Fumigants & Pheromones

Digital Newsletter Delivered by Insects Limited, Inc. *Issue 179*

Insects Limited's 2023 Recap

By Tom Mueller, Vice President of Insects Limited. Inc.

Go for Launch in T-Minus….
I wish we had a picture of the entire Insects Limited in astronaut uniforms. The kind with the bubble helmets where you can see our faces, and we are all sitting on a rocket ship. In the movies, we would all have little beads of sweat on our foreheads, with a slight look of exhaustion (but a good exhaustion). That nervous/ excited look where you can tell we have prepared, worked hard, and are proud/confident that the risks we are about to take are worth it. This is how our 2023 movie would start. Then it would flash back to this time last year with a caption reading “January 1, 2023.”

The reason this company exists is to make the world a better place by helping to protect its food and cherished belongings from damage by insect pests. We do this by providing Science, Education, Innovation, and the Highest Quality Pheromone Technology available to the market. Those utilizing our technology and expertise will agree with that statement.

We have a goal at Insects Limited. Growth. We want to expand our customer base to further our purpose. Sure, we added 278 new customers, and sure, our average order values increased by 5%, after considering inflation. This growth is important to be a healthy company, but this is not the growth that is giving us the nervous/excited (but confident) look on our faces.

In 2023, Insects Limited made 5 key hires. We added Samantha Kiever to our laboratory as a research entomologist and product support specialist. The addition of Samantha increases our capacity to create more science for our customers and for this industry. We added Brandon Rodriquez and Carlos Salinas to our production team to help meet the increased order demands of both our new and existing customers. We have also taken another step in automating the production of our base products, allowing us to say yes to customers with special product requests. The representation of the high-quality Insects Limited pheromone technology capacity has also increased. We are proud to announce that Ed Bredemeyer and Patrick Callahan have joined our team as independent sales representatives. These two additions increase our capacity to service our existing customers from New Mexico to North Carolina while growing our customer base for those who have not benefited from our products in the past.

In June, Insects Limited fulfilled our promise of education to the industry by hosting another international conference focusing on Stored Product Protection. We were joined by 125 individuals from 7 countries on 6 continents. Those in attendance joined us from industries such as pest control, food manufacturing, grain, academia, government, and supply chain distribution.

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Recognizing a need for increased efficiency, the entire company took on the task, led by our administrative team members, of implementing a new ERP system called NetSuite. This software has already started revolutionizing our business processes, from how an order is received, and how it flows through our different departments, to how it is shipped and billed promptly. The great thing about NetSuite is that we have barely scratched the surface of its capabilities. It will also improve our customer's experience by providing a customer portal, increased capabilities with customer service, and of course, creating profitability through increased efficiency allowing us to invest back into this company, and therefore, into this industry.

As if everything that has already been mentioned is not challenging enough, Insects Limited started and finished construction of our new Center for Stored Product Protection. We now have our very own 10,000-square-foot facility designed specifically for our needs and the needs of our customers. Creating the Insects Limited Center for Stored Product Protection™ and adding a research entomologist increases our capacity for our existing professional services. We can now perform food package penetration studies for customers working to protect their products throughout the supply chain. Our ability to perform insect identification for food manufacturers receiving customer complaints and conduct forensic entomological analysis on the genesis of insects in food products has improved. We now can conduct research on minimal-risk products for customers interested in eco-friendly pest control options. And to top it all off, our ability to create, improve, and test our innovative products has gotten as close to perfect as any company can. Our very own Ethan Estabrook, BCE had taken the initiative to create a native plant prairie in the back of our property, putting the cherry on top of our new facility and giving another example of our passion and love for insects.

Finally, I would like to say running a business is challenging. With a goal for growth comes a need to improve our structure and how we operate. We have found comfort through the implementation of EOS (the Entrepreneurial Operating System). If you have not heard of it, read the book Traction by Gino Wickman. This operating system helped to create a structure for Insects Limited giving us a better ability to tackle business issues head on and make decisions quickly. The Insects Limited team knows our 10-year goal and has created short and midterm goals to help us reach it.

Our team is ready for 2024, and we will continue to improve this company allowing us to deliver on our purpose; to make the world a better place by helping to protect its food and cherished belongings from damage by insect pests

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Clothes Moth History and Damage

Ethan Estabrook, BCE
Research Entomologist and Product Support, Insects Limited

Clothes moths have been a serious insect pest for thousands of years causing damage to clothes, furnishings, and other items made from animal materials like wool, fur, and feathers.

