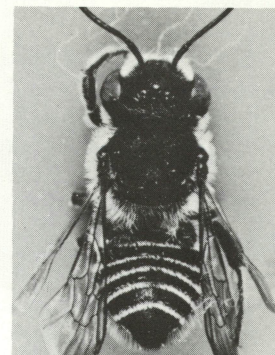


INSECT ENEMIES of the ALFALFA LEAFCUTTER BEE and THEIR CONTROL

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Most seed producers who depend on large populations of alfalfa leafcutter bees (*Megachile rotundata* (Fabricius)) for pollination are acutely aware of the pressing need for sustained action against the bee's many enemies. The brief descriptions and life histories of the enemies of leafcutter bees presented here can help bee raisers identify and become more familiar with these enemies. They are contained within three large insect orders: Coleoptera (beetles and weevils), Lepidoptera (butterflies and moths), and Hymenoptera (ants, wasps and bees).

COLEOPTERA

The American black flour beetle (*Tribolium audax* Halstead) now outnumbers all other beetles infesting bee nests in Idaho. Adults are black and are about $\frac{1}{8}$ inch long. The slender larvae will reach nearly $\frac{1}{2}$ inch in length and are pale brown, with darker brown rings at each body segment. Adults and larvae feed primarily on unconsumed pollen balls, but living bee larvae are killed as these beetles chew their way through the contents of a nest hole. Even at low temperatures these beetles and their larvae continue feeding. Whenever the temperature of leafcutter bee nests exceeds 40 degrees F during the winter feeding damage can be extensive. The red flour beetle (*T. castaneum* (Herbst)) is a close relative that can cause similar damage, however it is much less numerous in Idaho. As the name suggests, it is a reddish brown instead of black.

Eliminating these flour beetles is almost impossible under Idaho conditions. Keeping numbers down to a level where we can live with them is possible, but not without constant vigilance on the part of the bee raisers.

An effective program of controlling these beetles includes:

- Maintaining a winter cold storage temperature below 40 degrees F.
- A 21 day incubation period at 85 degrees F in the spring.
- Eliminating older, seriously infested nesting materials.

This program is outlined in Idaho Current Information Series No. 97, "Alfalfa Leafcutter Bee Excluder-Beetle Trap."

At least ten species of dermestid beetles are known to infest leafcutter bee nests. The more important species are: *Trogoderma glabrum* (Herbst), *T. parabile* Beal, *T. simplex* Jayne, *T. sternale* Jayne, *Anthrenus occidens* Casey, *Megatoma variegata* Horn, and *Attagenus piceus* (Olivier). Occasionally these nest destroying beetles cause more damage than all other predators and parasites combined.

Adults of a carpet beetle, *Trogoderma glabrum* are most often encountered. This common pest of stored grain is $\frac{1}{10}$ inch long, oval in shape and dull black with three lines of

whitish bristles across the wing covers. Full grown larvae are about $\frac{1}{4}$ inch long, have 11 brown bands around the body, and are covered with long brown hairs. Complete development from the egg to the adult requires about 35 days at 80 degrees F. Ordinarily dermestids are scavengers of dead animal and plant tissue, but living leafcutter bee larvae are readily consumed when contacted.

Life histories of the other listed dermestids are quite similar to *T. glabrum*. Control of this group of beetles is the same as that outlined above for flour beetles.

Other stored product beetles capable of serious damage are occasionally encountered in leafcutter bee nests. The Cadelle beetle, *Tenebroides mauritanicus* (Linnaeus), adults are about $\frac{1}{3}$ inch long, shiny black and much flattened. The larvae grow to be about $\frac{3}{4}$ inch long, are pinkish, white, or yellow, have a dark brown or black head, and two horn-like anal appendages. The adult females can live two years and lay 1,000 eggs each year. These hatch in as little as 10 days. The development from egg to adult may be completed in 70 days, but it frequently takes up to two years. This makes this insect one of the longest lived scavengers in bee nests.

