



Insects Limited, Inc. and Fumigation Service & Supply, Inc.

New Leadership Team

For the past two years a new leadership team has been preparing to take the reins of [Fumigation Service & Supply, Inc.](#) and [Insects Limited, Inc.](#) These two companies were founded by David Mueller in 1981.

Pete Mueller is now the Owner and President of Fumigation Service & Supply, Inc. Jeffery Waggoner is the General Manager. Both have worked for FSS for many years and know the technical and business side of the company.

Patrick Kelley is the new President of Insects Limited, Inc. Pat has been with Insects Limited for 33 years. Tom Mueller is the new Vice President and will work with sales, conferences, and new innovations.

David Mueller, who retired in December 2018, stated: *"All four will make good leaders for the future of our companies and for the stored product protection community."*



Pictured: Pete Mueller (top left), Jeff Waggoner (top right), Pat Kelley (bottom left), Tom Mueller (bottom right)

Fumigants & Pheromones

Insects Limited, Inc.



Ethan Estabrook, BCE

Now is the Time to Install Mating Disruption

A female Indian meal moth can lay 400 eggs in her life and can have up to 4 generations per year. That is a potential 1,600,000,000 Indian meal moths in that year! These disturbing numbers help us realize that gaining control of this damaging insect pest should occur sooner rather than later. Pheromone mating disruption is one option that can help control pest populations of this moth species.

To attract males to her for mating, a female Indian meal moth will produce and release pheromones from her abdomen. The pheromone release creates a plume that is carried in the wind. The plume allows male moths to use their antennae to follow the pheromone back to the source and to physically locate females. Mating disruption dispensers release large amounts of pheromone into an area, masking the natural pheromone coming from the female moths. This flood of pheromone makes it difficult for males to locate females. The stadium illustrations below help illustrate how this concept works. Since males cannot find females to mate with, fertile egg laying is reduced resulting in subsequent lower populations. By reducing the population of Indian meal moths, mating disruption can help protect your commodity, products and reduce customer complaints of insect infested product.



Imagine you are trying to locate your friend at a stadium. Your friend lights a flare to indicate their location. You follow the smoke trail until you find them.



Now imagine flares and smoke trails everywhere at a stadium. There is no way for you to find your friend. Mating disruption works similarly by masking the natural pheromone trail making it difficult for males to locate females.

Indian meal moth populations typically fluctuate with temperature and humidity. In Indiana, USA, we typically see Indian meal moth populations begin to increase around late March. Below is a graph of Indian meal moth pheromone trap captures in a 300,000 ft² seed warehouse

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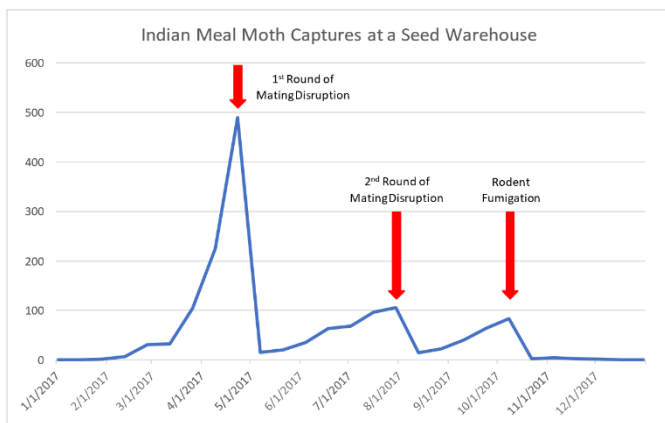
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in 2017. You can see populations beginning to increase around the end of March when outside temperatures average around 60°F at 80% humidity. Mating disruption was applied as a response to increasing Indian meal moth populations on April 23rd. After 2 weeks, Indian meal moth captures in standard pheromone traps dropped from 489 to 15 individuals. This is a 97% decrease. Installing mating disruption dispensers prior to the increase in populations could have prevented the 1st generation of mating insects from ever emerging, resulting in lower numbers for the rest of the year. It is never too soon to install these powerful (yet low toxicity) chemical tools.



Indian meal moth (*Plodia interpunctella*) captures in pheromone traps at a 300,000 ft² seed warehouse in 2017



NoSurvivor hanging trap with bullet lure used to monitor Indian meal moth activity at the seed warehouse ([Indian meal moth Kit](#)).

