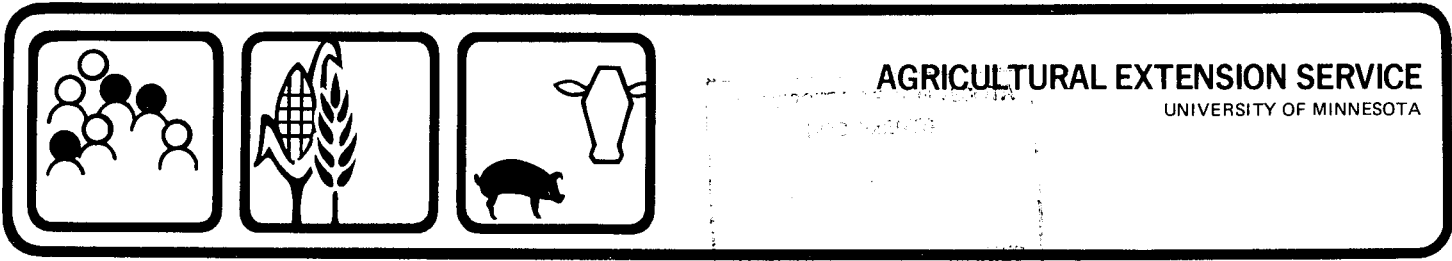


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Controlling Indianmeal Moths in Stored Shelled Corn and Soybeans

Identification and Biology

The Indianmeal moth, *Plodia interpunctella* (Hubner), is a common insect pest of stored grain (especially shelled corn) and is the primary storage insect pest of harvested soybeans in Minnesota. The adult moths have a wing span of about 3/4 inch and are easily distinguished from other stored grain moths by the color of their front wings. The outer two-thirds of these wings is reddish-brown with a copper luster. The remainder is whitish-gray.

Each female moth lays 100 to 300 eggs on the surface of the stored product. Within a few days, depending primarily on the temperature, small larvae (caterpillars) emerge from the eggs to feed. When fully grown, the larva is about one-half inch long and is dirty white, although it may vary from greenish to pinkish tints depending on the food it consumes.

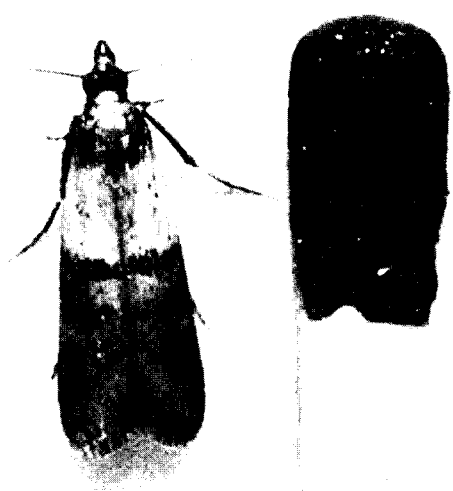
The larvae feed primarily on broken kernels, grain debris, chaff, etc. They generally stay within 18 inches of the surface of the grain and spin a silken web. Undisturbed grain or soybeans with heavy infestations may become completely webbed

over. Underneath this webbing the larvae are protected partially from changes in their environment including the application of chemical or biological insecticides. Consequently this webbing should be removed before treatment. In addition to the webbing and feeding, these insects contaminate the grain with their feces and cast skins.

The larvae spin cocoons when they become full grown. Many of the cocoons are formed on the surface of the grain, but some of the larvae move out of the grain and make their cocoons on bin braces, on rafters, or beneath perforated bin floors. The moths emerge from the cocoons, mate, and lay eggs to continue their life cycle. During the summer, this cycle can be completed in six to eight weeks.

Preventing Infestations

The most favorable temperature for Indianmeal moths is about 80° F, although they become active following winter when grain temperatures rise to 60° F. Since they infest only surface grain, which is usually the first to warm up with increasing spring temperatures, they become active relatively early compared to beetles and weevils that have penetrated deep within the grain mass.



▲ The close-up photo above shows the Indianmeal moth in the adult and larval stages in stored food products.

◀ The adult Indianmeal moth showing size and characteristic color pattern of the wings.

To chemically prevent adult moths in grain or soybeans, suspend one dichlorvos (Vapona) "Farm Strip" per 1,000 cubic feet of air space over the binned commodity before moths begin to emerge from overwintering cocoons. This treatment kills the adult moths before mating, thus preventing population increases. These farm strips are usually effective for four months if the storage structure is tight. Replace all strips when effectiveness is diminished.

Although not approved for soybeans, surface grain treatments with chemical insecticides involve the use of malathion as follows:

Malathion - 1/2 pint 50% to 57% premium-grade E.C. in 2 gallons of water per 1,000 square feet of grain surface area.

