

# Fumigants & Pheromones

Issue 67  
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2003

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A Newsletter for the Insect Control & Pest Management Industry

## The Practical Use of Pheromones: Part 2

### USING PHEROMONE TRAPS IN A WAREHOUSE

Pheromones are chemical signals that insects use to communicate. Much like hormones in our bodies, pheromones help determine behavior patterns like mating, food finding, and trail following.

Determination of the presence, or absence, of potentially harmful pest insects is needed wherever stored commodities are held for extended periods of time. Pheromone traps are excellent tools for this purpose.

All pheromone traps were not created equal. Traps for moths may perform differently than beetle traps. Pest management professionals cannot treat all stored-product pests the same when it comes to recommending an effective trapping program. Long-lived insect adults (e.g., flour beetles) tend to be less attracted to pheromone traps than short-lived insect adults. A flour beetle adult that lives for 12 to 18 months



*No Survivor Trap*

does not react as dramatically to a pheromone lure as an Indianmeal moth adult that may only live for one or two weeks.

### KNOWING THE PEST

Knowing the pest is half the battle in controlling it when establishing and managing a grain, bulk commodity, or bagged product pest management program. This fact holds true when interpreting the results and data from a pheromone monitoring program.

*For example:* Many adult male beetles emerge from the pupae stage five to seven days before the female. When males are captured in pheromone traps, there will be a five-to seven-day period to find



*Pantry Patrol*



*PC Traps*

the infestation and implement control measures before the reproductive adult females emerge looking for a mate.

After predicting the first generation of a population in a given year, a prediction of when the second generation is going to emerge can be made by studying the pest's biology and examining trap capture records from the previous year. For example, Indianmeal moths in the Midwest have appeared in the following

*(continued on page 2)*

## COPENHAGEN 2003

Fumigants & Pheromones Conference & Workshop  
June 3-5, 2003

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## History of Pheromones

(continued from page 1)

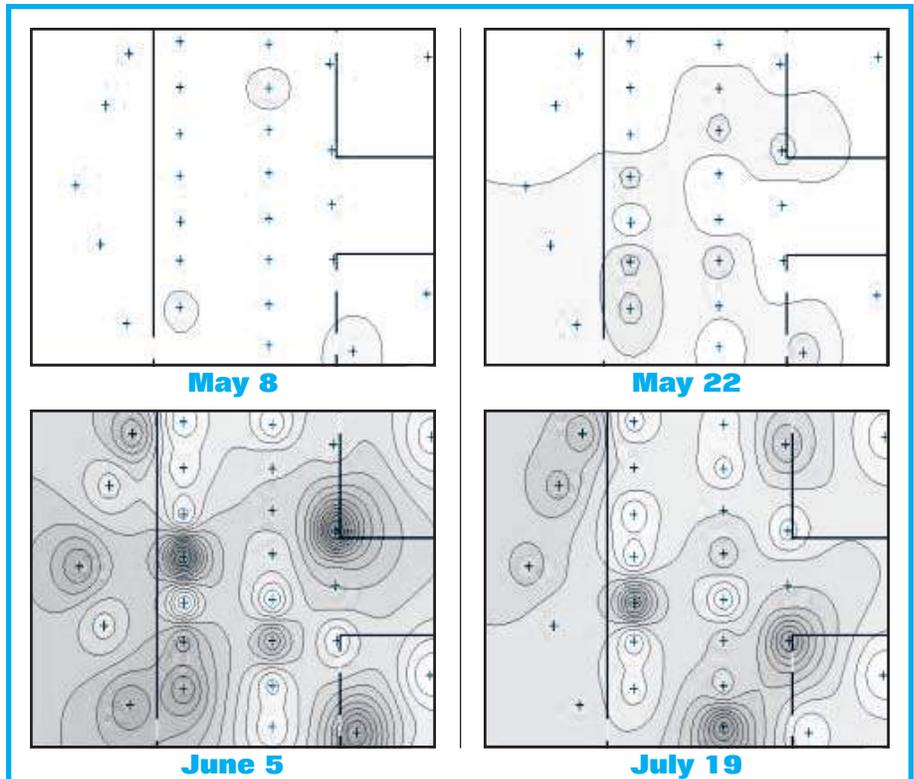
cycle: 1st generation appears near May 8, the 2nd generation around June 5, the 3rd generation about July 19, and the 4th generation by September 7. Some parts of the United States will have six Indian-meal moth generations per year. At 300 eggs per female, an extra generation can mean the difference in controlling or preventing a serious infestation in the fall.

## TRAP MAINTENANCE

It is important to change pheromone lures on a periodic basis. The length of time specific lures last can range from 4 weeks to 1 year depending on the manufacturer, the sensitivity of the pheromone, and the type package that the lure is stored in. A good rule of thumb for pheromone lure effectiveness is 8 weeks indoors and 4 weeks outdoors. The ideal lure will release a consistent amount of pheromone during the effective duration.

