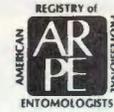


FUMIGANTS AND PHEROMONES



Issue No. 15 Spring 1988



By: Fumigation Service & Supply, Inc.
Insects Limited, Inc.
10505 N. College Ave.
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1988 FUMIGANTS & PHEROMONES ADVANCED SEMINAR

A date has been set for the sixth Fumigants & Pheromones Technical Seminar. On December 8 and 9, 1988 the program will be held on the IUPUI campus at the brand new Lincoln Hotel and University Conference Center. This is a state-of-the-art training facility located in downtown Indianapolis.

In 1986, over 230 attended this two day advanced program. They represented insect control specialists from over 25 states and Canada.



The speakers for this program will be the best available from the United States and Europe and a most interesting agenda is being planned.

You are invited to attend the 1988 Fumigants & Pheromones Technical Seminar in Indianapolis on December 8 & 9, 1988. Programs will be sent out about six weeks before the program and reservations will be taken at that time.

100 YEARS of BIOLOGICAL CONTROL

Biological control began in North America with the importation of the

Vedalia Beetle (Lady Beetle) from Australia in 1888-1889 to control the Cottony Cushion Scale in California citrus. This problem was handled by the lady bug in less than two years; the scale was nearly eliminated. Its use generated other successful biological control programs, and it remains an effective control agent today. The control of pests with natural enemies is being called on to replace more temporary pesticide control strategies.

"The future of insect control is without the use of toxic chemicals."

QUOTABLE QUOTES

Once the well is poisoned, it is too late." *Grassroots* publication, Texas Dept. of Agriculture on the groundwater issue.

"There is not much that can be done to improve the new federal grain standard, but we can do a better job at detecting the infestation that is present." Dr. Vera Krischik, Entomologist, FGIS, USDA at Kentucky Fumigation *Short Course*.

"We have never used Vapona™ in our dog collars", Hartz Mountain radio advertisement

"People who don't know will always buy from people who know," Orville Redenbacher, commenting on his secret hybrid popcorn.

"Let's face it. No matter who you are, no matter what you do, the only thing you leave behind are your children and a stone." Halsey Tuthill, memorial dealer.

"I'm not Bobby Knight. But I can work on my profanity." Jerry Reynolds, coach of the Sacramento Kings.



MALATHION RESISTANCE

Indianmeal moth... Of 43 strains of Indianmeal moth collected in the U.S. Grain Belt in 1981, 39 were resistant to malathion. Of these 39, all were 17 fold or more resistant. One strain was over 250 fold resistant.

Flour beetles... FAO (United Nations) surveyed 505 strains of Confused flour beetles from throughout the world in 1976: 87% were resistant to malathion and 60.8% of the 23 strains in North America were resistant to malathion. In Georgia in 1980 there was 73 fold resistance to these insects.

Editor's Note: Malathion is not effective in most areas of the United States and the world for stored product insect control. This product *should not* be used in pest management strategies for these pests.

ARTICLES IN THIS ISSUE

- Dichlorvos Update
- Grain Bin Fumigation...
- Beneficial Insects
- Grain Dust Explosions
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- Insect Spotlight
- Resistance
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- New Grain Standards

THE IMPACT OF NEW GRAIN STANDARDS

Dr. Vera Krischik, Entomologist, Federal Grain Inspection Service, USDA, Washington, DC. stated at this year's Kentucky Fumigation Short Course that the final changes in the insect tolerance on grain goes into effect on May 1, 1988.

- A. The term "weevily" is dropped and replaced by infested.
- B. New insect tolerances for wheat, rye, and triticale
 1. Two or more live weevils, or
 2. One live weevil and one or more other live insects injurious to stored grain, or
 3. No live weevils, but two or more other live insects injurious to stored grain
- C. New insect tolerances for corn, barley, oats, sorghum, and soybeans:
 1. Two or more live weevils, or
 2. One live weevil and five or more other live insects injurious to stored grain, or
 3. No live weevils, but 10 or more other live insects injurious to stored grain.

- D. Revised the Sample Grade definition in the wheat standards to include a limit of 32 insect-damaged kernels per 100 grams of wheat (FDA).

