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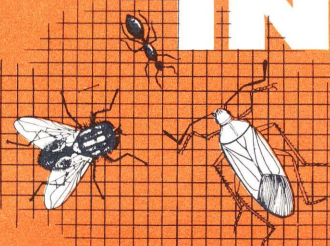
Insect Control for Motels, Resorts and Cottages
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Ray L. Janes, W.F. Morofsky, Entomology
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INSECT CONTROL

**for motels
resorts
cottages**



33.6

INSECTS



CONTROL MEASURES



INSECTICIDES



PRECAUTIONS



EQUIPMENT

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Michigan State University

Agricultural Experiment Station • Cooperative Extension Service

EAST LANSING

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Identification Key for Insects

Type of damage or nuisance	Description of damage or insect	Name of insect
Damage to wood	Fine sawdust sifting from small holes. Heartwood damaged, weakening wood.	Powder-post beetles
	Fine sawdust sifting from small holes in bark. Not very important.	Bark beetles
	Inside of wood shelved. Brownish, corky material present. No sawdust.	Termites
	Inside of wood shelved. No brownish corky material. Coarse, stringy sawdust.	Carpenter ants
Damage to rugs and clothing	Silver gray to brownish, wingless insects with three appendages at tip of abdomen.	Silverfish
	Small holes eaten in woollens by hairless caterpillars or worms.	Clothes moths
	Small grubs with tufts of hair mainly at tip of abdomen. Eat nap from carpets.	Carpet beetles
Nuisance around kitchens	Large flat-bodied, fast-running insects. Color: black or brown or tan.	Cockroaches
	One or two swellings on the waist between thorax and abdomen. Color black to yellow.	Ants
	Slender, reddish to brownish beetles, $\frac{1}{6}$ inch long. Usually found in or near cereals.	Pantry insects
	Small grubs with tufts of hair mainly at tip of abdomen. Damage cereals and carpets.	Carpet beetles
Invade buildings	Blackish-brown, rounded beetles, about $\frac{1}{4}$ inch long. Small holes (pits) on wings.	Strawberry root weevil
	Black, short-winged jumping insects about $\frac{3}{5}$ inch long when mature.	Field crickets
	Females have short wings and blackish color on top of abdomen.	Wood cockroaches
	Wingless creatures (not insects) with eight elbowed legs and two body regions.	Spiders
Damage to lawns	One or two swellings on the waist between thorax and abdomen. Color black to yellow.	Ants
	White, curve-bodied grubs with brown heads. When mature, body is $1\frac{1}{2}$ inches long.	White grubs
Flying and biting insects	Clear-winged, humpbacked flies, $\frac{1}{25}$ to $\frac{1}{5}$ inch long. Present around water.	Black flies
	Small-type horse fly with banded wings. Present around water areas.	Deer flies
	Large, heavily-bodied flies. Wings not banded. Present around water areas.	Horse flies
	Small, delicate, mosquito-like insects. Often called midges.	No-see-ums

INSECT CONTROL

for motels resorts cottages

Insects can be very annoying on a vacation trip. The alert tourist and resort operator will do everything possible to keep his premises free of these pests. Insect control must be thorough so that guests can enjoy your facilities. Your efforts will pay off in repeat business.

Three types of insects cause trouble. They are: (1) those that live in buildings, such as cockroaches and "pantry" insects; (2) those that live outdoors but invade buildings, such as crickets and strawberry root weevils; and (3) those that are mainly a nuisance outdoors, such as mosquitoes and no-see-ums.

To identify insects properly, learn the names of the important parts of their bodies. The outline drawings

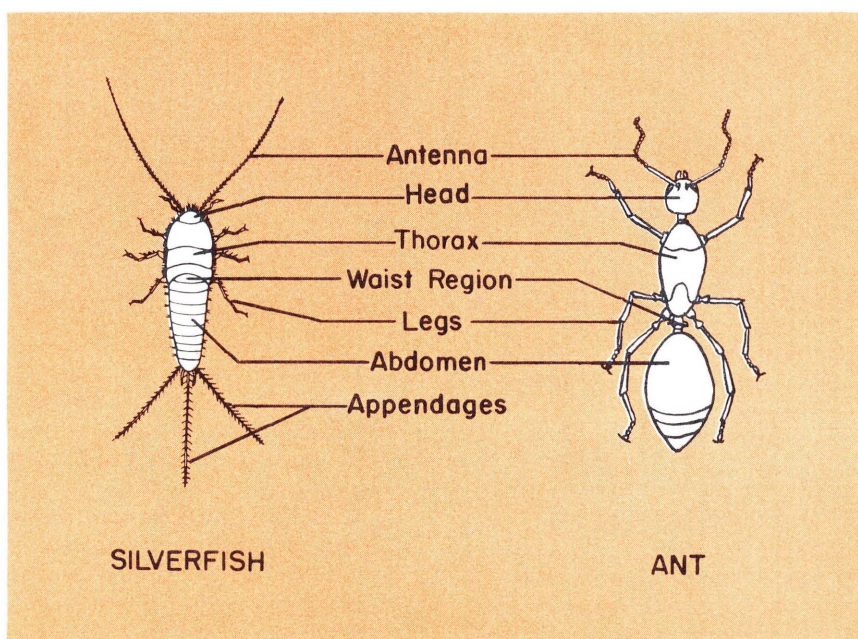
NOTE: When insects have wings, they are attached to the thorax.

on this page show a silverfish and an ant. The important parts of their bodies are labeled. Refer to these drawings when insects are described.

Insect control would be easier if the same methods could be used on all kinds. Different insects, or even closely related species, may require special treatment. **To help you with this problem, control of each insect is discussed separately.**

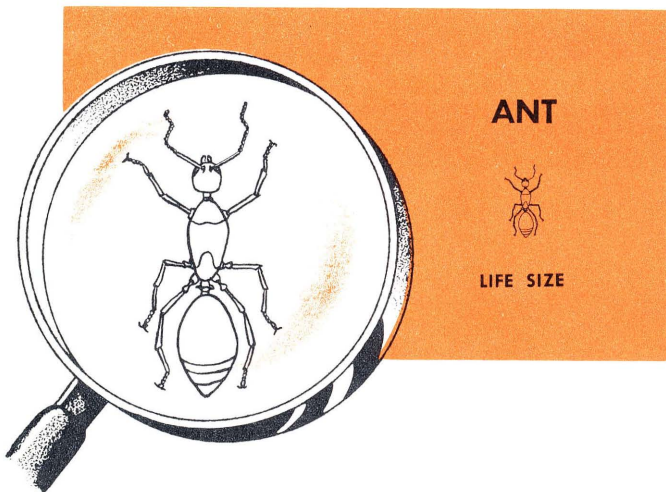
This circular has three sections. The first describes insects, spiders, and mites, and lists control methods. The second gives dosage rates and warnings about the insecticides you will be using. The third describes the equipment needed.

The number in parenthesis following each insecticide in Section I refers to the same number in Section II which describes this insecticide.



SECTION I

Insects and Their Control



Ants are found in most places where man lives. They are easily recognized by their threadlike waist (abdominal petiole) made up of one or two nodes or swellings. The waist connects the abdomen and the thorax. The thorax, which is just behind the head, bears the wings and legs. The abdomen is the last part of the body and is behind the thorax.

The narrow, threadlike waist of ants distinguishes them from termites. Termites are broadly joined at the thorax and abdomen. All ants live in colonies and, with few exceptions, have well-defined castes of males, queens, and worker groups.

Carpenter and Shed Ants

Carpenter and shed ants are common Michigan wood destroyers. You will find them destroying dead heartwood in living trees, logs, house timbers, or almost any wood material. These ants, however, do not damage structural timbers as much as termites.

Carpenter ants are dark brown to black in color. They are the largest of our Michigan ants.

The workers range in size from about one-fourth to one-half inch long. These are the big, black ants that you see wandering around pavements, lawns, and trees

and wood of all kinds. During late spring and early summer, some of them become winged. They swarm and establish new colonies at this time.

Shed ants are smaller than carpenter ants. Shed ants are more brown than black in color. They are often found in and around window sills and door casings, and especially in basements or other places where firewood is stored.

Control Measures

There are several control measures, **but first the nest must be found.** Inject chlordane (2d), or lindane (5c) or dieldrin (4d), or pentachlorophenol (9) into the nest. For treating areas where carpenter ants are moving about, use chlordane (2d or 2c), or dieldrin (4d or 4c), or DDT (3d or 3c), or rotenone (12d).

Also, read the next section on "Common Household and Lawn Ants." Much of this information can be used in carpenter ant control.

Common Household and Lawn Ants

Everyone is familiar with these ants. They look like carpenter ants in shape, but they are much smaller. They may be black, brown, red, or yellowish in color. Ants invade buildings in search of food. Some may eat sweets, while others eat fats. Once they are established in a building, it may be hard to get rid of them.

In addition to the ants that infest buildings, there are some that infest lawns. Ant control should begin with the lawn, progress to the foundations and porches, and end up inside the building.

Control Measures

1. Lawns: Treat the top of anthills with chlordane dust (2c), or chlordane wettable powder (2a), or dieldrin dust (4c), or dieldrin wettable powder (4a), or DDT dust (3c), or DDT wettable powder (3a).

After applying **one of these materials**, rake it into the top of the anthill with a garden rake. Rake the hills every day or two. Repeat treatments in 7 to 10 days if ants are still active. Controlling ants in lawns may take a long time, so keep at it.

