Practical Use Of Fumigants & Pheromones
An International Technical Conference and Workshop

The theme for this three-day conference is "International Sharing Through Education" and will be held December 1-3, 1993, in Lübeck Germany (Northern Germany near Hamburg). This seminar will bring together scientists and industry to discuss new and innovative ways to control insects in food, tobacco, grain, seed, food processing plants, and museums. Invited speakers from the European Community, Israel, and the western hemisphere will discuss their methods for controlling pests around the world. Major topics for this conference are Pheromones and Insect Behaviour, Controlled Atmospheres in Stored Product Protection, New Fumigation Techniques, Modern Monitoring of Fumigants, and Methyl Bromide-Ozone Depletion. Workshops regarding New Monitoring Software, New Methods in Stored Product Protection, and Pesticides/Aflatoxin Detection will complete this three-day technical conference.

Invited speakers for this conference and workshop include:
Dr. H. Levinson and Dr. A. Levinson, Dr. C. Reichmuth, Dr. L. Ryan, D. Mueller, Dr. W. Francke, L. Pierce, Dr. R. Watson, Dr. J. Brown, D. Pinniger, Dr. W. Burkholder, Dr. U. Schwarz, Dr. L. Benzing, Dr. L. Zettler, Dr. P. Trematerra, Dr. J. Sullivan, Dr. S. Ignatowicz, Dr. M. Calderon, Dr. D. Maier, P. Kelley, J. Beasley, M. Schyga, H. Lange, J. Riis, C. Smith, J. Mueller.

More information can be obtained about the Practical Use of Fumigants & Pheromones.
Detection of Stored Product Insects

Wendell E. Burkholder, Ph.D.
USDA, ARS Stored Product Insects Laboratory
Department of Entomology University of Wisconsin

Dr. Burkholder will be a speaker at the Practical Use of Fumigants & Pheromones Seminar & Workshop to be held December 1-3, 1993, in Lübeck, Germany. His title is "Thirty Years of Patient Research of Insect Behavior".

Pheromone technology for the management of stored product insects has developed steadily over the past twenty years. The pheromones of many of the major pests have been identified and can be purchased from commercial suppliers. In addition, improvements have been made in traps and food attractants that can increase the insect catch. This review will summarize the current status of the pheromones, traps, and management protocols used by the food processing, storage, and retailing industries.

Pest managers in many food industries have learned that pheromone traps are useful in determining the location and intensity of insect infestations. The result has been an improvement in their sanitation and housekeeping programs and timing of their pesticide applications. Recently, there has been an increased interest by museum managers and householders in using pheromone traps. In some instances, such as in organic food stores and in homes, the traps are used to simply remove the insects as a partial measure of control.

Early detection of insects is extremely important for processed food products because infested material will nearly always be destroyed at a considerable loss. Certainly the removal and destruction of infested food is suggested to prevent the spread of infestation.

THE PHEROMONES

Pheromone users need to have some general information about insect behavior and biology before making decisions on how to proceed with their plans. It is useful to know that there are two general types of communication and reproductive strategies of stored-product insects. Species with short-lived adults generally produce sex pheromones and have a highly-synchronized communication system with daily activity rhythms. The adults do not feed and there is often a distinct calling behavior associated with the pheromone release.

For example, Indianmeal moths are usually active in the early to late evening. The long-lived beetles have male-produced aggregation pheromones and require food for pheromone production and egg maturation. The aggregation pheromone is a signal that food is present and leads to mating encounters. In general, the sex pheromones attract over a longer distance than the aggregation pheromones. The aggregation pheromones have been variable in their effectiveness. We have found that food lures will increase the effectiveness of some aggregation pheromones.

THE PHEROMONE TRAPS

A variety of traps for stored product insects is available. The moth traps, consisting of glue-coated cardboard, are often like those used in orchards and in field crops. They are called "wing" or "Delta" traps. There are several kinds of funnel traps that are used for both moths and beetles and are similar to those used in forests or fields. The beetle traps used inside buildings usually include some kind of "pitfall" system for crawling insects in addition to the glue traps for the flying insects. The bottom of the pit may contain a food bait or oil. The pheromone is placed near or above the oil-baited dish. Plastic probe traps have been developed for use in bulk grain. These traps are often used without pheromone because the traps have been highly successful even without lures.

