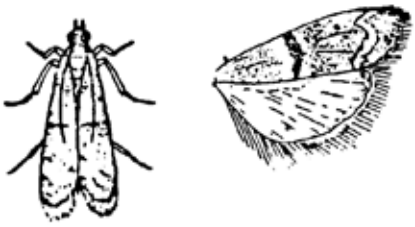
CHAPTER 29
THE BEST CONTROL FOR STORED PRODUCT PESTS
Or what's that in my soup?

In 1996 the USDA Pesticide Data Program analyzed 575 domestic (1996) milk samples; a total of 105 samples (18%) were reported with pesticide poison residue (contamination) detections. One sample was reported as a presumptive tolerance violation. In addition in 1996 there were 243 presumptive violations in 198 samples (196 fruit and vegetables, 1 wheat and 1 milk). Overall, 71.8% of the 4,856 fruit and vegetable samples analyzed by the PDP participating laboratories contained at least 1 pesticide (poison) and 91% of the 340 wheat samples had at least 1 pesticide (poison) "residue". A survey by Potter and Bessin in 1998 indicated 75% of urban people were concerned about pesticide "residues" in their food.

These Stored Product Pests Compete with Humans Pre- and Post-Harvest for Our Grain Crops

Indian meal moth

Mediterranean flour moth

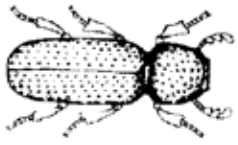


Almond moth

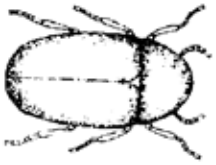
Rice weevil

Granary weevil

Angoumois grain moth



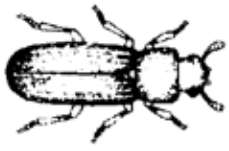
Lesser grain borers



Cigarette beetle

Sawtoothed grain beetle

Drugstore beetle



Confused flour beetle

PEST OVERVIEW

Stored-product insects are small and often difficult to detect and properly identify. About 300 different species of stored product pests may be encountered with only about 18 species of primary economic importance. In spite of all the pesticide poison's used/misused, insects still destroy over 30% of the world's food crops each year. Suriving field pest eggs or larvae commonly pass from the farmer to the processor to the warehouse to the store and into our buildings and pantries and food - virtually unnoticed. These are important economic pests that contaminate our stored food with their excrement, cast skins, dead bodies and webbing. They consume or damage large quantities of our food, and as they chew through and damage packaging materials they cause even greater indirect food damage and resulting economic loss. The number of populations in the United Kingdom of various stored-product pests exhibiting insecticide resistance is increasing (Picket, et al 1990). EPA wants to eliminate the production and importation of methyl bromide by 2001, because of its expected ozone depletion potential (EPA 1993). Phosphine fumigation is under attack because of carcinogenic concerns (Gary, et al 1989, 1990) and pest resistance (Zetter and Keever 1994). Many stored product pests worldwide are also now resistant to chlorinated hydrocarbons (e.g., lindane), organophosphates (e.g., malathion, fenitrothion), carbamates (e.g., carbaryl), and synthetic pyrethroids (e.g., deltamethrin) but they still are not resistant to Safe Solutions, Inc. Enzyme Cleaners, carbon dioxide, vacuums, food-grade 100% diatomaceous earth and/or heat and/or cold and/or common sense. For complete control of these pests, you must determine the source, type, severity and importance of any infestation. Grain temperature and moisture are the main factors on insect population growth. Add automatic aeration and you can greatly reduce potential pest problems.

Being properly equipped to conduct a thorough inspection is extremely important. The following equipment and materials are recommended in the Purdue University Food Plant Pest Management correspondence course.

- A simplified floor plan or map of the areas to be inspected.
- A simple illustration showing the perimeter of the plant and its immediate outside surroundings (proximity of fields, grain bins, railroad tracks, drainage ditches, etc.)
- An explosion-proof, heavy-duty flashlight equipped with fresh batteries and capable of throwing a strong beam of light (spare batteries and an extra bulb should be readily available).
- Tungsten, halogen lamps provide the brightest light (try the newest SCUBA flashlight).
- Flashlight holders attached to the belt will facilitate easy transport, and reduce the frequency of dropping the light or leaving it behind. A holder that lies flat against the body when not in use is best to prevent the holder from becoming caught or snagged in equipment during inspections.
- A flushing agent, such as a pyrethrin (or air), in a small pocket-sized aerosol container.
- A pocket knife.
- Various sizes of metal spatulas for digging into cracks and crevices.
- Hardware such as a Philips and standard head screwdriver, small crescent wrench, mini-crowbars to facilitate removal of panels or inspection covers on equipment, floor drains, etc.
- A hand magnifying lens (10 times or more) for viewing insects. A portable, lighted microscope (30 times) can also be obtained and is excellent for pest management inspections.
- Specimen vials with labels for collecting and recording information about insect specimens.
- A small polished-metal mirror with telescoping handle for inspecting inaccessible areas. **Glass mirrors should not be used in food plants.**
- An inspection belt and pouch will permit the inspector to carry the above equipment on his or her person and allow the hands to be free.
- Protective clothing that complies with plant regulations. This includes coverall, hair nets, snoods (beard nets), and in some cases cotton booties and plastic gloves. In many food plants this clothing is required for all persons entering production areas.
- Safety equipment, such as a bump cap, knee pads, ear plugs, filter masks, safety glasses and steel-toed shoes.
- Portable black light or detecting rodent urine.
- Clipboard and pencil.

The Author would use air or a large assortment of monitoring (blunder and pheromone) traps or duct tape (sticky-side up) rather than any pyrethrin.

Once inside our buildings, field pests are referred to as stored-product pests and/or pantry pests. Usually, the

first sign of a pest problem is the appearance of small beetles crawling over the counter tops, moths flying across rooms, or caterpillars crawling up walls or across ceilings. As pests of stored grains they damage about 10% of the world's annual food production. In the United States the annual loss due to stored-product pests was estimated to be about $1 billion in 1981. The solution requires finding and destroying all infested products in which these pests have developed, a general cleanup, and use of proper exclusion, sanitation, sealed storage containers and quality control to prevent recurring problems. Physical and Mechanical control techniques include: lighting, packaging, landscaping and inspection methods, e.g., tougher incoming goods (plant and product) inspections and proper rotation and storage of stock, etc.

While adults are usually the only visual signs of an infestation, merely killing them is not the solution. Infested articles must be found and destroyed. Identification of the pest can provide clues on where to look but some of these insects can live on a wide range of materials. Infestations of stored product pests are usually caused by bringing infested food or decorative items home.

In general, the greater the number of insects seen, the older the infestation. Often the initial source is found in partially used boxes or bags of products that have been forgotten in the backs of pantries and shelves. The infestation spreads as the active adults search for new food sources. A thorough search is needed to locate all infested items. If they are not found in pantries or cupboards, then begin to look at such things as decorative items or bird seed.

Disposal of all infested materials is the best way to eliminate the problem. Also check all items in pantries or on shelves. Often beetles can be found in cracks, beneath cans and other items. Steam clean these areas and/or thoroughly vacuum the shelves, both upper and lower surfaces, and use a crevice attachment to clean cracks and crevices; then clean with diluted Safe Solutions, Inc. Enzyme Cleaners. It is better to do a very thorough job one time than to have to repeat a hasty inspection and cleanup. After treatment, **good sanitation and proper storage** are keys to preventing future pest problems. Place products from cardboard, paper, or plastic containers into jars or other containers that can be sealed tightly. Decorative items such as Indian corn, dried flower arrangements, or bird feed may be treated with heat (155^{o} F for about 20 minutes with the oven door propped open) or in a non-self-defrosting freezer at 0^{o} F for four days.

Insect pests of stored products can be separated into four groups according to their feeding habits:

1. **Internal feeders.** The insect larvae feed entirely within the kernels of whole grain. Examples: rice weevil, granary weevil and Angoumois grain moth.
2. **External feeders.** Insects feed on the outside of the grain or chew through the outer coat and devour the inside. These are known as external feeders. Examples: lesser grain borer, drug store beetle, flat grain beetle, cadelle, khapra beetle and the cigarette or tobacco beetle.
3. **Scavengers.** Scavengers feed on grain only after the seed coat has been broken either mechanically or by some other insect. Examples: confused flour beetle, red flour beetle and saw-toothed grain beetle.
4. **Secondary pests.** Secondary pests feed only on materials which are deteriorating, damp and have some mold growth present. Some of them feed on mold rather than the food product. Examples: yellow mealworm, some grain mites and psocids.

Most stored product pests feed on readily available starch of broken or ground-up seeds and grains. Some are called "bran bugs". Few species can chew through the strong seed coat or place their eggs inside intact grains. Pests that can are: the rice and granary weevil, the Angoumois grain moth, the lesser grain borer, several species of seed beetles, or pea and bean weevils in the family Bruchidae. The beetles (Coleoptera) are the largest and most important group of stored-product pests - there are about 90 species. The moths (Lepidoptera) are the second largest group and second in importance - there are about 25 species. The mites (Acari) are the next largest group but are usually of minor importance - there are about 12 species. The only fly (Diptera) of importance is the cheese or ham skipper. There are many other species which also may be considered stored-product pests.

Our stored products can be infested at every point from their origin to final use:

- in the field, where the product is grown, picked or harvested
- in storage bins or granaries where it is held until it is sold

- in mills, where it is ground, mixed or packaged
- in warehouses, where it is held for use or redistribution
- in food processing plants, where it is added to other products, e.g., candy, pet food, baking mixes
  in retail food stores, where it is sold and
- in our pantries and cupboards, where it is held for use
- Do not store products paper, cardboard or in plastic bags or in containers with plastic tops; either freeze these packages or put the product into insect-proof containers.

The most commonly attacked products are cereal grains, spices and nuts. Less commonly attacked are dried fruits, candy, rodent bait, dried dog food, dried decorative flowers and such diverse materials as museum artifacts, cosmetics and drugs. Old, neglected or hard-to-reach products provide the greatest potential for infestation and reinfestation. Remember to thoroughly clean all areas with diluted enzyme cleaners or soaps at least monthly. The job is very simple, quick and easy, especially with a power washer. If you use rodent baits be sure to replace them all at least monthly. If your child plays with and/or "decorates" with beans, peas, macaroni or other "food stuffs", these products can quickly become the "source" of your infestation of stored product pests.

Flour contamination with Bla g2, a major cockroach allergen, is common according to Dr. Rosa Codina, Ph.D. at the University of South Florida and previous studies have documented cases of anaphylaxis and allergic reactions that have occurred after ingesting baked goods and flour products contaminated with *Tenebrio molitor,* a microscopic beetle found in flour, or with mites.

Just one more reason for not using any volatile, synthetic pesticide poisons: Stored products can be contaminated and destroyed with pesticide poisons as evidenced by the 8/10/94 DETROIT FREE PRESS ARTICLE.

Note: It would seem obvious that poison can contaminate and destroy more product than the pests.

Cereal firm opts to toss oat brands

General Mills is sued over pesticide use

Associated Press

GOLDEN VALLEY, Minn.--General Mills is throwing away 50 million boxes of cereal made from oats, some treated with a pesticide not approved for use on the grain, the company, confirmed Friday.

Meanwhile, the country's second-largest cereal maker faces a class-action lawsuit filed by consumers who bought cereal made from oats treated with the pesticide, Dursban, before the problem was detected and sales were stopped.

Dursban-treated oats were used to make Cheerios, Frankenberry, Kix, Lucky Charms, Oatmeal Crisps and Reese's Peanut Butter Puffs cereals.

General Mills said the suit, filed in Chicago, is without merit because government food regulators have determined that the pesticide treatment did not present a health hazard.

But Clinton Krislov, a lawyer for the plaintiffs, said the company breached its warranty by not disclosing package contents, even though the mislabeling was unintentional.

"The fact that no one has been harmed at this point isn't important," he said. "People are very concerned about what their children eat, and the description on the box didn't fit the contents."

The class of plaintiffs in the suit includes all buyers of oat-based General MIlls cereals dating back to May 1993. The action seeks refunds and attorney's fees.

A federal grand jury indicated Y. George Roggy, an Edina, Minn., businessman hired by General Mills, over the matter. Roggy was to treat millions of bushels of stored oats with Reldan 4E, a pesticide registered for use on oats by the Environmental Protection Agency.

The felony indictment alleges that Roggy substituted Dursban for Reldan; saving him about $85,000, and concealed the switch from General Mills.

Dow-Elanco, which makes Dursban, never sought EPA clearance for its use on oats, although it is approved for other foods.

Stephen Johnson, director of the EPA's registration division, said General Mills has scrapped plans to seek permission to use cereal made from the Dursban-treated oats for animal feed. A General Mills spokesman confirmed Friday that the company has been hauling the cereal to landfills in Illinois, Pennsylvania and Utah.

Habitat Alterations

- **Practice proper sanitation.**
- **First in - first out, inventory control is a must.**
- **Institute a good ongoing cleaning program** with Safe Solutions, Inc. Enzyme Cleaners. Pesticide poison use without cleaning will never control stored product pest infestations, so why use the poisons? Lightly dust with food-grade DE per the label.
- **Caulk all cracks and crevices** (especially wall penetrations) that communicate with other rooms. Use Safe Solutions, Inc. Enzyme Cleaners with or with Peppermint and vacuum and/or steam clean.
- **Screen out birds and rodents.**

- **Recommend proper lighting.**
- Collect and properly discard old rodent bait monthly. **Do not use if you do not have rodents.**
- **Maintain alleys or inspection paths** between stacks of products and between products and walls (Have them painted a light color.)
- Install air curtains at doors to keep out flying insects. **Install and maintain dehumidifiers and fans.**
- **Recommend rotating stock.** Throw or give away anything stored over 1 year.
- Recommend storing materials that are not commonly infested, e.g., animal bedding, paper products, canned goods away from infestable products.
- **Quickly and properly discard all infested materials.** Sanitation is the primary method of population reduction where infested stored products are found. Steam clean the entire area, or repackage in insect-proof containers, vacuum and/or clean with diluted Safe Solutions, Inc. Enzyme Cleaners.
- **Freeze (old) stored products or store them in coolers below 50° F.**

INTELLIGENT PEST MANAGEMENT® CONTROL AND MANAGEMENT OVERVIEW

Inspection - The first step in controlling pantry pests is to locate the source of the infestation. In large facilities, you will want to become familiar with the entire operation before making an inspection. The pathway a product takes is vitally important to detection. Pests can occur in machinery, stacked products, waste dumps, delivery spills, etc. In homes and retail businesses, excess clutter, bad lighting, storage areas with blocked access and rooms located above or below infested materials are special target sites. Look behind moldings, paintings, clocks, shelves, flower pots, hinges, cracks and crevices, etc.

- Monitor the situation with blunder or pheromone traps. Look for holes, webbing, fine dust or cast skins in packaging and/or fine dust in the stored product, or a product with a “lighter” color (caused by the dust).
- All inspections should be conducted with strong flashlights. A knife, a good hand lens, strong (bendable) knees, screwdrivers and mirrors are also useful equipment.
- Often stored product pests when touched, poured, shaken or moved, will draw in its legs and “play pos sum” and appear to be innocuous at least initially. If you wait you will see more movement.
- Special attention should be given to all spills. Check for pests, cast skins and tracks in spilled products or fine dust. Inspect the back of pantry shelves, floors under shelves, and all dark areas. Look for pupal cases under box tops. Check rims of pots, pans, dishes and other surfaces.
- Unscented yellow rodent glue boards make excellent monitoring traps for stored product pests as well as catching rodents, or try duct tape sticky-side up.
- Pheromone traps, available for nearly all stored product pests, should be used where routine inspections are made. Remember to label, date and place them properly.
- Keep detailed inspection records. Written inspection findings and recommendations for changes by management or maintenance must be clear.
- **Be safe. Use bump hats and be careful of heat machines and electrical hazards.**

GENERAL INTELLIGENT PEST MANAGEMENT® CONTROL OVERVIEW - The Food and Drug Administration has established defect action levels (DALs) for approximately 100 common foods, e.g., corn meal is only rejected if it contains more than 1 whole insect or 50 insect fragments per 50 grams.

Thoroughly inspect all incoming items, e.g., cereal products, nuts, spices and bird seed for presence of insects and **discard or reject all infested packages and/or goods.** Thoroughly clean with diluted Safe Solutions, Inc. Enzyme Cleaners or steam clean and vacuum food cabinets and shelves. Keep dry food and spices in tightly sealed containers or in the freezer. Keeping non-human food at 32° F. for 3 to 4 days will kill eggs and larvae. Use self-closing doors or manually close them a.s.a.p. Exterior overhead doors should be equipped with inflatable dock cushions, folding dock covers, air-doors and/or plastic curtains to help prevent pest entry. Be sure you interview all the occupants to find the source of the infestation(s).