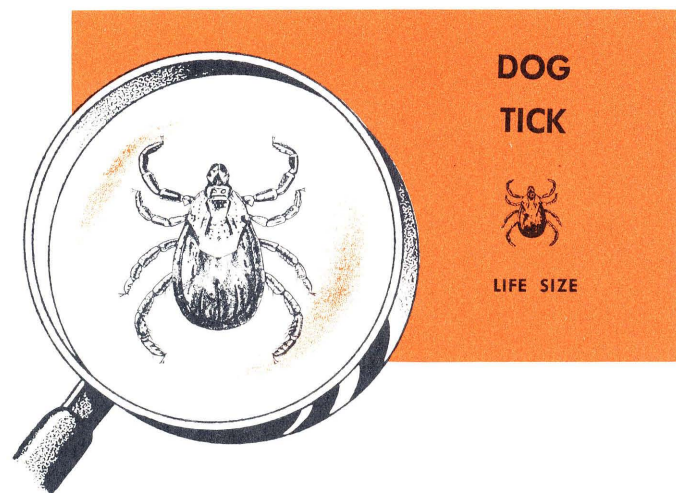
2. Foundations and porches: Use chlordane wettable powder (2a), or dieldrin wettable powder (4a), or DDT wettable powder (3a), to spray the foundation and base of porches. Also, spray or dust the grass and shrub area a few feet away from the foundation with one of the same materials.

3. Inside buildings: Use chlordane (2d or 2c), or DDT (3d or 3c), or methoxychlor (7c) along baseboards and behind the kitchen stove. Where a dust is objectionable, apply chlordane (2d), or DDT (3d) in nonstaining oil. Avoid spraying oil onto asphalt tile floors.

Baits (F.) can also be used. If possible, buy a bait containing both sweet and fat ingredients so that you will not be disappointed when sweets-loving ants fail to eat a fat-containing bait. Place baits in ant runways where children will not find them.

Ant control in buildings usually is not easy. Therefore, keep at it, and do not become discouraged too soon.

For more information on ant control, write the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Ask for Home and Garden Bulletin No. 28 entitled "Ants in the Home and Garden—How to Control Them." (10¢)



The American dog tick is also called the wood tick. Ticks have eight legs, four on each side of the body. The adult wood tick is the only stage that attacks man. The unfed female is about three-sixteenths inch long. When fully fed, she measures one-half inch in length.

The color of the American dog tick ranges from chestnut brown to blue-gray. The fully fed female is

usually blue-gray in color. The unfed tick is flat; the fed tick is round.

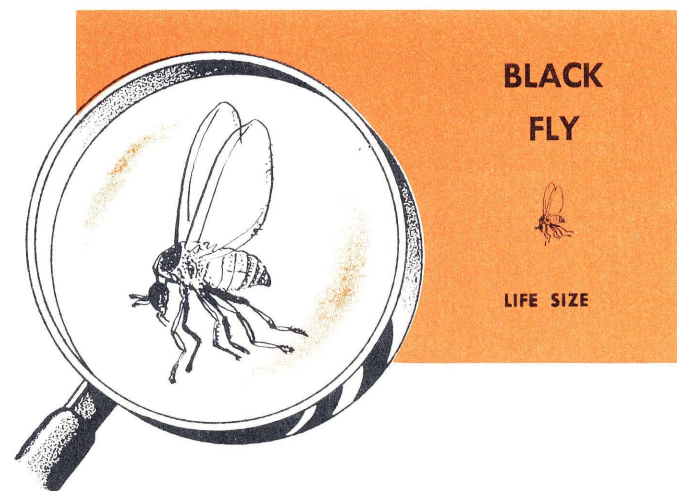
The American dog tick is found during the spring and early summer. It is quite rare after about August 1. It usually lives in moist areas where underbrush and grass grow.

Control Measures

1. If you find a dog tick anchored to your body, see your doctor. It should be removed and the wound treated.

2. Dust or spray the grass and underbrush around cabins or other buildings, and on each side of pathways with DDT wettable powder (3a) or DDT dust (3c). Remember, it is hard to eliminate all ticks from an area with a single treatment of DDT. Repeat treatments if necessary.

For more information, write the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Ask for leaflet No. 387, "Wood Ticks—How to Control Them in Infested Places." (5¢)



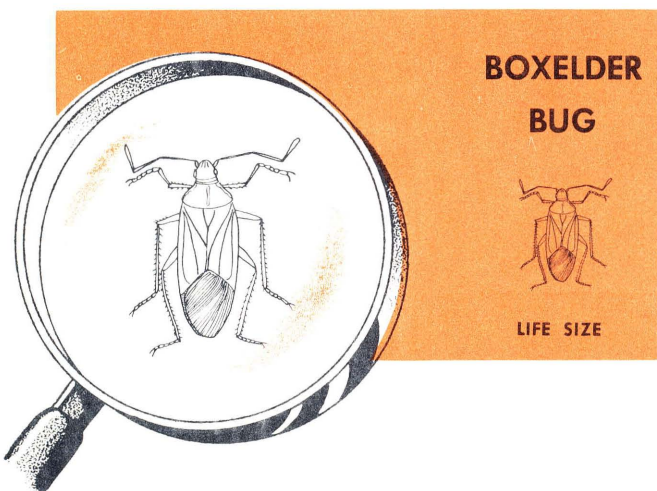
Black flies are small, chunky, and humpbacked. They are about one-twenty-fifth to one-fifth inch long, depending on the species.

Adult black flies bite all warm-blooded animals. Their bites cause irritation, swelling, or itching for several days.

These insects are common in nearly all parts of the United States and Canada; they are especially annoying in northern Michigan. The black fly maggots live in water and are usually found in our cold, fast-flowing streams. The maggots attach themselves to weeds, stones, or plant stalks in the stream. They usually appear as adults in the spring, although some species may appear later in the season.

Control Measures

1. Protect yourself from these pests by wearing boots, head veils, and gloves.
2. Use repellents (H.). Protection can last up to 5 hours.



The adult boxelder bug is about one-half inch long. Its body is rather narrow and flat-topped. The body color is red and black, and the veins on the wings are red. Immature boxelder bugs are bright red.

The favorite food of the boxelder bug is the flowers and seed pods of the female boxelder tree. If possible, plant only male boxelder trees. But even this may not solve the problem entirely. The boxelder bug also feeds upon ash, maple, and many fruit trees. With these trees, however, the situation is not serious.

Boxelder bugs can be very annoying around buildings most of the year. In summer, they cluster on the outside of buildings. They are often present in large numbers on lawns, especially under boxelder trees where leaves have fallen. In the fall, winter, and spring, you may find them clustered on the warm side of buildings; they may even come inside. They do not destroy clothing, but they do stain curtains, clothing, and wallpaper.

Control Measures

1. Boxelder bug control is not easy. The first thing to do is cut down boxelder trees, especially the seed-bearing females. If you cannot do this, use all of the following treatments, if necessary:

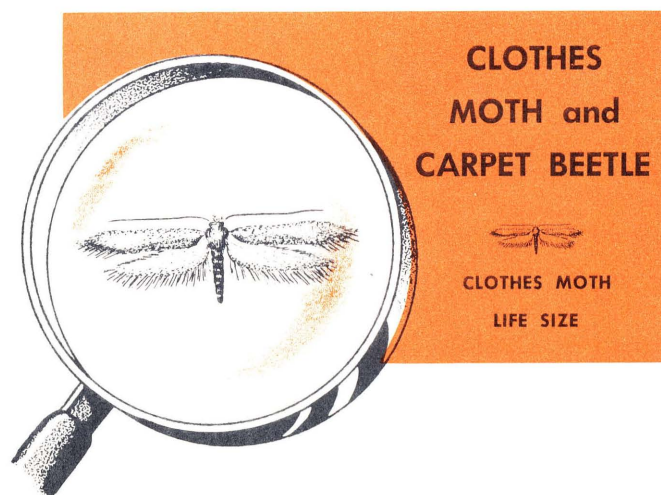
1. Morning Treatment: Scrape them into crankcase oil or hot water. The best time to do this is when it is cool and the boxelder bugs are clustered in large groups.

2. Summer Treatment: Beginning in June, spray boxelder tree trunks and foliage with chlordane (2b or 2a), or dieldrin (4b or 4a), or lindane (5b or 5a). Use this treatment also to control boxelder bugs on outside walls, stumps, or walks. **Repeat treatments when needed.**

3. Fall Treatment: Spray tree trunks, outside walls, fences, and other places where you find boxelder bugs with chlordane emulsion (2b), or dieldrin (4b), or lindane (5b).

4. Winter Treatment: Spray boxelder bugs as they appear around doors and window openings with chlordane (2b), or dieldrin (4b), or lindane (5b). Also, spray clustered bugs and the places where they hide.

NOTE: Avoid using emulsion sprays on buildings if the label says they stain painted surfaces.



These insects damage all woolen fabrics, furs, feathers, down, bristles, hair, and mohair. Carpet beetle larvae (grubs) also feed on cereals and other grain products.

Adult clothes moths have a wingspread of about one-half inch and are yellowish or buff in color. You see them flying away from light into corners or other dark places. The adults do not damage fabrics because they are unable to chew in this stage. **The larvae (caterpillars) are the ones that do the damage.** Clothes moth caterpillars are white, except for the head, which is dark. Their bodies are almost hairless and they are about a third inch long when full grown.

Adult carpet beetles are small, measuring not more than one-eighth inch long. Color varies greatly in the adult beetles. It may be black in some, and a mottled red, black, and white in others. If you look closely at an adult, the body appears to be covered with small scales.