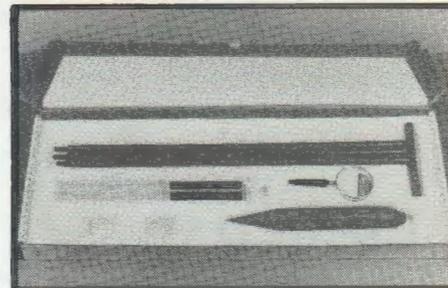
Dr. Krischik made some important statements during her presentation on their New Federal Grain Standards, when she stated that the Russians have discounted over half of the millions of tons of grain we shipped them 75 cents/ton. These are insects that are not being detected 20 days earlier in the United States. She went on to say that the Russians must be doing a more thorough job of inspecting and sampling our grain.

Dr. Krischik stated that the present Federal Grain Standard was watered down from the original version proposed last year, however, we can take a lesson from the Russians and "do a better job of inspecting for the insects that are in the grain".

The Kentucky Fumigation Short Course was well attended in February. Over 140 people were present for this very educational bi-annual technical seminar. Dr. Chris Christensen and his staff again did a great job of putting it together.

GRAIN INSPECTION KIT

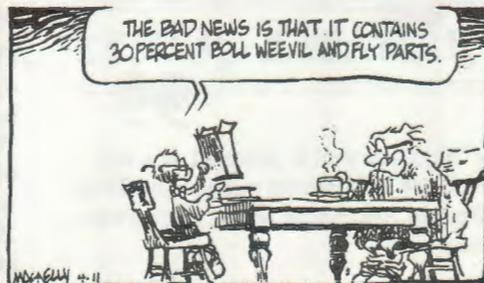
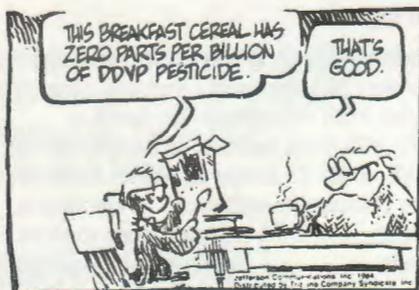
A handy, inexpensive, grain inspection kit is now available. The Douglas Grain Inspection Kit contains two 14" grain probes (Burkholder style), with the new temperature strips, a magnifying glass, two specimen containers, a grain sampler and a 9-foot plastic extension push probe.



Insects Limited, Inc. is distributing this useful grain management inspection kit for \$64.95 each.

The grain probe sampling method has shown to be up to 20 times more sensitive in detecting light infestations of grain insects over the conventional grain trier sampling method. Detection should be the first step of any insect control program.

By Jeff MacNelly



DICHLORVOS UPDATE

On February 24, 1988, The EPA issued in the Federal Register its Position Document #1 called: **Dichlorvos; Notice of Initiation of Special Review.** This is different from the normal re-registration sequence for pesticide labeling. It is the first of a four-step approach to allow for a risk/benefit analysis for this suspect insecticide.

Summary: This notice announces that EPA is initiating a Special Review of the pesticide, dichlorvos (2,2-dichlorovinyl dimethyl phosphate). Dichlorvos, also known as DDVP, is an insecticide registered for use in areas where flies, mosquitoes, gnats, cockroaches, fleas and

other insect pests may be a problem. Dichlorvos has been classified as a carcinogen based on ocogenic effects in mice and rats. Dichlorvos also causes adverse liver effects in dogs and has been shown to be a potent cholinesterase inhibitor in rats and dogs. The EPA has determined that the exposure to dichlorvos from the registered uses may pose an adverse oncogenic risk. They also state that there are inadequate margins of safety for cholinesterase inhibition and liver effects to exposed individuals. During the Special Review, EPA will examine the risks and benefits of using dichlorvos and will determine whether such uses should be canceled or otherwise regulated.

For further information contact: Joan Warshawsky, EPA, (703)-557-5778 in Washington, DC.

REPLACEMENT FOR DDVP

There is not just one product available to replace dichlorvos. However, a sound integrated 'bio-rational' pest management program utilizing the use of less toxic insecticides will allow for the safe and effective elimination of insect pests.

Insects Limited, Inc. has supplies of: .5% pyrethrum, 1% pyrethrum, 3% pyrethrum, 6% pyrethrum concentrate (Kicker), Dianex (IGR), pheromone traps, and beneficial insects. Along with the knowledge to use them safely and effectively.