1. **Prevention and physical exclusion.** Caulk and seal all cracks, crevices, voids, pipes and/or openings inside or into the building and storage areas to reduce pest entry, and then provide proper filtered ventilation. Use 20-mesh screens that are properly fitted on all appropriate open (tightly fitted) windows and doors. Properly inspect all incoming goods. Routinely clean with diluted or Safe Solutions, Inc. Enzyme Cleaners wherever possible. Lightly dust with food-grade DE per the label.
2. **Practice proper sanitation.** Quickly remove all spilled or infested materials. Routinely practice good

inventory controls and housekeeping. Throw away all infested material; vacuum and clean regularly with Safe Solutions, Inc. Enzyme Cleaners and caulk and seal all surfaces. Initiate proper grounds maintenance to reduce exterior sources of pests and attractiveness to pests, e.g., debris, trash and/or undesir able plant growth.

3. **Ventilation.** Reduce or keep the food moisture content low; mites require at least a 12% food moisture content. Use a dehumidifier, dryers, air conditioning and/or fans.
4. **Stock rotation.** The rotation of food stock with nonfood stock and using the oldest stock first helps to prevent infestation and unremoved debris. Stored foods that have a high possibility of becoming infested with pantry pests include: pasta, dry pet foods, biscuit, bread and pancake/waffle mixes, flour, macaroni and cheese mixes, bird seed, rodent baits, spaces, raisins, nuts, cereals, pop corn and cake mixes, etc. Practice first in first out product storage and inventory rotation.
5. **Proper storage.** This usually consists of having all items up on pallets. that the pallets be at least 18" away from the wall to allow for proper inspection. Repair or replace all torn bags; store all susceptible products in proper containers. Lightly dust with food-grade DE per the label. Store at temperatures below 50° F.
6. **Vacuum and caulk/seal all openings, cracks and crevices.** Don't forget the drop ceiling - it needs to be taken down and thoroughly cleaned with diluted Safe Solutions, Inc. Enzyme Cleaners at least once a year.
7. **In milling or processing plants, warehouses and stores properly install insect traps or pheromone traps or light traps or insect electrocutors to attract/kill flying insects.**
8. **Investigate and use blunder traps and/or insect pheromones** and/or baited monitoring devices for killing as well as for detecting infestations; in addition to your routine visual inspections of all suspect areas accessible and inaccessible. Damaged merchandise should be returned at least weekly or stored in tightly sealed metal garbage cans or plastic tubs or simply thrown away. Transfer and store all products packaged in paper, cardboard or plastic bags into tightly sealed jars or Tupperware-type containers; spices are usually all right in their original metal or glass containers. A vacuum cleaner or steam cleaner or, better still, diluted Safe Solutions, Inc. Enzyme Cleaner spray can be used to remove and/or kill exposed adults. All debris must be routinely removed from pantry cracks and crevices, and caulked.
9. **Detection** is trying to find the infestation as soon as possible by looking for insects and their trails, webbing, excrement, and damage. One of the important tools in detecting insects is the insect electrocuter. The insect electrocuter will attract most of the flying stored food and many other miscellaneous insects. The insect electrocuter must never be employed on the assumption that it will completely rid the premises of insects. It will decrease the insect population to a degree, but the insects in cracks and crevices and in other protected areas cannot see the black fluorescent light of the insect electrocuter. The electrocuter must be serviced at least once every two weeks, but once a week is preferable.
    - The more often the insects collected in the electrocuter are examined, the better one can quickly and accurately evaluate the condition of the premises if one can recognize the pests.
    - Many of the insects, such as the dreaded warehouse beetle, the Indian-meal moth, and certain flies that are in the electrocutor trap are dead, per se. However, the peristaltic action of the muscles in the genital area is still functioning and the fertile eggs can still be emitted by the female. These eggs eventually hatch and the larvae feed on the dead insects, creating a new infestation within the uncleaned trap. When the larvae mature, they may fall onto the floor beneath and start another infestation in the food.

If the infestation source is not found in the warehouse, cupboard, kitchen or pantry, check wallpaper (paste), in closets, dresser drawers and display or play areas for items made from nuts, ornamental corn or various grains and seeds, rodent droppings, bird nests, dead insects in attics, wall/ceiling voids, light fixtures and wasp nests, stored furs and woolens, bird feed, dry pet food and old rodent poison bait which can support a wide variety of stored product pests.

10. **Temperature controls.** Insects are cold blooded and they respond in direct proportion to changes in temperature. As temperatures are lowered, activity decreases. Lower the temperature quickly and you quickly kill these pests. Conversely, as temperatures increase, life expectancy is shortened, activities increase until some vital biological process is unable to continue - pest activity ceases and/or the pests die. Stored product pests can be killed by placing them in a freezer (not a self-defrosting kind) at 0° F. for 4 days. This is a particularly useful control method for decorative items of plant origin such as Indian corn arrangements, jewelry made from plant seeds etc. Heat can also be used to kill stored product pests by

placing stored products such as cereals in a shallow tray in an oven at 150° F. for 20 minutes with the oven door propped open a few inches and stirring the material every few minutes. Portable trucks called "reefers" can be called into your location to help you freeze products.

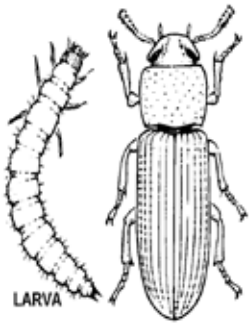
11. **Irradiation.** Irradiated males that mate with normal females result in infertile eggs and/or sterile offspring. Irradiation can also be used as a direct treatment to kill stored pests.

12. **Atmospheric controls.** Purge the entire facility with carbon dioxide, nitrogen or with the gases that result from combustion in a modified atmosphere generator. Carbon dioxide CO_s is used because it is safer, cheaper, has a faster insect kill, requires less sealing and the performance is not as adversely affected by fluctuations in atmospheric concentrations in the storage facility. Be careful to use the proper breathing equipment. Properly install and use dehumidifiers, dryers and/or air conditioning.

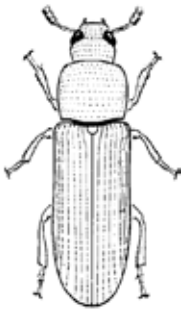
Follow-up - Lightly dust with food-grade DE per the label wherever needed.Ongoing monitoring and inspection plans should be put into effect in all food handling establishments. A complete pest management program is recommended for these operations. Clear communication with occupants is important. Recommendations on cleaning and sanitation should be evaluated continuously. **The Author always suggests the routine use of high pressure washers using Safe Solutions, Inc. Enzyme Cleaners.**

SPECIFIC EXAMPLES

CONFUSED FLOUR BEETLE & RED FLOUR BEETLE
***Tribolium confusum* (DuVal) and *Tribolium castaneum* (Herbst) = *T. ferugineum* (Mot.)**
Order - Coleoptera, Family - Tenebrionidae



CONFUSED FLOUR BEETLE


RED FLOUR BEETLE

Adult - Small, elongated and reddish-brown, about 1/8" - 3/16" long; the confused flour beetle antennae are gradually enlarged toward the 4 segmented club at its tip. The red flour beetle antennae are abruptly club-like with a 3-segmented club at the tip. Along with the saw-toothed grain beetle, these two have been referred to as the *bran bugs* and are about 80% of the insect problem in flour mills. Live for 3 - 4 months to more than 3 years depending upon climatic conditions. *Confused* do not fly; *reds* fly short distances. The red variety are generally found in the South; the *confused* variety in the North. They are so small they can force themselves into virtually any container. The life cycle takes about 30 days.

Larva - Yellowish or brownish-white in color, slender, wire-like and somewhat flattened , about 1/8" - 1/4" long, with six tiny legs on the forward portion of the body. Two spines are at the tip of the abdomen. Any where from 5 - 18 instars.

Pupa - White and naked and found in and around infested food product(s).

Egg - Very small, clear white and sticky. Average 300 - 500 eggs produced but laid at a rate of only 2 - 3 per day and hatch in 5 -12 days (average 9 days).

The confused flour beetle and the red flour beetle are the most common and serious pests of flour, cereal, and broken grains. They are closely related, similar in appearance, and often occur together. Flour beetles emit a foul-smelling gaseous secretion when disturbed. Antennae of the confused flour beetle terminate in four segments that gradually enlarge to form a club-like shape, whereas antennae of the red flour beetle abruptly terminate in three larger, club-like segments. Their small size provides them access to closed containers that would normally be insect -proof. Adult beetles run quickly when disturbed. In addition to feeding damage, they produce secretions that contaminate the material they feed on, giving it a disagreeable odor and taste. Note: Like grain beetles, both flour beetles usually do not feed on whole kernels or sound or undamaged grain. They attack damaged grains and milled or ground grain products, flour, cereals, peas, beans, shelled nuts, dried fruits, grain dust and debris, spices, milk chocolate, drugs, beans, snuff, cayenne pepper, and herbarium, insect and other museum specimens. **They have been routinely found to infest poisoned rodent baits.**

PREFERRED HOSTS

Confused flour beetle: Almond meats, barley, beet pulp, breakfast cereals, corn, cottonseed, cottonseed hulls, cottonseed meal, mixed feeds, oats, pecans, powdered milk, rice, safflower meal, vetch seed, walnut meats, wheat, and wheat bran.

Red flour beetle: Alfalfa seed, almonds, barley, copra meal, cotton gin trash, cottonseed meal, dried figs, flax seed, flour, millet, milo, mixed feeds, oats, peas, raisins, rice, safflower seed, wheat, and wheat bran.

The confused flour beetles are attracted to light even though they apparently do not fly. Red flour beetles can fly and are also attracted to the light. Both of these two common species of similar flour beetles infest dry milled cereal products in schools, flour mills, retail food stores and homes. Other closely related species are found from time to time, but the two that are best known are the red flour beetle and the confused flour beetle. These beetles are about 1/8" long, reddish-brown in color, with short, stout antennae. Larvae are slightly longer than adults, creamy-white, with few hairs.

Only those flour mills with the most thorough cleaning programs keep populations of flour beetles consistently low. (These beetles can thrive on flour spills.) Packaged milled cereals such as flour, cornmeal and cake mixes bought in large quantities may be stored long enough to allow eggs or larvae that have slipped through the milling and packaging process to develop.

INTELLIGENT PEST MANAGEMENT® CONTROL AND MANAGEMENT

- **Locate and destroy** all infested rodent baits and/or food products or freeze for at least 6 days at 0^{O} F.; then vacuum and clean thoroughly the entire area with diluted Safe Solutons, Inc. Enzyme Cleaners and lightly dust with food-grade DE. Spot treat as needed with Not Nice to Bugs®.
- Storgard flit-trac kits with the *Tribolium* aggregation pheromone will attract both male and female adults for weeks.
- Control both types with temperatures of 102^{O} F. for several hours.
- **Routinely inspect** all processed flour products and discard those that are infested.
- Recommend a sanitation and cleaning program with Safe Solutions, Inc. Enzyme Cleaner for mills, stores, schools, etc. Lightly dust with food-grade DE as needed.
- **Recommend that stored products be rotated**, bought in smaller quantities, and older packages discarded if use is not planned. Store all merchandise up off the floors. Lightly dust with food-grade DE per the label.
- Follow-up in homes is usually not needed. Retail foods stores, schools and warehouses should have ongoing monitoring programs. **Inspect all incoming goods.**
- Heat storage areas to 120^{O} F. (at floor level) and maintain heat for several hours.
- "Fumigate" with carbon dioxide.

SAW-TOOTHED GRAIN BEETLE AND MERCHANT GRAIN BEETLE
***Oryzaephilus surinamensis* (Linnaeus) and *Oryzaephilus mercatur* (Fauvel)**
Order - Coleoptera
Family - Cucujidae

Adult - Adults have long, narrow bodies, with well developed wings (but do not fly), flattened and small. About 1/10" - 1/8" long and dark red to dark brown. The thorax has six saw-toothed projections along each side. Both species are usually seen running rapidly over stored food. Can live from 1 - 3 months to over 3 years depending upon climatic conditions. The saw-toothed grain beetle is a tiny, slender, dark-brown beetle that measures a little under 1/8" long; it is also called a **bran bug.** With a good hand, lens you can identify three ridges that appear as fine lines on top of the thorax with six fine teeth on either side. The saw-toothed grain beetle's Latin name literally means "rice loving from Surinam". Eggs from both are deposited on infested food and hatch into tiny white larvae. The life cycle takes about 30 days. It readily penetrates packaged food.


SAWTOOTHED GRAIN BEETLE


MERCHANT GRAIN BEETLE

Larva - Both species have elongated bodies tapering from heads to tails, yellowish-white in color with brown heads. Less than 1/8" long, the body has six tiny legs and two prolegs at the forward end. 2 - 4 instars or molts, depending on temperatures. They cannot feed on whole grains. At full growth, larvae are slightly smaller than the adults. They become covered with the material they infest and appear to be very small lumps. (Pupae are equally inconspicuous.) Larvae do not leave the infested material. Adults do, and while they do not fly, they wander about in conspicuous numbers in the same vicinity as the infested material. They are scavengers.

Pupa - Both species are covered by a protective shell formed around the mature larva by sticking together small bits of food material. The pupa transforms into the adult beetle within this shell.

Egg - 45 - 285 shiny eggs laid singly or in small batches in crevices, packaged food, e.g., fine ground products or simply around food sources. Hatch in about 3 - 17 days. Both are usually found attacking foods, e.g., chocolate, rice, oats, cereals, dry fruit and meat, sugar, tobacco, macaroni, flour, bran, walnuts, meat and occasionally people.

Saw-toothed grain beetle larvae feed on items such as alfalfa seed, almonds, baking soda, barley, candy, clover seeds, chocolate, sugar, rice, wheat, cereals, dried fruits, breakfast foods, corn, cornmeal, corn starch, flour, garbanzos, hay, honeycomb, milo, mixed feeds, oats, raisins, rice, figs and other dried fruits, safflower seed, peas, vetch seed, pecans, drugs, dried meat, tobacco and nutmeats. These insects probably cannot attack whole kernels, grains and they are often found with other pests feeding on the kernel, grains and they have been already damaged by other pests.

The merchant grain beetle is not a major pest of grains or cereals, but prefers seeds and nuts. **The merchant grain beetle also cannot attack sound kernels.** Its flat body also permits access through very small cracks and into imperfectly sealed packages. **Adults can fly and they are attracted to light.** They are not commonly found in grains, but appears to prefer oilseed products, including nuts and cereal products. It mostly commonly attacks cereals, e.g., rolled oats, copra meal, dog food, dried figs, raisins, rice flour, cake mixes, macaroni and cookies. They have also been found infesting nuts, coconut and candy bars made with peanuts and puffed rice.

The saw-toothed grain beetle's flat body also permits access through very small cracks and into imperfectly sealed packages. Adults are not known to fly and are not attracted to light. They attack an extremely wide variety of foodstuffs which include cereals, bread, breakfast foods, macaroni, dried fruits, nuts, sugar, chocolate, dried meats, candy bars, drugs, tobacco, snuff and many other products.

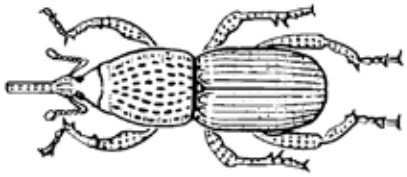
Note: All stages of both species of these pests can not survive temperatures below 5° F. for a day or temperatures above 125° F. for an hour. **Don't forget to inspect your packaged bird seed.**

Little harborage alteration is indicated. Older products will produce large populations simply because more generations can develop over time. Saw-toothed grain beetles infest the same materials as the Indian meal moth. Likewise, finding the infested product and throwing it away or sterilized with heat or cold and vacuuming and thoroughly cleaning the area of infestation is of prime importance. (Capture in these bait stations may be the first indication of beetle infestation.) Volatile pesticide poison sprays are of little use when infested material is discarded and cracks and crevices are thoroughly cleaned with diluted Safe Solutions, Inc. Enzyme Cleaner or their Peppermint Soap and caulked/sealed. Lightly dust with food-grade DE. Follow-up normally is not needed.

