



# Pest Facts

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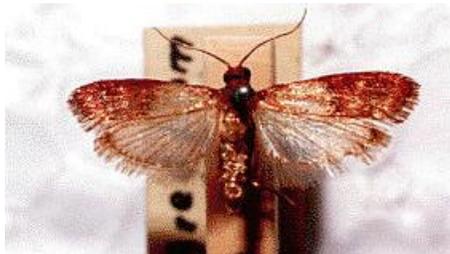
## Indian Meal Moth

Indian meal moth is frequently found infesting a variety of food stuffs including pasta, dried fruit, nuts and pet food, causing millions of dollars in damaged or destroyed goods. Although a native of South America, its name comes from the United States, where it was first recorded as a pest of "Indian corn" or maize. Today, Indian meal moth may be found infesting stored goods throughout the world. Successfully managing Indian meal moth as well as many other stored product pests requires integrating a variety of chemical and non-chemical techniques into a comprehensive program of surveillance, exclusion, sanitation and control. The following discussion provides general guidelines for developing an effective program. However, because each situation is different, contact your local pest management professional for assistance

### Description

Adult Indian meal moths are small ( $3/8$ - $1/2$ " long) insects with a wing span of about  $3/4$ ". Their forewings have a distinctive coppery luster covering the outer  $2/3$  and whitish grey on the inner portion or body edge. The hind wings are also whitish grey.

Larvae are approximately  $1/2$ " long when fully grown. They display a dirty white color sometimes varying to greenish and pinkish hues depending on their diet. The head is brown. The pupa is enclosed and protected in a light brown silken cocoon. Eggs are tiny (at least 10 can fit on the head of a pin), white and translucent.



## Life Cycle

Indian meal moth undergoes complete metamorphosis (i.e., egg, larva, pupa, adult). The female moth emerges from her cocoon with eggs (100-300) fully developed begins ovipositing (laying eggs) next to an appropriate food supply, three days later after mating. She attracts male moths by emitting a pheromone. This behavior is exploited by pest managers during surveillance activities. Adult life span may be from 2-3 days in warm weather and to 30 days in cooler weather. Adult moths do not feed, their sole function being reproduction.

Within a few days fertilized eggs hatch and small whitish larvae emerge. After five or six instars (developmental stage), larvae crawl out of their food and construct cocoons in which they will develop into pupae.

Completion of the life cycle may take 4 to 44 weeks depending on temperature, humidity and availability of food (i.e., warm and humid conditions encourage growth). There are generally four generations per year with a fifth surviving winter and producing adults in the spring. In warm weather/tropical areas, moths will often produce more than 4 generations per year.

## Behavior

Adult Indian meal moths are most active during the evening (approximately 2000 to 2100 hours), at which time mating and oviposition occurs. The moth commonly flies only 4-5 feet off the ground but will tend to migrate upwards following warm air currents. This behavior becomes important when positioning traps. During daytime, the moth is frequently found resting in dark, quiet areas including beneath or behind shelving, folds of packaging, cracks and crevices near the infested product etc.

The female moth is capable of determining the presence of food suitable for her offspring. Once found, she lays her eggs on or next to the food material so that emerging larvae will be near their source of nourishment. Food sold from bulk containers and spilled product under shelving or pallets is highly susceptible. However, packaged food may also be infested.

Some containers, whether made from cellophane, plastic, paper or cardboard, have extremely small air leaks where they are incompletely sealed, folded or damaged. The female moth will find and lay her eggs next to these small openings. When her eggs hatch, the tiny larvae will crawl through the openings to infest the food inside.

When larvae have reached their final stage of development and are ready to pupate, they wander to preferred pupation sites. These sites most often include corners and crevices, shelving, and pallets. Additionally, they also like folds found in many types of packages; and, in the storage area, they like corners created by one bag/box laying on top of another. If confined inside a container, they will pupate in a corner of it or on the surface of the material in it. Corrugated cardboard is another common pupation site.

Late stage (full grown) larvae have the ability to bore holes in some types of packages as do some other insects. This ability, coupled with larval tendency to wander, explains the

small round holes they sometimes leave in creases and corners of packages. It also indicates from which direction the holes are bored. The tiny larvae that find their way into a package eat and grow until they are full grown and ready to pupate. They can bore their way out of the package and continue searching for a pupation site.

## **Food**

The Indian meal moth will feed on a variety of food stuffs including:

- Dried fruits such as dates, raisins, cherries, apricots, peaches, etc.
- Grain and grain products such as rice, wheat, cereal, corn meal, flour, ready mix biscuit, cake products and pasta.
- Legumes such as dried beans and peas
- Nuts
- Seeds
- Candy bars (nuts, carob, chocolate)
- Pet food

## **Damage**

The Indian meal moth larvae is responsible for damaging merchandise. Although larvae feed on the host material, they damage far more than they eat by leaving loose masses of silken webbing with excrement and cast off skins which cling to the product rendering it unsaleable.

The adult moth is mostly an aesthetic problem possibly annoying customers when it is flying. Inconspicuous contaminants associated with adults are moth eggs, wing scales and other adult body parts.

## **Integrated Pest Management Program**

The following information describes general guidelines followed during the development and implementation of a comprehensive Indian meal moth management program. While an effective program will contain many of these elements, every program is dependent on site specific parameters and should be reviewed by a pest management professional before and after implementation.

## 1. Surveillance: Identifying the Problem

### Visual Inspection

All facility areas (inside and outside) must be thoroughly reviewed to identify active/potential problem areas and to document program effectiveness. Include the following:

-Outside of the facility: Keep the area around the facility clean. Keep vegetation trimmed. Do not let pallets and debris collect. These are potential harborages for rodents and insects. Eliminate horticultural plantings that attract insects (i.e. pittosporum shrubs attract flies, many flowers attract warehouse beetles). Replace any outside mercury vapor lights with sodium vapor lights which attracted fewer insects.