THE TRAPPING STRATEGIES

Placement of traps in warehouses is dependent in part on the size of the building and on the available supporting posts. Generally the traps should be placed in the corners and near the interior walls and the supporting posts. They should be placed from one to two meters above the floor for easy access. The building should be trapped in a grid pattern to monitor all areas. Intervals of 8 to 15 meters are suggested; however, this may depend on the amount of obstructing equipment or storage items. Ideal trapping locations include areas that collect dust such as under equipment, near conveyors, ledges, and closed storage bins. If one area appears to have an infestation, additional traps may be used to pinpoint the source to a particular package or site and may be accompanied by a follow-up manual search for insects. Monitoring should continue in order to eliminate stray insects and to determine the effectiveness of associated control programs.

To minimize entry of insects from the outside, traps should be placed away from doors and windows during the peak flight season of insects, such as with der-
mestid beetles (June and July), inside trapping should be reduced. Traps should then be placed outside for perimeter trapping. Fences, posts or trees are convenient if they are at least 15 meters from the building.

**GRAIN BINS**

The placement of pheromone traps in farm grain bins depends on the size of the bins and the amount of time and expense that may be allowed by the farmer. The plastic probe traps in circular steel bins should be placed in the center and in at least each of the four quadrants of the bin approximately one meter from the edge. For flying insects at least one glue trap should be suspended at a convenient location above the grain.

**PHEROMONE TRAP SERVICE**

At least a weekly schedule for monitoring the traps should be maintained. Certainly more often is suggested during the summer and early fall and less often during the winter weather. Careful checking of the trap records is necessary to not only locate possible sources of infestation but also to monitor changes in population trends. Care should be taken to replace damaged traps or those that are contaminated with dust or other materials. The pheromone lures should remain in the package and be refrigerated or protected from heat prior to use and replaced according to the manufacturer's recommendations. Care should be taken in discarding old lures and traps so that trash bins will not attract insects and should also be disposed of with care.

**TABLE 1**

<table>
<thead>
<tr>
<th>Stored-product insects that are short-lived as adults and have sex pheromones that attract the opposite sex:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beetles</strong></td>
</tr>
<tr>
<td>Dermentidae (females)</td>
</tr>
<tr>
<td>Trogoderma inclusum: (larger cabinet beetle)</td>
</tr>
<tr>
<td>T. variabile: (warehouse beetle)</td>
</tr>
<tr>
<td>Anthrenus verbasci: (varied carpet beetle)</td>
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<tr>
<td>Anthrenus flavipes: (furniture carpet beetle)</td>
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<tr>
<td>Bruchidae (males)</td>
</tr>
<tr>
<td>Acanthoscelides obtectus: (bean weevil)</td>
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<tr>
<td>Anobidae (females)</td>
</tr>
<tr>
<td>Lasioderma serricorne: (cigarette beetle)</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Gelechiidae (females)</td>
</tr>
<tr>
<td>S. cerealella</td>
</tr>
<tr>
<td>(Angoumois grain moth)</td>
</tr>
<tr>
<td><strong>TABLE 2</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stored product beetles that are long-lived, feed as adults, need to feed to reproduce and have male-produced aggregation pheromones that attract both male and females.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bostrichidae</td>
</tr>
<tr>
<td>Rhizopertha dominica: (lesser grain borer)</td>
</tr>
<tr>
<td>Tenebrionidae</td>
</tr>
<tr>
<td>Tribolium castaneum:</td>
</tr>
<tr>
<td>Curculionidae</td>
</tr>
<tr>
<td>Sitophilus oryzae: (rice weevil)</td>
</tr>
<tr>
<td>Cucujidae</td>
</tr>
<tr>
<td>Cryptolestes ferrugineus: (rusty grain beetle)</td>
</tr>
<tr>
<td>C. turcicus</td>
</tr>
<tr>
<td>Oryzaephilus mercator: (merchant grain beetle)</td>
</tr>
<tr>
<td>Prostephanus truncatus: (larger grain borer)</td>
</tr>
<tr>
<td>T. confusum</td>
</tr>
<tr>
<td>S. granarius S. zeamais</td>
</tr>
<tr>
<td>(granary weevil) (maize weevil)</td>
</tr>
<tr>
<td>C. pusillus</td>
</tr>
<tr>
<td>O. surinamensis</td>
</tr>
<tr>
<td>(flat grain beetle) (sawtoothed grain beetle)</td>
</tr>
</tbody>
</table>