As with clothes moths, it is the carpet beetle larvae (grubs) that do damage to carpets and clothing.

You can recognize carpet beetle grubs by their hairy appearance. Note that they have blackish or brownish bristles at the small end of the body.

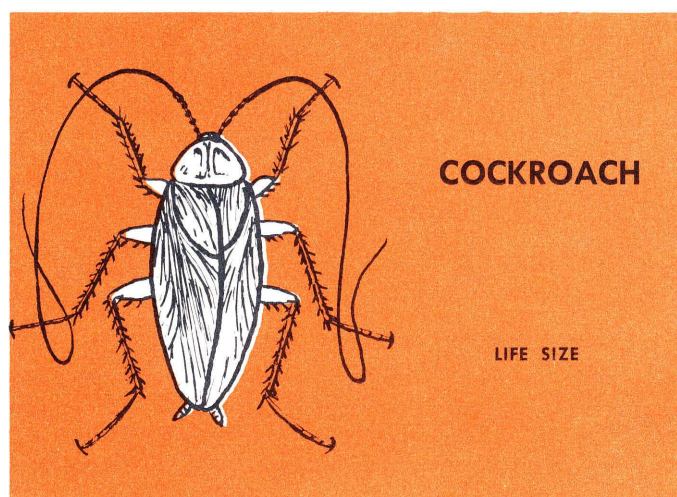
Control Measures

1. Good housekeeping is very important in preventing or controlling carpet beetles and clothes moths. Regular use of the vacuum cleaner removes lint upon which the larvae feed. You will find that carpet beetles are more apt to cause damage to carpets and rugs under heavy furniture where it is hard to clean regularly and thoroughly. They also cause trouble where carpets fit close to walls, especially if the carpet is under the quarter round. Keep closets clean by using the vacuum or by other cleaning methods.

2. Fumigate or wash pillows containing feathers to kill clothes moth infestations.

3. Apply DDT (3d) to baseboards, closet floors, walls, carpets, and to other areas of the building where these insects occur. Use only chlordane (2d or 2c), or dieldrin (4d or 4c) or lindane (5c) for treating edges of wall-to-wall carpets. Chlordane and dieldrin are better than DDT or lindane for stubborn cases of carpet beetles.

Consult your county agricultural agent if you have a carpet beetle or clothes moth problem. For more information, get Home and Garden Bulletin No. 24, "Clothes Moths and Carpet Beetles—How to Combat Them," by writing the Superintendent of Documents, Washington 25, D. C. (15¢)



Domestic cockroaches spend their entire life inside buildings. Usually, you will find them in basements, bathrooms, and kitchens.

There are several kinds of cockroaches. It is hard to give a good general description that will fit them all. Color in the different species ranges from tan to brown,

while some are brownish-black. They are flat-bodied and skinny, and run very fast when disturbed. The brownish-black American cockroach shown in the illustration may grow to 1½ inches or more in length.

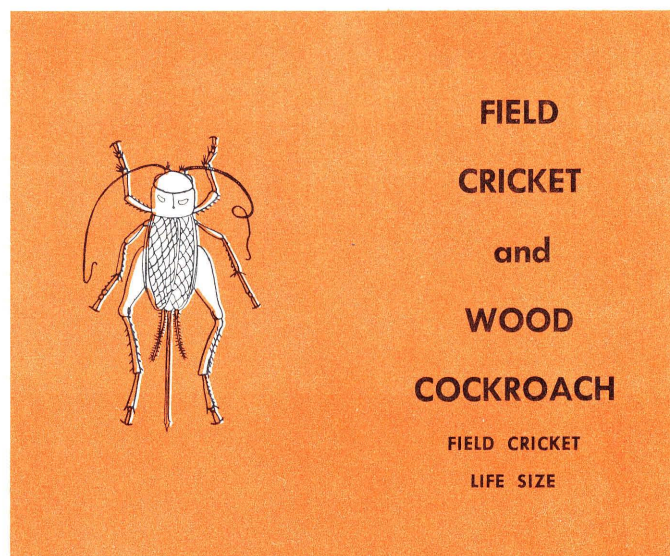
Control Measures

1. Keep food cleaned up in the cupboards and from behind stoves. Kitchens must be kept immaculately clean. **THIS IS A MUST.**

2. Apply chlordane (2d or 2c) or dieldrin (4d or 4c) where cockroaches are found, especially along their runways.

3. Borax or sodium fluoride can be used to control cockroaches. **Remember, these materials are poisons and must be used carefully. Read the directions on the label.**

For more information, write the Superintendent of Documents, U. S. Printing Office, Washington 25, D. C. Ask for leaflet No. 430, "Cockroaches—How to Control Them." (5¢)



Field crickets are blackish-brown in color and are about three-fifths inch long. The feelers (antennae) on the head are about 1½ times as long as the body. The hind legs are thickset, making them suited for jumping.

Wood cockroaches are not year-round inhabitants of buildings as are the domestic cockroaches. The female of the common wood cockroach has wings shorter than its abdomen. The female abdomen is blackish on top. The wings of the male are longer than the tip of the body. The males are from two-thirds to 1 inch long and can fly long distances.

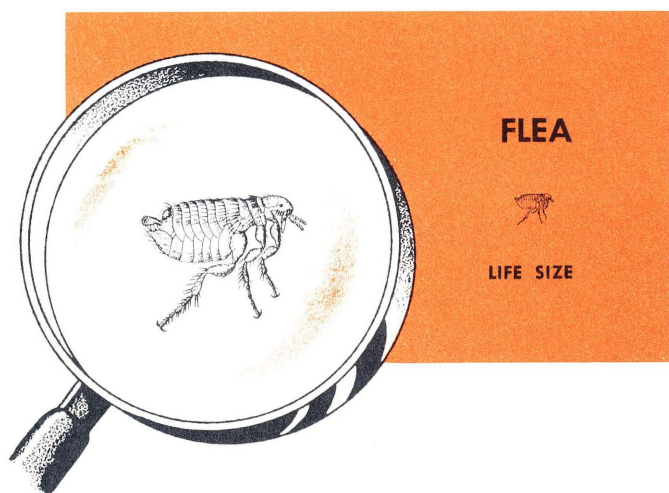
Field crickets and wood cockroaches get into buildings, usually during late summer and early fall. This is especially true when buildings are near fields and woodlots. Wood cockroaches enter buildings either on wood taken into basements, through cracks in the foundation,

or through open doors. Wood cockroaches and field crickets are mainly nuisance insects, although field crickets may occasionally feed on some types of clothing.

Control Measures

1. **Outside buildings:** Spray the outside of the foundation with chlordane (2a or 2b) or dieldrin (4a or 4b). With these same materials, spray the grass for 10 feet away from the foundation. Pay special attention to areas around doorsteps and other places where field crickets and wood cockroaches get into buildings.

2. **Inside buildings:** Apply chlordane (2d or 2c) or dieldrin (4d or 4c) to small areas. Take cockroach-infested wood outdoors for storage. Clean up the areas where the wood was stored.



Cat and dog fleas cause trouble in and around resort buildings. Only adult fleas bite. They may be found in all rooms of a building, in sleeping quarters of dogs and cats, and outdoors around buildings in the summer. Dog and cat fleas found outdoors are often called "sand fleas."

Adult fleas normally live on cats and dogs. The eggs of fleas **are not glued** to the animal's hair as is the case with lice. When flea eggs are laid, they usually roll from cats or dogs to the ground, kennel bedding, or floors. The worms of fleas feed on dust, dirt, lint, and other foods with organic material in them. This habit of egg laying and worm feeding permits fleas to spread through buildings.

Adult fleas sometimes are still present 12 to 14 days after a dog or cat has been in a building. **In other words, it is not necessary** for a cat or dog to be around at the

exact moment you are having trouble with adult cat and dog fleas.

Control Measures

There are four important steps in the control of fleas. They are:

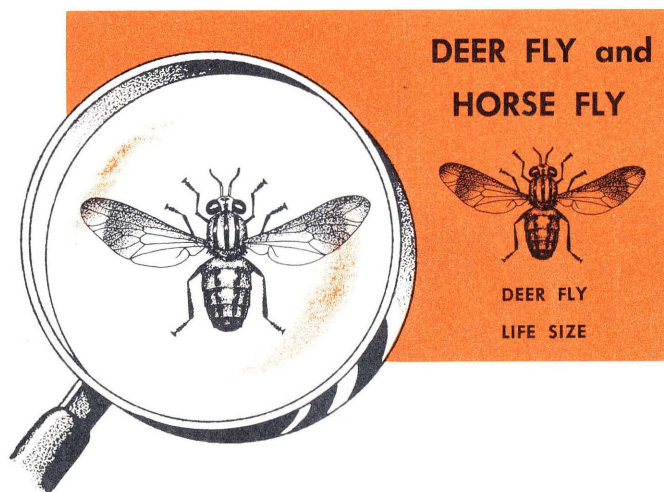
1. Use rotenone (12d) to treat either cats or dogs. Apply DDT (3c) only to dogs.

2. Clean cat and dog sleeping quarters thoroughly. Treat the kennel floors with pyrethrum (11a or 11b) or rotenone (12d or 12a or 12b). Use DDT (3c) for treating dog kennels only.

3. Spray motel and cottage floors with methoxychlor plus pyrethrum plus piperonyl butoxide (7c) or pyrethrum (11a or 11b).