The date when the trap was placed in service should be noted on the trap with a "magic marker" type pen. Other record keeping information should not be written directly on the traps as such a practice will only allow unauthorized individuals access to the results of the trapping program. Trap catch information should be maintained in a trap log or computer software each week.

Many lures normally have some pheromone left in them after eight weeks. The old lure can be left in the trap and a new lure can be placed next to the old lure. Discarded lures should be placed in a sealed plastic bag and discarded in an outdoor trash receptacle. The pheromone trap itself should be discarded when it has captured so many insects that it has lost its ability to hold the target pest.



*This diagram of a warehouse filled with packaged dried fruit was monitored with 25 Indianmeal moth pheromone traps services every two weeks. Notice the migration of moths captured in the From June 5 to July 19.*

Traps also should be discarded if they begin to have a poor appearance from dirt, scales from moth wings, or from physical damage. Fresh looking traps offer an appearance that a pest management program is well maintained.

Each week, freshly captured insects should be removed from the trap, as this helps in accurately counting newly captured insects the following week. Another reason to remove the insects from the trap each week and replace the traps periodically is that regulatory and quality control inspectors feel more confident about the facility's control program when they see clean traps compared to those filled with insects.

## Common Insect Pests in Grain and Processed Food

### TYPES OF TRAPS

It is important to recognize that no one type of trap is best to use in a

pest monitoring program in warehouses. It is important to match the specific trap to the particular conditions in each trapping situation. Some examples include:

- 1) dusty versus non-dusty area;
- 2) hot versus cold temperatures;
- 3) outdoor versus indoor use;
- 4) crawling vs. flying insects;
- 5) sex-attractant vs. aggregation pheromones; and
- 6) mass trapping vs. monitoring.

Too much dust can cause sticky traps to be ineffective. In this situation, alterations to the sticky trap can prevent an excessive buildup of dust, or a pitfall-type trap could be incorporated. Dusty warehouses offer challenges for conventional sticky glue traps. In these extreme conditions, a sticky trap may become useless after several days, or even after several hours. The selection of a trap that can deflect the dust, or a pitfall-type trap that does not include glue as the entrapment mecha-

nism, will need to be implemented.

### OUTDOOR TRAPS

Trapping for stored-product insects around the outside of a food warehouse can offer several advantages in an overall pest management strategy. The trap selected for outdoor trapping must be able to withstand the weather (e.g., plastic construction, wax coated) and should not be prone to becoming saturated with insects quickly.

By placing pheromone traps on the outer perimeter of a storage facility, potentially harmful insects can be intercepted or lured away from stored food and grain. A feral population of many of the most common stored-product insect pests is present outdoors throughout the United States and Canada. Thus, the outdoor pheromone trapping technique can help the modern pest manager predict the arrival of indoor populations of insects and prevent many from causing an infestation.

### TRAP PLACEMENT

No particular number of traps is right for any particular warehouse to detect the presence or absence of pest insects. The number of traps needed changes according to several factors including:

1) Quality assurance standards by management; 2) Agricultural products versus finished goods; 3) Pharmaceutical versus raw intermediate products; 4) Regulatory pressure.

### Important questions to ask prior to placement of traps are:

1) What is the goal of the sanitation program? Is the goal zero insect tolerance?  
2) Is an attempt being made to reduce the population by mass trapping or to just monitor a pest population?

### PRACTICAL EXAMPLES

Here is a situation where one trap per 100,000 cubic feet is placed in a finished grocery product warehouse. The pest management inspector checks each trap weekly and records the results on a trap log. A map made of each trap location can assist in finding the traps and in determining patterns of activity within the warehouse. Each trap in this practical example contains two lures:

(1) *Plodia* complex (Indianmeal moth), and (2) *Trogoderma* complex (Warehouse beetle, *T. glabrum*, furniture cabinet beetle, Khapra beetle). An optional lure for the Cigarette beetle could be placed in select traps should that beetle also be targeted for monitoring by the pest management professional.

In this situation, it was determined that this warehouse contained few or no detectable target pests in half of the facility, so the traps were moved to the half of the warehouse where insects were found in the pheromone traps. Another approach that may be used instead of moving the traps is to employ more traps in a uniform

grid pattern in the suspect areas of the warehouse. After three to seven days, these traps are checked and captures recorded. At this point, one trap per 50,000 cubic feet is present. If the pest management inspector has more time, he/she can tighten the grid even further to pinpoint the infestation (e.g., one trap per 10,000 cubic feet). The inspector can then start visually searching for signs of an active infestation in the areas where the most insects were captured. Signs of activity might include caste skins of *Trogoderma* larvae; odor distinctive to certain insects (e.g., flour beetles); webbing on bags, flaps of the bags, or the surface/sidewalls of a grain bin; pupal casings in corrugated cardboard; or actual live insects on finished product.