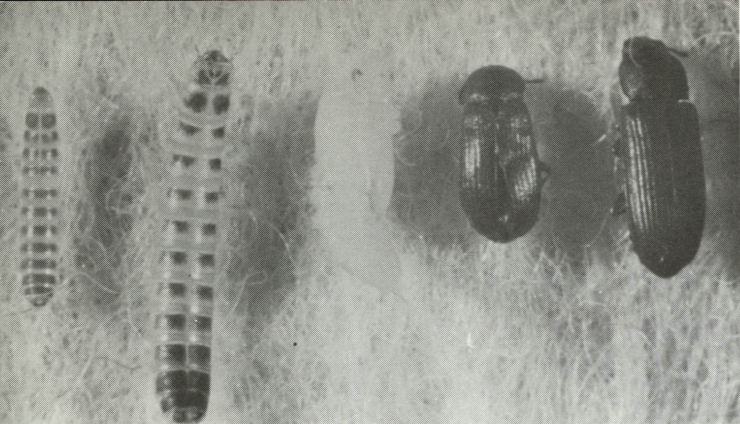
The saw-toothed grain beetle, *Oryzaephilus surinamensis* (Linnaeus), adults are about $\frac{1}{8}$ inch long, pale to dark brown, slender, and flat with a series of six saw-teeth on the lateral margins of the section behind the head. Development from egg to adult may take place in 3 weeks under summer conditions. No special control has been worked out for these two species other than the one outlined above for stored product beetles.

Nemognatha lurida LeConte is a yellowish-tan meloid or "blister beetle," $\frac{1}{4}$ to $\frac{1}{2}$ inch long. Adults have long, tube-like, permanently extended mouthparts. Females place their eggs on the undersides of wild sunflower heads in clumps of 10 to 40 eggs. The newly hatched "triungulin" beetle larvae attach themselves to bees that visit the flower head, thus catch a ride back to the bee's nest. There the triungulin ingests the contents of a bee egg, then consumes the store of pollen and nectar and overwinters in the same bee cell. Destroying sunflowers growing in the vicinity of bee domiciles may be beneficial since these are the only known plants on which females deposit eggs.

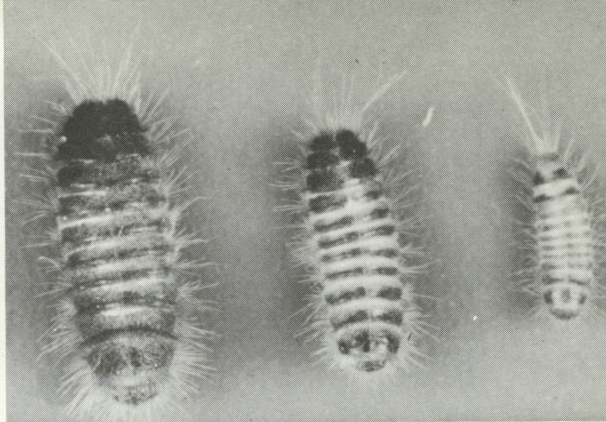
The clerid beetle, *Trichodes ornatus* Say, is about $\frac{1}{2}$ inch long and metallic blue in color with bright red or yellow markings. Adults are called "checkered flower beetles." Their larvae are dark pink with brown heads, thoracic shields, and hook-like structures at the anal end. Full grown larvae are $\frac{3}{5}$ inch long. It is unknown how the larvae reach the bee cell. After destroying the leafcutter bee egg, the life cycle is quite similar to that of meloid beetles, except the contents of two or three cells are consumed. No control is known; however, damage is of little importance except in rare instances.