Some of the earliest references to them can be found in the Bible, such as in Isaiah 51 verse 8 “For the moth will eat them up like a garment; the worm will devour them like wool” and in Matthew 6 verse 19 “Do not store up for yourself treasures on earth, where moth and rust destroy”.

Other early references are included in early Greek and Roman literature who describes moths attacking the feather plumes of combat helmets.

Clothes moths were likely spread throughout the world by early sea travel which is illustrated by the diary of a naturalist on board the HMS Challenger in the 1870s who wrote “Clothes moths were a terrible pest and destroyed several garments for me in my cabin.” Between 1957 and 1977 webbing clothes moths were found infesting products on cargo ships including dried blood, feathers, bone meal, mohair, sheepskin, camel hides, and whale meat. Bird nests and other keratin-rich food sources such as fur and debris in animal burrows could have been the original habitat of clothes moths before they invaded man-made environments.

Today, clothes moths are found infesting items in households, museums, grain storage facilities, pet food warehousing, and other structures that work with wools, furs, and feathers.

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It is difficult to calculate estimates of the financial damage clothes moths contribute. In the 1950s, Britain officials calculated clothes moth damages to be around 6 million dollars annually, with 80% of all households stating that they took some level of precautions against clothes moths.

In the 1980's the United States, where it is found in every state, clothes moth damage to wool-contained textiles was estimated at 200 million dollars annually. More recent estimates show clothes moth damage around 1 billion dollars each year in the United States alone. The materials and items often attacked by clothes moths include wool, fur, feathers, animal hides, taxidermy, upholstered furniture, piano felt, natural bristles, garments, and textiles, particularly those soiled with food, sweat, or urine.

Clothes moth larvae cause all the damage to these items as the adult moths are unable to feed. Clothes moth larvae damage items by chewing holes, producing webbing tubes, and soiling items with their fecal pellets. Damage is usually concentrated on soiled areas of materials and in dark folds and creases. Items are more likely to be attacked if left in undisturbed and dark areas such as basements, attics, and closets. Large larvae CAN chew holes in synthetic materials, which they cannot digest if those materials are soiled or stored near more munchable items like wool. Fabrics composed of natural materials mixed with synthetic fibers have also become more popular. Clothes moth larvae are quite capable of selecting out and feeding on the wool fibers in these mixtures.

It is important to Start with the Insect First!

Identifying the clothes moth species and understanding their biology is the first step to an effective integrated pest management program. Once the clothes moth has been identified, inspect areas for ideal food sources such as wools, furs, or feathers.

Pheromone lures and traps are great tools to monitor and help identify the source of infestation. Finding and treating the source can help pest management professionals solve a difficult pest problem to help protect household items like your favorite wool sweater to museum artifacts of historical importance.

If you have any clothes moth or pheromone questions, you can contact me at E.Estabrook@InsectsLimited.com.

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Why Pest Identification Matters

Patrick Kelley, BCE
President of Insects Limited

If part of your job involves pest management, trying to solve pest outbreaks can often become a roller coaster ride with all its ups and downs.

Initially, insect pests make themselves known to us by spilling into our living spaces and workspaces.

First reactions can include annoyance, disgust and in some cases shock when pest damage is revealed.

There is often a knee-jerk reaction is to apply a pesticide to the area to kill everything on six legs.

Although this brute force tactic may work on occasion, we find plenty of examples where the insects simply pop out somewhere new after a pesticide application, and pest managers find themselves in a maddening game of Whac-A-Mole.

Geographic location, time of year, and the physical environment all play a role on the pest activity that shows itself. Being a skilled pest manager means that one needs to use all the tools available to attempt to permanently solve the pest issue at hand.

One of the most valuable tools any pest manager can use is being able to identify the pest. Once we know the exact pest species that we are dealing with, we can better focus on how to cause it to leave or die.

At Insects Limited, our IPM strategy is to “Start with the Insect”. What this means in a nutshell is that when approaching a pest management situation, the very first thing that should be done, is to identify the pest. Knowing your pest means gives you a great advantage in controlling it.