In one particular warehouse, old code-dated rolled oats were found to be infested with Indianmeal moths, Sawtoothed grain beetles, and Flour beetles. Some nearby dog food also contained large numbers of stored-product insects that could have entered this warehouse from the continuously opened dock door during the

(continued on page 11)

**Insects Limited, Inc. has *PHEROMONES* for all of these insects and more...**



**New PC Traps for Beetles**  
Works well on Saw-toothed grain beetles and many other pantry pests.

Pheromones are chemical signals that insects use to communicate.



Insects Limited duplicates these fine chemicals in our laboratory and tests them in the field to determine optimum attractiveness to the Bullet Lures. Pheromones are used as a monitoring and evaluation tool by pest managers all over the world to make pest management decisions. Pheromones can help your business, your customer, and the environment.

Call on the Pheromone Experts at Insects Limited to help start a pheromone trapping program today!

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or contact your Pest Control Supplier

Explore our new website: [www.insectslimited.com](http://www.insectslimited.com)

**Insects Limited has been an innovator in stored product pest management since 1979.**

## Dave's Soapbox

...for what it's worth



# It's time to get serious.

Temperature data for 2002 indicate that the year is the second warmest on record, exceeded only by 1998. These data from the Goddard Institute for Space Studies in Washington DC indicate the temperature for the first 11 months averaged 14.65° C, down slightly from the record high of 14.69° C in 1998, but well above the average of 14° C that prevailed from 1951 to 1980.

Pest Control International states: "Farmers may now be facing higher temperatures than any generation of farmers since agriculture began 11,000 years ago. Crop yields have fallen as temperatures have climbed in key food producing countries such as the USA and India."

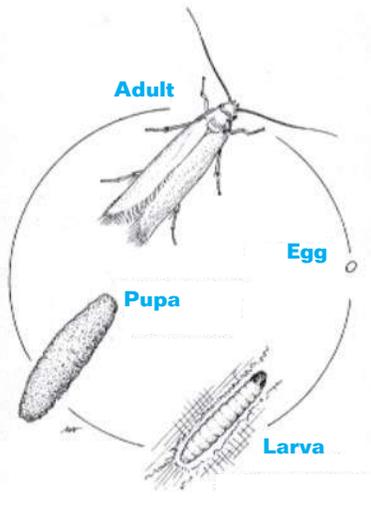
"Temperatures reached 46° C in southern India last summer claiming more than 1,000 lives. Hot weather in the United States last year withered crops and reduced the grain harvest yields well below the projected figures.

The scientific rule of thumb is that a 1° C rise in temperature above the optimum reduces grain yields by 10%."

Insects are sensitive indicators of change. The summer of 2002 brought continuous warm temperatures. Indianapolis recorded

40 days over 90° F and over 80 continuous days of 80° F. What will the summer of 2003 be like?

An Indianmeal moth can normally go from egg to adult in 4 weeks at 75° F. At 87° F and 60% RH the same Indianmeal moth can go from egg to adult in 17 days.



### You do the math.

If a female IMM can lay 400 eggs in her life and she has 3 generations per year, that is a potential

**800,000 IMM** produced in a summer.

Now, if the weather is unusually warm, like the 7 hottest summers in the past 100 years in the past 12 summers in the United States, you can get four generations or more of IMM per year (tropical Florida can get up to eight generations per year) 400 x 400 x 400 x 400 equals: **1.6 billion offspring.**

**Warm summers produce insect problems, but hot summers can cause record customer complaints concerning insects in stored products.**

The key to any insect pest management program is to kill the first generation and not allow any more pest insects to re-invade the structure or product.

Pest Management in the spring months eliminates the potential for multiple generations per year to emerge in late summer and early fall.

**The moral to this story is simple...start now to eliminate pests in your structures, fields, and commodities. Weather will have less of an impact on you no matter how hot this summer is.**

## How Temperature Affects the Indianmeal Moth

Minimum (°F) for population increase	Optimum (°F) for development	Maximum for (°F) development	Relative Humidity	
			minimum	optimum
65° F (18° C)	84° F (30° C)	95° F (35° C)	20%	75%

IMM life cycle is about 25 days from egg to larvae to pupae to adult. Each female adult lays 200-500 eggs in her short life span of 7-10 days. The Indianmeal moth remains the number one stored product insect pest in the United States.