These products along with good sanitation can replace dichlorvos in most situations.

ILLINOIS OFFICE

John Mueller
New Phone #: (309) 827-7233
1718 Springfield Road, Suite #4
Bloomington, Illinois 61701

Call on John for: "Competitive Prices & Unbeatable Service"

STORED PRODUCT INSECTS

In the United States; A survey

by David K. Mueller, RPE

In cooperation with the State Extension Service and the various Land Grant Colleges.

This is an informal survey in which 44 states were contacted and asked to respond to four questions concerning stored product insects in their state. This survey was conducted in 1980 and we will repeat it again for the 1988 Fumigants & Pheromones Technical Seminar.

Stored Product Insect Survey

1. Which stored product insect is most frequently sent in to be identified?
2. List the stored product insects which cause the biggest problems in your state on RAW GRAIN.
3. List the stored product insects which cause the biggest problems in your state on PROCESSED FOOD.
4. Is there an insect or group of insects that is gaining importance in your state?

RESULTS:

Which stored product insect is most frequently sent in to be identified?

National Survey

Rank	# States	Insect	Scientific Name
1	14	Sawtoothed grain	<i>Oryzaephilus surinamensis</i>
2	11	Indianmeal moth	<i>Plodia interpunctella</i>
3	5	Flour beetles	<i>Tribolium spp.</i>
4	4	Cigarette beetle	<i>Lasioderma serricorne</i>
5	3	Weevil complex	<i>Sitophilus spp.</i>
6	3	Flat grain beetle	<i>Cryptolestes pusillus</i>
7.	2	Dermestids	<i>Trogoderma spp.</i>
8.	1	Almond moth	<i>Ephestia cautella</i>
9.	1	Foreign grain beetle	<i>Ahasversus advena</i>
10.	1	Lesser grain borer	<i>Rhyzopertha dominica</i>

Question #1 Regional Survey

North Central States

Sawtoothed grain beetle: Colorado, Kansas, Kentucky, Minnesota, Montana, Illinois

Indianmeal moth: Illinois, Michigan, Missouri, Ohio, Wisconsin

Flour beetles: North Dakota, Minnesota,

Cigarette beetle: Kentucky

Flat grain beetle: South Dakota, Montana

Foreign grain beetle: Wisconsin

QUESTION #2

List the stored product insects which cause the biggest problems in your state on raw grain. (44 states responded to this question)

National Survey

Rank	# States	Insect	Scientific Name
1	27	Indianmeal moth	<i>Plodia interpunctella</i>
2	20	Sawtoothed grain beetle	<i>Oryzaephilus surinamensis</i>
3	19	Rice weevil	<i>Sitophilus oryzae</i>
4	17	Confused flour beetle	<i>Tribolium confusum</i>
5	16	Red flour beetle	<i>Tribolium castaneum</i>
6	10	Angoumois grain moth	<i>Sitotroga granarius</i>
7	8	Granary weevil	<i>Sitophilus granarius</i>
8	8	Lesser grain borer	<i>Rhyzopertha dominica</i>
9	7	Flat grain beetle	<i>Cryptolestes pusillus</i>
10	7	Foreign grain beetle	<i>Ahasversus advena</i>

Question #2 Regional Survey

North Central States (15 States)

Rank	# States	Insect	Scientific Name
1	10	Indianmeal moth	<i>Plodia interpunctella</i>
2	10	Sawtoothed grain beetle	<i>Oryzaephilus surinamensis</i>
3	8	Flour beetles	<i>Tribolium spp.</i>
4	7	Foreign grain beetle	<i>Ahasversus advena</i>
5	6	Flat grain beetle	<i>Cryptolestes pusillus</i>
6	4	Rice weevil	<i>Sitophilus oryzae</i>
7	2	Larger black flour beetle	<i>Cyaneus angustus</i>

QUESTION #3

List the stored product insects which cause the biggest problems in your state on *processed food*. (44 states responded)