-Bulk display bins and dispensers: Clean around, underneath and in. Take special care to clean all inside corners.

-Shelving and display cases: Clean and dust under, on and around shelves and display cases. Prevent food particles from collecting by sealing cracks with silicone or other flexible caulk.

-Pet food aisles: Check for torn bags and buildup of debris. Monitor shelving for pupal cases. Inspect all pet food before stocking on shelves.

-Checkout counters: Keep clean. Do not allow build-up of food matter behind or underneath scales, cash register and counter.

-Floors: Fill or eliminate cracks. Sweep and mop regularly. Inspect corners and edges for insect activity. Keep free of dust and debris. Inspect old drain holes and clean out or eliminate them if possible.

-Cellars: Keep clean and well organized. Do not allow refuse to build up or storage of damaged or returned product. Examine for pest accesses such as holes around utility lines, poor fitting doors, window screens absent or in disrepair and pest harborages such as crevices around utility boxes, sinks, door frames, etc.

-Product storage areas: Keep food off floor on pallets or shelving made of non-porous materials at least 18" from the wall. This provides an inspection and cleaning corridor. Dust ledges and window sills, examine for signs of insects. Return or discard damaged/infested stock immediately. Place in isolated (morgue area) away from other products. The longer infested product remains in the facility, the better chance the infestation will spread. Practice sound product rotation (first in, first out).

### Pheromone Trapping

Pheromones are scents (chemicals) used by insects for communication. Some pheromones are emitted by female insects to attract the male for mating. These are called sex attractants. Some insects also produce aggregation pheromones. These chemicals attract both males and females to areas favorable for living and hiding.

Pheromones are generally species specific. Each pheromone attracts only insects of one species or those of closely related species. The Indian meal moth pheromone, for example, attracts the Indian meal moth, Mediterranean flour moth, raisin moth, almond, moth and tobacco moth.

Pheromone traps consist of a two part system: the lure which attracts insects to the trap and the trap which captures insects once they have been attracted to it. Neither the lure nor the trap contains chemicals that kill insects. The lure is simply an attractant. The trap employs a sticky substance to which the insects adhere to, thus preventing escape.

*Pheromone Trap Monitoring: Indian Meal Moth*

The following provides general information concerning pheromone surveillance. Additional information may be obtained from the Armed Forces Pest Management Board publication Technical Information Memorandum Number 27, Stored-Product Pest Monitoring Methods. Before implementing a pheromone surveillance program, consult your local pest management professional for guidance.

-Monitoring for an Infestation (preventive): With traps in place, any increase in the size of a moth population will be detected. If this occurs, it is an indication that a general infestation is being established or infested merchandise has been imported into the facility

-Locating an Infestation: If an infestation is located in a specific area, traps closest to the vicinity of the infestation may have a higher than normal catch. Manual searches for the infestation may then be concentrated in this area.

-Determining the Effectiveness of Control Management Measures: When management measures are implemented and prove to be effective, traps will indicate a population reduction. If numbers remain stable or increase, control measures must be re-evaluated.

-Indication of Need for Improved Protection: A trend indicating elevated trap counts may signal a need to improve/modify of preventive measures. This may mean removal of



infested merchandise and elimination of an infestation site (i.e., spilled merchandise)

## 2. Exclusion/Sanitation

Seal off/repair/pest proof possible entry points and eliminate harborages. These include improperly stored or excess equipment, poorly fitted doors/windows/screening, cracks, crevices and holes, vents, etc. Ensure high levels of sanitation. (See inspection/monitoring)

## 3. Preventive Inventory Stocking Procedures.

### a. Warehouse and Receiving Area

- Date stock as it enters warehouse or receiving area. Rotate on first in, first out basis.

- Rotate entire inventory on a regular basis

- Keep excessive inventory down to help facilitate rotation. Buying a large lot on sale and storing it may lead to problems unless it can be rotated quickly.

- Keep slow moving products

## 4. Suppliers/Distributors

Suppliers/distributors are an important link in the food distribution chain and must be considered when planning a pest management program. Suppliers have their own pest management problems to handle and sometimes are, unavoidably, the source of infestation/re-infestation.

Keep excellent documentation. If you are regularly receiving infested merchandise from a particular supplier/distributor, consider the following actions:

- Carefully examine incoming merchandise

- Document all problems, offer suggestions to the distributor/supplier. Change the label of a consistently infested product.

- Change supplier/distributor if the problem is not resolved

## 5. Climatic Manipulation

Climatic conditions have an important impact on insect populations. Cool and dry conditions tend to suppress growth and development and may result in mortality. Warm

and humid conditions tend to speed development, increasing the number of generations produced per year. If possible, place infestable products (i.e., pet foods, pasta) in cool/dry storage areas or, if possible, refrigerator/freezer.

## 6. Chemical Control

Chemical control should only be considered in conjunction with other techniques and performed by a certified applicator. Crack and crevice (residual) treatments are often used in areas where adult moths rest or larvae migrate to pupate. Space sprays or fogs are used periodically in isolated areas, mainly to reduce adult density (space sprays are not residual insecticides and only affect those insects which directly contact the chemical during application). Trapping may also be used for surveillance and in isolated areas to reduce the size of isolated or small populations. **Remember, application of insecticide without addressing the causes of an infestation will result in limited short-term success.**

For additional information regarding stored product pest management, contact your local pest management professional or DSCP at 510-337-8122, DSN 686-8122 or email [paa5245@exmail.dscp.dla.mil](mailto:paa5245@exmail.dscp.dla.mil).

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