The following list are just a few of those advantages:

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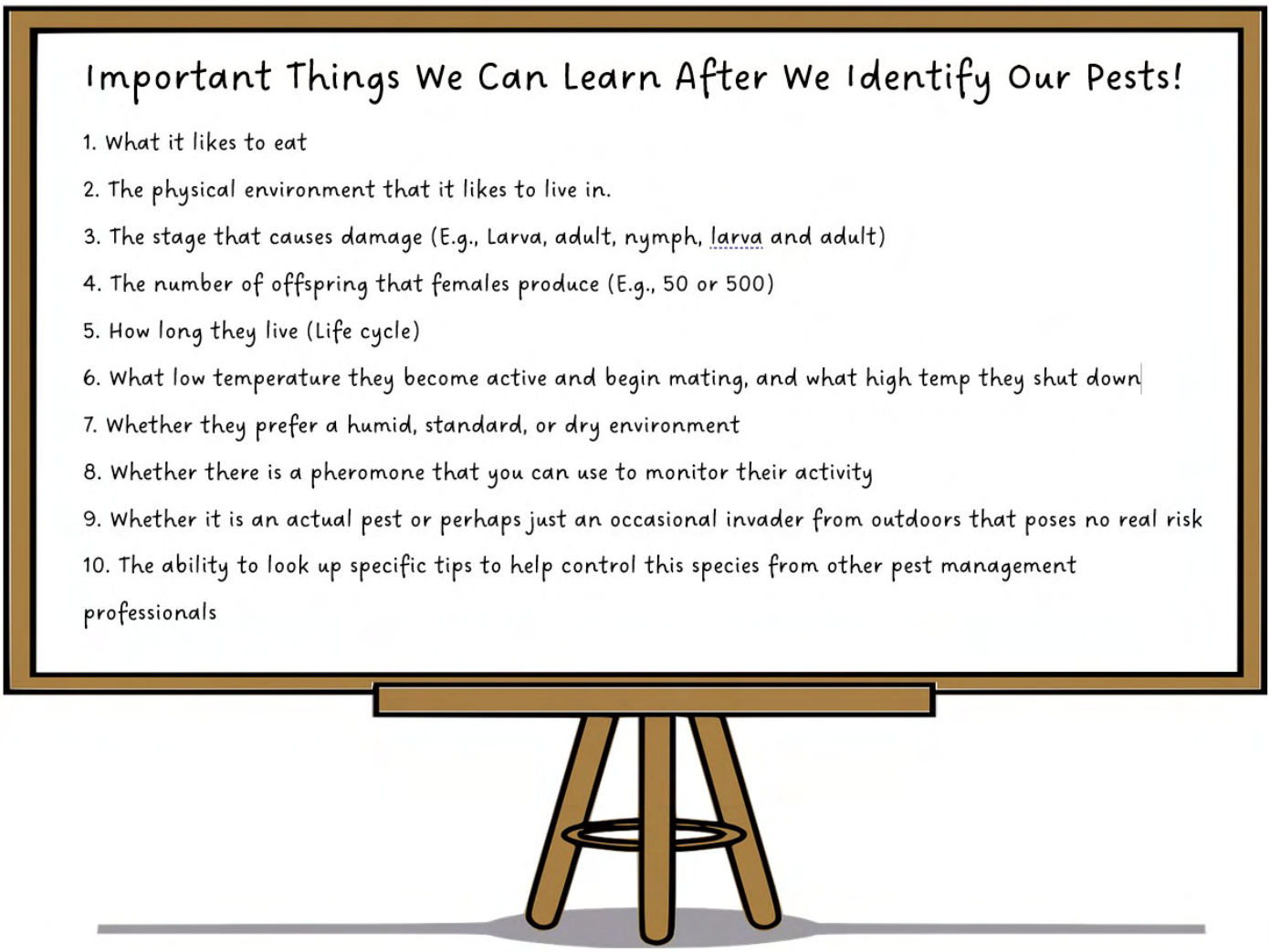

An informed and knowledgeable pest manager is always going to do a better job for their client, for their institution or for themselves than someone who stumbles blindly into a pest management situation.

After a proper identification is performed, insecticidal treatments are often not necessary to eliminate a pest. IPM tools such as sanitation, pest exclusion or other non-chemical means can solve issues with no harmful environmental effects or safety concerns.

On a another note, pheromone monitoring can provide a pest manager with crucial information on where pest infestations are coming from or if their attempts at reducing the pest population are working. Pest identification is extremely critical when wanting to use pheromones as part of a greater IPM program.

Most pheromones are species-specific, meaning that they will attract one, and only one species. Take for example a drugstore beetle, *Stegobium panaceum* and a cigarette beetle, *Lasioderma serricorne*. These two beetle species look nearly identical to the untrained eye, but the pheromone for one has absolutely no attraction to the other.

Without a proper identification, one could spend lots of money on a pheromone trapping system that is doomed to fail. With proper identification, pest managers can easily zero-in on the locations the beetles are coming from.

There are lots of great identification aids out there for pest managers to tap into.