Source: Cox and Bell

## C O M P A N Y P R O F I L E

## Problem Solvers

### ...a company profile

By Amy Cahill



Dave Mueller

David Mueller uses many of the lessons he has learned from insects to run his business. Insects, according to Mueller, survive by finding a niche and adapting to it. He says that "Insects are persistent and they do know how to survive." Mueller has found a niche with Insects Limited and survives by keeping his business focused on its core competencies—solving pest problems and educating about pest management.

Pheromones are chemical scents that insects use to communicate. Much like hormones in our bodies, pheromones help determine behavior patterns like mating, food finding, and trail following.

Mueller states: "In 1979 I used a pheromone trap I received from Purdue's Entomology Department in a seed warehouse for the popular Indianmeal moth. Immediately I knew that this technology would change the way we control insect pests. I knew that we now had a 'thermometer' to determine the severity of a pest population. I quit my job and started planning a business to synthesize, manufacture and distribute pheromone traps and lures. It was a hard decision to make, but I can say that I have never regretted making that decision over the past 21 years."

Unlike many traditional pest

control companies, Insects Limited's motto is to "Start with the Insect First". Rather than indiscriminately fumigating or spraying insecticides when there's an outbreak, Insects Limited identifies the pest, uses pheromone traps to determine how bad the problem is and then only calls on the second portion of this business, Fumigation Service & Supply, as a last resort.



Before a fumigation, the company advocates using pheromone traps for early monitoring and after the fumigation to evaluate the population rebound. Insects Limited works closely with the stored grain, bird food, popcorn, pet food, food processing and flour milling industries. They have domestic distributors in all 50 states and international distributors in 35 countries worldwide. About 20% of their business is international. This segment of their pheromone business is growing the fastest.

While fumigation is a major part of Mueller's business, he prefers to let his brother John Mueller run this business while he focuses on pheromones, consulting, writing, and training. He publishes a newsletter called *Fumigants &*

*Pheromones* that is sent out to 15,000 each quarter. Mueller stated: "This popular newsletter is a way for us to communicate to our customers and potential customers. "We have mailed over 700,000 newsletters since Issue 1 was published in 1981. This newsletter now reaches people in 60 countries." Mueller says.

Each year, the company has a variety of conferences on pest identification, pest management, methyl bromide alternatives and fumigation certification at its

Westfield location. People have come from as far away as Saigon, Adelaide, Bangkok and Harare to attend the conferences. Insects Limited also organizes an international conference on pheromones and fumigants every two years. The 2003 conference will be in Copenhagen, Denmark on June 3-5, 2003.

Mueller stumbled onto his unusual field in college, when he was looking for a career in science and nature. In 1975, he received his degree in entomology and environmental science from Purdue University and in 1981 he founded Insects Limited and Fumigation Service & Supply, Inc., which remains a family business with 26 employees.

*Hamilton County Business, January 2003*

# Fumigation Smart System?

By John Mueller

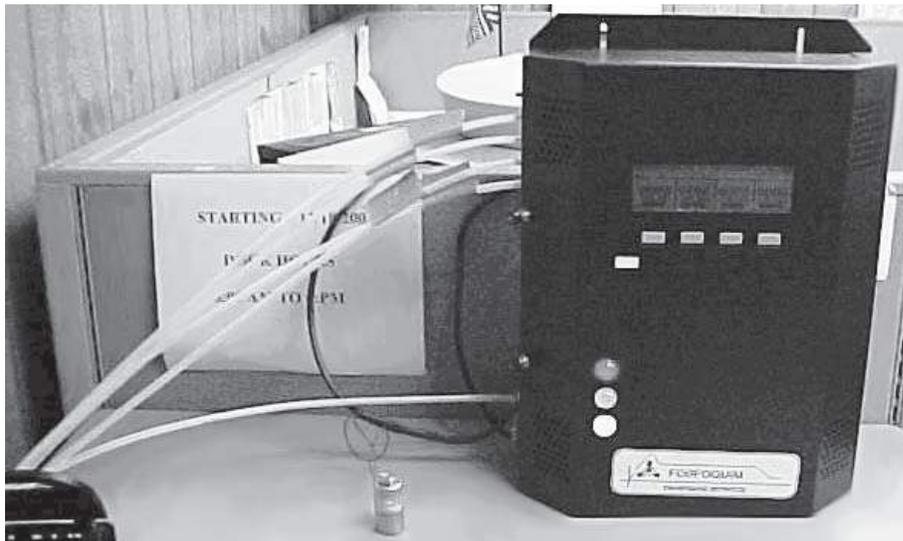


Simply awesome—Fosfoquim's new high range infra-red phosphine monitor. If you are not familiar with infrared [IR] monitoring technology, IR sensors are very accurate and the cost of this technology has dropped considerably over the years. Fumigation Service & Supply, Inc. has been working with this monitor/fumigation system for more than a year. We have been very impressed with the monitor's simple controls, durability, and comprehensive data collection capability [5,000 data points].