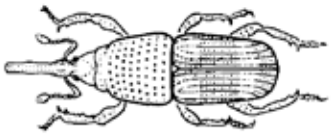
GRANARY WEEVIL AND RICE WEEVIL AND MAIZE WEEVIL
***Sitophilus granarius* (Linnaeus) and *Sitophilus oryza* (Linneaus) and *Sitophilus zeamais* (Mot.)**
Order - Coleoptera
Family - Curculionidae

These are all internal feeders and are commonly called snout beetles - the adult granary weevil is about 1/8" - 1/4" long and shiny reddish-brown or black and can live from 1 month to 2 years, depending upon climatic conditions. The top central area of its thorax is covered with elongated pits or punctures. Granary weevil adults have non-functional, vestigial wings. By contrast, the rice weevil is a good flyer and is slightly smaller, dull reddish-brown to black, and usually has four reddish, yellowish or lighter spots on the elytra. The top central area of the thorax of the rice weevil is covered with round or irregularly shaped pits or punctures, whereas the granary weevil by its elongated (oval) pits on the thorax and its wing covers lack the four reddish spots found on the rice and maize

weevils. The adult granary weevil is resistant to the cold and hibernates during the winter. Rice and maize weevils are not found north of North Carolina, and they can live from 3 months to 2 years depending on climatic conditions. The Latin word/name *Sitophilus* means "grain loving". The life cycle can be completed in 30 days. There are about 442,000 weevils to the pound.



GRANARY WEEVIL



RICE WEEVIL

Note: These three weevils are found in stored whole grain throughout the United States. Adult weevils have snouts with jaws (mandibles) at the tip. With these jaws, females chew holes in the grain and deposit eggs. Larvae devour the inside of the seeds, pupate, and later emerge to renew the cycle. Rice and maize weevils (originally from India) are more common in the southern states and can fly. Granary weevils (more common in cooler climates) cannot fly. It is thought that as it made its transition from wild acorns and grain to stored grain, the granary weevil lost its use of its functional wings and now depends on humans for dissemination. These three weevils are more common in granaries and mills than in stores and homes, but they infest a wide variety of cereal grains and seeds that are found in storerooms, pantries, garages and other storage sites. The word "weevily" is still used in general reference to infested grain products whether or not the infesting pest is a weevil. Rice and granary weevils adults will pretend to be dead by drawing their legs up close to their bodies and remaining still.

Another weevil with a much longer snout infests acorns, pecans and hickory nuts. Acorn weevil larvae leave the acorns and nuts to pupate. When infested nuts are brought inside, fat white larvae often escape and wriggle across tables, floors, etc.

Pupa - Naked and white, granary weevils usually pupate in 5 - 16 days within a grain kernel, sunflower seed, acorn or chestnut. Rice weevils take 3 - 9 days; after metamorphosis they remain inside the kernel for several more days and then chew an emergence hole and leave.

Larva - Soft, creamy white, legless grub with a brownish-black head. About 1/8" long when fully grown. 4 instars take 3 - 5 weeks. Found within a kernel of grain or in caked flour and tightly compacted cereals. **Rice and maize weevil larvae** can be found infesting: alfalfa seed, barley, cottonseed, Dallisgrass seed, liver meal, apples, pears, beans, cashews, Indian corn, milo, mixed feeds, rice, rice hulls, vetch seed, and wheat. They probably are our most important grain pest. **Granary weevil larvae** can be found infesting: barley, beans, milo, mixed feeds, oats, rice, rye, spinach seed, wheat, and wheat bran.

Egg - 35 - 254 eggs laid but deposited singly into a cavity bored by the female in a single kernel of unground grain. After the tiny egg is deposited, the cavity is sealed; hatch in a few days. Approximately half of the rice weevil eggs are infertile.
Note: The optimum conditions for weevil activity are 80 - 86° F. and 75% - 90% relative humidity and wheat having a moisture content of 13.5-17.6%. So destroy infested goods, and reduce the temperature and humidity to control weevil infestations. **Clean routinely with diluted Safe Solutions, Inc. Enzyme Cleaners or peppermint soap. Lightly dust with food-grade DE.**

Granary weevils have become adapted to living entirely in stored grains and never forage in the wild for food, hence their lack of wings; usually a northern pest. Adults can not fly, larvae can not walk; so man must distribute them. Rice weevils and especially maize weevils, however, fly to fields and infest grains such as corn, rice and wheat are usually a southern pest. After harvest, infested grain mixed with clean grain causes widespread contamination during storage. All stages of granary weevil can be killed by exposure to temperatures of 120° F. for 1 hour or 130° F. for 30 minutes. Try to control rice and maize weevils with the same heat. The larva when disturbed draws its legs up to its body and plays *dead* as do the adults.

CABINET OR WAREHOUSE BEETLES
Trogoderma species
Order - Coleoptera, Family - Dermestidae

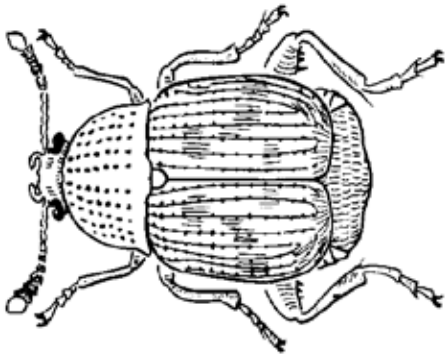
In the same family as carpet, hide & larder beetles (see Fabric Pests), *Trogoderma* and closely-related species (cabinet, larger cabinet and warehouse beetles) principally infest grain-based products. One species, the Khapra Beetle, *Trogoderma granarium* (Everts) is a very serious grain pest; routine federal quarantine inspections are made to prevent its entry and establishment in the United States. It has been known to build up in large infestations. The warehouse beetle, *Trogoderma variable* (Bullion) or *Trogodermal parabile* (Beal) is second only to the Khapra beetle as a dermestid pest of stored products. Unlike the Khapra beetle, it can fly.

The warehouse beetle is about 1/8" long, oblong and with brownish-black background color with brownish-orange, wavy horizontal lines running across the wing covers. The larva is about 1/4" long with many thousands of arrow-shaped and rattail-like hairs on the body. The ingestion of the larvae of this genus has been known to cause illness and these incidents have been reported in two articles (Okumura 1967 & 1972). There are many species of Trogoderma. Any identification of this group should be done by a specialist. A female lays about 50 eggs and it takes about six weeks from egg to adult.

Warehouse beetles commonly infest: Alfalfa seed, almond meats, animals (dead), Austrian peas, barley, beans, beehives, beef cube, beet seed, blood meal, breakfast cereals, broccoli seed, brome seed, burnet seed, burr clover seed, cake mix, candy, cantaloupe seed, carrot seed, chicken soup (dehydrated), chili pepper (dried), chocolate mint, cobwebs, cocoa, cookies, copra, corn, cornmeal, cottonseed, cowpea, cucumber seed, Dallisgrass seed, dandelion seed, date pollen, dog food (dried and 'burgers'), egg noodles, eggplant seed, fescue seed, figs (dried), fish meal, flaxseed, flour, fudge mixes, garbanzos, hominy, grits, insects (dead), junket, Ladino clover seed, lettuce seed, macaroni, millet, milk (powdered), milo, mixed feeds, mud dauber nests, noodles, oats, onion seed, peas, pea soup (powdered), peaches (dried), peanuts, pecan nuts, pepper seed, pistachio nuts, potato chips, powdered pudding, pumpkin seed, raisins, rice, rice bran, rye, ryegrass seed, safflower seed, sesbania seed, soybeans, spaghetti, spices, spider egg masses, spinach seeds, squash seed, Sudan grass seed, sunflower seed, sweet corn seed, tapioca, tomato seed, tortillas, turnip seed, vetch seed, walnut meats, watermelon seed, wheat, wheatgrass seed, wild rice and yeast. They are good package penetrators. The larval stage is dark-loving; the females switch and become light-loving, one hour to several days after egg laying. Lightly dust with food-grade DE.

Trogoderma adult beetles range from 1/16" to about 1/4" in length. They are about half as wide as long, which gives them an oval or oblong appearance. Their base color is black with three reddish-brown, golden or gray irregular lines across the body. Larvae are stout and capsule-shaped; their segments are seen as stripes across the body. The male has five molts and the female has six molts before pupation.

BEAN WEEVIL
Acanthoscelides obtectus (Say)
Note: Not really weevils but belong to the seed beetle Family Bruchidae.



Adult - Light olive-brown in color, dotted or mottled with darker brown and gray spots and reddish legs. About 1/8" long. It has one large and two small spines on the tip of the hind femur and the legs and the antennae are reddish, and the body narrows evenly toward the small head. Wing covers do not cover abdomen completely. Can live from one month to one year depending upon climatic conditions. The adults do not feed on the beans. The life cycle takes about 21-80 days. Found throughout the United States.

Pupa - Pupal stage is passed in 5 -18 days in the beans inside the larval cell which has a cylindrical extension to the outside but does not penetrate the thin seed coat; after pupation the adult bores an emergence hole to escape.

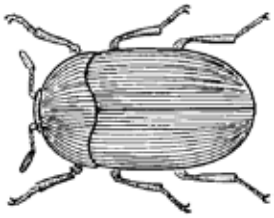
Larva - Very tiny, whitish, hairy grubs equipped with short slender legs upon hatching. They molt after several days and then appear as white grubs with very small heads, no legs and no long hairs, they enter the beans and eat out a cavity. When mature in 11 - 42 days they are 1/8" long, nearly half as thick, wrinkled and humpbacked. They can be found infesting: barley, beans, corn, milo, mixed feeds, oats, rice, rye, soda crackers, sorghum and wheat. It is an internal feeder.

Egg - Whitish, ellipsoidal laid singularly on or near seeds or pods of beans, peas or lentils; hatch in 5 - 20 days

NOTE: Grains, cereals and other stored food products are not infested by bean weevils. Infestation of stored legumes can easily occur from harvested products being brought in from the field.

The bean weevil is very similar to the cowpea weevil *Callosobruchus maculatus* (F) which also breeds in stored beans, peas and cowpeas, but the cowpea weevil is generally only found in the South. Control both by simply burning or burying all infested material, or heat to 145° F. for 2 hours or store at 32° degrees F. for two months.

BLACK CARPET BEETLE
***Attagenus unicolor* (Brahm)**



The black carpet beetle was described primarily as a fabric pest. This insect is widespread and also feeds on a large variety of dried foods including beans, peas, corn, wheat, rice and many types of seeds.

COWPEA WEEVIL
***Callosobruchus maculatus* (Fabricus)**
Note: Not really weevils but belong to the seed beetle Family Bruchidae.

This weevil is, obviously, so named because it feeds primarily on cowpeas. Originally African in origin, it is now found in the U. S. southern states and throughout the warmer parts of the world, or anywhere infested cowpeas are shipped. Adults are usually 1/16"-1/8" long, brownish with creamy and blackish markings. Body elongate, oval with head not usually visible from above with a short snout. Mature larvae up to 1/8" long, C-shaped, legless, cream colored, sparsely covered with a few short hairs (setae). Most abdominal segments with two dorsal folds. Similar to other bean weevils. Also attacks stored soy beans. Larvae develop within the seed (up to 3 per seed). Infestation usually starts in the field. Adults are great fliers and can travel distances up to a mile. They may live up to 12 days, but do not feed. Heat infested materials to 145° F. for two hours or freeze them for 58 days. The life cycle can be completed in 21-80 days.

Species that infest processed grain can be found in warehouses, storage rooms and homes. These beetles commonly infest cereal, spices, rodent bait, dry dog food, wheat germ and other processed cereal products with a high protein content.

Inspection

- Give special attention to products with a long shelf life such as dry animal food; large pest populations can build up because more attention is given to the rotation of more perishable products.
- Make extensive inspection to locate all infested material.

Habitat Alternation

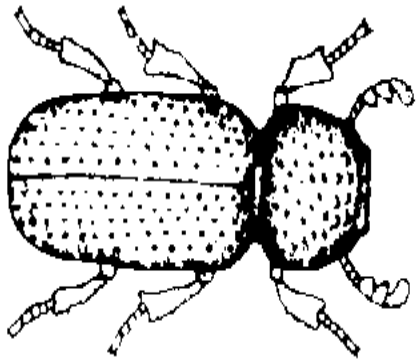
- Advise intensive cleaning of warehouses and storage rooms. Vacuum or remove all dead flies, rodents, bees and/or other dead insects and animals. Steam clean. Lightly dust with food-grade DE.
- Routinely clean and/or spray with diluted Safe Solutions, Inc. Enzyme Cleaners.
- Lower the temperature and relative humidity.

Intelligent Pest Management® Control

- Find the primary source(s) of infestation(s) and properly eliminate them all!
- Warehouse beetles, *Trogoderma variable*, can be trapped and/or monitored with StorGard FLIT-TRAK M2 pheromone traps.
- Steam clean and vacuum and thoroughly caulk/seal all visible cracks and crevices.
- Use temperature controls as needed - heat and/or cold.
- Lightly dust with food-grade DE.
- **Practice proper sanitation - routinely clean and/or spray with diluted Safe Solutions, Inc. Enzyme Cleaner.**

Follow-up - Set up regular monitoring programs in warehouses and food storage areas. (Pheromones for stored product infesting beetles are very helpful in such programs.)

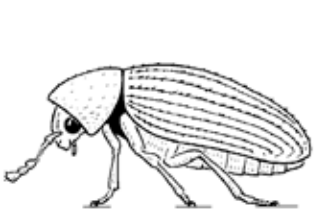
LESSER GRAIN BORER
***Rhyzopertha dominica (*Fabricus)**
Order - Coleoptera, Family - Bostrichidae

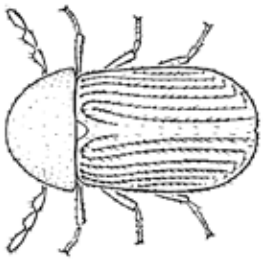


A small, cylindrical, (somewhat shiny) dark brown or black beetle about 1/8" long. Its head is hidden beneath the thorax. The thorax is very rough and the overall shape of the body is cylindrical. It attacks whole grains. The eggs are laid in clusters on the surface, and the larvae burrow into the kernels. This beetle is an important pest damaging grain in storage or transport (trains, ships, etc.). Like many of its relatives (the *Bostrichids*, most of which are wood borers, e.g. false powder post beetles), the lesser grain borer has strong jaws and can chew through seed coats into grain where it completes its life cycle. This beetle is rarely a problem in urban homes or stores. Adults fly and are attracted to light. The life cycle takes about 58 days. They are good package penetrators. The larger grain borer, *Prostephannus truncatus* (Horn.) is very similar but larger (about 1/6" long) and lives in the warmer areas of the U. S. and the Americas.

DRUG STORE BEETLE
***Steogbium paniceum* (Linnaeus)**
Order- Coleoptera
Family - Anobiidae

The drug store beetle is very similar in appearance to the cigarette or tobacco beetle; while both are related to some wood borers or powder post beetles, their habit are quite different. Adult cigarette and drugstore beetles are oval, about 1/16" - 1/8" long and reddish-yellow, reddish-brown to red or brown in color; they can fly. The cigarette beetle is covered with short, tiny hairs that give it a golden sheen. The drugstore beetle appears dull and darker because of deeper lines on its wing covers. They have a characteristic humped appearance. The last 3 segments or club of the drug store beetle's antennae are larger than the rest of the antennae. The drug store beetle's legs and antennae are pressed to the body when this insect rests. Its Latin name *paniceum* means "it feeds on bread", but in reality the drug store beetle will eat virtually everything including poison. The life cycle of the cigarette beetle takes 30 - 50 days. The drugstore beetle has a life cycle of about 60 days. They are good package penetrators. They are extenal feeders. See also Cigarette Beetle.





Pupa. Pupal stage lasts about 12 - 18 days. The larvae form a silken cocoon or cell in the food material and pupates there.

Larvae are tiny, white, curved and covered with infested material causing them to look like tiny lumps of the stored product. This stage lasts 4 - 5 months. They four well developed segmented legs. The head is light brown, grub-like, C-shaped, hairy, whitish in overall color about 1/16" - 1/8" long. There are 4 - 6 instars. They feed on practically everything edible and many things non-edible to people.