Rank	# States	Insect	Scientific Name
1	33	Sawtoothed grain beetle	<i>Oryzaephilus surinamensis</i>
2	29	Indianmeal moth	<i>Plodia interpunctella</i>
3	24	Dermestids	<i>Various species</i>
4	24	Red flour beetle	<i>Tribolium castaneum</i>
5	15	Confused flour beetle	<i>Tribolium confusum</i>
6	13	Cigarette beetle	<i>Lasioderma serricorne</i>
7	6	Drugstore beetle	<i>Stegobium paniceum</i>
8	3	Merchant grain beetle	<i>Oryzaephilus mercator</i>
9	3	Psocids (booklice)	<i>Liposcelis spp.</i>
10	3	Mites	<i>Various species</i>

Others listed

Flat grain beetles, Rice weevil, Almond moth, Foreign grain beetle, Mediterranean flour moth, Angoumois grain moth, Mealworms, Squarenecked grain beetle, Dried fruit beetle, Brown spider beetle.

Regional States (14 states)

Rank	# States	Insect	Scientific Name
1	13	Sawtoothed grain beetle	<i>Oryzaephilus surinamensis</i>
2	12	Indianmeal moth	<i>Plodia interpunctella</i>
3	11	Dermestids	<i>Various species</i>
4	11	Red flour beetle	<i>Tribolium castaneum</i>
5	7	Confused flour beetles	<i>Tribolium confusum</i>
6	2	Cigarette beetle	<i>Lasioderma serricorne</i>
7	1	Drugstore beetle	<i>Stegobium paniceum</i>
8	1	Angoumois grain moth	<i>Sitotroga granarius</i>
9	1	Merchant grain beetle	<i>Oryzaephilus mercator</i>
10	1	Psocids	<i>Various species</i>

QUESTION #4

Is there an individual insect or group of stored product infesting insects that you feel is gaining importance in your state? (21 states responded)

- Florida- Cowpea weevil
- Georgia- Indianmeal moth, Red flour beetle
- Maine- Indian meal moth
- Maryland- Trogoderma spp. in cereal products
- New Jersey- Cigarette beetle on spices and herbs
- Nevada- Dermestids
- Oklahoma- Indianmeal moth on stored grain
- Pennsylvania- Fungivores, Foreign grain beetle and other fungus-feeding insects
- South Carolina- Maize weevil (300% increase), Red flour beetle
- Texas- Larger black flour beetle
- Utah- Dermestids
- Washington- Merchant grain beetle



Regional Survey

- Colorado- Indianmeal moth
- Illinois- Fungivores, Foreign grain beetle
- Indiana- Fungivores, Indianmeal moth
- Minnesota- Larger black flour beetle
- Missouri- Larger black flour beetle, Indianmeal moth
- Ohio- Fungivores, moisture related insects
- Wisconsin- Fungivores

STORED PRODUCT INSECTS IN PROCESSED FOOD ...

A Regional Outlook

North Central Region

1. Sawtoothed grain beetle
2. Indianmeal moth
3. Dermestids
4. Red flour beetle
5. Confused flour beetle

Southwestern Region

1. Cigarette beetle
2. Red flour beetle
3. Dermestids
4. Drugstore beetle
5. Confused flour beetle

Eastern Region

1. Indianmeal moth
2. Sawtoothed grain beetle
3. Dermestids
4. Cigarette beetle
5. Drugstore beetle

Pacific Region

1. Sawtoothed grain beetle
2. Indianmeal moth
3. Dermestids
4. Red flour beetle
5. Confused flour beetle

Southeastern Region

1. Sawtoothed grain beetle
2. Cigarette beetle
3. Red flour beetle
4. Drugstore beetle
5. Almond moth

BENEFICIAL INSECTS

An alternative to pesticides is the use of natural enemies of insect pests. Stored product moths can be eliminated in a natural food store environment, a seed company warehouse, or in grain storage with nature's original control method.

These beneficial insects are very small and do not harm man. If enough pests are present, the beneficial insects will reproduce until they have searched-out and destroyed their hosts. These insects are about the size of the period at the end of this sentence.

