bee larva. At maturity the larva is about 18 mm (2/3") long. They usually leave the bee cell and construct a reddish-brown pupal chamber at the opening of the leafcutting bee nesting tunnel where they overwinter. A large proportion of these larvae can be removed during tumbling of bee cells.

There are a number of other parasites, predators and nest destroyers of the leafcutting bees in the southern latitudes of the western Canadian provinces and in the United States. The effectiveness of different control measures on some of these species is summarized in Table 1.

## 6. CONTRACT POLLINATION

Some alfalfa seed producers prefer to contract out the pollination of their seed fields. A leafcutting beekeeper is then responsible for the introduction and maintenance of the bees and all the related equipment necessary to ensure optimum conditions for pollination. A suitable fee for this service is negotiated between the seed producer and beekeeper. Pollination costs are determined on a fee per acre basis or a previously agreed to percentage of the crop seed yield or a combination of both of the above. Information on beekeepers interested in contract pollination can be obtained from the Alfalfa Seed Producers' Associations in the prairie provinces or local District Agriculturists.

#### 7. POLLINATION OF OTHER FORAGE LEGUMES BY THE LEAFCUTTING BEE

The leafcutting bee has been used to pollinate experimental plots of a number of other legumes -- the clovers (alsike, red and sweet), birdsfoot trefoil and sainfoin. Studies on the use of this bee to pollinate large acreages of other legume crops are currently underway.

Table 1. Effectiveness of Different Control Measures\* on Individual Species of Natural Enemies.

Control Methods	Chalcid Parasites	Carpet, Flour, Spider, Cadelle Beetles	Flour Moth	Checkered Flower Beetles	Blister Beetles	Cuckoo Bees, Bee Flies	Yellow-jackets	Ants, Earwigs
Phasing out	2	3	3	1	1	1	0	0
Cold storage 35-38°F	0	2	2	2	0	0	0	2
Black lights	3	2**	3	0	0	0	0	0
Sprays	1	2	1	1	0	0	0	0
Fly strips	2	1	2	0	0	0	0	0
Sawdust coverings	3	0	0	0	0	0	0	0
Sorting, tumbling	0	3	2	2	2	0	0	0
Vapona strips	3	1	2	0	0	0	0	0
Squashing	0	1	0	2	0	1	1	1
Insecticide paint, oil baths, grease	0	1	0	0	0	0	0	3
Sticky boards	2	2	2	0	0	0	0	0
Vacuuming	3	1	1	0	0	0	0	0

\*0 - no control, 1 - poor control, 2 - fair control, 3 - good control

\*\* Except giant flour beetles

(Adapted from Parasites, Predators and Nest Destroyers of the Alfalfa Leafcutting Bee, Megachile rotundata by J.D. Eves, D.F. Mayer and C.A. Johansen, wrep 32, 1980.).