Eggs are laid singly in whatever food is being eaten at the time.
Adults can fly and are attracted to light. They are difficult to detect unless the product is dumped and sifted. These beetles are commonly found in spices (red pepper, paprika, ground pepper, ginger), milled cereals (four and cornmeal), dry dog food, bread, breakfast foods, rice, raisins, tobacco, cosmetics, drugs, as well as some human poisons, belladonna, aconite, strychnine, pyrethrum dust and dried flowers (through the glue that attaches the flower head to wire stems). In homes, spices are favorite foods, especially paprika. Drugstore beetle larvae especially can survive on items of low food value due to yeast-like organisms in their digestive systems. They also attack and feed upon any household food e.g. alfalfa meal, almond, barley, beans, beet seed, copra meal, cornmeal, cottonseed meal, cottonseed meal pellets, cucumber seed, fish meal, flour, garbanzos, instant chocolate, milo, mixed feeds, mustard seed, nutmeats, paprika, powdered milk, spaghetti, wheat, wheat bran and germ, as well as such things as hair, horn, leather, museum specimens and books and manuscripts. Bury or burn all infested materials. Lightly dust with food-grade DE. Store foods in tightly sealed containers or the refrigerator. All stages of this pest can be killed by heating the infested material to 140° - 176° F. for several hours or in the freezer at 0° F. for four days. Locate the infested material (beginning with spices) and properly discard all infested products. Clean the area with diluted Safe Solutions, Inc. Enzyme Cleaners. Put out styrofoam cups with water and a few drops of Safe Solutions Enzyme Cleaner (with a light above) as traps. Follow-up is seldom needed.

SEED BEETLE OR PEA AND BEAN WEEVIL
Order - Coleoptera, Family - Bruchidae

These beetles are not true weevils and do not have the weevil snouts. They infest only the seeds of one large plant family, the Legumes: peas, cowpeas, most beans (including mung beans). Each of these pests specializes in seeds of only one kind. Most species measure 1/8" to less than 1/4" long. They are rather broad and have light and dark markings. They lay eggs on beans; larvae bore inside, devour the middle, then emerge through obvious 1/8" holes. The pest can be a problem in restaurants and homes. Infested and potentially-infested legume seeds should be properly discarded.

MEALWORM BEETLES
Tenebrio spp.
Order - Coleoptera, Family - Tenebrionidae

The mealworm is not a worm but a wire-worm like larva of the darkling beetle of the phylum arthropoda, a word meaning "jointed legs;" these are the largest insects attacking stored grain and are about 1/2" long. The bright yellow and the dark mealworms are the two most common species. The darkling adults, as they emerge from the pupa are at first white, but soon they turn shiny black with well-developed wings. It is difficult to tell the difference between males and females without a microscope and dissection. Both of the adults fly and are attracted to light (*Tenebrio* means "darkness"). They infest milled grain that has high moisture. The life cycle can be completed in 10 months. The yellow mealworm, *Tenebrio molitor* (Linnaeus) and the dark mealworm, *Tenebrio obscurus* (Fabricius) both go through complete metamorphosis, and can be found infesting the human gastrointestinal tract. Both are used as bait for (ice) fishing. Yummy! Mealworms can be found inside in dark areas, in barns, grain storage facilities and in food preparation areas infesting grain products, e.g., cornmeal, bran, rolled oats, etc. promptly discard all infested products. The beetles and larvae also eat decaying vegetation and occasionally new plant growth, feces and dead insects. Install fans, air conditioning, and/or dehumidifiers and **routinely clean with diluted Safe Solutions, Inc. Enzyme Cleaners. Lightly dust with food-grade DE.**

GRAIN MOTH OVERVIEW

Moths belong to the insect order Lepidoptera. Larvae of moths infesting stored food products may be confused with beetle or weevil larvae because of their worm-like shape. Unlike beetles and weevils, the larval stage of the moth is the only stage that causes damage. A telltale sign of infestation is the appearance of small to medium-sized moths in food containers and packaging, or flying around or clinging to walls in a room or storage area. There

are commercial moth traps or you can make one yourself by mixing one part molasses with two parts vinegar and putting this mixture in a yellow bowl or container - clean and replace liquid as needed. Remember, moths always pupate hanging upside down - so keep this in mind while inspecting. The larval stages are good package penetrators. **Diapause** is a common feature of the life cycle in many species of moths that infest stored grains and flour. It is a period of 2 - 9 months in which all feeding activity and development in general is suspended. Diapause may be induced in response to a short (12 hours or less) photo period, or to low temperatures or it may be in response to a large population increase in the habitat.

SPECIFIC EXAMPLES

ANGOUMOIS GRAIN MOTH
***Sitotroga cerealella* (Oliver)**
Order - Lepidoptera, Family - Gelechiidae

Adult - Small, buff to gray to golden to yellowish-brown to white. Has about a 1/2" - 5/8" wing span with pale yellow forewings and gray pointed hind wings. It is larger than the common golden-colored clothes moth, that has rounded wings. The angoumois grain moth is most commonly found in whole corn in the South and Midwest. Like the weevil, it is more often a problem in grain storage, but if whole corn is brought into homes, schools or stores, sooner or later these moths are likely to become pests and fly about. Finger-like projection of forewing characteristic. Prefers damp barley, rye, wheat, rice, corn, oats, seeds, beans, chestnuts and buckwheat. It was first discovered in this Country in North Carolina in 1728.

Pupa - Reddish - brown dormant stage found within whole grain kernels. Pupal stage usually takes 10 - 14 days. Has four small pseudopods.

Larva - Usually found within whole grain kernels, 1/5 - 1/4 inch long, white with a yellowish - brown head and dark reddish brown mouth parts. Bores a hole, enters and then seals the hole with silk. This stage lasts about 3 weeks; has about 3 molts or instars. It can hibernate until spring. They can be found infesting: barley, corn, cornmeal, flour, milo, mixed feeds, vetch seed, and wheat.

Egg - Average of 40 (up to 300 occasionally) eggs, very tiny, white turning red, laid in both stored grain and/or unharvested grain, with an ovipositor. Hatch in 4 - 8 days.

HABITS - Adults cause no damage. Only the larva requires a whole kernel or caked material for development. This pest is active at low temperatures and can cause considerable damage during the winter. Infested grain has a sickening smell and taste which makes it unpalatable. The moths leave a lot of debris on top of infested grain. Male moths have been observed only at dusk by pheromone traps in the field.

Both adults are attracted to light. Only males are attracted to pheromone traps.

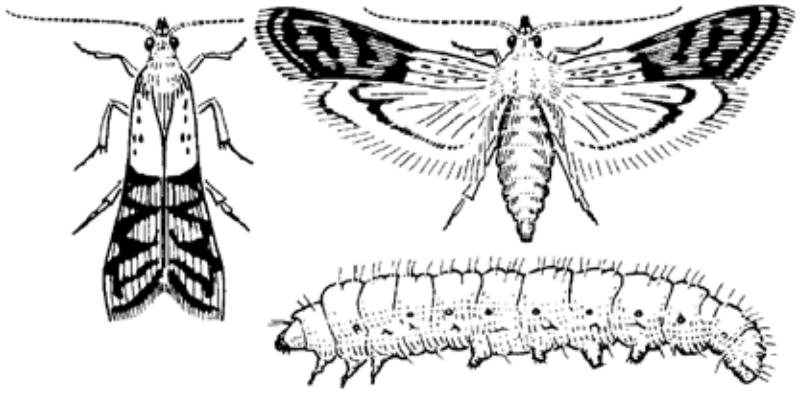
In the north, it overwinters as a larva and completes its development in early spring. The emerging moths fly out to the field in spring and lay eggs on the developing grain.

The Angoumois grain moth prefers to attack barley, rye, corn, oats, rice, and various seeds. It attacks both grains in the field and grains in storage, but only whole kernels. It prefers damp grain as opposed to old dry grain. Will also infest red beans, buckwheat and hulled chestnuts.

Infested grain and seeds have a sickening smell and taste. Look for small holes in the grain. It will hibernate over the winter inside the whole grain. Destroy all infested material and routinely clean with Safe Solutions, Inc. Enzyme Cleaners. Lightly dust with food-grade DE.

INDIAN MEAL MOTH
***Plòdia Interpunctélla* (Hübner)**
Order - Lepidoptera, Family - Pyralidae (The third largest family of moths.)

Adult - Has a wing span of about 5/8" - 3/4". The Indian meal moth is a small colorful moth, commonly found outside and in stores, warehouses, mills, restaurants and homes. Resting on a wall, it is 1/3" long (somewhat longer with wings folded backward). The head and thorax are brown; the basal half of the wings are gray, and the last coppery with dark bands. These moths can fly short distances indoors and are mildly attracted to light. Active flight for several days wears off most of the colored scales, but their gray band and coppery scales can be seen using a hand lens. The outer two-thirds of the forewing is reddish-brown with a coppery luster the rest is pale gray. The inner or body end is also pale gray. The adults cause no damage. Use pheromone traps to attract, inspect, monitor and/or locate infestations, but remember only 1 in 8 Indian meal moths that are attracted to these traps will actually enter them. The life cycle can be completed in 60 days. **They are nocturnal = inspect at night!**



Pupa - Light brown dormant stage found within a silken cocoon. **Note: Moths always pupate hanging upside down. The larva can travel many feet from where they were feeding to pupate.**

Larva - Usually found with their webbing and frass; they are dirty white, or cream-colored (sometimes pinkish or greenish) the different hues usually reflect food eaten, they have a brown head and prothoracic shield. Although not easily seen, fairly long hairs grow sparsely on each larval segment; when the larva is in a dusty environment, small particles will stick to these hairs. About 1/2" long. Most common pest of coarsely ground flour and cornmeal - the life cycle lasts 1 - 10 months. Feeds upon grain and grain products, barley, beans, bee hives, dog food, dried red peppers, dried fruit (especially figs) and mushrooms, garlic , meat scraps, powdered milk, chocolate candy, nuts, seeds, cereal, crackers, fresh apples & pears, flour especially the coarser grades, e.g., whole wheat, graham flours and cornmeal but they can breed in shelled or ear corn. You will usually find them in the kitchen and pantry but they can be anywhere throughout the building. The larvae are surface feeders and generally produce a lot of webbing throughout the infested part of materials. Be sure to check bird seed, rodent baits and pet food when you are looking for infested materials. Mice and/or rats may have hidden infested materials deep inside walls, attics, refrigerators, stoves and other protected places. They are surface feeders. Lightly dust with food-grade DE per the label.

Egg - 100 - 400 (average 128) grayish-white eggs laid at night singly or in groups in food material e.g., flour, cornmeal, shelled corn, broken grain, dried fruit, beans, peas, dry milk, chocolate, candy, red peppers, dry pet food, crackers, biscuits, nuts, etc. in 1 - 18 days. As soon as they hatch the larva begin to disperse. Larval period lasts 13 - 288 days depending on temperature and food availability. Eggs in infested cereal will die in 24 hours when placed in a freezer.

NOTE: When the larvae wander about looking for pupation sites in homes, they are often mistaken for clothes moth larvae. Likewise, when the moths are flying, they are also mistaken for clothes moths. Adults are attracted to light. Most common stored product pest in the U. S.; found worldwide.

Infestations in packaged products start with small numbers; the longer the product is kept without use,

the larger the population grows. Larvae spin silk from their lower lip wherever they go. In large numbers, they can cover the top of a product with silk as they wander around on the surface. As a population grows, larvae may wander outside the package (often for long distances: from a room in lower levels, through holes in the floor into upper areas, from a pantry to the ceiling); they may dangle from ceilings or silk strands. Their numbers, wandering habits and large size easily distinguish Indian meal moth larvae from the tiny clothes moth larvae that do not wander openly. A pheromone that specifically attracts the flying Indian meal moth and other members of this family Pyralidae is a very effective monitoring tool to use in warehouses and food service or retail sale food stores; in large areas, pheromone trap results may reveal several infested areas. Insect development ceases at average temperatures below 55° F. All stages of this moth are killed when the internal temperature of the food reaches 140° F. for 1 hour or 120° F. for 2 hours. Properly discard all infested materials and routinely clean with diluted enzyme cleaner. Caulk all cracks and crevices. Store foods in plastic or glass containers with tight-fitting lids. A wasp parasite, *Bracon hebetor* (Say) can provide you with natural control as can a biological pesticide *Bacillus thuringiensis*.

Indian meal moths infest most milled or ground cereals such as flour and cornmeal; all starchy processed products such as crackers, cake mixes, pasta, dog food and rodent bait. They particularly respond to nut meats like pecans and walnuts, nuts in candy, powdered milk, some spices and dried fruit. Products stored or unused for a long time are always primary suspects for infestations. They will infest grass seed, nuts, chocolate, toys stuffed with grain or rice, rodent baits or the food that squirrels and/or rodents have stored behind the walls, dog food, bird food and basically any food you have improperly stored.

Control and management of these pests is the same as that for the saw-toothed grain beetle - all infested items should be properly discarded or chilled to below 55° F. immediately. (This cooling may not kill these pests, but will inhibit them from developing.) Routinely clean with diluted Safe Solutions, Inc. Enzyme Cleaners. **Routinely vacuum shelves, cracks, crevices and food storage areas.** Use pheromone traps. Lightly dust with food-grade DE per the label.

MEDITERRANEAN FLOUR MOTH
***Anagasta kuehniella* (Zeller)**
Order - Lepidolera
Family - Pyralidae

Adult - About 1/2" long, wing span about 3/4-7/8" long, pale gray in color. When resting, head and tail are slightly raised to form a sway-back appearance. Forewings are pale gray with black zig-zag lines running across them; the hind wings are dirty white and are bordered by fringe-like hairs. Flies at night in a very distinct and rapid zig-zag pattern. **The adults cause no damage and are attracted to light.**

Pupa - The larva pupates in a cocoon in the flour or on the surface of the floor, or in some crack or crevice, either with or without a cocoon. Pupal stage lasts about 10 days.

Larva - Caterpillar-like in shape, whitish or pinkish body, a dark reddish-brown head, and from 5/8" - 3/4" long when mature. Confines itself to a silken tube which it spins constantly. Food material collects on this silk to form balls. Larval stage lasts about 40 days and the larva feed on a great variety of foodstuffs including acorns, flour, nuts, chocolate, cornmeal, wheat, wheat bran, wheat germ, biscuits, seeds, beans, dried fruit, etc. You

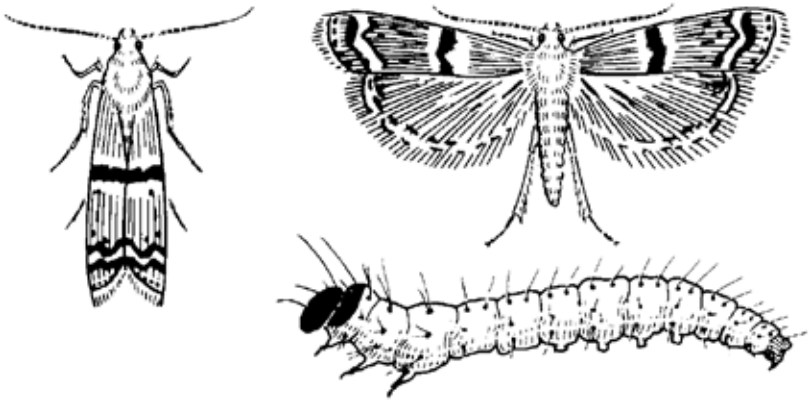
may find them anywhere in your building. They are external feeders.

Egg - 116 - 678 tiny white eggs laid in flour, meal, or grain or fastened to chalk. Hatch in 3 - 6 days.

Note: The larvae cause most of the problems because as they crawl around extensively, and spin silken threads which mat food particles together. These silken food mats can clog flour mill machinery, sometimes causing shutdowns until they are removed. In homes and other buildings, their extensive crawling means the larvae can be found far from the original infestation. Properly discard infested materials and routinely clean with diluted Safe Solutions Enzyme Cleaners. Use pheromone traps to monitor for infestations. Lightly dust with food-grade DE.

ALMOND MOTH
***Cadra cautella* (Walker). Formerly named *Ephestia cautella* (Walker)**
Family Pyralidae

The almond moth is capable of causing considerable damage to cereals, dried fruits (especially figs and dates), flour, grain, seeds, and shelled nuts. Adults are slightly smaller than the Indian meal moth, having a wingspan of about 5/8 inch. They are a mottled gray color and may have a fawn-colored pattern on the forewing. Larvae are dirty white tinged with brown or purple dots, giving them a striped appearance. They leave matted webbing as they feed.



Females lay an average of 100 eggs, which hatch in about a week into dirty-white larvae, as they age they are tinged with brown or purple spots on the back and look “striped”. The larval period usually continues for 2 months. Lower the temperature to 60° F. and it takes 145 days! So clean with Safe Solutions, Inc. Enzyme Cleaners, lightly dust with food-grade DE and “chill out”.

GENERAL NOTES: STORED PRODUCT PEST HABITATS

They are found in any area where dried grain or grain products are stored or milled, from field grains to farm storage to processing plants to packaged products in the store or in any pantry.