Insects Limited's website has lots of identification aids for stored product insects.

The website also has a section dedicated to pests found in museums.

Reference books, posters or one of the several staff entomologists at Insects Limited can assist with identification. Contact us if you need any guidance on this.

Most importantly, remember to take the time to correctly identify the pest when a new pest management situation comes your way.

Pest identification matters!

Ethan Estabrook of Insects Limited studies the insects on a glue to trap identify the species

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"Start with the Insect First!" The Cornerstone of Integrated Pest Management for Stored Product Insects

Ethan Estabrook, BCE
Research Entomologist and Product Support, Insects Limited

In the grand narrative of food security, pests play the part of the uninvited guests.

Given the pressing global challenge to feed an ever-growing population, the 'Start with the insect first' approach is crucial.

This approach holds particular importance when it comes to stored product insects, the quiet underminers of our collective food security efforts.

A Bite into Our Food Supply

Stored product insects account for significant losses in post-harvest stages. They feed on, breed in, and contaminate stored food, resulting in significant quality and quantity losses. From grain to dried fruits, no stored food product is truly safe from their insidious damage. Therefore, understanding and managing these pests effectively is key to safeguarding our food supplies and feeding a hungry world.

Figure 1. Insect damage to wheat over 128 days. Photo Credit: Edmond Bonjour, Oklahoma State University Extension

Identification: Know Your Enemy

An integral part of 'Starting with the insect first' is proper pest identification. Knowing your adversary's identity allows you to understand its behavior, life cycle, and food preferences. Different insects pose different threats and require different management approaches. Misidentification can lead to ineffective treatments and unnecessary costs. Thus, correctly identifying the pest is the foundation of successful Integrated Pest Management (IPM).

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Figure 2. Red flour beetle and rice weevil on kernels of wheat.

Behavior and Life Cycle: The Pest's Playbook

Knowing an insect's behavior and life cycle provides insight into its weak points, which can be exploited for effective management. For instance, understanding an insect's breeding season or its attraction to certain food products can inform when and where to apply treatments. This understanding can significantly improve treatment effectiveness and efficiency.

Treatment Effectiveness: The Right Tool for the Job

Choosing the right treatment for the right insect is paramount. Treatments vary in effectiveness based on the pest's identity, life stage, and other factors. Thus, starting with the insect first ensures that the most effective treatments are utilized, reducing unnecessary treatments and minimizing potential impacts on non-target organisms.

Monitoring and Evaluation: Keep Your Friends Close, and Your Pests Closer

Continual monitoring and evaluation of pest populations and treatment effectiveness are essential components of IPM. Regular monitoring allows for early pest detection and intervention, preventing large-scale infestations. Evaluating the success of treatments ensures resources are not wasted on ineffective methods, while providing valuable data for future pest management.

Figure 3. Remote pheromone monitoring device called the SightTrap from Insects Limited. Photo Credit: Ethan Estabrook

Feeding a Hungry World: Every Grain Counts

Every successful intervention against stored product insects is a step towards food security. By preserving the integrity of our stored food products, we ensure that more food reaches the plates of those who need it. This is the broader goal of 'Starting with the insect first' - it is not just about managing pests, but about protecting food to help feed a hungry world.

The 'Start with the pest first' approach forms the backbone of effective IPM for stored product insects. It reminds us that each pest management journey begins with understanding the pest. Let's continue to build our knowledge and skills in IPM, and contribute to the global effort to feed our growing world.

Figure 4. Lesser grain borer damage to wheat over 6 months. Photo Credit: Ethan Estabrook, Insects Limited

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Are we inviting clothes moths into our living and working spaces? The full menu of clothes moth larvae includes dead rodents and birds

Patrick Kelley, BCE
President of Insects Limited

Clothes moths are the number one pest in the world that consume and damage our clothing and rugs. Unknown to many, adult clothes moths do not eat, instead the larval stage of this damaging pest is the only one doing the damage.

When thinking about what clothes moth larvae like to feed on, materials such as feathers, wool, and fur come to mind.

While these materials can be food sources, the menu list for clothes moths expands to include dried and desiccated carcasses of rodents, birds, and other animals as well.

Hidden reservoirs of dead animals like these (inside or outside) give the moths a foothold to keep their populations high until they see a chance to invade our spaces and consume our belongings. By not actively seeking out and removing dead animals, we are more than likely inviting them into the spaces where we live and work.