The unit automatically activates a solenoid valve to release cylinderized phosphine into the fumigated structure if it reaches this default setting.

*The unit automatically activates a solenoid valve to release cylinderized phosphine into the fumigated structure if it reaches this default setting.*

We recently used this unit on a very large fumigation and utilized a feature which allows the unit to determine when a gas concentration falls below an established set-point and activate ECO<sub>2</sub>FUME phosphine fumigant cylinders to add gas to the structure. The unit automatically activates a solenoid valve to release cylinderized phosphine into the fumigated structure if it reaches this default setting. The unit then continues to monitor and when the gas readings get to an upper set-point, the unit will turn the cylinders off. Literally an automatic fumigation system. Currently, the quantity of cylinders we attach to this system cannot exceed the maximum



*John's New Play Toy*

allowable gas concentration in the building. We are using this unit to utilize the absolute minimum amount of fumigant needed during a fumigation which offers to the best effectiveness.

The Fosfoquim phosphine monitor has four independent monitoring ports that allow you to take readings at 16 different locations. You can control an independent solenoid valve with each port. The data collected from the unit can be downloaded to a PC and a printer can be connected directly to the unit with a 9-pin cable. The

multifunctional display will give four current readings simultaneously. This unit will give the fumigator better control over the fumigation by knowing the exact phosphine gas concentrations throughout the structure or storage bin.

If you would like more information on this exciting fumigation quality management tool, call John Mueller at 1-317 896-9300 or fumig8r@aol.com or explore the web at [www.FumigationZone@aol.com](http://www.FumigationZone@aol.com)

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## Food Security



Washington—Congressional auditors say the country's food supply is vulnerable to terrorist attacks, partly because the government cannot ensure the security of processing plants. The General Accounting Office issued the report March 18, 2003 as the Agriculture Department told food companies, retailers, and farmers to boost security because of a heightening security alert.

The Food and Drug Administration issued more security guidelines to food companies including employee background checks, banning purses and other personal items from food-storage areas, and training workers to recognize suspicious behavior or possible food tampering.

The FDA also increased inspections of certain food factories and/or imported foods. The congressional auditors said the USDA and FDA, which share oversight of the food supply, could lower the risk of an attack if food companies had to share detailed security plans. Now, companies are asked to volunteer the information.

Garry McKee, administrator of food safety at the USDA, said the agency generally agreed with the report. FDA officials said their agency has laws in place to protect food from tampering.

Manufacturers disagree with the GAO's suggestion that they be required to share security plans with regulators. That would make them susceptible to terrorism, they argue, because their plans could be made public.

The voluntary system is better because "it would allow flexibility...to fit the evolving needs and also to protect the security of information," said Tim Willard, of the National Food Processors Association.

by Emily Gersema, AP

## Quotable Quotes

*"The first thing to go during war is the truth."*

—Danish Prime Minister

*"What is the first sign of spring?  
Bags of mulch at the gas station."*

—anonymous

*"History is caused by surprise.  
We study history to be prepared for surprises."*

—Kurt Vonnegut, Jr., Slapstick

*"The more you know—the more you see."*

—Dr. Robert Corrigan,  
Pest Management Consultant

*"Life is a series of conflicting demands."*

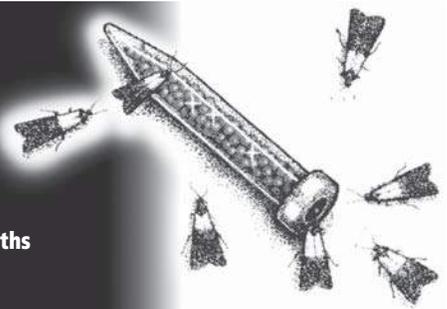
—Karen Hughes, White House Advisor

## PHEROMONES

**It's not nice to fool Mother Nature...**

**But we have made exceptions at  
Insects Limited, Inc. since 1979.**

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- ✓ Ready to Use
- ✓ Lasts for Months



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# Fogging

By Nathan Stocker,  
Food Safety Manager



With fumigation costs rising, more people are fogging today than ever before. Fogging is the use of a pesticide in a ULV or ULD form. ULV and ULD

stand for Ultra low Volume and Ultra Low Dosage. These terms actually refer to the droplet particle sizes generated. The micron size particles generated vary from 5-50 microns. To give you a better reference point, farmers spray fields with micron particles of approximately 200-300 and cans of aerosol insecticide you purchase at the store offer particles from 20-50. Fogging is also primarily, but not always, a contact insecticide.