NATURE OF INJURY - Damage caused by food pests includes direct feeding on grain products, webbing in food material sometimes to the extent of clogging milling machinery, and holes cut in food packages. The mere presence of these pests in food marked for human consumption far outweighs the damage they do. Because of public demand, the Food and Drug Administration has been empowered to sample products in all stages of processing and condemn foods found contaminated by insects, rodents, their parts or droppings. Annual loss in the United States due to contamination has been conservatively estimated in the many millions of dollars.

There are many more beetles and moths other than those described herein which damage stored food products. Those capable of living within entire grain kernels include the granary weevil and angoumois grain moth and two other species, the rice weevil and lesser grain borer. These four species are termed our primary pests of grain. The confused flour beetle, saw-toothed grain beetle and Indian meal moth are representative of a large group of secondary grain pests, which are only capable of attacking and infesting cracked, broken of milled grains.

Harborage Points - Food packages, waste grain, litter, feed, and cracks and crevices in food storage areas. Especially inspect paprika and old foodstuffs including spices and dried fruits and meats.

INTELLIGENT PEST MANAGEMENT® CONTROL - Institute the proper Intelligent Pest Management® techniques including inspection, sanitation, exclusion, proper storage, segregation, rotation, habitat reduction, remove any/all conditions conducive to infestation, monitor, etc. Real control of food pests begins with sanitation and the elimination of all infested articles preferably by fire or burial. You may also destroy them in infested goods with the use of heat or freezing. In your building it is necessary to remove all objects from cabinets and shelves where infested products are stored. Destroy them or properly dispose of all infested food packages. Thoroughly clean the area by steam cleaning or (power) washing with diluted Safe Solutions, Inc. Enzyme Cleaner and/or brushing or vacuum cleaning. **Remember, you are dealing with food. Use every precaution to avoid contaminating it with any volatile pesticide poison or cleaning chemical.** Lightly dust with food-grade DE per the label.

If adult moths are found in the area, a vacuum or a fly swatter can be used to quickly and safely eliminate them.

Read all labels thoroughly and follow all directions pertaining to recommended treating techniques, specific insects controlled and safety precautions to follow.

KHAPRA BEETLE
***Trogoderma granarium* (Everts)**
Order - Coleoptera, Family - Dermestidae

Adult - Small, brownish-black, oval and about 1/8" long. Does not normally feed. Not known to fly. They normally live about one year.

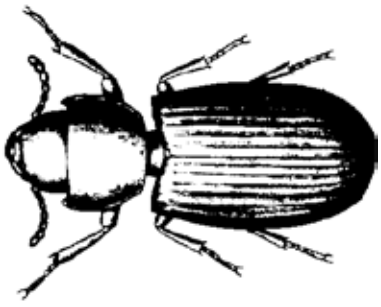
Larva - Yellowish-brown with yellow inter-segmental rings, covered with long brown hair. When mature are about 1/4 inch long. Normally feeds within the top layer of the food material, e.g., usually grains like rice, wheat, barley, but will also feed upon dried blood, fish meal, dried milk, pollen and dead insects they can be and are attracted to wheat germ oil. Prefers grain and cereal products to animal products.

Egg - Small, white oval. Hatch in about 8 days.

Note: This beetle, unlike most dermestids, prefers grains and cereals to animal products. The name is an Indian word for "brick" because it secretes itself in brick pores in that country. Seal/caulk all bricks, openings, and cracks and crevices. They are extenal feeders.

Control - Properly discard and destroy any and all infested materials by either burning or burying. You may also destroy these pests by freezing, rotating stock and thoroughly cleaning with diluted Safe Solutions, Inc. Enzyme Cleaners. Use pheromone traps. Lightly dust with food-grade DE per the label.

CADELLE BEETLE
***Tenebroides mauritanicus* (Linnaeus)**
A/K/A/ The "bread beetle and bolting cloth beetle"
Order - Coleoptera, Family - Trogositidae



Adult - About 1/3" - 3/8" long, shiny black, head and thorax distinctly separated from the abdomen. Thorax is attached to abdomen by a rather loose, prominent joint or visible gap between the rear of the prothorax and the front edge of the wing covers. They are known to chew through packages and boards. They avoid light. Normally live about two years.

Pupa - About 3/8" long, no case enclosing it, with two small, pointed tips at the end of the abdomen. This stage may be found anywhere.

Larva - White to grayish-white in color with prominent black head, black spots on the three thoracic segments just behind the head, and two dark short hooks at the tail of the body. About 2/3" long when mature. This stage

lasts 38 - 414 days and may include 3 - 7 molts.

Egg - White, in batches of 10 - 60, laid at random in grains and cracks and crevices especially near stored food, e.g., flour and milled cereal products. One female produced 3,581 eggs!

Note: These pests are usually found outdoors under bark and rotten wood feeding upon wood destroying insects. In your building you may find these pest adults and larvae gnawing through sacks, paper packages and wooden boards and inside packages of ground cereals, spices, cinnamon, nutmeg, rice, tobacco, in nuts, oats, breakfast foods, potatoes, fruits and other stored food stuffs including biscuits and bread. They will also enter timbers and feed on wood destroying insects. Both eggs and pupae are easily killed at low temperatures, but larva and adults can survive 15° F. for several weeks. The adults and larvae avoid light and hide in packages, sacks and/or dark corners. Eliminate any wood that can serve as pupal chambers for the cadelle. Eggs and pupae are easily killed by low temperatures. **Kill the larvae and adults by routine cleaning with diluted Safe Solutions, Inc. Enzyme Cleaner with Peppermint and/or lightly dust with food-grade DE per the label.**

SPIDER OR PTINID BEETLES
Order - Coleoptera, Family - Ptinidae

OVERVIEW

A number of species of these small, oval beetles are (nocturnal) scavengers on stored products. They are attracted to moisture and excrement and are found in nests of animals. Spider beetles range in size from less than 1/8" long to nearly 1/4" long. They often resemble giant mites or small spiders. They have long legs and antennae. Their abdomen is usually oval and much larger than their head and thorax combined. Most species have short hairs covering their thorax and wing covers; several common species have shiny, hairless, globular wing covers making them look like large mites. They are good package penetrators and hide deep inside cracks - avoiding the light.

Spider beetle larvae are white and grub-like. Pupae are enclosed in silk cases covered by the materials they infest; they look like lumps of the stored product. The variety of foods they infest is inexhaustible: flour, cornmeal, all broken cereal grains, fish meal, seeds (including tobacco seeds), spices, dried fruit, dog biscuits. In museums they infest skins, hair, wool, feathers, textiles, insect specimens, leather goods, brushes and old, wooden artifacts. Other materials include soap, rat, mouse and house fly manure, mammal and bird nests, decaying animal and vegetable refuse and even opium cakes.

Inspection

- Use a red light and conduct a nocturnal inspection.
- Use sticky traps or cockroach monitors/blunder traps or rodent glue boards.
- When small infestations of spider beetles are found, search for their source.

Habitat Alteration

- Properly discard the infested product source; clean thoroughly with diluted enzyme cleaner.
- Eliminate all clutter, debris and unused products.

Control

- Vacuum and eliminate all infested materials; practice proper sanitation, product rotation, caulk all cracks and **routinely clean with diluted Safe Solutions Enzyme Cleaner. Lightly dust with food-grade DE per the label.**

Follow-up - A monitoring program using sticky traps should be followed until the population is eliminated.

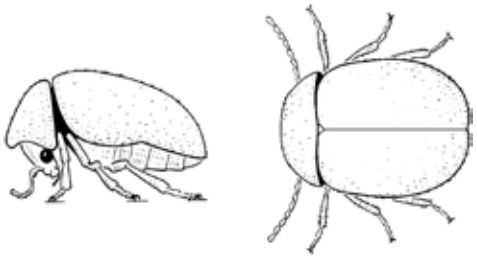
GOLDEN SPIDER BEETLE
***Niptus holoeucus* (Fald)**

Adult - About 1/8-3/16" long, golden brown in color, with numerous long yellow-silky hairs covering the head and thorax. The head and first thoracic segment are much narrower than the rest of the body, which is broadly oval. Wingless; they only spread by crawling.

Larva - Go through 2 molts; small, curved, short-legged. Food habits similar to adults.

Egg - Females lay 25 - 30 eggs which become adults in about 6 - 7 months.
NOTE: Adults and larva feed on dirty wool, silk, linen, leather, bones, excreta, paper, books, flour, seeds, sponges, brushes, casein, bread, feathers and dead animals and insects.

CIGARETTE OR TOBACCO BEETLE
***Lasioderma serricorne* (Fabricius)**
Order - Coleoptera, Family - Anobiidae



Adult - Squat, rounded in outline, light-brown color, about 1/16" to 1/8" long, head and prothorax bent downward to give the insect a distinct, strangely *hump-backed* appearance. Antennae saw-like and about the same thickness from base to top. Wing covers are unlined and smooth. Strong fliers that are active in subdued light. Adults fly readily and can bother people by landing on them and "searching" them. Very similar in appearance to the Drug Store Beetle. They are good package penetrators.

Pupa - Usually takes 2 - 3 weeks in a silken cocoon or cell which has been covered with bits of food material.

Larva - Yellowish-white, very hairy, curved body. They usually go through 4 - 6 instars in 5 - 10 weeks. Can be found infesting old rodenticide baits, fish bait left in tackle boxes, candy bars left in coats, dried flowers, potpourri, spices, tobacco, flour, yeast, herbs, peanuts, paprika, dry dog food, cigars, cigarettes, cocoa, coffee and dry beans, biscuits, dried fruit and vegetables, rice, ginger, peppers, dried fish, raisins, rodent baits, dried plants and straw flowers, silk, dates, drugs, seeds, etc. and also can be found infesting alfalfa seed, almond hulls, barley, beans, copra, corn meal, cottonseed meal, fish meal, hay, lettuce seed, milo, rice meal, safflower meal and cakes, soybean meal, wheat bran, books, flax tow, some upholstered furniture, book binders paste and books, dried insect collections and even rodent baits and insecticide poisons containing pyrethrum. They are external feeders.

Egg - Oval, whitish, 1/50" long. 30 - 42 laid in about 3 weeks, in and about food materials, in warm weather; they hatch in 6 - 20 days.

Control all stages with heat or light; use 140° F. for 6 hours or lower the temperature to 25° F. for seven days. The adults are attracted to bright lights; when they hit the light they pretend to be dead and fall down into soapy water, glueboards or a thin film of olive oil and really die. Properly destroy or treat infested materials with food-grade DE and then monitor with pheromone traps. **Routinely clean with diluted Safe Solutions, Inc. Enzyme Cleaners and/or lightly dust with food-grade DE per the label.**

HIDE AND LARDER BEETLES

ORDER - Coleoptera
FAMILY - Dermestidae ("to devour a skin")
TYPE METAMORPHOSIS - Complete

Egg - Laid in cracks of skins, hides or meat.

Pupa - Larvae pupate inside wood and/or their food supply.

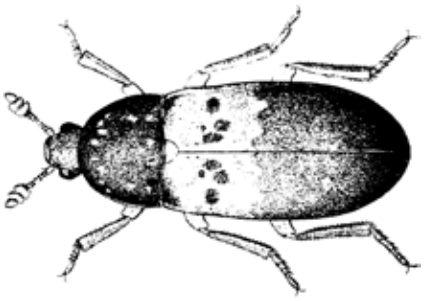
Larva - Worm-like stage which feeds on skins, hides, meats or similar products.

Adult - Male and female beetles.

TYPE MOUTHPARTS - Chewing

DISEASE ASPECTS - Not known to be disease carriers; considered to be beneficial scavengers.

LARDER BEETLE
***Dermestes lardarius* (Linnaeus)**



Adult - Dark brown to black in color, approximately 5/16" long, with a pale grayish-yellow six (black) spotted band on the wing covers or elytra. Undersurface of the body, including the legs, is covered with fine yellow hairs.

Pupa - May pupate in last larval skin but commonly bores into meat (ham or bacon) or other object for pupation.

Larva - Brownish in color, 3/8" - 1/2" in length, with two curved spines on the last visible body segment. About 5 - 6 instars; prefers fatty protein to lean; frequently infests dog food and dog biscuits.

Eggs - 100 - 174 eggs laid in June - August that hatch in 12 days or less.

Note: There are other related species including *D. atar* (DeGeer), *D. frischii* (Kug), *D. peruvianus* (Castelnau), *D. carnivorous* (F.), and *D. Mamoratus* (Say). *Dermestes* feces have been found to contain anthrax bacilli and the hairs of the larval stage produce allergic reactions.

HIDE OR LEATHER BEETLE
***Dermested maculatus* (DeGeer) a/k/a *Dermestes vulipinus* (Fabricus)**

Adult - Dark colored over entire body except light colored margins of the pronotum, approximately 1/4" - 3/8" long. Undersurface is mostly white. Wing covers end in a fine point. Strong, active fliers.

Pupa - Similar to the larder beetle.

Larva - Similar to the larder beetle but extremely hairy and active; they go through 5 - 11 instars.

Eggs - Creamy in color and about 2 mm in length. 600 - 800 eggs laid singularly or in batches of 2 - 20 in cracks, skins, hides, dead flies, meat, etc. Hatch in 2 - 12 days.

Note: The hide beetle larvae are used to strip the flesh from the bones of delicate museum specimens.

HABITAT - They both are found where hides, leather, cheese, dried milk or blood, fish, ham, smoked sausage, bacon, tobacco are being processed or cured and in piles of dead flies or insect collections and in mausoleums.

Larder beetles have been found infesting animal trophies, furs, dog food and biscuits, bread, ham, bacon, meats, cheese, stored tobacco, dried fish, dead flies, e.g., cluster flies and even wood.

Hide beetles have been found infesting hides, leather, smoked meats and cheese.

NATURE OF INJURY - Larder beetles simply contaminate and destroy cheese and meat products by their presence. Hide beetles can ruin valuable hides and leather, including many different types of insect, museum specimens by feeding on these products. They may also feed upon and contaminate some meats and a great variety of other materials, e.g., dead cluster flies, stored tobacco, dried fish, dog food, ham bacon and flowers and shrubs. Cannibalistic, the adults may eat the young larvae and the larvae may eat the fresh pupae.

HARBORAGE POINTS - Meat scraps, exposed meats, leather, tobacco or hides, etc.

INTELLIGENT PEST MANAGEMENT® CONTROL - **Properly discard infested products.** Wrap and store cheese and meat products at normal refrigerator temperature. Any *need* for control depends to a large extent on the proper storage, freezing or refrigeration of bacon, ham and cheese, etc.; purchasing only what you will use quickly and good sanitation techniques, e.g., promptly eliminating meat scraps. Bury or burn all infested items. Throw away all infested (museum) specimens or have them fumigated. Trap with old fish meal baits. **Routinely clean (or power wash) with diluted Safe Solutions, Inc. Enzyme Cleaners and/or lightly dust with food-grade DE per the label.**

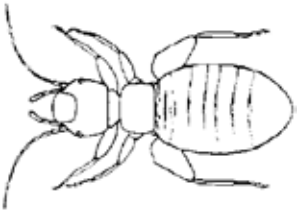
When large quantities of hides or leather are involved, fumigation may be necessary. A residual spray, e.g., a labeled sodium borate treatment followed by a long-lasting sealer to protect against any possible borate contamination, will help to protect wooden bins or other wooden materials since both beetles will bore into wood to pupate. However, strict adherence to the label is mandatory. Remember that only labeled (dust) crack and crevice treatments can be made in areas where foods may be exposed later. Follow all label restrictions and safety procedures. It is far better and safer to routinely clean with diluted Safe Solutions, Inc. Enzyme Cleaners, vacuum and caulk and seal all cracks and crevices and other openings. Lightly dust with food-grade DE per the label.

Do not allow cluster flies to enter and die inside the walls, attics, etc. Vacuum up all dead flies and other insects. **Never kill cluster flies inside walls!** Install 24-hour light bulbs and vacuum daily under lights.