Mating disruption is labeled for use on stored grains, processed grains (flour in mills and bakeries), pet food, nuts, tobacco, dried fruit, chocolate and other confectionary products. It targets the Indian meal moth (*Plodia interpunctella*), Mediterranean flour moth (*Anagasta (Ephestia) kuhniella*), Almond moth (*Ephestia cautella*), and Tobacco moth (*Ephestia elutella*). Dispensers should be attached in grid patterns according to the labeled rate. While pheromones used in monitoring traps are exempt from EPA registration, those same pheromones used as mating disruption are a labeled pesticide. Dispensers will typically emit effective amounts of pheromone for approximately 90 days.

Pheromone monitoring should be continued throughout the application to provide feedback on the results. Remote monitoring traps like the [SightTrap](#) will provide real-time data on moth population

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increases and will better show the relationship of temperature and humidity with insect populations.

To order or for more information about mating disruption or the SightTrap, contact Insects Limited Research Associate, Ethan Estabrook, BCE at E.Estabrook@InsectsLimited.com or 317-896-9300.

Indian Meal Moth Spotlight



Adult Indian meal moth (*Plodia interpunctella*)

Description

- Adults are bi-colored with a cream/yellow at the base and a copper/dark gray color on the outer portion of the wings
- About 12-14 mm wingspan length and 6 -7 mm body length

Life History

- Females lay 200-400 eggs for about a 7-10 day lifespan
- Infestation can establish at temperatures as low as 64°F (18° C), but development is prolonged
- Optimum development takes place around 86°F (30° C) at a relative humidity of 70%

Damage

- Feed on cereal, corn, rice, sorghum, spices, nuts, dried commodities and wheat
- Larvae eat broken kernels of grain and grain dust
- Larvae leave silky webbing that can contaminate commodity and clog machinery
- Webbing can result in condensation that causes increased humidity and micro-habitats for toxic molds
- Adults fly which allow easy dispersal for infestations in other areas
- Infestation can lead to heating and increased moisture levels in grain

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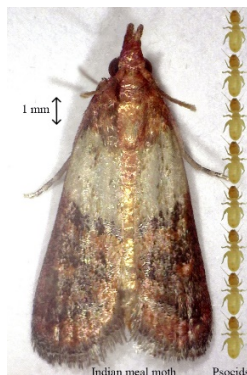


Pat Kelley, BCE

The Reasons Why We “Start with the Insect”

Since its inception, one of Insects Limited’s company mottos has been to “**Start with the Insect**” before planning a strategy to eliminate or reduce that pest. The question recently arose asking, “What does that really mean?” Let’s take a moment to break down what that means and why we at [Insects Limited](#) and [Fumigation Service & Supply](#) use it as our rally cry.

Beginning with the meaning of the phrase, it is really telling ourselves that any pest treatment begins with proper identification of the pest. This first step in pest management can be a difficult one depending on your experience or entomological background. Most of the stored product insects that we deal with are relatively small. On the larger end of the scale are Indian meal moths, *Plodia interpunctella* measuring at 3/8 inch to 1/2 inch (10 – 13 mm) in length. On the smaller end of the spectrum are the psocids (*Otherwise called “book lice”*) that measure in at less than 1/16 inch (1 - 1.5 mm) in length. You could literally line up 8 or more psocids in a straight line to equal the length of one Indian meal moth adult. In order to correctly identify creatures this small, it is often necessary to have magnification in the form of a magnifying glass or even a microscope.



Comparing the average length of an Indian meal moth adult to that of booklice, you could line up 8 booklice to equal the length of a single Indian meal moth.

Once you can see who your potential enemy is, it is vital to know different types of identifying features in their physical shape and size. Other identifying features include; shape and length of antennae, coloration, presence of wings, vein pattern in wings, hair pattern, scale shape and many others. It’s much like being a detective. There are educational classes in insect identification available through Insects Limited, books references (Mallis Handbook, PCT Field Guides, Peterson Field Guides, etc.), online resources (Bugguide.net, MuseumPests.net, etc.) as well as direct contact with entomologists through professional companies or universities that can assist with identification. Double checking your identification through multiple sources can prove beneficial toward obtaining a correct conclusion.