Ironically, IPM specialists and pest professionals can sometimes use pest control measures that benefit the populations of clothes moths. Louis Sorkin, the renowned Board Certified Entomologist from the American Museum of Natural History (retired) stated this, “Pest Management Professionals, technicians, etc., forget where they place rodent traps, monitors, bait stations and those dead, dried corpses become prime larval feeding areas over time. They can be in somewhat inaccessible places. Anticoagulant rodent baits also contribute to potential larval food items when the rodents die in inaccessible (to us) places, but small moths and dermestids will find them.” Lou also backed up his comment by granting us permission to use a plethora of his images of clothes moths actively feeding on dead animal carcasses. You will those at the end of this article (Viewer beware: Some may find these images disturbing).

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Imagine a mouse in a city environment that is living outside a museum or a residence. That mouse runs to a bait station box, strategically placed by a pest management professional, and consumes some of the toxic bait that was placed into that box to specifically kill it. After a few days, the mouse begins to feel sick. The mouse's natural instinct in its weakened state is to find a quiet and protected space away from predators. Looking for safe harborage, the sick mouse locates and easily slips through a small ¼ inch (6.35 mm) gap on the outside of the building and finds a void inside a wall. Here in the void, the mouse feels safe, but dies a few days later when the effects of the toxic bait finally reach a lethal level. Flesh-eating flies find the corpse quickly to consume the rotting flesh, but after one or two months, that dead mouse dries up and sits there. Six months to a year later, a lone female clothes moths (potentially from a resident population in the building) happens to find the dead mouse in that wall void and lays her eggs on it. Her 30 - 50 eggs hatch in a few days, and an infestation begins that can rapidly reach hundreds of moths searching for food sources to lay their eggs. When hatched, these hungry offspring will eventually find the collections being stored at the museum or will find your closet full of wool or your favorite Persian rug. Now imagine this scenario playing out in multiple locations around the museum or a residential building, while each and every dead mouse carcass is a prime food source for clothes moth caterpillars.

Individuals that set up and forget about mouse traps that they set and placed in rarely seen areas, can also lead to clothes moth and carpet beetle issues. I have also seen structural defects on the roofs of city buildings that allow birds to fly down into a crevice, get trapped there and die, where moths eventually find them.

Regardless of how a dead rodent or bird ends up in close proximity to people and their belongings, the fact that they are present, poses a risk that they will attract clothes moths and/or carpet beetles that can eventually cause serious damage. Understanding the complexities of this insect and its diet will ultimately help us control the amount of damage that it does.

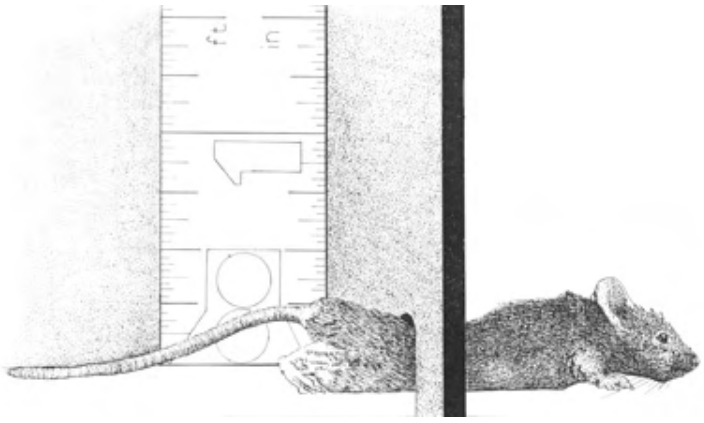

Illustration by J. Crocker, taken from Rodent Control: A Practical Guide for Pest Management Professionals, with permission from GIE Media

Moths and caterpillars around a dead mouse on a glue board. Photo courtesy of Louis Sorkin, BCE

Clothes moth frass on a rodent carcass. Photo courtesy of Louis Sorkin, BCE

A completely consumed rodent carcass covered in webbing clothes moth frass and some empty pupae. Photo courtesy of Louis Sorkin, BCE

Clothes moths and dermestid beetle larvae have consumed the hide and hair from the rodent on the left. The image on the right also shows evidence of clothes moth and dermestid larval feeding alongside blow flies and sarcophagid flies and puparia. You can see these two mice on this glue board are earlier in their decomposition since there is more flesh and skin evident. Photos courtesy of Louis Sorkin, BCE.

**A very special thanks to Louis Sorkin, BCE for the ideas behind this article and the detailed images of clothing moths on dead and desiccated rodents.

Louis Sorkin, BCE showing off some live arthropods. Photo taken from https://twitter.com/AMNH/status/1115673710487375873, American Museum of Natural History, Twitter account April 9, 2019.