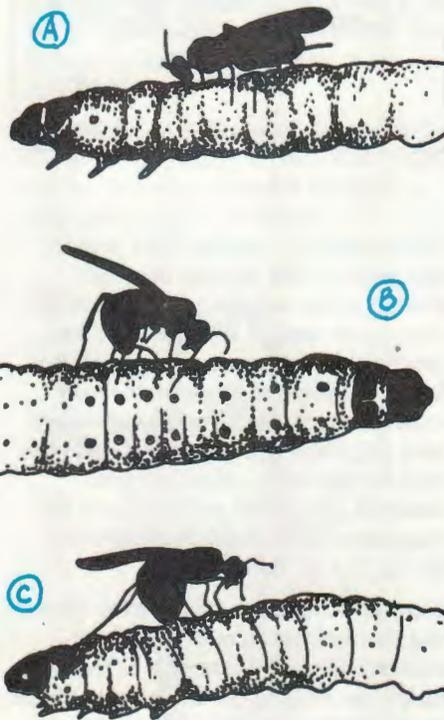
The "natural enemies", beneficial insects, were researched by the USDA-ARS scientists at the Stored Product Research Laboratory at Savannah, GA. The scientists found that all the insects that attack stored grains could be controlled by releasing beneficial insects.

If you have a moth or beetle infestation that needs immediate corrective action, the combination of pheromone trapping and the release of beneficial insects will help control these pests. Their lives and the lives of their progeny depend on it to survive.

Start controlling pest insects today without the use of toxic chemicals. The technology is available. Insects Limited, Inc. can help you plan your "Bio-rational Insect Control Strategy". Call for more information on this biological control.

"Bio-rational"

Bracon hebetor:



Bracon hebetor S. adult female, in three poses: A, feeding on body fluids of Mediterranean flour moth larva, with straight ovipositor protruding behind; B, in position for puncturing body of larva preparatory to laying an egg; C, with ovipositor well inserted in larva, just before laying an egg.

Advantages of Beneficial Insects

- They reproduce when hosts are available
- Pests can't develop resistance to them
- They are good hunters, their survival depends on it
- They produce no residue
- They are safe to use

Facts about Beneficial Insects

- It is an integral part of many IPM programs
- Most parasites are very small
- Most parasites have short life cycles
- Most parasites have a high reproductive capacity
- Most parasites have the ability to overtake pest populations

Some Disadvantages for Beneficial Insects

- Most are host specific
- Some are indiscriminate
- May produce results slower
- Frequent releases are required
- Some parasites are sensitive to chemicals

Test results from the USDA Laboratory in Savannah on farmer stock peanuts infested with Indianmeal moths showed the following results:

Trichogramma alone produced a level of control at ... 96.6%
 Bracon hebetor alone produced a level of control at ... 97.3%
 Combination of both produced a level of control at ... 98.0%

INSECT SPOTLIGHT

Beneficial Insects... Search-out, Attack, and Destroy

Man has enemies and so has his old antagonists, the insects. The insect problems which we encounter today would no doubt be much worse if it were not for the parasitic and predaceous insects which prey upon the insects which prey upon man.

Swarms of small wasplike insects, the size of the period at the end of this sentence are often found in bulk grain. These insects may also be seen on the windows of flour mills and other establishments where cereal products are handled. These parasitic insects are not harmful to man or the grain but are beneficial because they attack and destroy the insects that infest grain and grain products.

Bracon hebetor is a wasp that specializes in the destruction of the Indianmeal moth and other flour moth larvae. The female wasp paralyzes the host larvae with several stings, then proceeds to lay several eggs on the caterpillar. The small legless larvae are hatched and feed upon the body juices of their host. The life cycle of this wasp is about 2 weeks or less.

This can be a successful control tool for those locations where the primary target pest is the Indianmeal moth. (ie. Natural food stores, flat storages of grain, seed warehouses, popcorn warehouses). The combination of pheromones for detection and the timely release of beneficial insects can help eliminate this "Public Enemy #1".



Bracon hebetor adult female, in three poses: A. feeding on body fluids of Indianmeal moth larva, with straight ovipositor protruding behind; B. in position for puncturing body of larva preparatory to laying an egg; C. with ovipositor well inserted in larva, just before laying an egg.

AC's: The most important parasite of the rice and granary weevils is a tiny wasp called **Anisopteromalus calandrae** or nicknamed AC's. The female wasp can

detect the presence of the grain-weevil grub hidden from sight within the grain and paralyzes it with a few thrusts of the ovipositor. She then deposits one egg on the exterior of the grub or in close proximity to it. The egg hatches, and the parasite grub feeds on the paralyzed weevil grub and destroys it. In silos full of rice in Arkansas, this insect has been shown to penetrate over 80 feet to search out and attack rice weevils in stored rice. The developmental period from egg to adult is about 2 weeks. One female parasitic wasp can lay as many as 283 eggs.