**Continued on page 4**
SUMMARY

Pheromone traps are especially valuable for early detection of low-level populations of stored product insects. Pest managers are able to locate problem areas and to take corrective action before the insects spread to other products and cause further damage. Management decisions on timing of pest controls are improved when based on the analysis of trap data. The use of food attractants with pheromones has enhanced trap catches. Information on insect biology and behavior such as daily activity periods is valuable to pest managers. It should be noted that feral populations of stored-product insects are often trapped outside storages and they may serve as reservoirs of insects for infestations.

Dave's Soapbox - for what it's worth

CRISIS = Danger + Opportunity

In the Chinese language there is not a word or symbol for crisis, instead they use two words; wei - ji.

Question: Is this a rock slide or an avalanche?

Conflict

There is a process that we seem to all go through in the pesticide/fumigant industry: CFC's, Halons, EDB, Vapona, and methyl bromide have or are all going through this process:

The Process of Conflict

1. Deny there is a problem.
2. Question the science.
3. Look for alternatives.
4. Deny any participation in the problem.

Question: Where are you in that process?

Danger or Opportunity

Alternatives for methyl bromide et.al. are going to be challenging. The opportunity for those with imagination, innovation, and determination will be great.

Phosphine (Phostoxin) will play an active role in replacing, some uses of methyl bromide, but in combination with heat and inert gasses (maybe oxygen depletion for some applications), and some uses of irradiation, Vikane, soil sterilization with steam (ie. Holland), new soil sterilants, advanced uses of pheromones for mating disruption, and many more alternatives will come forward in the coming years to replace methyl bromide in part. But the most important alternative to methyl bromide et.al. will be a Systematic Approach - a type of pest management that depends on knowledge more than toxicants.

Situation Awareness

Situation awareness is the ability to walk into a pest problem with no pre-determined idea of what will be done, but rather the use of a systematic approach where the problem solver surveys the situation at-hand. With all his/her knowledge of the target pest(s) and the environmental conditions at that exact time and many other important factors, he/she will dial in the most-correct solution to the problem. It is not the “look at the calendar and production schedule and turn on the bug juice because that’s the way we always have done it” method.

“In the future you will not be allowed to use a pesticide unless you can show that there is an existing problem.” Dr. Austin Frishman, 1983.

Take Home Message

The key to effective pest management is to offer conditions that are not favorable for the growth and development of the pest.

Examples:

Heat, cold, wind, sticky glue, growth regulators, exclusion, pheromones, enhanced natural predator populations, new low toxic pesticide application (ie. abemectin, deltamethrin, cyfluthrin, natural pyrethrin, etc.) and finally the safest and most effective pesticides available... if needed.

Alternatives

The alternatives are not going to come from “Big Daddy” pesticide manufacturers (mostly European companies) with big PR firms, and enormous advertising budgets. This is not a $100 million dollar market we are in. The alternatives are not going to come from “Big Brother” government agencies. The alternatives will come from small innovative and imaginative niche companies and individuals who are willing to try something that may or may not work in the practical world. There will not be just one alternative to methyl bromide, there will be dozens.

The best alternative will be education, education, education. This sharing experience will bring people together to talk about alternatives to conventional methods and what works and what doesn’t. The question that we all ask when we see a new idea is: Does it work? Education will slowly change the mind-set of the majority of pesticide users from a “spray now because the calendar says it’s time no matter what because we have always done it this way” method to a true pest management philosophy.