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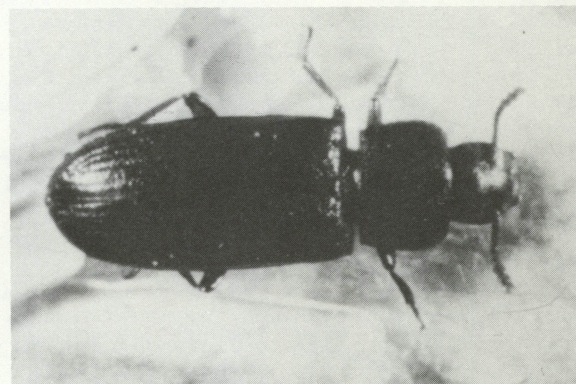
The American black flour beetle is the most numerous of the beetles that infest bee nests.



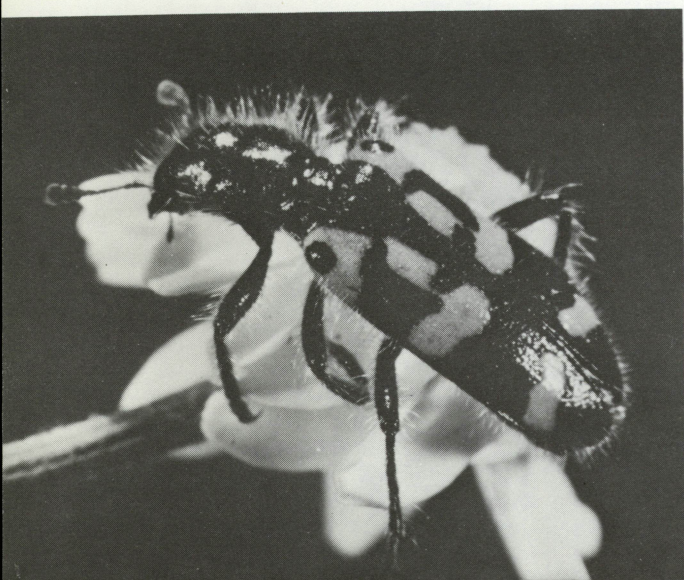
Dermestid beetle larvae (above) and adult (below). This species can cause more damage than all others combined.



The cadelle beetle is one of the longest lived scavengers in bee nests.

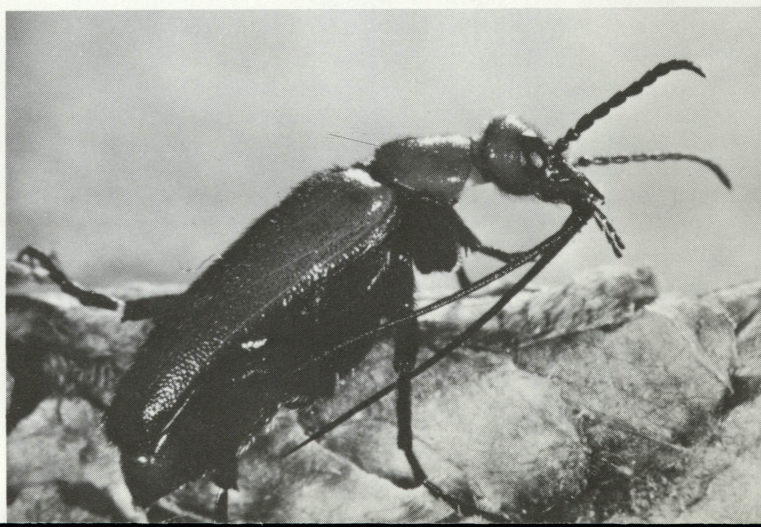


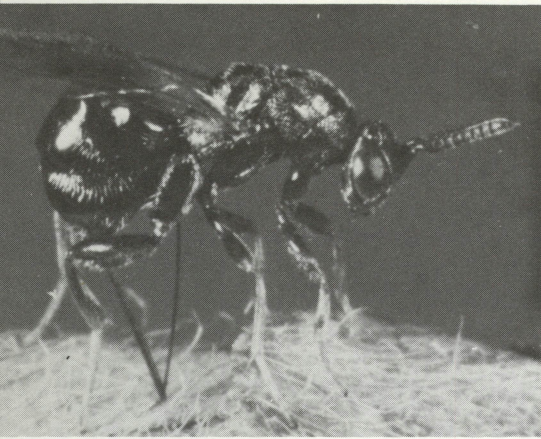
The red flour beetle, like the black flour beetle, is almost impossible to eliminate.