A typical Insect Identification class held at Insects Limited offices.

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Life Cycle: Once you have identified what species your pest is, you should follow up by doing a bit more research to find out what the life cycle is of that species. Sun Tzu, the famous Chinese philosopher and military strategist from 500 BC said it best in his book, “The Art of War”. Tzu said “If you know the enemy and know yourself, you need not fear the result of 100 battles. In other words, Sun Tzu was saying that knowing our enemies is vital to winning our battles against them. This is an important concept for anyone dealing with insect pests.

“If you know the enemy and know yourself, you need not fear the results of 100 battles” Sun Tzu in *The Art of War*

Besides the life cycle, listed below are a few more of the most important areas where we need to know and understand our enemy.

Environmental Conditions: By understanding the habitat preferences of these pests, we are better equipped to make decisions that will cause this pest insect to leave or die. As an example, psocids (booklice) do not survive well in relative humidity levels below 50%. By lowering the RH in your storage areas by even a few percentage points, you can reduce large numbers of this pest. A second example is the fact that storage temperatures effect insect mobility. We know that Indian meal moths will only actively fly in temperatures above 65°F (18°C). If we can hold a temperature in our storage areas below this, the chances of reproduction of this moth are eliminated.

Food: Knowing the types and ranges of food a certain insect pest feeds on gives us a plethora of information. Knowing an insect’s dietary habits allows us to know what it may be feeding on in our storage or production areas. It allows us to focus our pest management attention to better protect or monitor those food sources. This information also allows us to figure out how to starve out the insects so they will leave your facility or die there.



Pheromones, such as this Bullet Lure are powerful tools for pest managers, but a correct identification of the pest is needed in order to find the correct lure.

Pheromones: Many stored product insect pests use pheromones to communicate and find each other. This makes them a powerful tool for pest managers who want to monitor spaces for these damaging pests. The problem is that many of these pheromones are species specific, meaning that they will only attract that single species and no others. The pheromones themselves can be quite expensive, as the chemistry involved with making the pheromone can take several months of constant work from a chemist to create the correct molecule. The chemist’s time is expensive, and the laboratory time is also expensive. For this economic reason, it is again essential to first identify the insects that you are encountering. Once an identification has been made, then you can see if an aggregation or sex pheromone is available for that insect. Your money spent on the correct pheromone lure will pay for itself through lessening the amount of damage this pest inflicts on your products or lessening the potential damage to your company branding.

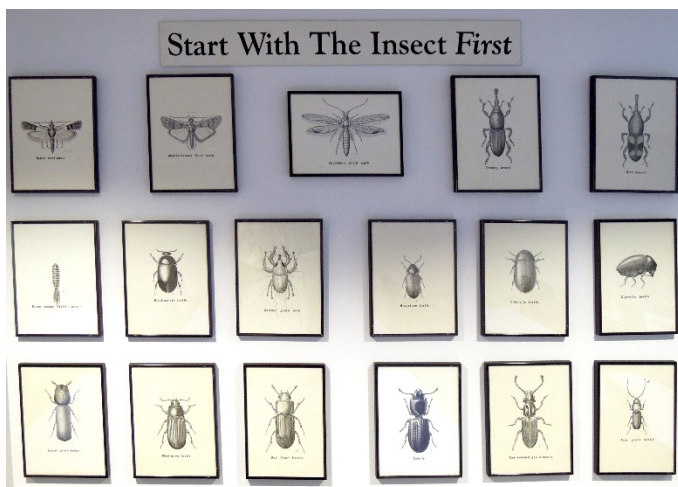
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The Reasons Why We “Start with the Insect”



The “Start with the Insect” Wall in the classroom at Insects Limited and Fumigation Service & Supply

Stepping back and looking at the big picture of pest management, it should now be a bit clearer on why it is so important to begin with a correct identification of your pest. Starting off in the correct direction can quickly give you the results of less pest activity. In the long run, both money and time will be saved by taking the time to correctly identify the pest. I hope you can now join us at Insects Limited and Fumigation Service & Supply in our rally cry: **“Start with the Insect!”**.

(Note: David Mueller, founder of Insects Limited and Fumigation Service & Supply is credited with promoting this phrase over many decades of providing education to the stored product pest industry. We are proud to continue with his sound advice!)