Education + Situation Awareness + Alternatives = The FUTURE
An Alternative to Methyl Bromide in Stored Products


In some situations, the use of methyl bromide can be replaced with phosphate fumigants as a means of dealing with pest problems in commodities and structures; however, methyl bromide does not have a replacement for all of its uses. Fumigants are necessary for the future of pest control for two reasons: 1. They have the ability to eliminate a broad spectrum of pests. 2. They are the only choice when penetration is needed to solve a pest problem.

The purpose of this paper is to discuss alternative methods of controlling insects in commodities (ie. grain, seed, popcorn, and animal feed).

Billions of bushels of grain will be stored this year throughout the world. Two major fumigants are primarily used to protect these commodities: 1. metal phosphides 2. methyl bromide. Most of the grain that is fumigated will be treated with aluminum phosphate, but there is a certain percentage that still use methyl bromide. In China, over 30% of the grain fumigated is treated with methyl bromide. This is a country with a surplus available of aluminum phosphate. Most of the methyl bromide fumigations in the United States are performed by custom fumigators. Some members of the popcorn industry still fumigate finished products in bulk storage themselves.

It has been estimated that 50% of all grain that is treated, is fumigated with metal phosphate, 15% is fumigated with methyl bromide and 35% is being protected with pirmiphos-methyl (Actellic), chlorpyrifos-methyl (Reldan), or malathion.

Metal Phosphides
Solid fumigants that release hydrogen phosphate are available worldwide to eliminate insect infestations in commodities.

Conclusion: During the 1980's we lost over 80% of our fumigants in this country. This list includes such notable gasses as EDB, carbon tetrachloride, hydrogen cyanide, ethylene dichloride, methylene chloride, carboxide, and usages of chloropicrin.

The survivors are metal phosphides, methyl bromide, sulfonyl fluoride, carbon dioxide, and limited uses of chloropicrin. Metal phosphides continue to have a place in the fumigation of commodities throughout the world. Sixty percent of all metal phosphides in the United States are used for grain. In order to adapt the uses of phosphine for structural fumigations

How to Speed Up an Insect's Respiration

1. Increase temperature
2. Increase carbon dioxide
3. Decrease oxygen

Pest Management Tip

BUGS ON WIND-SHIELD

make some people smile

Thanks for the specimen, but your collection technique leaves something to be desired!

Bugs on the windshield! To most people that means poor driving vision and the need for strong windshield cleaner fluid. The pest management specialist may view the situation differently. The presence of large numbers of insects on the windshield might signal an approaching pest problem. For instance, large numbers of moths on the windshield on a quiet night may mean that it's time to closely check your warehouses and grain storage.

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Three generations of Muellers at Association of Operative Millers (AOM) International Conference and Trade Show in Indianapolis. Albert F. Mueller was selected as Honorary General CoChairman at the Indianapolis meeting and an Honorary Member after 35 years of active participation. Our congratulations to Al!

Purdue’s Bug Bowl 93 was a great success. Over 5500 attended this two day insect gala.

Road trip to S.C. Johnson and Son, Racine, Wisconsin “The Bug Farm with Dr. Art Hageman and Dave Campbell, and Insects Limited, Inc.” May, 1993

Bob Reid, Mennel Milling Co., A Flour Miller’s Perspective of Grain Quality

John Mueller Fumigation Service & Supply, Inc. Program Chairman, Modified Fumigation Techniques

Jerry Mason General Mills, Toledo Sanitation Through Design and Super Heating

Garrit Cuperus, Ph.D. Oklahoma State University New pesticide survey of grain elevators and flour mills throughout the United States.

Peter Mueller (age 9) with live African Walking Stick. “Children and live insects, what a great attraction!”

Bug Bowl ’93, Male honey bees on Francie Mueller, Age 5.
Entomologists also use light traps and pheromone traps to collect adult insects to determine the time for scouting operations. Philosophers still debate whether the chicken or the egg came first. Entomologists, on the other hand, know that after you see the moth, the larvae can't be far behind. - by Tom Turpin, Purdue University entomologist.

Bug Scout is a popular series that ran in the Indiana Prairie Farmer magazine from 1978 - 1983. The illustrator is Natalie Brown and the creator and author is Tom Turpin, Ph.D.