OFF THE LEASH

By W.B. Park



Trichogramma pretiosum: This versatile tiny wasp attacks the eggs of stored product moths and the eggs of some 600 other moth species. Whereas the other beneficial insects work primarily on the larvae as their host, this minute insect attacks the egg stage. *Trichogramma* are used primarily by the vegetable and row crop industries for controlling pests outdoors. It is grown on the eggs of the Angoumois grain moth by people like Biofac, Inc. of Mathis, Texas.

Since primeval man crawled from his cave and decided that he might better his existence through the storage of foods for future use, he has been forced to battle the insect kingdom to protect his stored products. In spite of modern methods and chemicals, this battle rages more fiercely today, than ever before. This is likely to continue as long as man exists.

References: USDA, Agriculture Handbook #500, Lauhoff Grain Company Insect Manual



DAVID MUELLER

David started Fumigation Service & Supply, Inc. and Insects Limited, Inc. in 1981. He graduated from Purdue University in 1975 in Entomology and Environmental Science. David is married to his wife Mary Beth and has three children.

As a member of the American Registry of Professional Entomologists, Dave helps promote professionalism in this science and is the president of the Ohio Valley RPE chapter. He is a 1987 inductee into Who's Who in the Midwest.

Besides testing and developing new pheromone systems for stored product insect pests, David has been active in public speaking to various companies and groups throughout the United States, Canada, and Great Britain for the past thirteen years.

In his spare time, David enjoys racketball, softball, snow skiing, and hunting. He works with the Boy Scouts and is active with Ducks Unlimited, an organization devoted to protecting wetlands habitat. His family is important to him and the time he spends with them is valued.

"Small business is a place where individual effort, enthusiasm, and a personal touch can give you an edge. People want to know the safe and proper way to control insects. I try to understand each company's individual needs and develop a sound strategy to solve its problems. We are not chemical salesmen, we are problem solvers."

"It is truly exciting to work in a field where changes are occurring almost daily. Insects are fascinating animals from whom humans could take a few lessons. The application of pesticides, in the future, will occur only when pest populations are likely to grow high enough to cause intolerable damage. A trend to biorational alternatives is inevitable. It is just a matter of how fast our industry will respond."

Call on David Mueller to help solve your insect problems.

NEW PRODUCTS

Degesch MAGTOXIN®
Gets Federal Label.



The spot fumigant, Degesch MAGTOXIN, received an EPA label in January 1988 for all 50 states for the spot treatment of food and feed processing machinery and equipment. Previously, this product was only available in those states where a 24-c (special use) permit was allowed.

Degesch America, Inc., the leader in quality pre-packaged metal phosphides, manufactures MAGTOXIN Prepac for spot treatments to control stored product insects in bins, silos, holding tanks, elevator boots and heads, filters, conveyers, spouting, purifiers, food processing equipment, sifters, rollers, dusters, and related equipment in mills, food and feed processing plants, breweries, bakeries, and similar industries.

The 34-hour minimum exposure period is intended to interrupt the life cycles of the insect pests. Since one or more life stages may survive this short-term treatment, spot fumigations must be repeated periodically to control the insect infestation.

It is important to note that Degesch America, Inc. has placed a special restriction on this product. They request that only people trained by their company or their distributors shall be offered this specialty product.

MAGTOXIN is packaged 66 magnesium phosphide pellets per strip (porous fleece), 5 strips per non-resealable foil pouch, 12 foil pouches per 6 1/2 gallon metal pail. Each strip will treat 660 to 1320 cubic feet. MAGTOXIN costs \$450 per pail and is UPS shippable.

PHOSPHINE RESISTANCE

Concern: Resistance to fumigants is of concern because of the great value of fumigants for pest control and because of the very limited numbers of materials available.

What is resistance? The continuous and intensive use of certain insecticides against various insect pests has resulted in the development of races or strains sufficiently resistant to the action of the insecticide as to necessitate a complete change in control measures.

Resistance is a genetic characteristic that is passed on from one generation to the next.

Resistance vs. Tolerance

When a population of insects is exposed to an insecticide, some individuals are killed more easily than others. The insects that are more difficult to kill may survive after the treatment and produce offspring that are also hard to kill. These insects are said to be more tolerant because they can withstand above-average doses of the poison.