PESTS OF MOLDY, DAMP OR OUT-OF-CONDITION GRAIN AND GRAIN PRODUCTS

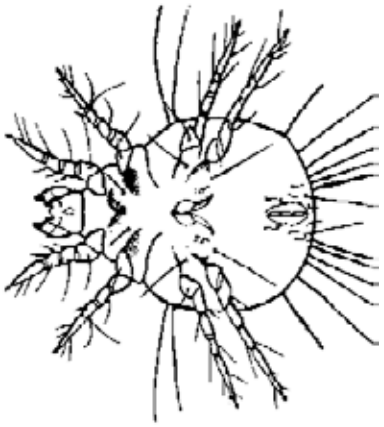
Milled or ground cereals and cereal-based products become heavily infested with fungi and bacteria when their moisture content is high. Many insects feed on the decaying organic matter that involves starches, proteins, certain vitamins, and other chemicals produced in the process of decomposition by microorganisms. Spoiled products may include animal foods, milled cereals, flour spills, caked milled grain. Pests can be found in unclean grain storage elevators, barns and mills as well as in kitchen pantries and cabinets with moisture leaks or ineffective ventilation. The infesting pests are scavengers whose nutritive requirements are met by fungal-infested cereal products; they can develop into large populations. These pests include grain beetles, mealworms and mites. Only two merit special attention:

PSOCIDS
Order - Psocoptera



Psocids are tiny, pale gray or yellowish-white, wingless, soft-bodied insects little mo
feed primarily on mold that grows on decomposing starchy materials. Psocids are sor
because they are found in great numbers on books and papers sized with starch and s
Psocids require a minimal relative humidity of at least 50%; this level accomplishes two purposes: the moisture keeps the psocids from drying out, and it promotes the mold or fungal growth on which they feed. A relatively high humidity can be maintained in poorly-ventilated rooms, closets, basements, cabinets and pantries with a moisture source. To eliminate psocids, simply discard the starchy source of mold and dry out the storage area. **Mop with borax and diluted Safe Solutions Enzyme Cleaner with Peppermint. See Chapter 26.**

TRYOGLYPHID, CHEESE, FLOUR OR GRAIN MITES
Class - Arachnida
Subclass - Acari
Order - Acarina



The most common grain mite is called *Acaras siro* (Linnaeus), A,K.A. *Tyroglyphus farinae* (DeGeer). These tiny tick relatives look like dust with a slightly brownish tinge. A constant humidity level is even more important to grain mites which prefer relative humidities between 62.5% and 85% - so use air conditioning, dehumidifiers, dryers and/or fans. Grain mites are almost colorless but have long, microscopic hairs. When they molt, the hairs of the cast skins cling to those of others. (They can pile up in a fluffy ball the size of a man's palm. A population of that size can be produced in a humid kitchen cabinet with as little as a scant dusting of flour over the shelf.) Like psocids, grain mites can

be eliminated by discarding infested materials and cleaning and drying out the area(s). Grain mites have been known to be responsible for allergies like those caused by house dust mites in humid homes. Use preparations containing tannic acid (carpet cleaners or brewed tea) or diluted Safe Solutions, Inc. Enzyme Cleaner applied to mite cast skins or steam clean to suppress this protein allergy. Mold mites *(Tyrophagus sp)* can be attracted to traps with soft, moist cat food baits.

Mites occasionally can be found infesting stored food products. They are known to feed on cheese, flour, grains, dried fruits, dried meats, cereal foods, dog and cat food and animal feeds. Because mites are extremely small, their presence goes unnoticed, but the damage they can cause is sometimes very serious. Infested items become contaminated with living and dead mites, cast skins and fecal materials. Feeding by some mite species alters the nutritional quality of grains and other food items; mites often attack the germ of grains. Flour from mite-damaged grain can become sour and have poor color, and bread made from it will not rise properly.

Some mites are fungus feeders. They invade commodities that have become moldy, bringing spores of certain fungi, and feed on the fungi once they become established. Even after the mites are controlled, the fungi persist and continue to cause damage, so steam clean and dry out the storage area.

Cheese mites can be any of several different species including *Tyroglyphus casei L.*, *Tyrolichus casei Oudemans* and *Tyrophagus casei Oudemans*. They are just visible to the naked eye and gain their name from the fact that in addition to corn, dried fruits, grease, bandages, grains, flour, cured meats and insect detritus, they are also known to favor older, moist cheese. The mites burrow tiny holes in the surface of the cheese and are sometimes intentionally introduced to flavor cheeses like Milbenkäse and aged Mimolette to impart a “piquant” taste. Cheese that is infested with the mites can have a sweet, minty odor and will appear to be covered in a fine gray dust of the mites, their dander and excrement. Unclean conditions in the curing room such as greasy shelves, old, dirty cheese boxes, dirty walls, ceilings or floors encourage the development of mites.

They are 0.39 - 0.7 mm in length and appear pearly-white in color. Their legs and mandibles are reddish-brown. Females are larger than males. Cheese mites live between 15 and 18 days under an ideal environment of 23°C (73°F) and 87% humidity.

Cheese mites are considered vermin in the food service industry. They are known to cause a mild form of dermatitis called *baker’s* or *grocer’s itch* and can inflame asthma and dust allergies. Control of the mite can be as simple as adjusting environmental conditions and taking sanitary steps such as regularly cleaning surfaces and emptying bulk containers completely before refilling them.

Controls - Cheese can be protected by a thin layer of unbroken paraffin wax. Store food in a clean, dry area. Increase air circulation to reduce relative humidity and prevent mold and mildew. Install fans, vents and/or dehumidifiers to reduce Rh to below 55 to 60 percent and the moisture content of the media to below 12 percent. Lower the temperature to 32° F. and the infestation problems cease. Over 40° F. and activity increases. Both the cheese curing room and storage room and shelves should be thoroughly scrubbed including ceiling, walls and floors at least twice a year or as needed with 2 oz. of Safe Solutions Enzyme Cleaner with Peppermint. Cheese mites can be scalded to death with plain water at 160° F. or more. Paraffining will kill the surface mites and protect the cheese from further attacks. Lightly dust with food-grade DE.

Intelligent Pest Management® Control - Proper sanitation practices will remove mites and their food sources. Thoroughly clean containers with steam before using them to store foods to remove food residues, mites and their eggs. Reduce the moisture content or ambient humidity below 62.5% and you stop most mites, mold and fungus, so install and properly maintain a dehumidifier, air conditioner and/or fans to create proper air circulation. The most difficult part of managing stored-product usually mites is to find “the” mite infestation. Large populations can develop before their tiny presence is discovered. The stored food product may take on an odor variously described as minty, sweetish, or musty when it is infested with mites. This odor may be the first indication you have that mites are present. **Routinely clean with diluted Safe Solutions, Inc. Enzyme Cleaners.**

Use a microscope or hand lens to inspect stored products for the presence of mites. Under magnification, these small, colorless or cream-colored mites can be seem moving about. **Take several samples throughout the stored product; throw away all infested product; vigorously clean all containers and storage areas with diluted Safe Solutions, Inc. Enzyme Cleaner and/or lightly dust with food-grade DE per the label.**

OVERVIEW OF INTELLIGENT PEST MANAGEMENT® GUIDELINES FOR STORED-PRODUCT INSECTS

Stored product pests include a wide range of insects that feed on grain, seeds and other plant parts that are stored, milled or processed. Some of these pests infest stored products at every point from their origin in fields to granaries, mills, processing plants, warehouses, retail stores, food-serving establishments and homes. Some species of stored product pests can feed on the while intact grain. Most can only feed on grains that have been broken or milled, and some feed on processed herbs and spices. Each pest species have a preferred environment and group of foods. Stored product pest infestations are not easy to discover when populations are low or building up. Pheromone traps (traps that use specific attractants) are very helpful in monitoring stored products in a pest management program. Locating and discarding infested products in schools, homes and restaurants is a common method used in stored product pest control.

Control of pantry pests requires the elimination of all existing infestations and prevention of new outbreaks by good housekeeping, changing the conditions conducive to these infestations, proper storage of food, spices and garbage. Frequent inspections, and timely, safe and proper controls being utilized whenever needed. Routinely clean wherever possible with diluted Safe Solutions, Inc. Enzyme Cleaners and/or lightly dust with food-grade DE per the label. **Discard all infested materials.**

Shelves should be regularly steam cleaned and/or thoroughly cleaned with diluted enzyme cleaner and borax, sealed and caulked to eliminate spilled food particles on exposed surfaces and in cracks and corners. Use of a powerful vacuum cleaner with suitable accessories is a must. Small quantities of materials in open containers should be promptly used or destroyed, particularly if the building is to be vacated for the summer or for extended vacation periods. Usable but infested products may be sterilized by heating in an oven for 30 minutes at 130° F., or by exposure for a longer period outdoors in the heat of the noonday sun, or by placing the products in the freezer at 0° F. for 4 days. New food purchases should be inspected for pests before being stored. Uninfested or heat-sterilized dry foods should be stored in glass or metal containers with tight-fitting inspect-proof lids. **A good trap for moths is to mix one part molasses with two parts of vinegar and place in a yellow container - clean as needed.**

Fumigation with carbon dioxide is another method of controlling stored grain insects. Use a 5-gallon container of heavy plastic or metal. As the containers are being filled with grain, spread about 2 ounces of crushed dry ice (solid carbon dioxide or gas) on 3" to 4 " of grain at the bottom of the container then add the remaining grain until the container is filled. For larger quantities, use 6 ounces of dry ice per 100 pounds of grain.

The vaporizing dry ice produces carbon dioxide fumes that are one and one-half times heavier than air, which push out the existing air in the container. Allow from 30 minutes to an hour for complete vaporization before sealing the lids on tightly. Premature sealing can literally burst the container. If plastic bags are used in the cans as liners, do not seal until vaporization is complete. Carbon dioxide in closed containers destroys most adults and larvae, however, some eggs and pupae may escape. Dry ice can produce serious burns and should be handled with caution. **A simpler, safer method is to deep freeze products, e.g., grain, for 3 to 4 days to destroy all stages of these pests.**

Stored-product insects, especially eggs, are tiny and extremely difficult to see in bulk or packaged food products, so even with *close* visual inspection, these pests are routinely transported from farms to processing plants to warehouses to grocery stores to restaurants and household and institutional kitchens. Even under the most carefully controlled conditions, it is probably that some of these pests, in egg, larval, or adult forms will enter your building. Total eradication at any level is impossible due to the size and complexity of the food distribution industry. Once an infestation occurs in any commodity, it can quickly spread to others unless appropriate and timely control measures are taken. Each entity in the complex maze of food distribution, from the farmer on down to the ultimate buyer, must all assume a responsible role in the proper management of stored -product insects. **Inspection and monitoring, the proper identification and safe control methods for stored-product insects have to be ongoing, not sporadic.**

A beetle or moth infestation found in your spices or only in one box of cereal must be quickly removed or the infestation will spread to other products stored in your building. **Effective control begins with the quick removal and destruction of any infested materials (or returning them in a sealed container for a refund) and storing all uncontaminated food products in insect-proof containers, the refrigerator and/or freezer.**

In addition your pest control efforts should include proper habitat modifications, and routinely correcting any conditions you find conducive to infestation and/or growth. Early detection will not only simplifies your control program, it will reduce your control costs and efforts, and prevents extensive damage to stored food. Monitoring is used to detect, locate, and identify pests, determine the proper time to apply proper controls, and evaluate the success of the effectiveness of your management program. **Proper sanitation using diluted Safe Solutions, Inc. Enzyme Cleaners is suggested, along with lightly dusting with food-grade DE per the label.**

INSPECTION, MONITORING AND DETECTION

Daily inspection, routine monitoring and early pest detection are vital for an effective stored-product pest management program, because they initially provide information about the pest and suggest and evaluate your control programs and later they are used to monitor for reinfestation. Use pheromone traps whenever possible to monitor.

You must make a complete and thorough inspection of the premises to locate all actual potential sources of infestation. Carefully examine all stored food items such flour, dog food, spices, meats, cheese, as grains, dried fruit, flour, and seeds. Check outdoor areas surrounding buildings, as some stored-product insects are attracted to certain types of flowers and shrubs, and may also be attracted to outdoor lighting. Try an occasional inspection at night with a red light.

Use Blunder traps especially pheromone traps or food attractants inside a building or structure to monitor pest activity; pheromones are available for most of the insects that cause damage to stored food.

When using pheromones or food attractants for monitoring, place one trap per 250 to 500 square feet of storage space. For flying insects, locate traps near storage containers; put them inside containers for insects that do not normally fly.

Sometimes the use of different types of pheromones in an enclosed area may prevent target insects from efficiently locating traps. Before installing traps for other species of insects in an area where one type of pheromone trap is already being used, check with the manufacturer or supplier to determine if such a combination will confuse the issue.

Flying insects locate pheromone traps by following a trail of pheromone scent upwind, detecting its increasing concentration in the air. Enclosed areas where traps are located therefore should have some air movement so the atmosphere does not become saturated with pheromone. Keep traps away from bright lights that may repel some target insects.

Monitor or check traps on a regular basis. At each inspection, record the number of pest insects caught and remove them from the traps. Replace pheromones according to instructions supplied by the manufacturer. Change sticky parts of the traps whenever they become so coated with debris that they are ineffective.

Pheromone attractants can also be used in traps for control of stored-product insects. Trapping is extremely preferable over any insecticide use because foods are not exposed to insecticide residues. Locate traps close to the source of infestation for maximum control and increase the density of traps to about one to each 25 to 50 square feet of storage space.

For stored bulk grains, use pheromones with specially designed probes positioned at different levels inside storage bins. Check probes periodically for the presence of insect pests and use catch data to locate areas of infestation. Monitoring in this manner can be used to effectively evaluate your control program.

Cleaning - Routinely spray and clean (preferably with a power washer) using diluted Safe Solutions, Inc. Enzyme Cleaners. You will be amazed how clean and insect free even grossly contaminated/infested areas can quickly become using a power washer even once a month.

EXCLUSION - Prevent insect entry by inspecting all incoming cardboard, packages, packing materials, grains, cereals, flour, and other bulk and any other packaged products as they arrive. Check for holes, webbing, insect frass, eggs, living insects, and insect parts. Immediately return any infested materials or destroy them. Never

store infested materials in your own facility even if they can be enclosed in a tight container and they can be refrigerated. Prevent contamination of *clean* flour, grain, cereals, or dried fruit by storing them in insect-proof containers or sealable containers. Promptly remove all empty or damaged boxes and bags from the building.

Keep insects out by using screens over door and window openings. Close off all other openings with foam, hydraulic cement, wire screening or caulking. If it is not possible to exclude pests from the entire building, be sure at least your food storage area is protected. Locate and close rodent holes as stored-product insects can enter through these openings. If rodent poison baits are being used in the area, routinely inspect the baits for insect infestation; even stored or unused bait may harbor insects, so routinely replace them. To keep from attracting insects into buildings, locate outdoor lighting away from doorways. Use sodium vapor lights or yellow bulbs rather than mercury vapor lights or regular white bulbs for outdoor lighting as insects are less attracted to yellow light.

SANITATION - Routine and proper sanitation is the safest and most critical part of consistently controlling stored-product insects pests. Clean up spilled materials to eliminate food sources for pests. Seal cracks in shelves and bulk food containers to eliminate places where pests can hide and to keep grains, flour, or other food debris from accumulating. Keep storage shelves far enough away from walls to leave room for cleaning. Raise shelving in warehouses and other storage areas off the floor to make cleaning underneath easier and all storage areas should be well lighted for ease in cleaning and finding pest infestations. **Inspect for moths at night (with red lights) when they are active. Conveyors, augers and food processing machinery must be thoroughly cleaned on a regular basis to prevent them for becoming potential pest harborages.** Routinely spray and/or clean everything with Safe Solutions, Inc. Enzyme Cleaners if or wherever possible.

Modifying the Environment - Manipulating storage temperatures or humidity is a technique that can be used to destroy many stored-product pests. Heat treatment kills some pests outright; cold usually blocks their development. For adequate control it may be necessary to subject products to a prescribed period of high temperatures followed by cold, after which they should be kept stored at a constant, lowered temperature. In general, a temperature of 60° F. prevents insect feeding; 40° F. kills insects over a period of time. Some products can be kept frozen/sealed to protect them for insect damage.

Moisture - Food inhabiting mites and most insects only grow in environments with a relative humidity of more than 50% and in or on products with moisture contents of greater than 12%, so try to regulate/control moisture as a safe, effective control. **So properly install and maintain air conditioners, dehumidifiers, dryers, fans and/or automatic aeration.**

Food-grade Diatomaceous Earth has great potential as a grain or stored product protectant. Toxicity is so low that food-grade diatomaceous earth (DE) is not counted as a foreign substance when grain is rated by the U.S.D.A. when the moisture content of the grain is low (less than 9.25%) and large enough concentrations of food-grade DE are used, stored products are protected better with food-grade DE than with the standard malathion (poison) treatment. **But, do not breathe the dust! The Author recommends Safe Solutions, Inc. food-grade DE.**

HEAT OR COLD CONTROLS - Insulate, cover and/or seal the area to be controlled to maintain the target temperatures - consider all items that could be damaged by high or cold temperatures. The cooler you can keep the product, the greater the reduction in potential pest populations. Remember, thorough cleaning and sanitation procedures should **still** be routinely followed.