4. Treat flea-infested lawns and yards with DDT (3a or 3b). Use methoxychlor (7c) on yards where there is no grass.

For more information on flea control, write the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Ask for leaflet No. 392, "Fleas—How to Control Them." (5¢)



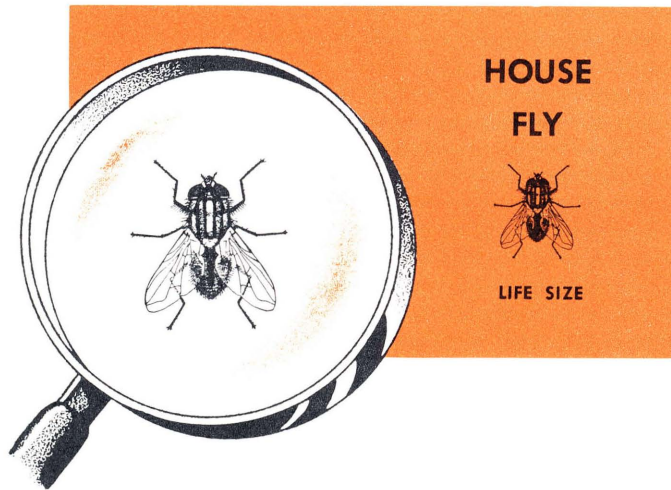
Horse flies and deer flies are closely related. Some horse flies measure 1 inch in length and do not have dark bands on the wings. The body color of these flies is usually black or brown. The smaller horse fly species may have banded wings. Deer flies belong to this latter group.

The larvae (maggots) of horse and deer flies live on the bottom of ponds, marshes and wet meadows, and the adults are usually nearby. The adult horse and deer flies break open the skin of animals and man with their sharp mouth parts. They suck blood through these openings.

Control Measures

1. Draining ponds, wet meadows, and other water areas will help control these insects. However, since the adults can fly in from other areas, drainage measures may not be too effective unless done on a large scale.

2. Spraying horses, cows, and other animals with a water mixture of pyrethrum and piperonyl butoxide (11a or 11b) will reduce the problem for a few days. Humans may get some relief from these insects by using a repellent (H.) and protective clothing.



Everyone knows a house fly when he sees it. Not everyone, perhaps, knows that they carry such diseases as typhoid fever, tuberculosis, and dysentery. House fly maggots live in all kinds of filth such as manures, dead animals, and rotting plants. The adults carry this same filth to man's food, face, and hands.

During periods of rain and warm weather, flies can develop from egg to adult in about 12 to 18 days. This is why there are more of them in some years than in others.

Control Measures

Several things will help keep flies under control:

- Do away with their breeding places.
- Get rid of all sewage and garbage regularly. Keep a tight lid on all garbage cans.
- Use screens to keep flies out of buildings.
- Use flytraps to catch them.
- Use insecticides to kill them.

Breeding places: Careful disposal of all manures, rotting plants, and other organic materials is a "must"

in controlling house flies. It is almost impossible to control house flies with insecticides when large numbers are present.

Sewage and garbage: Sewage and garbage are prime sources of flies. Prevent breeding by disposing of sewage and garbage properly. **Water-soaked areas around garbage cans are important fly breeding places!** Obtain sanitary garbage disposal plans from your county health department.

Screens: Screen all doors and windows to keep flies out of buildings. Paint or spray the screens with 5 percent DDT in refined (white) kerosene (3d). Methoxychlor mixture (7c) can also be used, but it must be applied more often than DDT. Apply sprays to screens from the inside of the room out through them. You can use a brush to apply treatments to screens.

Flytraps: You can use traps to catch live flies. Traps are especially effective when there are large numbers of flies. Place traps on the sunny side of buildings, out of the wind. In hot weather, however, the south side of buildings may not be the best place. Get plans for making flytraps from your county agricultural agent or from Michigan State University. Several types of commercial traps are also available.

Make baits for flytraps from one of the following materials:

(1) A mixture of one part of blackstrap molasses and three parts of water. (NOTE: Any sweetening material will do.)

(2) Milk.

(3) Fruit waste, such as apple peelings.

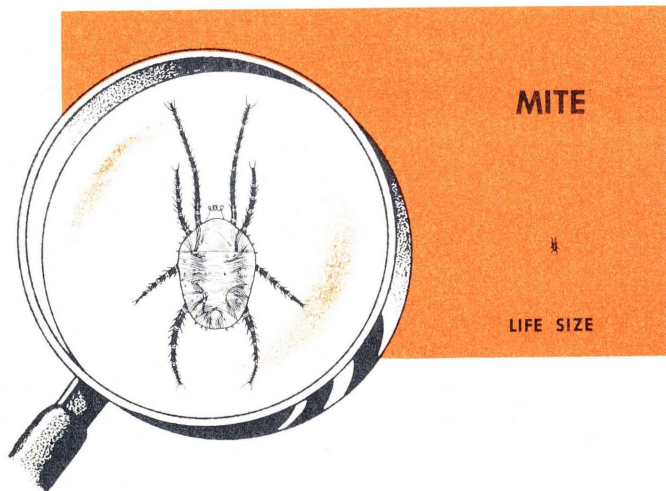
Fly control inside buildings: Use household sprays of DDT (3d), or pyrethrum (11a), or pyrethrum plus piperonyl butoxide combinations (11b or 11c or 11d). Also use aerosols (F.) of the above materials. Do not breathe the fumes of aerosols.

Flypaper and flyswatters are also effective. In the long run, they may work just as well for some fly control problems as any other method.

Fly control outdoors: Spray wet areas around garbage cans with malathion (6a) or chlordane (2a). This will help prevent maggot development. Repeat the treatments as necessary.

Get detailed instructions on fly control from your county agricultural agent or Michigan State University. House fly control with chemicals is continually changing and, for best results, you need up-to-date information.

Mites are not insects, and they can be easily distinguished from insects. They are small animals belonging to the spider group. Mites have a single head and thorax region, while the head and thorax of insects are divided into distinct parts. Insects have six legs, mites have eight.



Mites cause varying degrees of trouble. Some injure plants, others carry disease, some are animal parasites. Still others are more of a nuisance than anything else. "Nuisance" mites include those that invade buildings, usually in the spring and fall. The clover mite is such a pest.

Clover mites (see illustration) are about one-twenty-fifth inch long. Because of their size, their presence is usually overlooked until they become pests. They spend the winter on clover and other host plants, or under siding and in the cracks of houses. Brick houses are much more likely to become infested than frame buildings.

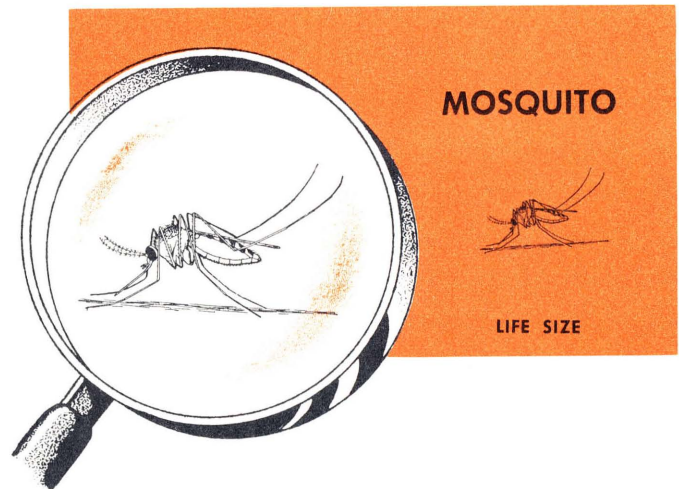
Control Measures

1. Plant, Flower and Shrub Beds: An 18-inch or wider strip of grass-free and weed-free soil around the foundation usually keeps clover mites out of the house. Flowers and shrubs can be planted in the strip. Shrubs and flowers need not be sprayed for clover mite control. NOTE: Miticides should not be applied to either flowers or shrubs unless the label indicates this is a safe practice.

2. For best control, keep mites out of buildings. Thoroughly treat foundations and a 10-foot strip of grass with ovex (8a or 8b) or Aramite (1a or 1b). Malathion (6b or 6c or 6d) or rotenone (12a or 12b or 12c or 12d) can be used for clover mite control, but they are not as effective as ovex or Aramite.

3. When mites are inside buildings, not much can be done with sprays. Careful use of the vacuum cleaner will help eliminate them. Liquid household fly sprays containing pyrethrum (11a or 11b), applied to floors, baseboards and window casings, will help control them.

4. Calking cracks around foundations, doors and windows will also help. Remember, however, that mites are small and will enter buildings through the smallest of openings.



Since there are some 140 species of mosquitoes in North America, very few places are free of these insects. Mosquitoes feed on the blood of all warm-blooded animals. Many species are carriers of human diseases. Only the female mosquito bites.

Mosquitoes spend part of their life in water as wigglers. The adults have wings and do not live in water. Mosquitoes pass the winter as eggs, wigglers, or adults. Adults hide in washrooms, cellars, outbuildings, hollow trees, and other sheltered places. Wigglers remain frozen or in a dormant condition on the bottom of streams, ponds, and lakes.

Because Michigan has many lakes and streams, mosquitoes are found over the entire state, and control is difficult.

Control Measures

1. To be successful, mosquito control must be handled as a community problem. The larger the area treated, the better the results.

Survey your property well before trying mosquito control. To do this successfully, you should know something about their life habits. This includes such things as life cycles, breeding habits, and hibernating places.