Indianmeal moths, Flour beetles, and flies are the insects most commonly targeted for fogging, but they are not the only ones. The fogging particle attaches to the hairs on an insect. Through capillary action the particle wicks into the thinnest part of the exoskeleton at the base of the hair. It reaches the insect by contact. Fogging is **not a fumigation**, and the same results should not be expected.

Fogging is not some kind of cure all for insect problems. Fogging is a supplement to proper sanitation and is much more effective when dust and dirt particles are removed.

The need to fog can be determined in a couple of ways. The first determining factor should be through routine inspections. In

*Fogging is a good tool to knock down insect populations in a cost effective and timely manner.*



the routine inspections you should be looking in cracks and crevices and hard to reach areas where a food source is readily available. The second way to determine the need to fog is through pheromone monitoring (see Pheromone History, part 2). There are too many variables to give you an insect count that dictates a need to fog. Your facility should have a number in mind or a weekly trap count gain in mind. When pheromone traps show **population growth**, it is time to take action.

There are several pesticides you can use to fog, but you should choose the insecticide best suited to solve your problem. One pesticide option is Pyrethrin. Pyrethrin is a non-residual botanical contact insecticide and flushing agent in one. Pyrethrin typically can be purchased in .5%, 1%, or 3% concentrations. Pyrethrin used at .5% is best suited to handle flies, at 1% it will give you good control of exposed stages of Indianmeal moths, and at 3% it will give you great control of exposed Indianmeal moth adult and larvae and some control of stored product beetles.

## Back-to-Back Applications

In recent field studies using 3% pyrethrin in a food warehouse, one labeled application of 3% pyre-

thrin killed only 30% of the flour beetles placed in an open petri dish. After 4 hours another fogging using 3% pyrethrin was offered to these test insects and the results were much improved with 80% of the exposed flour beetles killed with the second fogging. The first fogging killed 30% and provided the other 70% with a sub-acute dose. These weakened beetles can not tolerate the next fogging where 80% succumbed. This was accomplished in an 8-hour shift causing minimum shutdown time for the food processor.

Conquer® is another option as a fogging agent. Conquer® is a residual insecticide that can be mixed with water, oil, or pyrethrin. Alone, Conquer® will give you great control of Indianmeal moths and good control of exposed Flour beetles. Adding Conquer® to Pyrethrin will give you improved control of both Indianmeal moths and Flour beetles. Another option for a fogging agent is Vapona or DDVP, a vapor that has slight penetration qualities. Vapona gives control of Indianmeal moths and good control of exposed Flour beetles.

Vapona is an organophosphate. It is under review by EPA. Marsha Milkey, of the EPA's Office of Pesticides Programs, mentioned in February 2003 that DDVP is

midway through the review process. Out of the 37 organophosphates listed by EPA, 34 have been reviewed and greatly restricted if not removed for indoor usage.

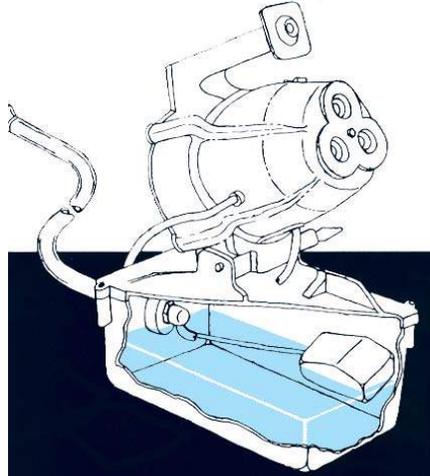
When fogging, you can also use Gentrol®. Gentrol is an Insect Growth Regulatory. Insect Growth Regulators work something like birth control for insects. They offer a long term effect and can be added to your fogging agent.

Before fogging multiple times, you should always consult the label on minimum time allotments allowed between foggings.

When choosing which chemical to use, consider the time frame needed. When using Conquer, Pyrethrin and Gentrol, depending on the concentration, you must keep the building closed for at least thirty minutes to one hour after application and ventilate thoroughly before re-entry. When using Vapona, you must keep the area closed for one hour and the building should not be entered without personnel protective equipment for twenty-four hours.

### Safety Equipment

Fogging does require safety equipment. Always read the most current label and MSDS before purchasing and using any fogging agent. All fogging agents require the following: cotton disposable suit, rubber gloves, chemical goggles, rubber boots, pants, long sleeved shirt, and full face mask with Organic Vapor filter. Vapona requires additional safety precautions such as a Self Contained Breathing Apparatus (SCBAs) and warning signs on the building during treatment. Safety equipment should be worn while pouring, mixing, and fogging with all fogging agents.



There are many foggers on the market to choose from. Determine which foggers to purchase by the volume of space you will be fogging. Gasoline, propane, and electric models are available. Always check the micron size particles generated and the micron size particles needed for your fogging agent before purchasing your fogger(s).