**Chilled Grain Aeration - A Non-Chemical Storage Technology**

written by
Dr. Dirk E. Maier
Dr. Linda J. Mason
(\text{Dr. Maier will be a speaker at Fumigants & Pheromones Seminar and Workshop on December 1-3, 1993 in Lübeck Germany.})

**What is Grain Chilling?**

Grain chilling is a non-traditional, non-chemical preservation technology for the storage of cereal grains and oilseeds. A grain chiller utilizes a refrigeration system to control the temperature and moisture content in stored grain independent of local weather conditions. Grain chilling has been used effectively throughout the world to improve quality and prevent insect infestation in stored grain. Over 1 billion bushels of grain are chilled annually in countries such as Argentina, Australia, Germany, Great Britain, France, Indonesia, Israel, and Mexico.

**Why Chill Grain?**

Agricultural commodities in North America are treated with pesticides at several points in the food and feed processing chain. In particular, chemicals (such as malathion, Reldan and Actellic) are commonly used to protect bulk-stored grains, while fumigants (such as metal phosphides, and methyl bromide) are commonly used to eradicate an insect problem. The process of chilled aeration, followed by low temperature storage, is a technically feasible grain treatment to prevent stored-product insects without chemical pesticides, while maintaining optimum grain quality.

As a dependence on traditional chemical pesticides continues to be limited further due to stricter regulatory rules and heightened environmental concerns, alternative technologies, such as grain chilling, will continue to gain in importance. For example, some wheat flour millers no longer accept any grain that has been treated with malathion.

**How Does Grain Chilling work?**

Grain temperature is critical to stored grain management because the development of insects and molds depends on it. Commonly, grain is cooled in steel bins, concrete silos, or flat storages using conventional aeration systems. Fans lower grain temperatures to within several degrees on the minimum ambient temperature. In most regions of the United States, grain temperatures can be lowered to less than 50 F by late fall.

However, grain is generally harvested during the warmer weather, and stored for extended periods above 60 F, which is optimum for insect and mold development. Rewarming of cooled grain during the spring and summer limits the ability to maintain low temperatures for the entire storage period.

In contrast, grain chilling is defined as the cooling of grain independent of the minimum ambient temperature by using a refrigeration system. In a mobile grain chilling system, ambient air is ducted over a bank of refrigeration coils in order to decrease the air temperature. Because dry grain will absorb moisture at high humidity levels, the chilled air is reheated a few degrees to reduce the relative humidity to 60 - 75 percent before entering the storage bin and silo. Once the trailing edge of the cooling front exits the top of the pile, the cooling cycle is completed. Due to the insulating properties of the grain, only occasional rechilling for short time periods is required to maintain chilled storage conditions.

**How much does Grain Chilling Cost?**

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**Figure 1. Schematic of the grain chilling process using a mobile grain chiller connected to an upright grain storage silo.**
For chilled grain aeration and storage to be economical, the costs of utilizing the technology have to be offset by the sum of its benefits.

**Costs:**
- Grain chiller
- Depreciation
- Operational
- Maintenance

**Benefits:**
- Reduced fumigation and grain protectant needs
- Improved grain quality
- Reduced shrink loss
- Less insect damage
- Reduced spoilage potential
- Increased worker safety and health

For example, if a grain chiller was sized to provide an average airflow rate of 0.1 cfm per bushel of storage capacity, it would take about 135 hours to move a cooling front completely through a grain pile. The needed refrigeration capacity to cool the pile to below 60°F would cost about $1,231 to chill 250,000 bu of grain below 60°F once, or about 0.5 cent/bu.

The above calculations do not consider the potential monetary benefits due to improved worker safety and reduced liability, since no (or fewer) chemicals are handled; reduced shrink losses, since chilled aeration causes less grain moisture and dry matter loss than ambient aeration; reduced spoilage potential, since lower grain temperatures can prevent molds and mycotoxins; reduced insect damage, since lower temperatures reduce the development rate of insects; and lower drying costs, since grain can be safely stored and maintained at the optimum marketing moisture content. Economic evaluations of grain chilling systems incorporating some of these benefits yield payback periods of 2 - 4 years.