All mosquitoes must have water for wriggler development. **Drainage, pumping, siphoning and other measures**

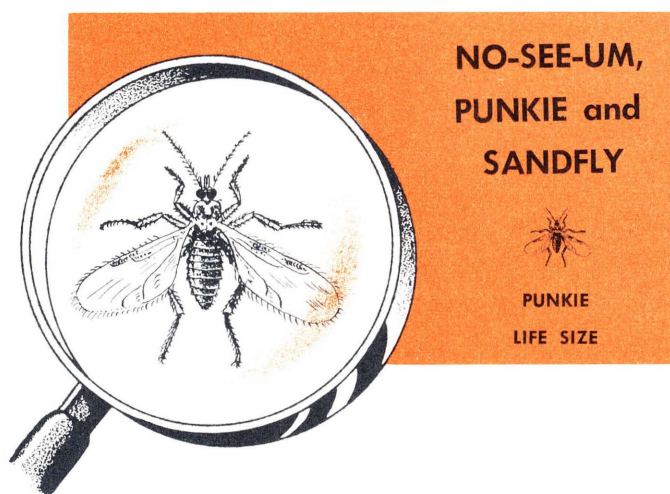
which reduce mosquito breeding places are fundamental in the control of these insects. Usually, an expert should be consulted to get best results.

2. Keep the grass cut around buildings. Mosquitoes hide during the day in these places. Treat shrubs with a DDT spray (3a), or DDT dust (3c), or a combination of DDT (3a) and chlordane (2a).

Do not use DDT on privet, delphinium, or bleeding heart because it damages those plants. **Do not apply DDT or chlordane to large trees and shrubs where birds are roosting or nesting;** use malathion (6b or 6d) or methoxychlor (7a, 7b, or 7c) instead.

(NOTE: Malathion does not last as long as DDT or chlordane, so you will need to use it more often.)

For U. S. Department of Agriculture Leaflet No. 386, "Mosquitoes—How to Control Them on Your Property," write the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. You can also get information on mosquito control from your county agricultural agent's office or the entomology department, Michigan State University. (5¢)



No-see-ums, punkies, and sandflies are bloodsucking midges. They are small two-winged flies about one-twenty-fifth to one-fifteenth inch long. Breeding places for the larvae (maggots) include water, decaying leaves, ponds, and moist rot-holes in trees.

These insects are very annoying to vacationers—they usually bite in early morning and early evening. They are attracted to lights and may become a nuisance in cottages. These insects are at their worst from mid-summer to late summer.

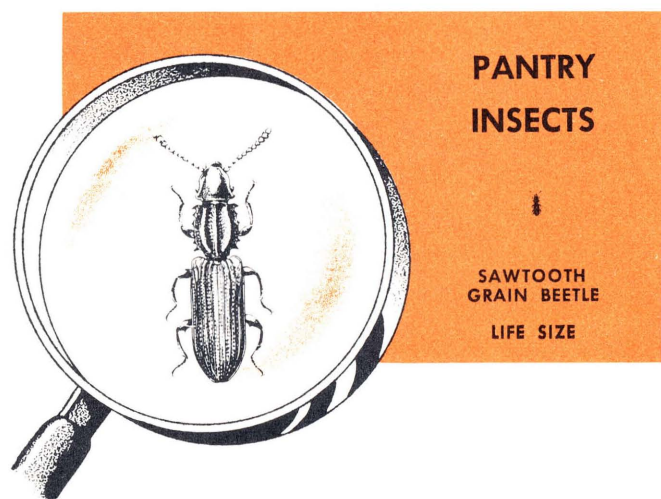
Control Measures

1. Clean up the leaves and weeds that drift in along the lakeshore. If possible, drain puddles and soggy ground near camps or buildings. Treat rot-holes in trees with DDT dust (3c) or chlordane dust (2c).

2. To other breeding areas (except lakes and rivers), apply 12 to 15 pounds of DDT dust (3c) to an acre.

3. Paint window and door screens with DDT in kerosene (3d), or methoxychlor (7c). For more permanent control, either reduce the size of the screen openings by applying aluminum paint, or install smaller-meshed screens. This will help keep these small midges out of buildings.

Repellents: Mosquito repellents (H.) may give some protection. Apply them to your skin and clothing.



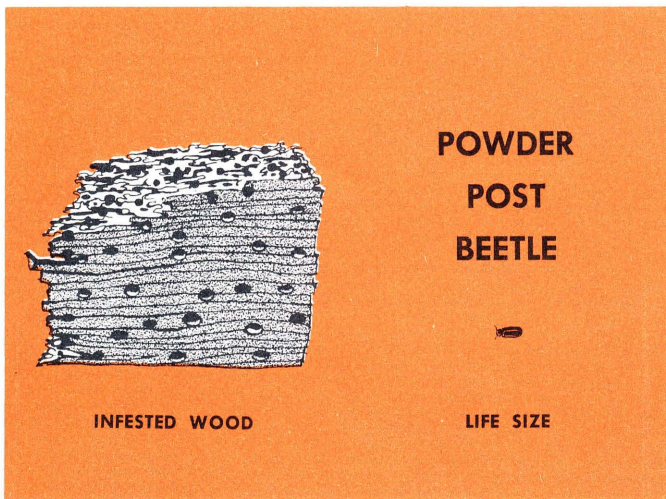
Several beetles and two well-known moths make up the group known as **pantry insects**. Adult beetles range in size from about one-tenth to 1 inch in length. The larger beetles tend to be black, while the smaller ones are usually red, reddish-brown, or brown. The adult moths are about $\frac{1}{2}$ to $\frac{3}{4}$ inch long when the wings are folded over the back. The Indian meal moth is reddish-brown, except for the wings, which are grayish near the body and reddish-brown near the tips. The Mediterranean moth is pale gray all over; when standing still, its head end is slightly raised.

The beetle grubs and the moth caterpillars eat cereals and other grain products. Both the beetle adults and grubs cause damage. Only the caterpillar stage of the moths is destructive.

Control Measures

1. Clean the kitchen thoroughly. Remove all opened and spilled cereals. Remove spilled cereal and grain products from behind cupboards and bins. Carefully use the vacuum cleaner to clean these areas.

2. Spray areas of cupboards where "pantry insects" are found. Use DDT in white, deodorized kerosene (3d), or methoxychlor plus pyrethrum plus piperonyl combination spray (7c). Remove everything from the shelves before spraying. Replace the dishes after the spray has dried.



Powder-post beetles include several small, brownish, dry wood-eating insects ranging in size from one-twelfth to one-fifth inch long. Two families, Lyctidae and Bostriichidae, are most common in Michigan.

Powder-post beetles were so named because the wood upon which they feed is gradually eaten into a fine, flourlike powder. They feed primarily on hardwoods, but they may also attack softwoods. Oak, ash, hickory, and poplar are especially damaged. They **prefer** the sapwood of hardwood trees when it is well seasoned.

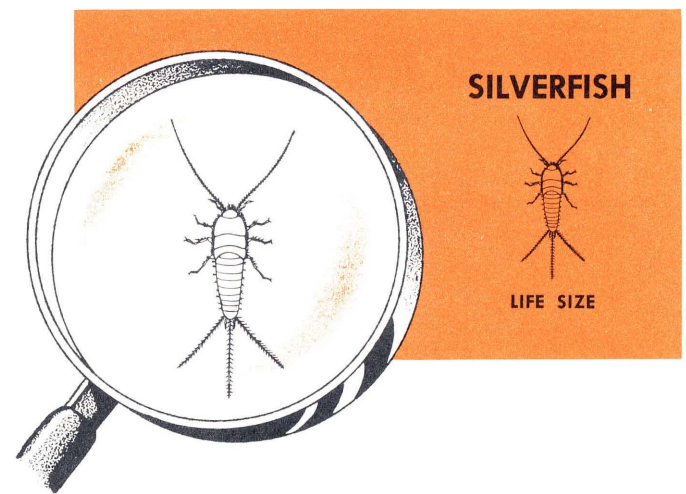
You can easily recognize the work of powder-post beetles. When the adults emerge, usually in June, some species leave small holes about the size of a pin in the surface of the wood; others make holes the size of pencil lead. From these holes, a fine, powderlike sawdust sifts almost constantly. Normally, these insects have a 1-year life cycle; this means that the adults will appear only once each year.

Control Measures

The sooner these insects are controlled, the better. Delay only makes the damage greater. Use pentachlorophenol (9), or DDT (3d), or pine oil (10) to treat the surface of infested wood before the adults appear in June.

Fumigations may be advisable in cases of severe powder-post beetle damage, especially where other methods have failed or where rapid elimination of the insects is desired. However, remember that **FUMIGATION FOR POWDER-POST BEETLES OR ANY OTHER INSECT SHOULD BE DONE ONLY BY AN EXPERIENCED FUMIGATOR**. Fumigants are highly poisonous, and people can be easily killed by them unless proper precautions are taken.

For further instructions, get leaflet No. 358 on "Powder-Post Beetles in Buildings" from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Information on powder-post beetle control is also available from your county agricultural agent or Michigan State University. (5¢)



Silverfish are often called fire brats or bristletails. Their color varies from silver-gray to greenish-gray to brownish. They sometimes look faintly spotted. The body tapers from the head to the tail of the insect. The head bears two appendages (hairlike structures); the tail end has three. These appendages are nearly as long as the body. Adult silverfish are about one-half inch long and are wingless.

