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Indianmeal Moth, *Plodia interpunctella* (Hubner)¹

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Introduction

The Indianmeal moth, *Plodia interpunctella* (Huebner), is a very common household pest, feeding principally on stored food products. In fact, it has been called the most important pest of stored products that is commonly found in the home or in grocery stores in the United States. The larvae are general feeders, as they can be found in grain products, seeds, dried fruit, dog food, and spices. The Indianmeal moth received its common name from the United States where it was found to be a pest of meal made of "Indian corn" or maize.

Distribution

This insect is found in a wide range of climates in stored products and food storage facilities around the world. It is very common in Florida, where it also lives successfully out-of-doors.

Life Cycle

A life cycle can be completed in 27 to 305 days. A single female can lay up to 400 eggs after mating.

The mating and laying of eggs occurs about three days after adult emergence. The eggs can be laid singly or in clusters, and are generally oviposited directly on the larval food source. The eggs hatch in seven to eight days at 20 degrees C and three to four days at 30 degrees C. Upon hatching, the larvae begin to disperse and within a few hours can establish themselves in a food source. The larvae can complete their development in six to eight weeks at temperatures from 18 to 35 degrees C. The number of larval instars varies from five to seven (depending on the food source and the temperature). The pupal stage can last from 15 to 20 days at 20 degrees C and seven to eight days at 30 degrees C.

Description

Eggs

Eggs of the Indianmeal moth appear grayish white and range in length from 0.3 to 0.5 mm. Eggs are oviposited singly or in clusters, and are generally laid directly on the larval food source.

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Larvae

There are five to seven larval instars. Their color is usually off-white, but has been observed to be pink, brown or almost greenish, depending on the food source. The mature larvae are about 1/2 inch in length. They have five pairs of well developed prolegs that help them move considerable distances to pupate.

Pupae

The larvae pupate either in a silken cocoon or unprotected. The pupae are 1/4 to 2/5 inch long (6 to 11 mm) and are pale brown in color. Pupation takes place away from the infested material. In fact, the late instar larvae can travel such distances that they are often mistaken for clothing pests. Within the pantry the small larvae often climb to other shelves before pupating. This misleads people trying to find the source of the infestation.



Figure 1. Pupa of the Indianmeal moth, *Plodia interpunctella* (Huebner). The larva crawled up two shelves and then onto a stack of food envelopes before pupating on the inside of an military C-ration toilet paper packet. This shows how larvae have the ability to migrate to distance locations and thus confuse identification of the source of the infestation. Credits: Lyle Buss, University of Florida

Adults

Adults are a common sign of an infestation. When flying adults often appear to be fluttering instead of maintaining a direct line of flight. They are attracted to light and may move to distant rooms in the house away from the infestation. As a result, they are also commonly mistaken for clothing pests. Adults do not feed. Adults are about 1/2 inch long with a wing span of about 5/8 inch (16 to 20 mm).



Figure 2. Pupal case of the Indianmeal moth, *Plodia interpunctella* (Huebner). The larva pupated on the bottom edge of a soup can two shelves up from the actual infestation. All pantry goods must be examined carefully to eliminate the next generation of adults which can fly and thus distribute the infestation further. Credits: Lyle Buss, University of Florida



Figure 3. Remains of a pupal case of the Indianmeal moth, *Plodia interpunctella* (Huebner). The larva pupated inside the lid of a cardboard container one pantry shelf up from the actual infestation. This demonstrates how difficult it might be to eliminate an infestation even after it has been discovered. All pantry goods must be examined carefully to eliminate the next generation of adults which can fly and thus distribute the infestation further.

The forewings of this moth are reddish brown with a copper sheen on the outer two thirds and gray on the inner third. At rest the wings are held roof-like over the body. The head and thorax of the moth appears gray and the posterior brown, with a coppery sheen.