Cold - The general rule for freezing stored-product pests is to achieve a temperature at the site of the insect pest infestation of 0° F. for 7 days for complete control of all stages of insect life.

Heat - The general rule for heat is to achieve a temperature of above 120° F. for 16 - 24 hours.

Some refrigerated trucks called “reefers” will freeze your infested products to -40° F. Care should be taken to not freeze some delicate products, but there are many stored products and museum items that will take this pesticide-free technique. Heat and cold are being used successfully in pest management programs throughout the world today.

RESPONSE OF STORED-PRODUCT INSECTS TO VARIOUS TEMPERATURES

TEMP (F)	EFFECT
120+	Death in minutes.
111	Death in minutes.
95	Development stops.
85 - 88	Development slows.
69 - 84	Maximum rate of development.
56 - 88	Development stops.
40 - 5	Death in days (unacclimated).
5 -10	Death in weeks to months (acclimated).
3 - 11	Death in minutes; most insects freeze.

Toxic Note: Since 1990 numerous retail supermarkets have been caught directly spraying their display produce with insecticides such as Raid® and Black Flag® to eliminate fruit flies. Typically, store employees or former employees say they were told to conceal the illegal spraying from customers. Even natural food stores have pest control operators routinely spraying synthetic pesticide poisons. They mistakenly believe that by covering produce and other foodstuffs during these pesticide poison applications they were achieving adequate protection from pesticide contamination. The largest retail store in my Town, Meijers, routinely stores thousands of pounds of dangerous, volatile, synthetic pesticide poisons not 100' from their open bakery and meat counters and "organic" produce...all of which are never covered. Periodically the staff tells me a bottle of volatile pesticide poison breaks open and the odor fills the store. The free Meijer magazine, Outdoor Impressions (4/26-5/23/98) had many interesting comments. On page 8 they clearly stated, "The pesticides currently available are safe and effective when used as directed." On page 12 there is a picture of a man fogging without any protection, and on page 13 a man was spraying without any protection! The "Safety and Environmental" Officer of that large Corporation told me in no uncertain terms that he "was not interested in learning anything about pesticide poison contamination problems!" and he tried to get my Teacher Friend fired for bringing the matter to his attention. The Author would love to have *someone* care enough to test his *organic* produce for volatile, "registered," synthetic pesticide (poison) residue contamination!

Charles Wright, Ph.D., Professor Emeritus in the Department of Entomology at North Carolina State University has long written on the extensive migration of volatile, synthetic pesticide poisons; he noted that pesticides sprayed in one labeled location are often detected in areas/sites not sprayed, which are specifically excluded on the pesticide (poison) label. Dr. Wright has written extensively on the long-term migration/contamination of synthetic pesticide poisons after application. Whether the poison was applied in the field or in the store or in the warehouse, it still can harm you and yours. Food & Water, Inc. (FWI), R. R. 1, Box 68D, Walden, VT 05873, has launched a national campaign to convince supermarkets to stop the sale of foods grown with toxic chemicals. FWI notes that almost 1 in 2.5 people in the U. S. can now expect to get cancer and that cancer kills more children under the age of 14 than any other disease. Supermarkets have backed the pesticide *industry's* attempts to get pesticide regulations repealed. If you want to get these chains to stop promoting (or creating) toxic contaminated food at the expense of their customer's health, please contact FWI. Caution: At least 13 states have now passed agricultural disparagement or "veggie libel" laws. Al Meyerhoff, an attorney for the Washington-based environmental advocacy group called the Natural Resources Defense Council said, "Most of them ("veggie libel" laws) are flatly unconstitutional, but they are intended to intimidate." These *laws* are intended to squash reports of unsafe food. Senator Robert Cupp, a Republican said in part, "This will be a 'remedy' for farmers because of 'false' statements." The facts and tests prove our food has been contaminated with toxins, but the *Republicans* just want us to pretend the toxins are not really there! Amazing! **Whatever happened to the U. S. Constitution and our freedom of speech rights?** Obviously, some of these "republicans" want to give us "lefts and rights" in court as replacements for our constitutional rights.

The FEHR FOUNDATION Quarterly Report, SPRING 1999, Vol. 7, No. 2, MEDICATED FOODS RAISING CONCERN: We have come a long way since 1943 when the first loaf of white bread hit the supermarket having three added vitamins and a mineral. Today, the fastest growing category of foods is made up of those that contain not just added vitamins and minerals but also elements intended to prevent heart disease and cancer or to fight colds and depression.

These "designer foods" or "functional foods" are called "NUTRACEUTICALS". The line has become blurred

between food and medicine. There is concern among nutritionists and doctors as well as food regulators.

According to Dr. Michael Heasman, a senior research fellow at the Center for Food Policy at Thames Valley University in London, "Consumers are looking toward self-medication and ways to enhance their health...It's sort of a tidal wave waiting to crash, driven by corporate ambition to add more value in a basically static food market, and by baby boomers disillusioned with conventional health care."

Is it a good idea to add calcium to orange juice, and echinacea to other drinks? Stonyfield Yogurt has L. reuteri bacteria to protect against salmonella and E. Coli 0157:H7, and even Heinz claims its ketchup is higher in the antioxidant lycopene than raw tomatoes. Doughnuts are being supplemented with protein, and dozens of drinks have medicinal herbs. But did you know Johnson & Johnson's McNeil Consumer Products Co. is battling the FDA over the introduction of Benecol margarine, which the company claims lowers cholesterol? It claims the plant components it has added, which are made from wood pulp, are a dietary supplement and, therefore, do not need the Agency's approval. There are currently two margarine-style products, which contain a soybean extract reported to help prevent cancer.

Gene Grabowski, the vice president for communications of the Grocery Manufacturers of America in Washington, DC states, "According to several surveys we've taken, people would rather get their cholesterol-lowering elements or prevent osteoporosis or hypertension through tasty foods instead of pills. You are going to see a barrage of functional foods in 1999 and 2000."

The list of participants in "functional foods" is increasing daily, just don't be fooled by them. The best fruits and vegetable are still those grown naturally, in soil that has proper nutrients, and are picked ripe and consumed fresh. When you go to the supermarket you must take time to read each label. Even foods that were safe on your last shopping grip may have added something you may not want this trip.

ANIMAL PRODUCTS - ANTIBIOTICS AND HORMONES: The FDA is finally scrutinizing drugs used to treat people as well as promote growth in livestock, according to Dr. Stephen F. Sundlof, director of the center for veterinary medicine at the FDA. Many scientists attribute the mounting problem to the misuse in both humans and animals, as well as for pesticide use.

Of particular concern to scientists is that recent studies have found bacteria in chickens that are resistant to "fluoroquinolones", the most recently approved class of antibiotics and one that scientists had been hoping would remain effective for a log time.

Some 50 million pounds of antibiotics are produced each year in the United States. Of this, 40 percent is given to animals, mostly as feed additives to promote growth, and although drugs like penicillin and tetracycline require a prescription for human use, they are over the counter for animals. Some antibiotics used in humans are also available to farmers to be sprayed on crops as pesticides.

Dr. Brendan Fox, president of Elanco Animal Health, a division of the pharmaceutical firm of Eli Lilly and Co., said, "We believe the agency is greatly overstating the conclusiveness and the implications of the data and has put forth a seriously flawed proposal." However the Public Health Department and consumer advocates as well as many scientists say it is sad to see drugs needed for critical care and to maintaining human health squandered just to fatten animals.

RACHEL'S ENVIRONMENT & HEALTH WEEKLY #493, May 9, 1996, HEADLINES: ILLEGAL POISONS IN OUR FOOD: There are about 630 different "active ingredients" in pesticides (poisons) worldwide. In real-world use, these main ingredients are combined with other chemicals (called "inert ingredients") to make several thousand toxic formulations -- but the basic active ingredients number about 630.

The purpose of a pesticide is to kill (or injure) living things by poisoning them, so it is no surprise that these 630 chemicals are all toxic. In many cases -- especially the newer pesticides -- they are very toxic. For example, the most commonly-used insecticide is called chlorpyrifos (trade name: Dursban). Dursban attacks the central nervous system so effectively that one-fifth of an ounce is sufficient to kill an adult human.

To be used legally on fruits and vegetables, pesticides must be registered with U.S. Environmental Protection

Agency (EPA). Each use of a pesticide on each crop requires a unique registration. In other words, the pesticide named Captan must be registered for use on onions, and it must be registered a second time if it is to be used on peaches.

Under common law, putting poisons into your neighbor's well, or onto your neighbor's food, is considered very anti-social and is strictly illegal. However, after the manufacturer of a pesticide applies for a pesticide registration, for a fee the government (specifically, Congress) sells them the right to put poisonous residues on our food. (and into our water and air!)

When a pesticide is registered for a use on fruits or vegetables, a "tolerance level" for that pesticide on that crop is set by EPA. The "tolerance level" is the amount of toxic residue that can legally remain on the crop when the consumer eats it. According to the National Academy of Sciences, "Tolerance levels are not based primarily on health considerations.... Their primary purpose is to ensure compliance with good agricultural practice." In other words, the first concern in setting a tolerance is to allow enough of the pesticide to be used to kill (or injure) the target pests. Health is secondary.

After a tolerance level is set, EPA later (often years later) may set a "reference dose" (called an RfD) that the agency considers "safe" for consumers to eat. As a result of this peculiar process, EPA has set many "tolerances" at levels far higher than the reference doses that EPA has declared safe. In other words, EPA has set legal pesticide residue limits for many poisons on many fruits and vegetables that are higher -- in some cases much higher -- than the level the EPA considers safe.

For example, EPA's tolerance for Dimethoate is 64 times as high as the "safe dose" (the RfD) for Dimethoate. EPA's tolerance for methyl parathion is 41 times as high as the RfD for methyl parathion. EPA's tolerance for endosulfan is 24 times as high as the "safe" (RfD) dose for endosulfan. Furthermore, RfDs are set to protect adults, not children. The EPA has never set an RfD or a tolerance based on children's health. When the National Academy of Sciences studied pesticides and children's health in 1993, the Academy concluded, "A fundamental maxim of pediatric medicine is that children are not 'little adults'.... In the absence of data to the contrary, there should be a presumption of greater toxicity to infants and children." The Academy specifically recommended that tolerances should be reduced 10-fold to protect children: "The committee recommends that an uncertainty factor up to the ten-fold factor... should be considered when there is evidence of postnatal developmental toxicity and when data from toxicity testing relative to children are incomplete."

Data from toxicity testing relative to children are incomplete in the case of every pesticide currently in use. Researchers who reviewed the pesticide literature in 1995, specifically looking for information about children, wrote in December, "Thus major gaps exist in our knowledge of the health effects of chronic pesticide exposures to children. No published studies have examined the neurotoxic effects of low-level pesticide exposure to children." Thus if the National Academy's recommendations were to be carried out, **all pesticide tolerances would have to be reduced by a factor of 10 in an effort to protect children. However, since the release of the Academy's report in 1993, no tolerances -- not one -- for pesticides in food have been adjusted** in any way to protect infants and children.

It seems safe to say, therefore, that no legal levels of pesticides can be considered safe for children, and many legal levels of pesticides are clearly not safe even for adults.

Furthermore, the pesticide control system in this country was established to maintain pesticide residues on food not at "safe" levels but at or below "tolerance levels." EPA sets tolerance levels, and then the U.S. Food and Drug Administration (FDA) tests samples of food to see if the tolerance levels have been illegally exceeded, or if illegal unregistered pesticides or banned pesticides can be found on fruits and vegetables. How well does this system work?

Researchers with the Environmental Working Group (EWG) in Washington, D.C. looked carefully at the FDA's pesticide residue control system in 1995 and published an excellent report. Here is what they found:

The FDA takes samples of food and tests them in FDA laboratories. The results of those tests are then entered into a computer. However, the legal "tolerances" for those pesticides on those crops have never been entered into a computer, so the computerized test data must be compared to existing tolerances by technicians using

pencil and paper. If those technicians find that a tolerance has been exceeded, or an unregistered pesticide has been detected, they are supposed to report it to FDA's enforcement division. Unfortunately, the EWG's analysis revealed that FDA chemists only report 57 percent of the violations that they observe in their labs. Because of careless pencil-and-paper techniques--or perhaps because they simply ignore illegal pesticides--FDA chemists fail to report 43 percent of all the violations they find.

FDA data reveal that some foods are extraordinarily contaminated with illegal pesticides. For example, 24.7 percent of all peas contain illegal pesticides and 15.7 percent of all pears contain illegal pesticides. Some 12.5 percent of apple juice contains illegal pesticides, 12.4 percent of blackberries, and 11.7 percent of green onions. THESE ILLEGAL PESTICIDES OCCUR IN ADDITION TO THE LEGAL PESTICIDE RESIDUES THAT ROUTINELY CONTAMINATE OUR FOOD SUPPLY.

All together, FDA claims that only 3.1 percent of fruits and vegetables in American grocery stores contain illegal pesticides. However, the FORBIDDEN FRUIT report reveals, based on analysis of FDA's own monitoring data, that 5.6 percent -- or about one pound out of every 18 pounds of food on grocer's shelves--contains illegal pesticides. A person eating 5 fruits and vegetables a day will be eating illegal pesticides 75 times a year.

Unfortunately, even this is probably a gross underestimate of the size of the problem. In 90 percent of cases, FDA laboratories use pesticide-measuring techniques that can only detect half of the pesticides currently in use. Monitoring techniques that can detect the remaining half are very expensive and are not routinely used. For this and other reasons described in the FORBIDDEN FRUIT report, we estimate that about 13 percent of U.S. fruits and vegetables may contain illegal pesticide residues. IN ADDITION TO WHATEVER LEGAL PESTICIDE RESIDUES THEY MAY contain. If the 13 percent figure is correct, then someone eating five fruits and vegetables a day would eat illegal pesticides 174 times a year.

What happens to the 3.1 percent of fruits and vegetables that FDA says contain illegal toxic pesticide residues? Government studies show that 100% of the domestic portion is sold to consumers, and 60% of the foreign portion is sold to consumers. And this describes only the 3.1% that FDA says it has identified as illegally-contaminated; 100% of the illegally-contaminated food that FDA fails to identify is, of course, sold to consumers. The system does not protect consumers even when it identifies illegal pesticides.

It seems clear that the pesticide monitoring and enforcement system in this country is broken. In truth, it has been broken for many years. This is certainly not news to Congress, which (with the advice and consent of the food corporations) created the system to begin with. The General Accounting Office (which provides audits and evaluations at the request of Congress) has published 22 reports since 1980 describing the many ways in which the pesticide control system fails to protect consumers. Congress has consistently refused to make any changes. We can only conclude that Congress prefers the system the way it is. Or, more precisely, the food industry prefers the system the way it is and Congress is not able to break free from the steely grip of moneyed corporations.

What is the solution? Given the power of corporations over Congress, only a groundswell from the American people can change the system. Therefore anti-pesticide campaigners must devise a solution that will actually protect public health; a solution that everyone can understand; a solution that can appeal to Americans as something worth fighting for and worth sacrificing for.

We believe there is only one such solution: stop trying to "manage" persistent toxic pesticides and ban them all. To join such a campaign, phone Food & Water, Inc.,: 1-800-EATSAFE. To that the Author can only add, "Amen!"

Rachel's Environment & Health Weekly #645, 4/8/99 noted: "Cities began to provide running water into homes in the early 19th century. Water piped into homes had to be piped out again, often into open sewer ditches running in the streets. Outbreaks of cholera followed. A debate ensued: should sewage be transported back to farms, where the nutrients had originated, or should it be disposed of by dumping it into bodies of water? Although many cities for a time transported sewage to farms, by 1920 most sewage was being piped directly into bodies of water. This was a crucial choice.

Once the network of sewer pipes began to grow, industry saw these public pipes as a cheap place to dump industrial wastes. As a result, corporations began to dump all manner of toxicants into the nutrient- rich sewage

stream. This was another crucial choice. Once they were mixed together, nutrients and industrial poisons could not be separated at any reasonable price. Therefore the whole mess became a toxic waste disposal problem and excrement lost its value as a fertilizer. Dumping it into water bodies accelerated.

By the 1950s, most of the nation's waterways were badly contaminated with a combination of nutrients and toxicants. This gave rise to a demand for treatment of waste prior to disposal. Pipes that used to carry toxic sewage into streams and oceans now began to carry it into centralized "wastewater treatment plants" or "publicly owned treatment works" (POTWs).

Wastewater treatment plants remove the solids and some of the chemicals, creating a black, mud-like "sludge" in the process. It's a trade-off: improved wastewater treatment means cleaner discharge water but it also means more sludge and worse sludge (more toxic). Now a new, and truly intractable, problem appears: what to do with mountains of toxic sludge?