Silverfish like warm places. They may be found in kitchens, bathrooms, attics, and basements. They some-

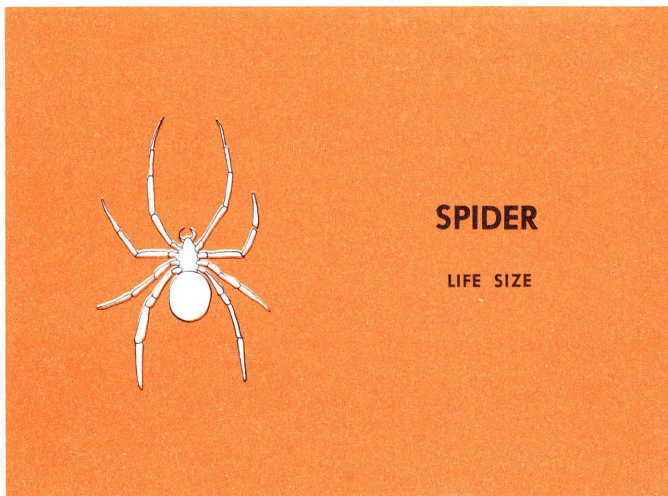
times live around baseboards and door casings. They like to feed on bookbindings, rayon fabrics, starched clothing, and wallpaper paste.

Control Measures

1. Reduce their food supply by keeping kitchens, bathrooms, attics, and basements very clean.

2. Use DDT (3d or 3c), or methoxychlor plus pyrethrum (7c), or pyrethrum (11a or 11b or 11c or 11d), or chlordane (2d or 2c). Apply to the places where these insects occur.

For more information on silverfish control, write the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Ask for leaflet No. 412, "Silverfish and Firebrats—How to Control Them." (5¢)



Spiders differ from insects by having a single head and thorax region. Insects, on the other hand, have the head and thorax divided into two distinct parts. Insects have six legs, spiders have eight.

Spiders are more a nuisance than anything else. Contrary to what many people think, they do not often bite.

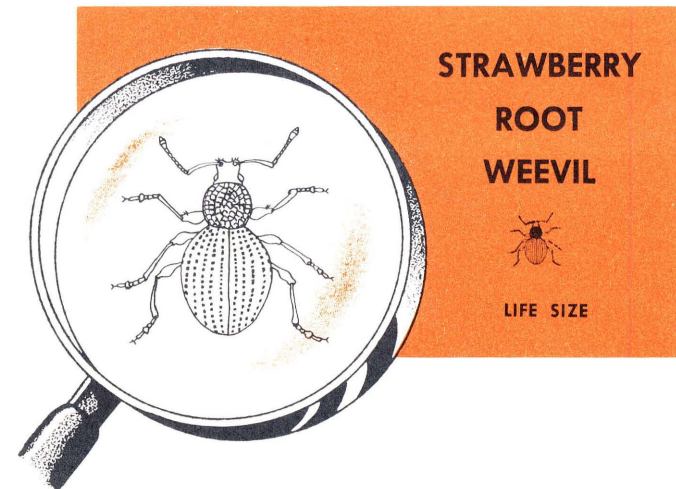
Spiders live in and around buildings, feeding on flies and other insects. Buildings with poor foundations or with none often harbor many spiders. They prefer basements or crawl spaces that are damp.

Control Measures

1. Calk or otherwise tighten the foundation so that spiders cannot get under buildings. This will also keep them from getting into living quarters.

2. For spiders under buildings, use chlordane (2a or 2c) or pyrethrum (11b or 11c or 11d). Treat all affected areas, especially the webs (nests). Apply the treatments with a coarse spray or dust.

3. If spiders are getting into living quarters, use chlordane (2c). Apply around baseboards where spiders are likely to get into rooms, and treat webs (nests) if they are present.



Strawberry root weevil adults are about $\frac{1}{4}$ inch long and blackish-brown in color. They have short, blunt snouts protruding from the front of the head. The body is hard-shelled when fully mature.

The adults usually begin migrating into buildings in July. For a month or two, they may be found in bathtubs, cupboards, or even hanging from ceilings. As far as is known, they do not damage clothes or food inside dwellings. Sometimes, they cause trouble by getting into the working parts of household equipment. They are important to the resort owner mostly because his guests mistake them for much more troublesome insects.

The immature form (grub) of the strawberry root weevil feeds on the small roots of strawberry, bramble, and evergreens such as pines.

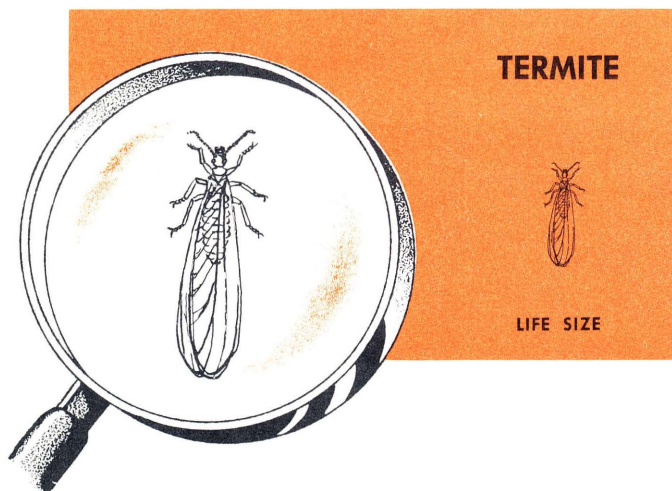
Control Measures

1. **Outside buildings:** At the first sign of strawberry root weevils, spray foundations thoroughly with chlordane (2a or 2b), or dieldrin (4a or 4b), or lindane (5a or 5b). Take special care to thoroughly spray the sides and base of steps. With these same materials, spray the grass for 10 feet **away from the foundation**.

2. **Inside buildings:** No insecticide is entirely satisfactory for control of strawberry root weevils once they are inside buildings. However, a good fly spray contain-

ing pyrethrum plus methoxychlor plus piperonyl butoxide (11b) will give some control. The best approach is to gather them up with a vacuum cleaner.

NOTE: Much of the trouble from strawberry root weevil in buildings arises from not beginning the spray program soon enough. No outdoor treatment is effective once these insects are underneath the clapboards, inside the walls, and protected by other areas of the building.



Termites, or "white ants" as they are sometimes called, are important wood-destroying pests in Michigan. (See Carpenter Ants for information on how to tell termites from ants.) **Michigan termites are subterranean (underground forms) and must have contact with moist ground in which to build their nests.**

The food of subterranean termites is largely cellulose and comes from many sources. In fact, all materials made from plants or cellulose-containing plant products are used as food by termites.

Subterranean termites are most abundant in moist, warm soils containing plenty of food. Such conditions are found beneath poorly ventilated buildings, scraps of lumber, stumps covered by fills, or any part of a wood structure close to the ground, such as porches or steps. Termites travel from nests in the soil through a brownish, corklike tube to their food supply. **WHEN THE CONTACT BETWEEN THE NEST IN THE GROUND AND THE WOOD UPON WHICH THEY FEED IS BROKEN, TERMITES DIE.**

Termites feed on the **inside** of sills, studding, floors, subfloors, and other wood structures. They rarely appear on the surface except when they are winged and swarming. If the wood upon which they are feeding is broken through, they immediately seal the opening with a brownish, cork-like material. **Termites do not leave sawdust as do powder-post beetles. Also, there are no small openings to the outside of the wood as in the case of powder-post beetles.**

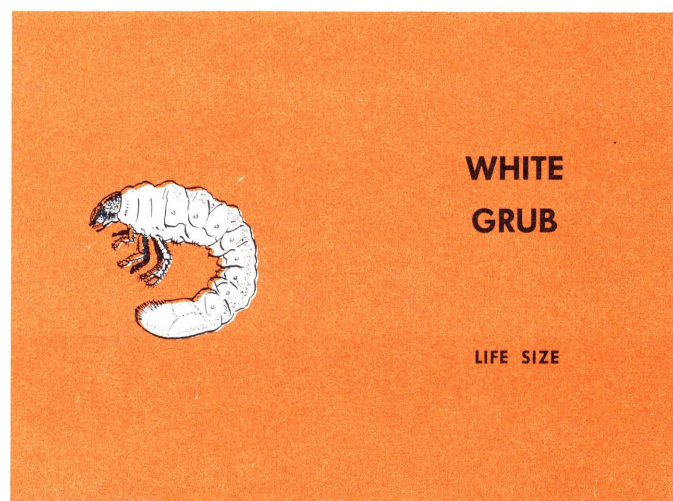
Control Measures

Resort owners should be constantly on the lookout for termites. An easy way to spot termite damage in sills, floor joists, and studdings is to plunge an icepick into the wood. If the wood is solid, the icepick probably will not go very far into it. On the other hand, if the icepick enters easily, you should inspect all wood carefully for termites.

When you find termites, take immediate steps to determine the extent of damage. Perhaps the infestation has not spread and only minor damage has been done to the building. To get rid of small infestations, clean up the loose wood around the building and treat the soil where termites are found. When an infestation is widespread and much damage has been done to the building, it is usually best to hire the services of someone who has training and experience in termite control. **Pay attention to both the control of the termites and to repair of the building!**

Eliminate termites from areas where new buildings are to be erected. This is especially important when a new building is to be built where an old, termite-infested building once stood or where there are wood scraps, stumps, logs, or sawdust.