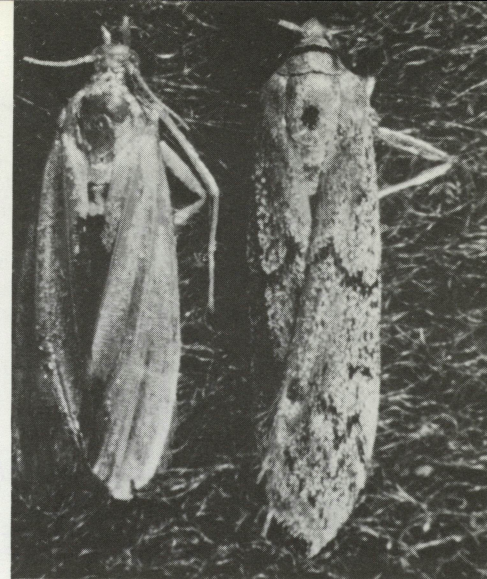
The clerid beetle causes little damage.

The blister beetle deposits eggs on sunflowers.

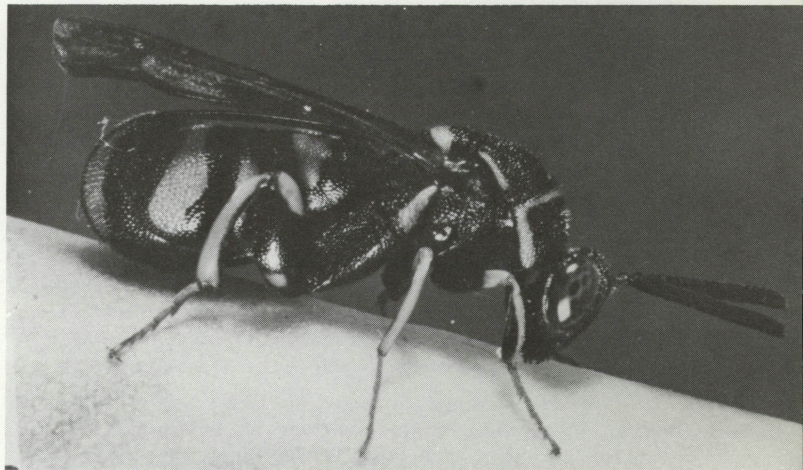
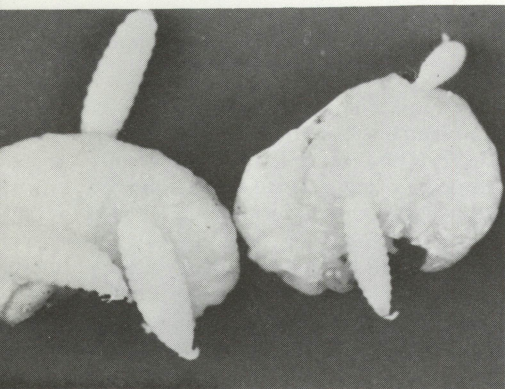




Chalcidoid wasp, *Monodontomerus obscurus*, can be attracted with black light and water traps. Adult is in photo above; larvae feeding on bee larvae in photo below.



The Indian meal moth and the dried fruit moth destroy many bees. Indian meal moth larva is in photo at left; adult Indian meal moth and dried fruit moth in photo at right.