**How is Chilled Aeration Incorporated into a Storage Facility?**

No major modifications are necessary to incorporate a grain chiller into an existing grain storage facility. If aeration fans have previously been utilized, they need to be removed to allow for the connection of the cold-air duct of the mobile grain chiller. The same perforated bin floor, or aeration ducts are used to distribute and force the air through the grain pile.

After a chilling cycle is completed, the duct is disconnected and the plenum of the storage structure is sealed with a tarp. The needed refrigeration capacity to provide an average airflow rate of 0.1 cfm per bushel of storage capacity, it would take about 135 hours to move a cooling front completely through a grain pile. The needed refrigeration capacity to cool the pile to below 60°F would cost about $1,231 to chill 250,000 bu of grain below 60°F once, or about 0.5 cent/bu.

For more information about chilled grain aeration and storage, contact: Dr. Dirk Maier, (317) 494-1175.

**OPPORTUNITY**

Fumigation Service & Supply, Inc. seeking Pest Management oriented person with a B.S. in biological sciences or the equivalent with experience preferred. Start on the ground by learning fumigation of grain and food processing facilities. Progress to supervisor of own fumigation crew and sales territory. Position will be in Chicago. Good salary (commensurate with exper.), Paid medical, paid life, paid disability, paid vacation, pension program, Travel, week-end, and holiday work expected. Join a progressive and innovative company which is on the grow. Career opportunity.

Send resume and salary history to: David K. Mueller, P.O. Box 40641, Indianapolis, IN 46280. No phone calls, please.
Welcome Angie Richards
Pheromone Entomologist

The newest associate at Insects Limited, Inc. is Angela (Angie) Richards. She is a native of Cedarville, Ohio, and a recent graduate of Purdue University. Angie has a Bachelors of Science degree in Entomology. While completing her studies at Purdue, she worked in the Center for Urban & Industrial Pest Management and the Indiana Department of Natural Resources. Here she worked on the pheromone trapping program for Gypsy moths.

Angie Richards will help evaluate new pheromone lures and trapping systems for stored-product insects and yellowjackets.

She will provide a service for customers wanting to establish trapping programs. She will also maintain colonies of beetles and moths for research purposes.

It is a pleasure to have this talented entomologist join our progressive and innovative company. We're on the grow.

Museum Conservation

The fifteenth international congress of The International Institute for Conservation of Historic and Artistic Works (IIC) will take place at the Ottawa Congress Centre, Canada, 12-16 September 1994. The title of the congress will be Preventive Conservation: Practice, Theory, and Research.

Authors wishing to present a paper or a poster should contact IIC, c/o Perry Smith, 6 Buckingham Street, London WC2N 6BA, UK or by Fax to +44 71 976 1564.

Introduction to Biodeterioration of Cultural Property, July 7-8,
Mr. Louis Sorkin, entomologist at The American Museum of Natural History and Dr. Robert Koessler, Research Scientist at the Metropolitan Museum of Art in New York. The two-day course will present an introduction to biodeterioration of cultural objects caused by insects. The emphasis will be on the use of non-chemical methods. For more information, contact: R. Koessler: 212-570-3858, fax: -3859)

Insect Identification:

If you would like a second opinion on an insect in question, entomologists at Insects Limited, Inc. can supply you with this service. If it is a stored-product insect or pantry pest, it can usually be ‘keyed’ out to the species. Send the specimen in a small box with tissue paper or in a vial of alcohol to preserve the legs and antennae. Please -- not stuck to a piece of tape. Write a short note describing where the insect was found (ie. grain bin, dark area, moist area, outdoors, dog food, etc.). A phone call and a written diagnostic report can be provided. There is a small charge for this service.

TOP EXPORTER

Top 10 nations sending products to the United States:
1. Mexico
2. Ecuador
3. Costa Rica
4. Colombia
5. Honduras
6. Canada
7. Chile
8. Guatemala
9. Dominican Republic
10. Mexico

TOP IMPORTS

Top 10 produce items imported into the United States:
1. Bananas
2. Tomatoes
3. Grapes (table)
4. Cantaloupes
5. Potatoes (table)
6. Cucumbers
7. Plantains
8. Watermelon
9. Onions (dry/bulb)
10. Squash

Source: The Packer 6/92
Not All Pheromones Are Created Equal.