When you fog, or sub-contract someone to fog, you should have a quality control measure. Many people use bioassays, or “Bug-Checks” in their facility during a fumigation, you can use Fog-Checks to test the efficacy of the fogging. You simply place the fog-checks in the area to be fogged, usually in main problem areas, and pull them out after the job is completed. Fogging is only effective on exposed insects, so you must place them where they will be exposed.

Finally, fogging is a cost effective way to knock down insect populations. Fogging is not a fumigation and the same results cannot be expected. Proper sanitation greatly aids the efficacy of a fogging and “bug checks” can ensure a proper job was done. Fogging does require safety measures, so always read the latest label and MSDS before applying.



**IL Expands**

Insects Limited, Inc. has expanded at its Westfield location. David Mueller, president of FSS stated: “We had an opportunity to purchase the business next to us in April. The 3500 sq. ft. building with offices, warehouse storage, and truck trailer fumigation bays offered a perfect place for future expansion for our companies. We have been in our present location for four years and the need for more room became obvious. The new one acre parking area will allow us room for much needed parking. The new fenced in and secure property has a unique feature that will help expand their capabilities to store products safely and conveniently.

If you are ever in Indianapolis, visit our new facilities at 16950 Westfield Park Road, Westfield, Indiana located 8 miles due north of I-465 off US Hwy.31. 1-317-896-9300 or visit our new property by exploring our virtual tour on our website at [www.insectslimited.com](http://www.insectslimited.com).

# Residual Insecticides in Food Establishments - 101

By *Nathan Stocker*

## Why does everyone use Tempo® WP residual insecticide?

Is Tempo (cyfluthrin) appropriate for what you are trying to control? There are many variables to consider when choosing residual pesticides in a food establishment. These variables include: type of surface being treated, what type of application is required, can treatment be made while facility is running, and resistance/ tolerance issues. All these variables should be addressed before any pesticides are applied.

You should always consider the type of surface and the environment that is being treated before you make any residual insecticide application. The type of surface affects the type of formulation best suited to handle the application. Surfaces are classified into three categories: Porous, Non-Porous, and Semi-Porous. Concrete and unfinished wood are examples of porous surfaces while glass, ceramic tile and stainless steel are no-porous. Semi-porous surfaces include: enamel and latex paint, and vinyl surfaces. The surface to which the pesticide is being applied directly affects the formulation which will have the best efficacy.

There are four main formulations of **residual pesticides** used: EC (emulsifiable concentrate), WP

(wettable powder), or ME/CS (micro encapsulated/capsule suspensions), and SC (suspension concentrates). When applying to a porous surface, a WP, SC, or a CS/ME is made most available to the insect. They remain on the surface and are not absorbed. They are also the best for applications on damp surfaces. In cases such as a deep, damp, crack or crevice, an EC, CS, or ME is the best choice. Special considerations also need to be made for hot environments (above 100° F.) Pyrethroids, like Tempo are broken down more rapidly in a hot and/or damp environment, therefore a microencapsulated/ capsule suspension should be applied. Also, you should apply more often in hot and damp environments for best results.

*The surface which the pesticide is being applied directly affects the formulation which will have the best efficacy.*

The next consideration is what **type of application** is desired. There are three types of applications mentioned in residual pesticide labels: General Surface, Spot, and Crack and Crevice Application. General applications refer to applying pesticides to entire areas of floor, rooms, or walls. Spraying small areas such as 2 ft. square areas are considered spot applications. Crack and

Crevice application is only applying pesticides to cracks and crevices. This is very important when choosing a pesticide because not all pesticides are available for all applications. For the pesticides that are available for general use application, they are not available for use while the food handling facility is in operation. All pesticides labeled for general use application require all food to be covered or removed, and all food contact surfaces cleaned and rinsed thoroughly. Food contact surfaces are never to be treated. Whatever surface you are treating, sanitation is a very important element in efficacy. Dusty and greasy surfaces will not transmit the pesticide to the insect as well as a clean surface.

Another factor to consider is **resistance/ tolerance**. You can promote resistance by allowing target insects to survive a treatment. Rotating pesticides annually will help prohibit pesticide resistance. Currently, pyrethroids are the only chemical class available in food establishments for residual treatment, so it is important to do what you can to prevent resistance. Organophosphates and carbamates are no longer labeled for food establishments, so there is no way to break chemical class genetic resistance linked with current residual insecticides.

There are two types of products you can add to your insecticide to give a more powerful punch to insects. The first is Insect Growth Regulators (IGR)s. IGR's act as a birth control and do not allow adults to reproduce. It takes several months for IGR's to make a big difference because they do

not kill any stages. They do not affect adults at the time of treatment, but they affect reproduction.