For detailed information on the control of termites, see United States Department of Agriculture Home and Garden Bulletin No. 64, "Subterranean Termites—Their Prevention and Control in Buildings." You can buy it from the Superintendent of Documents, United States Printing Office, Washington 25, D. C. (15¢)



The grubs of June (May) beetles feed on grass roots. When they are abundant, they cut the grass sod from the ground. Because the damaged sod can no longer get water and minerals from the soil, it turns

brown and dies. Lawns infested with white grubs may be damaged by moles which feed on white grubs.

Control Measures

1. Apply 25 pounds of 40 percent wettable chlordane powder (2a) or 200 pounds of five percent chlordane dust (2c) per acre to the lawn surface. This amounts to a half pound of 40 percent wettable powder (2a) or 5 pounds of 5 percent chlordane dust (2c) per 1,000 square feet.

You can use dieldrin instead of chlordane. Apply 6 pounds of 50 percent dieldrin powder (4a) or 300 pounds of 1 percent dust (4c) per acre to the lawn surface. This amounts to 2½ ounces of wettable dieldrin powder (4d) or 7 pounds of 1 percent dieldrin dust (4d) to 1,000 square feet.

2. Soak chlordane or dieldrin dusts into the lawn, but avoid washing them off in streams of water. It is a good idea to wet down lawns treated with chlordane or dieldrin sprays. (NOTE: Sprays are generally easier to work into soils than are dusts.)

Apply white grub treatments in the fall or spring. However, treatments can be applied anytime of the year, **JUST SO THEY ARE SOAKED INTO THE SOIL.** If you are preparing a lawn for seeding, apply chlordane or dieldrin to the surface of the ground and work it into the top 3 to 4 inches of soil.

For more information on insects affecting lawns, write the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Ask for Home and Garden Bulletin No. 53, "Lawn Insects—How to Control Them." (15¢)

SECTION II

Insecticides

For good insect control, you must know how to use insecticides (chemicals) effectively. Most insecticides are available in several different formulations. Each formulation has its own use for insect control in and around motels, cabins, and cottages.

This insecticide information is divided into two parts. The first discusses the forms (formulations) in which you can use the various insecticides. The formulations given are the more common ones. Read the label on the container for instructions on how to use formulations not discussed in this circular.

The second part of this section discusses the individual insecticides and lists the formulations usually available for insect control. Also included in this second part are the **WARNINGS** on the use of each insecticide.

Formulations

A. Emulsions

These insecticides are liquids. They have to be mixed with water, turning it milky. Emulsions are generally not used inside buildings. They are applied outdoors to both plants and foundations. Emulsions in

concentrated form are dangerous if spilled on clothing and skin. Wash with soap and water immediately after spilling on the skin. Change clothing.

B. Solutions

These insecticides are liquids which resemble emulsions. **They differ from emulsions in that they are used as bought and are not mixed with water.** Solutions are made with refined (deodorized) kerosene or other similar materials, plus an insecticide. They are used indoors to control household insects. They cannot be applied to plants because of the severe injury they produce. Solutions, like emulsions, are dangerous if spilled on clothing and skin. Wash with soap and water immediately after spilling on the skin. Change clothing.

C. Wettable Powders

These insecticides are similar to dusts. (See paragraph D below.) They contain, however, a higher percentage of chemical than dusts do. For some insect control purposes, wettable powders are used as bought instead of dusts. However, wettable powders are more often mixed with water and applied as sprays. These

sprays are seldom used indoors, but they are valuable for outdoor application. Avoid breathing or getting wettable powders on the skin by using masks and protective clothing.

D. Dusts

Dusts are dry powders which normally contain a lower percentage of insecticide than do wettable powders. Dusts are used as bought. **They are not mixed with water.** Use them both indoors and outdoors on those insects against which they are effective.

E. Baits

Baits contain at least two materials. One is an insecticide, **and** the other is a carrier for the insecticide. In some cases the carrier may also serve to attract insects. (For instance, the sweetening material in ant baits.) You can buy several types of ant baits. Use according to directions on the label. Baits are poisonous. Avoid placing them where children can get at them.

F. Aerosols

Aerosols are liquids under pressure. When released from the containers, some kinds form a gas, others produce a spray. Gas producing kinds are for flying insects (such as flies). Liquid types are for those insects that crawl or run on floors (such as ants). Choose to fit your needs.

G. Vaporizers

Vaporizers are electrical heating units that melt lindane and DDT into vapors. These vapors kill insects by spreading through the air in buildings. Vaporizers should not be used for buildings where children live, where people work for more than 8 hours, or where people sleep. Since motels, hotels, and tourist homes are used primarily as sleeping quarters, the use of vaporizers during the night is very undesirable. If you use vaporizers during the day, ventilate all treated sleeping areas thoroughly before guests occupy the rooms.

H. Repellents

These are chemicals used to prevent insect bites, especially those of mosquitoes, no-see-ums, black flies, and others. You get control only when you apply repellents before exposure to these insects. Not everyone will get the same amount of protection from repellents. You may have to try several different ones. Some of the

better repellents contain either dimethyl phthalate, indalone, Repellent 612, or mixtures of these materials. A new repellent is diethyl-toluamide.

Apply repellents to your skin and clothing. Follow the instructions on the package.

I. Colored Lightbulbs

Although not insecticides, colored lightbulbs can help reduce the annoyance of night-flying insects. Colored bulbs do not repel insects, but they are less attractive to insects at night than are white bulbs. Use yellow bulbs around buildings where night-flying insects gather. Whatever you do, avoid white bulbs over office doors and entrances to cabins or motels, or in similar places around other buildings.

The Insecticides

Descriptions and formulations of 12 insecticides and miticides suggested for various insect, mite, and spider control problems follow.

1. Aramite: This material is effective against clover mites. Aramite is destroyed by sunlight; in hot, dry weather, it is not effective as long as in more moderate weather. For best results, carefully spray foundations, grass, and soils around buildings.

Aramite is sold in two forms. The following table lists these formulations:

No.	Aramite formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
1a	15% wettable powder	2 pounds	2 tablespoons
1b	3% dust (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR CLOVER MITE CONTROL. See Section I.

Warnings:

- 1. Avoid breathing Aramite sprays and dusts.
- 2. If spilled on the skin, wash off with soap and water.
- 3. Avoid contact with eyes.
- 4. Read the label on the package. Follow the directions.

2. Chlordane: This insecticide is a chlorinated hydrocarbon somewhat related to DDT. It is available for insect control in four forms.

No.	Chlordane formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
2a	40% wettable powder	2 pounds	2 tablespoons
2b	72% emulsion	1 pint	1 teaspoon
2c	5% dust (Use as bought)	_____	_____
2d	2% solution (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR EACH INSECT. See Section I.

Warnings:

1. Inside buildings, apply chlordane to small areas only (such as baseboards). Do not apply to entire rooms or buildings.
2. Outdoors, avoid heavy applications to tender flowers and shrubs, especially when using chlordane emulsions.
3. Avoid breathing chlordane sprays or dusts.
4. If emulsions or concentrated wettable powders are spilled on the skin, wash immediately with soap and water.
5. Limit treatments, as much as possible, to walls, foundations, and areas near buildings.
6. Soak down lawn applications before allowing children in the area.
7. Read the label on the package. Follow the directions.

3. DDT: DDT is a chlorinated hydrocarbon. Also in this group of chemicals are chlordane, dieldrin, methoxychlor, and other similar materials. Remember that DDT residues last a long time. DDT is available in four formulations:

No.	DDT formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
3a	50% wettable powder	3 pounds	3 tablespoons
3b	25% emulsion	1½ pints	1½ teaspoons
3c	5% or 10% dust (Use as bought)	_____	_____
3d	5% solution (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR EACH INSECT. See Section I.

Inside buildings use DDT solutions (3d) or dusts (3c). Outdoors, use wettable powders (3a), dusts (3c), or emulsions (3b) where suggested.

Warnings:

1. Avoid using oil-type DDT insecticides on asphalt floor coverings.

2. Avoid applying DDT solutions to house or garden plants.
3. Do not apply DDT around food.
4. Avoid using DDT where children can get into it.
5. Do not use DDT in oil (kerosene) around open flames.
6. Do not use DDT on cats.
7. Do not apply DDT to creeks, rivers, ponds or lakes containing fish.
8. Read the label on the package. Follow the directions.

4. Dieldrin: This insecticide is a chlorinated hydrocarbon very similar to chlordane and is used in the same manner. Dieldrin is available for insect control in four forms:

No.	Dieldrin formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
4a	50% wettable powder	1 pound	1 tablespoon
4b	15% emulsion	3 pints	3 teaspoons
4c	1% dust (Use as bought)	_____	_____
4d	½% solution (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR EACH INSECT. See Section I.

Warnings:

1. Inside buildings, apply dieldrin to small areas only (such as baseboards). Do not apply to entire rooms or buildings.
2. Outdoors, avoid heavy applications to tender flowers and shrubs, especially when using dieldrin emulsions.
3. Avoid breathing dieldrin sprays or dusts.
4. If emulsions or concentrated wettable powders are spilled on the skin, wash immediately with soap and water.
5. Limit treatments, as much as possible, to walls and foundations.
6. Soak down lawn applications before allowing children in the area.
7. Read the label on the package. Follow the directions.

5. Lindane: This material is a chlorinated hydrocarbon related to DDT. Lindane is not widely used as an insecticide on fruits and vegetables because it may cause off-flavors (chemical taste). However, this is no problem when used outdoors to control insects described in this circular. Lindane is available in three formulations:

No.	Lindane formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
5a	25% wettable powder	1½ pounds	1½ tablespoons
5b	20% emulsion	1 pint	1 teaspoon
5c	1% dust (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR EACH INSECT. See Section I.