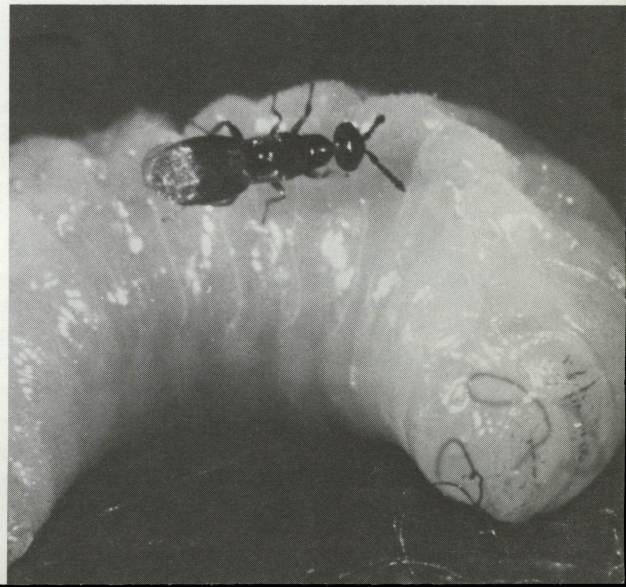


Leucopsis affinis Say, one of the largest chalcidoid wasps, is about 1/3 inch long.



Workers of the *Sapyga pumila* Cresson species run in and out of open bee holes during nesting period.

Melittobia chalybii Ashmead is less than 1/25 inch long.



LEPIDOPTERA

The Indian meal moth, *Plodia interpunctella* (Huebner), and the dried fruit moth, *Vitula edmandsae serratilineola* Ragonot, have similar life histories. Adults of both have a wing span of about $\frac{3}{4}$ inch. The wing markings on the adult *Plodia* are pale gray with the outer $\frac{2}{3}$ of the forewings metallic copper, while the forewings of *Vitula* are uniformly darker gray, speckled with black. Each may produce white, yellow, pink or greenish larvae which destroy several bee cells during development. From four to six generations occur each year. A great number of bees are being destroyed by these two species. Fortunately, the adults emerge earlier than bees do during the spring incubation operation. Large numbers of newly emerged adults are easily destroyed in waterpan traps because they are strongly attracted to lights, especially "black light." This method of control is described in detail in Idaho Current Information Series, No. 120, "Lights and Water Traps for Alfalfa Leafcutter Bee Incubators."

HYMENOPTERA

The chalcidoid wasp, *Monodontomerus obscurus* Westwood, is black, tinted with blue-green and has bright red eyes. Adults are $\frac{1}{8}$ to $\frac{1}{6}$ inch long. The posterior tip of the male abdomen is rounded and the tip of the female abdomen ends in a long slender ovipositor. She inserts this ovipositor through the leaf exterior of a cell wall, stings the leafcutter bee larva inside into immobility, and deposits 3 to 25 eggs on the interior of the cell and/or on the exterior of the larva. Eggs hatch in as little as 36 hours and the white larvae begin feeding externally on the bee larva.

There is no visible external evidence that bee larvae or pupae inside the cells have been parasitized. An infestation cannot be detected until adult parasites emerge. The life cycle of this parasite from egg to adult may be completed in 20 days, resulting in several generations per summer. They overwinter inside bee cells as mature larvae and emerge in the spring as adults a few days before the leafcutter bees.

Adults are strongly attracted to lights when they first emerge. By taking advantage of the early emergence and the attraction to lights, especially filtered black light, bee raisers have successfully eliminated this species as a serious parasite through use of these lights over waterpan traps during the period of spring incubation.

Leucopsis affinis Say is one of the largest chalcidoid wasps, about $\frac{1}{3}$ inch long. It is black with bright yellow markings and has enlarged hind legs. The female's long sturdy ovipositor at the tip of the abdomen curves upward and forward over the top of the abdomen. Females lay a single egg on a developing leafcutter bee larva by thrusting this ovipositor through solid wood, soda straw paper or the leaf capping plug. No controls are known. This species is not a serious pest in Idaho, but up to three percent parasitism has been recorded.