*Before applying residual pesticides in a food processing facility, remember to read the label and think about all factors involved and it will result in more effective residual insecticide applications. More effective applications result in less time spent applying, and less cost on insecticides and less risk to the finished products.*

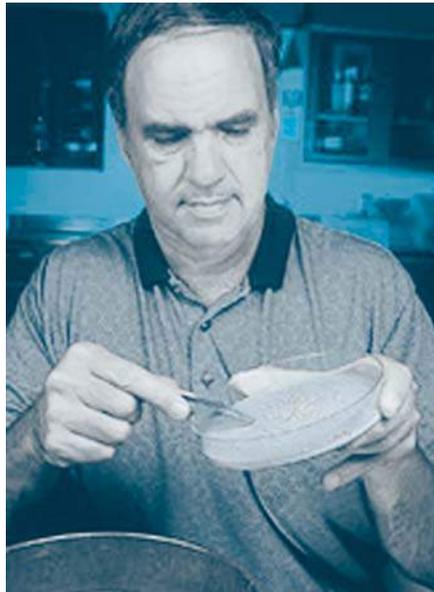
## History of Pheromones

*(continued from page 3)*

summer months. In this example, the cost of the pheromone traps/lures would typically run about \$300 to \$400 per year. The time needed to count and record seven traps each week would be about 30 minutes per week.

## INTERPRETING TRAP CAPTURE

A common misconception in a strategy used to manage grain, bulk commodities, and bagged food products using pheromone traps is that a set numerical threshold exists to trigger either an action or reaction, but **no such magic number exists**. The inspector must weigh all factors before making a decision. The key factor for interpreting trap catch is to



## Dr. Frank Arthur 2003 Burkholder Award Winner

Insects Limited created an award for excellence in stored product protection in 1993 called The Wendell Burkholder Award. It is a cash and conference travel award. The 8th recipient of this award is Dr. Frank Arthur. Dr. Arthur will deliver a guest lecture in Copenhagen in June titled: *Integrated Pest Management for Stored Grain; Components and Strategies*.

Dr. Frank Arthur is an entomologist internationally recognized for his comprehensive research program on insect pest management in raw commodities and processed food warehouses. Results of his research have implications for management programs in post-harvest systems and support insecticide regurgitation, improved efficacy of chemical controls, expansion of non-chemical pest management strategies, and evaluation of new and safer control technologies. Dr. Arthur is a Research Entomologist at the USDA Grain Marketing and Production Research Center, Manhattan, KS, USA and an adjunct Professor of Entomology at Kansas State University.



*Dr. Wendell Burkholder, USDA and University of Wisconsin; Wendell spent 30 plus years patiently studying insect behavior.*

look for increases in numbers of insects from one trapping period to the next (e.g., 1-5-30). It is easy to see when an outbreak or new generation emerges. At that point, the appropriate corrective actions (e.g., chemical, nonchemical, sanitation, discarding product) may be devised and implemented.

*Silence is the only successful substitute for brains.*

*(teacher's classroom wall)*



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Organized By:

## Insects Limited, Inc. USA

Contact: David Mueller  
16950 Westfield Park Rd.  
Westfield, IN 46074 USA

Phone: 1(317)896-9300 Fax: 1(317)867-5757  
email: insectsltd@aol.com

Website: www.insectslimited.com (Register On-line)

## Tanaco Danmark A/S

Contact: Henrik Lange  
Glentevej 11  
6705 Esbjerg Ø  
Denmark

Phone: 4575144800 Fax: 4575143184  
email: lange@tanaco.dk

Website: www.tanaco.dk

6TH INTERNATIONAL

## Fumigants & Pheromones Conference & Workshop June 3-5, 2003



## Red Flour Beetle



The Red flour beetle (*Tribolium castaneum*) has a long association with

human food and can be a major pest in buildings used for storing and processing grain-based foods. In this environment, food can occur in small discrete patches and the size of these patches influences how many offspring of this pest survive. It was found that female Red flour beetles were able to evaluate the size of the flour patches, and they increased the number of eggs they laid with increasing patch size. The number of eggs they laid was close to the optimal number of eggs needed to produce the most adults from that patch size. These results further support the importance of sanitation programs in controlling insect pest populations.

Source: Jim Campbell, USDA/ARS, GMPRC, [Campbell@gmprc.ksu.edu](mailto:Campbell@gmprc.ksu.edu)

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### Fumigation Service & Supply, Inc.

16950 Westfield Park Road  
Westfield, IN 46074-9374 USA

(1) 317-896-9300 voice

(1) 800-992-1991 toll free

(1) 317-867-5757 fax

e-mail: [insectsltd@aol.com](mailto:insectsltd@aol.com)

web site: <http://www.insectslimited.com>

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