If a population is repeatedly treated with the same insecticide and each new generation has increasingly higher tolerance, a "resistant" strain is produced.



In a recent article in the Journal of Stored Products Research, the subject of Phosphine Resistance was well

researched. The title of the article is "The Toxicity of Phosphine to the Immature Stages of Resistant and Susceptible Strains of Some Common Stored Product Beetles, and Implications for Their Control" by L.A. Price and K.A. Mills from the Ministry of Agriculture, Fisheries and Food, Slough Laboratory, England.

Abstract: — All developmental stages of 13 strains of six species of stored product beetles, including 7 strains known to be resistant to phosphine as adults, were exposed to the gas at 15° and 25°C in fumigation chambers. The strains resistant to phosphine in the adult stage were found to have resistant immature stages, and in all the resistant strains the most tolerant stage in the life cycle was the pupa.

Results indicated that for resistant as well as susceptible strains, time of exposure to phosphine was *a more critical factor of dosage than concentration*. However, for control of the resistant insects, it was also found necessary to achieve high dosage levels, which must be maintained for long periods. It is unlikely that either of these objectives could be achieved in a commercial treatment using current practices. **Thus effective control of both susceptible and resistant insects will only be possible if structures used for storing grain are made more gastight, or if bulks of grain stored on the floor are effectively sealed using suitable impermeable sheeting secured to the floor.**

J. stored Prod. Res. Vol.24, No. 1, pp. 51-59. 1988

It is important to point out that there has not been any reported cases of resistance to phosphine (Phostoxin) fumigants in the United States to date. Resistance to fumigants is, as yet, limited in extent and often at margin levels, but it was of considerable significance as it poses a real threat to the future use of fumigants as control agents.

As a replacement fumigant for phosphine is unlikely to be found, the need to amend current fumigation practices to prevent further development of resistance becomes increasingly urgent. Great improvements in the gas-tight sealing of commodities and the lengthening of exposures to the gas are needed.

The best way to prevent resistance of any insect species is to not allow any to survive the treatment!



GRAIN DUST EXPLOSIONS

...Down in 1987

Fourteen grain dust explosions were reported in the U.S. in 1987. This compares to 21 in 1986 and a 10-year average of 21 explosions. The best news was that there were no fatalities and only 16 injuries.

The principal location of the primary explosion was an elevator leg in 8 of the 14 explosions. Corn dust was involved in 12 of 14 cases. Most of the explosions occurred in a grain elevator, 10 of 14, while the remaining four were in feed mills.

Explosions occurred in 10 states; 2 in Ohio, Illinois, Iowa and Missouri and one each in Texas, Indiana, Minnesota, Georgia, Kentucky, and Michigan.

A PERSPECTIVE

Until recently the control of agricultural pests and disease vectors depended upon the use of unspecific toxicants. The dramatic reduction in vector-borne diseases and the overpopulation of food in the sixties seemed to herald a new golden age. However, these advances were not without cost because of the population explosion which followed. Soon there was a demand for even greater surpluses and the virtue of those pesticides were negated when their potentially carcinogenic, teratologic and mutagenic residues were recognized and found to accumulate in the biosphere. *The nature of the chemicals employed in the future must be more selective to the target pest and also environmentally safe.*

By: David L. Whitehead and William Bower, The International Centre of Insect Physiology & Ecology, Nairobi, Kenya.

BZZZZZ!



Earth's most numerous inhabitants are the guests of honor at "Insects", an

exciting new exhibit at The Children's Museum in Indianapolis. The exhibit features live colonies, giant models, and plenty of details about how insects live, eat, reproduce and work. When in Indianapolis, go to the world famous Children's Museum and stop by and see us.

NEWSLETTER

Fumigants & Pheromones is published by Fumigation Service & Supply, Inc. and Insects Limited, Inc. for the professional pesticide applicator. We hope that the information that you receive from this newsletter will help you in your business, and you, in turn, will support our business efforts. If you have an associate that would be interested in receiving this newsletter, please contact the address below. We would welcome any comments or suggestions for topics. Address correspondence to: David K. Mueller, Fumigation Service & Supply, Inc., P.O. Box 40641, Indianapolis, IN 46280 (317) 846-5444.

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