Sapyga pumila Cresson is a slender wasp, about $\frac{1}{3}$ inch long, black with small, light yellow abdominal markings. Occasionally it has a dark red hue around the mid-abdomen. Throughout the bee nesting period females of this wasp are found on the face of nests running in and out of open bee holes.

Eggs are laid in completed cells during that brief period between the time the female leafcutter lays her egg and when she places the first leaf cap on that cell to seal it. The newly hatched parasite larva consumes the bee egg, then finishes development on the nectar and pollen stored in the cell. Over-wintering occurs inside a papery brown cocoon within the same bee cell.

It has been speculated that this species actually destroys many more bees than its adult numbers might indicate.

Newly hatched larvae have been observed to unsuccessfully attack bee eggs, yet they must feed on an egg, or die. Unfortunately, the bee egg apparently always dies, too, if thus attacked. This interrelationship may be one partial answer to the unknown causes of immature leafcutter bee mortality.

This parasite is rapidly becoming a major pest in Idaho, yet one for which no practical means of control is known beyond the primitive, but often effective, method of squashing the adults as they run about on the face of bee nests with an index finger.

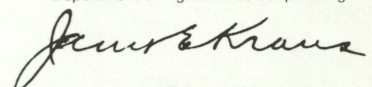
The parasitic bees, *Coelioxys* spp., are closely related to leafcutter bees, being similar in size and appearance except that females have a long, sharply pointed abdomen which lacks pollen collecting hairs on the underside. Egg laying may take place from before the host egg is laid until after the host larva has begun its development. The newly hatched larva is equipped with enormous mandibles with which it destroys the immature leafcutter bee. With this task accomplished the parasite proceeds with its development within the cell on the stored nectar and pollen and if examined would be extremely difficult to differentiate from a leafcutter bee larva. Species belonging to this widely distributed genus have only been recorded as parasites of alfalfa leafcutter bees from California, Idaho, Utah and Canada. They are not regarded as serious pests.

The extremely small chalcidoid parasitic wasp, *Melittobia chalybii* Ashmead, is less than $\frac{1}{25}$ inch long and is dark brown in color. The female has well developed wings and normal antennae, but has no visible external ovipositor. The slightly smaller, robust male has extremely short wings which are not functional for flight, and claw-like antennae which are used to clasp the antennae of the female during mating. Males are rarely seen because they remain in the bee cell after completing development. Females can fly, but more frequently walk or hop. The female chews into a bee cell and lays eggs on the surface of the bee larva, prepupa or pupa. The parasite larva feeds externally. The life cycle takes a little more than 15 days to complete and many generations occur in one season.

M. chalybii has not been recorded on alfalfa leafcutter bees in Idaho, although it has been found as a parasite on several species of bumble bees, wild bees and wasps. However, it has been recorded as a parasite of alfalfa leafcutter bees in several neighboring states. At present it can not be regarded as a pest, but there is great potential of this parasite becoming a serious pest of the alfalfa leafcutter bee in Idaho.

Three additional chalcidoid wasp parasites should be included as known alfalfa leafcutter bee enemies, although not yet present in Idaho: *Tetrastichus megachilidis* Burks, *Pteromalus venustus* Walker and *Dibrachys malculipennis* Szelenyi. Few life history details are known. All are $\frac{1}{25}$ inch long, or smaller, and it is believed their methods of attacking immature leafcutter bees do not differ greatly from the one described above for *M. chalybii*. *Tetrastichus megachilidis* has been recorded in California and Washington and attacks only mature larvae. Another species of *Tetrastichus* was responsible for the elimination of a strong colony of *Megachile concina* Smith located within an alfalfa seed field in Arizona in a single summer. *P. venustus* and *D. malculipennis* are European in origin and have been recorded in Canada as parasites of alfalfa leafcutter bee larvae there.

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