Damage

The larvae are surface feeders. Most of the "damage" to stored products occurs when the larvae spin massive amounts of silk that accumulate fecal pellets, cast skins, and egg shells in food products. The damage to stored products due to this



Figure 4. Remains of a pupal case of the Indianmeal moth, *Plodia interpunctella* (Huebner). The larva pupated on the side of a stack of paper cups. All pantry goods must be examined carefully to eliminate the next generation of adults which can fly and thus distribute the infestation further. Credits: Lyle Buss, University of Florida



Figure 5. Adult Indianmeal moth, *Plodia interpunctella* (Hubner). Credits: Lyle Buss, University of Florida

contamination exceeds the amount of food eaten by the insects. Homeowners and managers of food processing plants, warehouses, groceries and granaries should be alert for signs of infestation.

Monitoring and Sampling

Monitoring and Sampling can be accomplished with pheromone sticky traps. In some cases of low-level infestations, traps can be used for control as well. Traps are also useful in timing and evaluation of control procedures. In a study of pheromone trap



Figure 6. An infestation of Indianmeal moth, *Plodia interpunctella* (Huebner), in a jar of pistachio nuts. It was later determined that the nuts were purchased from a commercial supermarket that had an infestation in a bin of bulk foods. One of more infested nuts was brought home. The lid of the jar was slightly loose allowing several generations of Indianmeal moths to reproduce, and eventually allowing larvae and adults to escape to pupate and spread the infestation. If the jar had been tightly closed the infestation would have died, either from lack of air or from a buildup of moisture that would have allowed the development of fungus to destroy the larvae and adults. Observe the frass, insect fecal waste, on the outside of the nuts as well as the webbed pupal cases in the center of the photograph. A few adults are also visible. Credits: Lyle Buss, University of Florida

effectiveness in attracting Indianmeal moths, traps containing (Z,E)-9, 12-tetradecadien-1-yl-acetate (ZETA) proved useful in monitoring populations. One drawback of the pheromone sticky trap seems to be that population size and number trapped affect their effectiveness. For example, if large number of moths are in the trap, the ability to capture more moths decreases. The continued use of sticky traps (with pheromones) could lead to improved control programs and less incidence of insects in stored products on grocery shelves.

Sanitation

Elimination and exclusion are key elements in controlling pest populations of this moth. If a population is discovered, all infested food must either be discarded or treated. Any susceptible food source should be placed in sealed containers. Dog food and bird seed usually are overlooked as infestation sites, and these items should also be kept in sealed containers. All stored food products brought home from the grocery store should be examined for the tell-tale "white worms" and webbing.

Freezing the product for several days has proven to be an effective control measure. Heating in an oven or microwave also kills larvae and eggs.

Chemical Control

Numerous insecticides have been used to control Indianmeal moth populations, but effectiveness is limited. In a study evaluating the effectiveness of chlorpyrifos-methyl and chlorpyrifos-methyl plus methoprene (an insect growth regulator) it was found that even after treatment with these chemicals, Indianmeal moths were found in corn storage bins. In an additional study of chlorpyrifos-methyl on larvae in peanuts, it was found that at rates of 5 and 10 ppm no control of fifth instar larvae was accomplished. Only at 20 to 30 ppm was control of fifth instar larvae observed. Significant resistance to Malathion was also revealed in one study. In the same study, resistance to dichlorvos was also observed. Studies show that resistance increased with increasing selective pressure. Resistance was also observed in studies performed with the microbial insecticide *Bacillus thuringiensis*. Resistance was just as likely with exposure to single strains of *B. thuringiensis* as with mixtures of sequences of the insecticide. Resistance, once achieved, appeared to be inherited as a recessive trait, and with time was observed as genetically stable.

Insect Management Guide for Stored Grain Pests

Biological Control

Population suppression has been observed in the laboratory using egg and larval parasites. Both the egg parasite, *Bracon hebetor* (Hymenoptera: Braconidae) and the larval parasite, *Trichogramma pretiosum* (Hymenoptera: Trichogrammatidae) have demonstrated moth population suppression. When the parasites were used in combination, an 84.3 percent suppression was observed. *T. pretiosum* acting alone offered a 37.3 percent suppression rate while *B. hebetor* provided a 66.1 percent suppression rate.

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