Insects that are short-lived as adults, (such as these Indianmeal moths), usually have sex pheromones that attract the opposite sex. Most beetles are long-lived, need to feed to reproduce, and have male-produced aggregation pheromones that attract both males and females.

Not All Pheromone Lures Are Created Equal.

Insects Limited, Inc. offers the highest purity pheromone blends available. Insects Limited's, year-round testing facility in the tropics insures a standard of consistent quality.

Not All Pheromone Companies Are Created Equal.

Insects Limited services its customers with quarterly newsletters, educational seminars and workshops, New Pest Monitoring Software, educational materials, interpretation of trapping results, insect identification, and fast delivery worldwide. For your FREE Insects Limited Catalog, send in the bingo card on page 12 for more information.
This program provides an excellent means of keeping neat, accurate data in an easily accessible form. It also provides you with numerous graphic displays of your data which can add a “professional” touch to any report.

**What Pests Can I Monitor Using This Software?**

Pest Monitoring Software was designed to be used for a wide range of common pests ranging from mice/rats to Indianmeal moths and Cigarette beetles. This software is applicable to basically anything you can catch in a trap. Here are some examples:

**Pheromone Trapping**
Pheromone monitoring programs for insects like Indianmeal moth, *Trogoderma*. Cigarette beetle, etc. are becoming a standard practice for progressive pest control companies and sanitarians alike.

**Pest Monitoring Software allows you to make the most of the information you have gathered. You can accurately keep years of data at your fingertips.**

This ability gives you the advantage of being able to compare the insect populations from one year to the next, allowing you to make educated decisions based on hard data rather than over reaction.

**Rodent Trapping**
Pest Monitoring Software can easily be incorporated into your present rodent trapping programs. No matter if it’s automatic wind-up traps, snap traps, glue boards or anything else to catch mice and rats, this program will fit your needs. Pest Monitoring Software will give your customers or your superiors a professional report every time. It also gives you the advantage of knowing where potential “Hot Spots” exist and when they may become a problem.

**Where Can I Use Pest Monitoring Software?**

Pest Monitoring Software provides a wide range of locations in which it can be applied, including:

- **Grocery Stores**
- **Food Processing Facilities**
- **Herbariums**

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**Current Books Available from THE BOOK STORE:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Price</th>
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<tr>
<td>1</td>
<td><em>Earth in the Balance</em>, Al Gore, Jr.</td>
<td>25.00</td>
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<tr>
<td>2</td>
<td><em>Mallis Handbook of Pest Control</em>, 7th ed. (out of print)</td>
<td>89.00</td>
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<tr>
<td>3</td>
<td><em>Insect and Mite Pests in Food</em>, USDA, FDA (2 volume set)</td>
<td>65.00</td>
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<tr>
<td>4</td>
<td><em>Scientific Guide to Pest Control Operations</em>, 4th ed., Bennett, et al (text for Purdue Correspondence Course)</td>
<td>65.00</td>
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<tr>
<td>5</td>
<td><em>Common Sense Pest Control</em>, Least-toxic solutions for your home, garden, pets, and community, Olkowski</td>
<td>65.00</td>
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<tr>
<td>6</td>
<td><em>PCT Technicians Handbook</em>, Christensen</td>
<td>4.95</td>
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<tr>
<td>7</td>
<td><em>Managing Service for Success</em>, J. Beck, Pest control business self-help manual</td>
<td>30.00</td>
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<tr>
<td>8</td>
<td><em>Principles of Food Analysis for Filth, Decomposition and Foreign Matter</em>, FDA</td>
<td>65.00</td>
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<td>9</td>
<td><em>Ecology and Management of Food-Industry Pests</em>, FDA, J.R. Gorham</td>
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<td><em>Silent Spring</em> by Rachel Carson</td>
<td>16.95</td>
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