Warnings:

1. Avoid breathing lindane dusts and sprays. People with sinus trouble may find this material especially annoying.
2. Wash off concentrated liquids and powders immediately and thoroughly when they are spilled on the skin.
3. Use lindane mainly outdoors. Excessive use indoors may create unpleasant odors.
4. Do not store or use this material where children can be harmed by it.
5. Read the label on the package. Follow the directions.

6. Malathion: Malathion is a phosphate-type insecticide. In this circular, malathion is suggested primarily for control of flies and clover mites. It is available in four formulations. Formulations 6a and 6b in the following table are the same, but they are used in different amounts for various insects and mites.

No.	Malathion formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
6a	25% wettable powder	33 pounds	¾ pound
6b	25% wettable powder	3 pounds	3 tablespoons
6c	50% emulsion	1 pint	1 teaspoon
6d	5% dust (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR EACH INSECT OR MITE. See Section I.

Warnings:

1. Avoid breathing malathion sprays or dusts.
2. If emulsions or concentrated wettable powders are spilled on the skin, wash immediately with soap and water.

3. Limit treatments, as much as possible, to infested areas.
4. Read the label on the package. Follow the directions.

7. Methoxychlor: This insecticide is a chlorinated hydrocarbon closely related to DDT. Methoxychlor differs from DDT in being less dangerous to use; in many cases, it is also less effective. However, because it is quite safe to use, methoxychlor is suitable for insect control around buildings. It is available in three formulations:

No.	Methoxychlor formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
7a	50% wettable powder	4 pounds	4 tablespoons
7b	5% or 10% dust (Use as bought)	_____	_____
7c	5% methoxychlor plus ¼% pyrethrum plus 1% piperonyl butoxide (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR EACH INSECT. See Section I.

Methoxychlor is used primarily with pyrethrum in liquid formulations (solutions) for control of household insects. See formulation 7c in the above table.

Warnings:

1. Avoid using oil-type methoxychlor insecticides on asphalt floors.
2. Liquid combinations of methoxychlor and pyrethrum (solutions) are not safe to use on house or garden plants.
3. Read the label on the package. Follow the directions.

8. Ovex: This material is a long-lasting miticide. It has very little value against insects. Ovex kills both mites and their eggs. **Dogwood, flowering crabs, holly, hardy privet, hawthorn, certain varieties of roses, and barberry are quite sensitive to ovex.** Use it with caution on these plants.

You can buy ovex in two forms for control of clover mites. The following table lists the formulations:

No.	Ovex formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
8a	50% wettable powder	1 pound	1 tablespoon
8b	5% dust (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR CLOVER MITE CONTROL. See Section I.

Warnings:

1. Avoid inhaling dust or spray mists.

2. This miticide may cause skin irritation if it comes in contact with the hands, face, and body.
3. If ovex is accidentally spilled on the skin, wash it off immediately and thoroughly with soap and water.
4. Read the label on the package. Follow the directions.

9. Pentachlorophenol: This chemical is one of the phenol compounds. It is considered 100 percent effective as bought. **HOWEVER, WHEN TREATING WOOD FOR INSECT CONTROL, DILUTE AS FOLLOWS:**

Pentachlorophenol	5 parts
Fuel oil (No. 2)	95 parts

A pentachlorophenol mixture of this kind is a solution. Apply it with a brush or a compressed air sprayer. Pentachlorophenol can be bought as a 5 percent material ready to use without further dilution.

Warnings:

1. Protect the skin on both hands and face. Use oil-resistant rubberized gloves when applying this material.
2. Avoid application of pentachlorophenol to flowers, shrubs, or trees.
3. Do not apply pentachlorophenol near open flames and electric sparks. It is flammable.
4. Have plenty of ventilation when using pentachlorophenol.
5. Because pentachlorophenol has a strong odor, avoid using it where this would be objectionable, especially around food.
6. Read the label on the package. Follow the directions.

10. Pine oil: This material comes mainly from pines. It has limited use as an insecticide against powder-post beetles. To treat furniture that is to be painted, use it in its original form. Apply freely with a brush and allow to dry thoroughly before finishing the wood with paint or varnish.

Warnings:

1. Do not use pine oil around open flames or electric sparks.

11. Pyrethrum: Pyrethrum is made from the flowerheads of several species of chrysanthemums. It is one of the safest insecticides known. However, when used alone, it is not effective very long. In recent years,

pyrethrum has been mixed with piperonyl butoxide and other materials which make it effective longer.

For most household uses, pyrethrum is combined with piperonyl butoxide and methoxychlor, with piperonyl butoxide and DDT, or with piperonyl butoxide and DDD (TDE), to form liquid-type insecticides. Use them primarily inside buildings; **do not mix them with water**. Four pyrethrum combinations with other materials follow:

No.	Pyrethrum*	Piperonyl butoxide	Methoxychlor	DDT	DDD
11a	1/10%	10%			
11b	1/10%	10%	5%		
11c	1/10%	10%		5%	
11d	1/10%	10%			5%

*USE ONLY AS SUGGESTED FOR EACH INSECT. See Section I.

Warnings:

1. When pyrethrum is combined with insecticides like DDT, remember the dangers of the other materials.
2. Avoid applying pyrethrum liquid insecticide combinations to house and garden plants.
3. Avoid applying oil-type pyrethrum sprays to asphalt floors.
4. Read the label on the package. Follow the directions.

12. Rotenone: This material is an insecticide made from the roots of plants belonging to the pulse (pea) family. Rotenone is not very dangerous to handle since it is relatively nonpoisonous. It has one important drawback—it deteriorates rapidly and, after a few days, loses much of its insecticidal strength.

Rotenone comes in four forms. However, rotenone emulsions are not as effective as its wettable powders or dusts. The following table lists four common rotenone formulations:

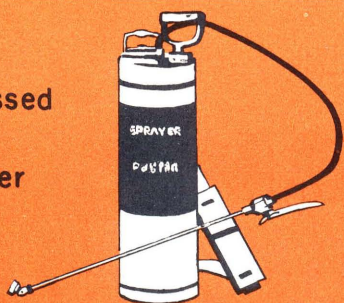
No.	Rotenone formulations*	Amount to 100 gallons of water	Amount to 1 gallon of water
12a	4% wettable powder	4 pounds	4 tablespoons
12b	5% wettable powder	3 pounds	3 tablespoons
12c	1% liquid concentrated	1 pint	1 teaspoon
12d	3/4% or 1% dust (Use as bought)	_____	_____

*USE ONLY AS SUGGESTED FOR EACH INSECT OR MITE. See Section I.

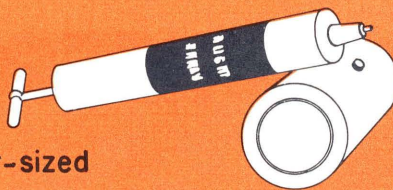
Warnings:

1. Read the label on the package. Follow the directions.

**Compressed
Air
Sprayer**



**Quart-sized
Sprayer**



Aerosol



SECTION III

Equipment

Choose equipment well and use it carefully for insect control around resort property. Types of equipment and their use are given below.

Compressed air sprayer

The water capacity of a compressed air sprayer is usually 3 to 4 gallons. Air is pumped into the tank, thus forcing the spray out when the nozzle is opened. A compressed air sprayer is ideal for outdoor application of wettable powders and emulsions. Its use indoors is limited if a lot of water is used with the insecticide. Agitate the sprayer when you use wettable powder.

Quart-sized sprayer

The quart-sized sprayer is a compressed air type. Air must be pumped continuously into this sprayer while it is in use. The quart-sized sprayer is satisfactory for applying emulsions and solutions but not for wettable powders. It can be used both indoors and outdoors for treating small areas. (NOTE: Where higher pressure is needed for good application, this type of sprayer has limited use.)

Rotary duster

The rotary duster is operated by a handcrank. Continuous cranking is necessary while it is in use. A duster of this type is limited mainly to outdoor use.

Quart-sized duster

Air must be pumped constantly into this duster while in use. It can be used for small areas both indoors and outdoors. However, it is not very practical for large areas.

Power sprayer or duster

Power-driven sprayers or dusters are best for treating large areas or where continuous pressure is needed.

Aerosol

Aerosols are liquids under pressure. When released from the containers, some kinds form a gas, others produce a spray. Gas producing kinds are for flying insects (such as flies). Liquid types are for those insects that crawl or run on floors (such as ants). Choose to fit your needs.

Paintbrush

A paintbrush can be used to apply insecticide solutions to baseboards, screens, and other similar areas inside buildings. A light film is usually sufficient.

All types of insecticide application equipment have faults as well as good features. Careful study of your insect control jobs will help you buy and use equipment effectively.

OTHER REFERENCES

Besides the references already listed, you can get more information on the control of insects affecting your business.

Bulletins and leaflets on specific problems can be bought from the Superintendent of Documents, Washington 25, D. C. Bulletins and mimeographed materials are available at the Bulletin Office, Michigan State University, Box 231, East Lansing, Michigan. Single copies of most of this material are free. Your county agricul-

tural agent also has literature from Michigan State University and the federal government.

A good reference book is Metcalf and Flint's **Destructive and Useful Insects**, 3rd edition, McGraw Hill Book Co., New York. Another book is Mallis' **Handbook of Pest Control**, 3rd edition, MacNair-Dorland Company, 254 West 31st St., New York 1, N. Y. These publications are available in libraries.