Communities with access to the ocean began dumping sludge there. New York dumped its sewage sludge 12 miles offshore; when that place developed obvious contamination problems, the dumping was moved to a spot 106 miles offshore, where, to no one's surprise, contamination soon developed.

The use of water to carry sewage, and the use of centralized wastewater treatment plants, had great political appeal for several reasons. Most political authorities tend to favor centralized solutions because they basically don't trust people to handle their own problems. Secondly, as we have noted, industry needed a cheap place to dispose of its wastes. [In 1997, according to the Congressional Research Service, industry "dumped 240 million pounds of wastes with hazardous components" into municipal sewers.] Third, and perhaps most important, laying sewer pipes and building centralized sewage treatment plants is extremely costly and engineering firms receive 20% of the initial cost. [Between 1970 and 1993, the federal government appropriated $69.5 billion for sewage construction projects. The Congressional Research Service recently estimated that between now and the year 2016 (17 years), the federal government will spend another $126 billion on sewage projects. These are serious amounts of money.] Only the Federal Highway Administration [and the military] spend more public money on construction. [If even a small fraction of this sewer money is kicked back at election time by consultants, lawyers, investment bankers and engineering firms, it can go a long way toward keeping the present crop of politicians in office.]

In the 1970s, many environmentalists and public health officials favored centralized sewage treatment because it seemed to offer an improvement over dumping raw wastes into waterways. The Clean Water Act of 1977 was essentially a sewering act. Everyone was then locked into centralized wastewater treatment systems.

In 1988, Congress discovered that sludge dumping in the oceans was harming marine life, and the practice was banned as of 1992. This created a massive problem for American cities: [11.6 billion pounds of sludge (that's the dry weight, not counting the water it contains) has to go somewhere, year after year.]

At that moment, EPA decided that the U.S. now needs to mimic 100 generations of successful farmers in Asia, returning human excrement (humanure) to farmland.

However, EPA has overlooked two important differences between modern sewage sludge and traditional "night soil" (unadulterated human waste):

1) Most of the nitrogen in human waste is in the urine and is water-soluble, so it is not captured in the sludge. Therefore, if sludge is going to substitute for commercial fertilizer, you have to use a lot of it to get enough nitrogen. And when you add a lot of sludge to soil, you are also adding a lot of toxic metals and a rich (though very poorly understood) mixture of organic chemicals and, very likely, radioactive wastes as well.

EPA has addressed the toxic metals by telling farmers to add lime to their soil along with the sewage sludge, to prevent the soil from becoming acidic. If soil turns acidic, then toxic metals begin to move around, either leaching down into groundwater or moving upward into the crops (which, by definition, are part of some food chain). If soils are alkaline (the opposite of acidic), the metals move more slowly.

[What EPA has overlooked is the fact that ordinary rain is slightly acidic, not counting the excess acidity provided

by “acid rain.” Normal rain drops falling through the atmosphere dissolve small amount of carbon dioxide, forming carbonic acid. Normal rain has a pH of 5.6 whereas 7 is neutral. Therefore, if soils are not kept alkaline by the regular addition of lime, sooner or later normal rain will begin to leach excess metals out of many soils. The only way to prevent this is to keep the excess metals out of soils in the first place.]

In sum, plowing sewage sludge into soils is essentially guaranteed to harm many of those soils as time passes. [See REHW #561.] [As we know from the ancients who poisoned their soils with irrigation salts, a nation that poisons its farmland is a nation that doesn’t have a long- term future.]

A series of bad decisions made during this century has brought us to an impasse: sewage sludge is unmanageable because you can’t know from day to day what is going to be in it, and so you cannot monitor its contents. (Even if you could manage the scientific problems inherent in monitoring an unknown mixture of unknown substances, as a practical matter there isn’t any government agency with enough staff to monitor the nation’s sludge.)...

[Every time we flush the toilet, 3.3 gallons of drinking water are degraded. At 5.2 flushes per day (average), each of us presently degrades 6260 gallons of drinking water each year to flush away our 1300 pounds of excrement -- (a minimum of) 1.6 trillion gallons of water per year in the U.S.].

Toxic industrial wastes should be managed by the industries that make them, not dumped into the environment that sustains all life. Unusable wastes are a sure sign of inefficiency.

Lastly, what to do with today’s mountains of toxic sludge? Obviously they must be handled as hazardous wastes because that’s what they are. [Probably above-ground storage in concrete buildings is the only satisfactory solution at the present time. (See REHW #260.)]

[You say we can’t do any of this because we’ve been doing it another way for 100 years? Ask yourself, what kind of people would dump their excreta into their drinking water in the first place? And what kind of people, faced with workable, cheaper, more environmentally sound alternatives would continue to insist that dumping their excreta into their drinking water is the only way to live?]” (Or putting it into their food? Yummy!)

March 12, 1999, PANUPS: “Opportunities for Organic Farmers Worldwide”

“Consumer demand for organically produced food is on the rise and provides new market opportunities for farmers and businesses around the world, according to a new report from the UN Food and Agriculture Organization (FAO). Typically, organic exports from developing countries are sold at impressive premiums, often at prices 20% higher than identical products produced on conventional farms. The report states that, under the right circumstances, the market returns from organic agriculture can potentially contribute to local food security by increasing family incomes, and recommends an FAO-wide, cross-sectoral program in organic agriculture. In several developed countries organic agriculture already represents a significant portion of the food system: 10% in Austria and 7.8% in Switzerland. Other countries such as the U.S., France, Japan and Singapore are experiencing growth rates in the organic industry that exceed 20% annually.

Some developing countries such as Egypt have small domestic organic markets and have begun to seize the lucrative export opportunities presented by organic agriculture, FAO said. Some countries export tropical fruits to the European baby- food industry, six African nations export cotton to the European Community, Zimbabwe exports herbs to South Africa, and China exports tea to the Netherlands and soybeans to Japan.

To maintain consumer confidence in the integrity of organic products, FAO recommends that countries promote their own organic certification organizations and better enforce organic standards by “punishing those who engage in fraudulent activities as well as undertaking systematic tracking and measuring of fraud and its impact on the market.”

The report concludes by stating: “FAO has the responsibility to give organic agriculture a legitimate place within sustainable agriculture programmes and assist member countries in their efforts to respond to farmer and consumer demand in this sector. Organic agriculture may contribute to the overall goals of sustainability.”

According to the report, the FAO organic program should focus on providing fora for discussions on organic production and trade; facilitating research, extension and networking; and technical assistance for developing skills, organic standards and certification capacities. FAO should also develop pilot projects that explore and promote organic agricultural techniques.

The FAO report, “Organic Agriculture” is available on the web at:
http://www.fao.org/unfao/bodies/COAG/COAG15/default.htm

Sources: UN FAO Press Release 99/3, “Organic Agriculture,” Item 8 of the Provisional Agenda, Committee on Agriculture, January 25-29, 1999. Contact: UN FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy; phone (39-06) 5705 3105; email Erwin.Northoff@FAO.org.

Groups quit U.S. pesticide panel, cite child safety

FINALLY: WASHINGTON, April 27, 1999 (Reuters) - A half-dozen consumer groups on Tuesday quit a White House pesticide review panel, saying chemical and farm interests were blocking attempts to protect young children from suspected cancer-causing insecticides used on peaches, apples and other foods. The departure of the World Wildlife Fund, Natural Resources Defence Council, Consumers Union and four other activist groups came after months of growing frustration with the slow pace of the 50-member advisory panel. At issue is how the Environmental Protection Agency decides which pesticides in food, drinking water, playgrounds, lawns and homes pose a health threat to young children. The consumer groups criticised the EPA for not banning methyl parathion and other chemicals linked to cancer. Methyl parathion is widely used on peaches, apples, pears, grapes and other diet staples of young children. Consumers Union, using U.S. Agriculture Department data, recently calculated that two out of five young children eat an unsafe amount of methyl parathion residue from peaches alone. Ned Groth, a food safety scientist for Consumers Union, said, ``The panel is a consensus process that takes forever and is an invitation to endless debate. The agency needs to make hard decisions based on the available data and go forward.'' As a precaution, parents should peel fruits and vegetables before giving them to pre-school children, or buy organically-grown produce, Groth said. Researchers say animal studies show the nervous systems and reproductive organs of infants, toddlers and small children may be vulnerable to certain chemicals. Of particular concern to health experts are a cheap and widely-used class of organophosphate pesticides for fruits and vegetables developed by the military during World War II in nerve gas experiments. But U.S. growers, now facing low commodity prices and stiff international competition, have pressed the EPA for more studies and proof that certain chemicals are dangerous. That has resulted in a virtual deadlock on the pesticide advisory panel created one year ago by Vice President Al Gore. At that time, Gore said he expected the panel to make final recommendations to the EPA by September 1998. The group, which met Tuesday, was scheduled to meet several times that summer...

From New Scientist, 28 November 1998
Against the grain
Oliver Tickell

NEXT time you tuck into a slice of bread or a bowl of breakfast cereal, you may be swallowing more than you bargained for. Increasing problems with resistance to pesticides mean that beetles and mites are contaminating an ever-larger proportion of cereal-based foods.

The problem was highlighted at the British Crop Protection Conference in Brighton last week by Ken Wildey of the Ministry of Agriculture, Fisheries and Food’s Central Science Laboratory in York. Wildey’s team studied grain from 279 commercial stores. Eighty-one per cent of the grain stores contained mites and 27 per cent contained beetles. The researchers have also studied 567 cereal-based food products, including flour, bread, breakfast cereals and biscuits. Of these foods, 21 per cent contained mites, which came from a total of 24 species. The technique used to sample the mites from food kills the creatures, so the researchers don’t know which of the foods contained living mites. But even dead mites can trigger allergic reactions in sensitised people, if there are enough of them. One product--a dried rusk baby food--contained 20 000 mites per kilogram.

Wildey believes the problem is escalating because of resistance to pirimithos-methyl and other organophosphate pesticides. A quarter of the populations of sawtoothed grain beetles *(Oryzaephilus surinamensis)* isolated from

grain stores showed some resistance to organophosphates. And 71 per cent of populations of *Acarus siro,* the most common mite in grain stores, survived 14 days of exposure to pirimithos-methyl at twice the recommended dose. Every single population of another species, *Tyrophagus putrescentiae,* was similarly resistant. “We have also found cross- resistance, with a number of mite strains resistant to all approved grain protectants,” says Wildey. “This may well result in a higher risk of contamination of foodstuffs by mites.”

Wildey fears a “total breakdown of chemical control options”. But pesticides aren’t the only option. Mites die if the moisture content of grain falls below 15 per cent, and most beetles are unable to breed below 15° C. Adjusting the conditions under which grain is stored and reducing treatment with organophosphates would also reduce consumers’ exposure to pesticide residues in food.

But 90 per cent of commercial grain stores in Britain rely on organophosphates. Peter Beaumont, director of the Pesticides Trust in London, argues that the government’s Advisory Committee on Pesticides should revoke licences allowing grain stores to use organophosphate.

The real problem may lie elsewhere, however. Robin Appel, who runs a grain store that doesn’t use organophosphates in Waltham Chase, Hampshire, says that farmers routinely treat grain with the pesticides. “Farmers think they have got mites contained but they are actually feeding live mites into the human food chain,” he says. “What they have to do is cool and dry their grain much more rapidly.”

Remember the 3 little monkeys?
“See no evil, hear no evil and speak no evil.”
It is interesting that “evil” backwards is “live.”
If we want to live we must ignore the evil little monkeys!

GRAS Disinfectants for Foodstuffs - Mist foods, e.g., fruits and vegetables or meat with 3% hydrogen peroxide and then mist with white vinegar (acetic acid). This mix will control most organisms, e.g., *E coli*, salmonella and shigella.

Safe Solutions, Inc. food-grade diatomaceous earth (DE), when applied at 7 pounds per ton of grain, will continue to kill insects for 10 or more years with only one application, under normal conditions. In addition to keeping insects out, food-grade DE keeps the grain from crusting or lumping and greatly inhibits the possibility of the grain causing an explosion and/or to be consumed by fire. Diatomaceous earth was once used in fire extinguishers. Diatomaceous earth helps keep grain fresh, clean and odorless. Diatomaceous earth will not normally dissipate. Diatomaceous earth is a naturally occurring mineral (composed of fossilized single-cell diatoms) that is in talc-like powder form which can be used as a dust or it can be mixed 2 oz. with a gallon of water and applied with a spray bottle inside or outside. Diatomaceous earth can be used to professionally treat animals and birds for internal parasites. Since the dawn of time, animals and birds have taken dust baths to remove ectoparasites. Fossilized diatom shells, when formed into a smooth talc-like powder, exposes thousands of microscopic “spears” that lacerate an insect’s body, which dehydrates the insect by draining out vital fluids. Amorphous diatomaceous earth also is extremely porous and this allows the material to dehydrate insects by absorption. Death comes in an average of 12 hours unless the insect has a constant source of food and water to replenish its fluid loss. In America simple road dust was observed killing cotton worms as early as 1880. Today food grade diatomaceous earth is used to help preserve grain in storage, for deodorizing, for flame retardation, for cleaning, as an anti-caking agent, for use in absorbing, deworming and it can also be safely used to kill and/or repel insects, e.g., dusting a sewer can give you 8 or more months of cockroach control. Diatomaceous earth (DE) is thought to supply over 14 trace elements necessary for animal and plant growth and development. So you can apply food grade DE to pet food to control ants, weevils, beetles, moths, flies and internal parasites and odors. **Avoid breathing the dust. Put DE only where bugs hide and try to avoid diatomaceous earth that contains more than 1% crystolline silica. Usually this is food-grade, fresh water diatomaceous earth or food grade DE, which is not normally harmful to humans or warmblooded animals.**

Japanese mint *(Mentha arvensis)* has an ingredient called menthone that can be used as a fumigant for stored grains. Rice weevils *(Sitophilus oryzae)* are contolled by Japanese mint.

Stored Product Pests - Typical First Strikes by Housekeeping & Maintenance

1. Routinely and thoroughly clean the pantry and all other storage areas with Safe Solutions Enzyme Cleaner with Peppermint.* Include regular inspections with a flashlight.
2. Purchase insect-free products. Inspect them all before you store them away. Caulk all cracks and/or crevices.
3. All out dated, broken containers, torn sacks and spilled foodstuffs should be removed promptly.
4. Stored animal feed should be stored away (isolated) from cereal products and dried fruits. All foods need to be stored in tightly sealed containers. Spot treat as needed with Not Nice to Bugs.
5. Vacuum and/or clean up all crumbs and spills promptly. Remember to clean out the toasters. Routinely clean the entire area with (1 oz. per 1 gal. water) Safe Solutions, Inc. Enzyme Cleaner with Peppermint. Do not forget the corners and cracks and crevices. Lightly dust with food-grade DE.
6. Store all food stuffs in insect-proof containers below 50° F. and on pallets 18" away from the wall.
7. Dispose of all out of date and/or infested food stuffs. Lightly sprinkle baking soda or Safe Solutions, Inc. food-grade DE. Caulk all cracks and crevices.
8. Practice first in first out inventory control. Supplies should be used as quickly as possible.
9. Install and properly maintain air conditioners, fans and a dehumidifier.
10. Install some pheromone traps or pantry pest traps or at least duct tape (sticky-side up).
11. Steam clean and/or lightly dust with food-grade DE per the label.
12. Fumigate with carbon dioxide. Remember, most pantry pests will only go 4" into the grain.
13. You can mix a few pounds of Safe Solutions, Inc. food-grade diatomaceous earth in a ton of grain or flour as an anti-caking agent. This will also prevent explosion, act as a fire retardant, help keep the product fresh for years and will destroy any insect pests.
14. You can sometimes catch moths by leaving one light on in the kitchen/pantry over some soapy water. Turn off all of the other lights so you can attract the moths from their hiding places.
15. **If you still have stored product pests, read the rest of the chapter.**

The real problem is not the "pests" but the poisons used to "control" them!
Need more data? See http://www.wholefoodsmarket.com/issues/fqpa_wfmsummary.html.

Note: The Spring 2000 issue of the American Entomologist noted on page 56: "According to a national survey, 91% of consumers are concerned with pesticide and fertilizer 'residues' in drinking water (Anderson, et al 1996)." Yet the poison "industry" seemingly is totally unconcerned about this majority opinion! Sad Note: Even organic food stores have some poison applicator applying pesticide poisons to "protect" the "organic" food on a regular basis.

***Safe Solutions products may be purchased online at:**
http://www.safesolutionsinc.com
or by telephone at:
1-888-443-8738.