Malathion - 1% premium-grade in wheat flour dust, 30 pounds per 1,000 square feet. (It is also available as a 2%, 4%, or 6% dust.)

Apply the malathion spray or dust formulation evenly over the surface immediately after the grain is loaded into storage and leveled off. This "topping off" treatment also helps prevent beetles or weevils from infesting the grain on the surface.

There is evidence from some areas in Minnesota that the Indianmeal moth is developing resistance to malathion. Research is in progress to determine the extent of this resistance.

A relatively new biological insecticide is now marketed as Dipel®. The active ingredient is the bacteria *Bacillus thuringiensis*, which kills moth larvae only. It is registered for application on stored grains and soybeans to kill malathion-resistant moths. Both liquid and dust formulations are available. Apply surface treatments of Dipel® immediately after the grain is loaded into storage and leveled off, or mix it into the last four inches of grain being augered into the bin. For surface treatments in full bins, apply 1 pound of Dipel® WP in 10 gallons of water per 500 square feet of grain surface area. Mix the top four inches of grain thoroughly with a scoop or rake. The effectiveness of Dipel® is not reduced when it is used simultaneously with most fumigants.

When late fall-harvested grain is not subject to moth infestations because of low temperatures, applications of malathion or Dipel® could be delayed until early spring before moth activity begins.

Most fumigants are registered for application on corn and stored small grains. Phosphine is the only fumigant that can be used both on soybeans and stored grain. Tablets of aluminum phosphide may be added as the product is being binned, or they can be probed into the product surface after the bin is filled. For details, see Entomology Fact Sheet No. 50, Fumigating Stored Grain.

Detecting Indianmeal Moths

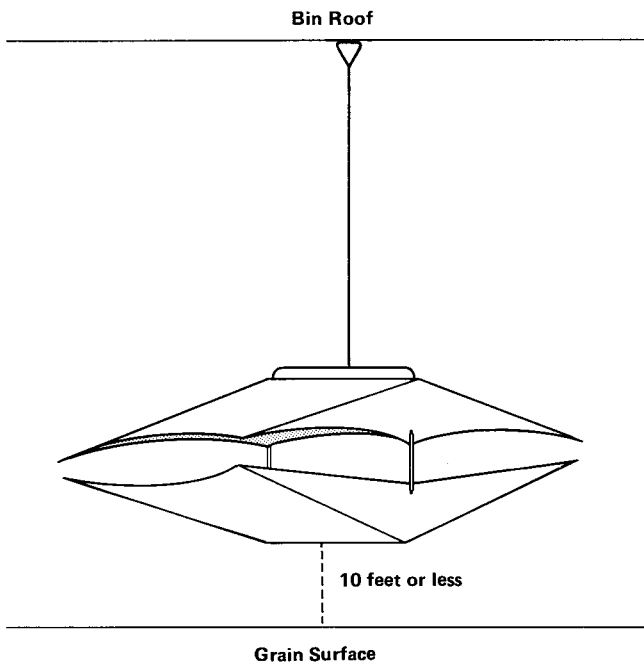
As stated earlier, when the grain surface warms up to 60° F in the spring, the larvae of the Indianmeal moth migrate to the top of the grain mass in search of a place to pupate and become adults. As these adults emerge, an effective way to detect them is by the use of pheromone traps (see Figure 1).

Pheromones are chemicals secreted by the female moth to attract the males to a particular site. After entering the trap the males come in contact with a glue-laced liner and are unable to escape. These traps should be suspended inside the storage structure, near the roof but within 10 feet of the grain surface. The moths will be attracted to these traps for as long as 6 weeks but they should be checked for moth activity every 5 to 10 days. The trap liners containing the glue can be replaced within the traps as needed. Do not consider these traps to be a means of moth control. They are only effective to detect and monitor moth infestations. Trapping 30 moths or more within a 5-day interval indicates the need to initiate a moth control program. The threshold for seed grain is 10 moths trapped within 5 days. Factors affecting the number of moths caught in pheromone traps are:

1. Temperature - Air or grain temperatures of less than 60° F inhibit moth activity.
2. Life Stages - the normal life cycle fluctuates in the moth population to produce peaks of adult moth activity. Visual observations at the larval stage will supplement trap detection.
3. Placement - Putting the traps too far away (more than 10 ft) from the grain or placing them in direct air drafts can reduce trap efficiency.
4. Dust and Damage - Dust can prevent the glue from holding adult moths, and a mutilated trap cover or base may inhibit moth entrance.

These traps are sold by many distributors of grain fumigants and protectants. They typically come as a kit containing 2-5 traps with replacement liners and 5-10 pheromone capsules.

Figure 1



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