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# IDAHO RECOMMENDATIONS FOR INSECT CONTROL

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DEPARTMENT OF ENTOMOLOGY

## *How to Save Time in Using This Bulletin*

Only the insects of economic importance in Idaho are discussed in this bulletin.

If you know the common name of the pest on which you wish information, it can be readily found alphabetically.

If you don't know the name of the pest, turn to page 68 where you will find an alphabetically arranged insect-host list. Check for the type of damage and the description of the pests which attack your particular crop or animal and determine the insect in question.

Because of the large number of insects involved, only a brief description of the pest, its damage and its control are given.

Further information concerning any pest may be obtained by writing the Entomologist, University of Idaho, Moscow, Idaho.

A list of accepted common and scientific names is given on pages 64 to 67 in case you wish to study other literature on any pest mentioned here.

## *Use of Insecticides*

A brief discussion of all insecticides recommended for insect control will be found on pages 60 to 63.

There is no "one-shot" insecticide. No one control measure will eliminate all insect pests. Know the insect you wish to control. When buying and using insecticides, read *all* the label on the package. What type of insecticide is it? How much killing agent does it contain? What precautions are necessary in its use?

Use only reputable brands well labeled. Use only the needed amount of insecticide—*do not waste*.

# Idaho Recommendations For Insect Control

By

H. C. MANIS AND R. W. PORTMAN\*

**ALFALFA CATERPILLAR.** The adult of this caterpillar is a butterfly with the undersides of the wings colored a solid sulphur yellow. The upper sides of the wings are yellow bordered with black. The larvae, when young, are dark brown and then change to green. A narrow white stripe, through which runs a fine red line, occurs on each side of the body of the caterpillar. The larvae feed upon the foliage of alfalfa.

**Control:** Spray or dust as recommended for alfalfa weevil, or cut the alfalfa as short as possible and remove the hay.

**ALFALFA LOOPER.** The color of the larvae varies from cream to yellowish-green and dark green. Fully grown larvae are about 1 inch long and crawl in a looping fashion. They feed on various weeds and crop plants, including alfalfa, rarely becoming numerous enough to cause serious injury.

**Control:** Infestations of importance usually develop on the first crop of alfalfa a short time before the date for cutting. The most practicable means of control is to cut the first crop as soon as damage starts to become severe. Cure and remove the hay from the field as soon as possible.

**ALFALFA WEEVIL.** The adult is a dark brown beetle  $\frac{3}{16}$  inch long, with a moderately long snout which points downward from the underside of the head. Fully grown larvae are about  $\frac{1}{4}$  inch long. The color of the larva varies from dingy yellow, when very young, to light green when mature. Larvae are readily recognized by a faint white stripe down the middle of the back and by a black head. They destroy the tips of first crop of alfalfa or, when infestations are heavy, defoliate the plants as well as retard the growth of the second crop.

**Control:** When injury is severe the first crop should be sprayed or dusted. The spray is prepared by adding 2 pounds of 50 percent DDT or chlordane wettable powder to 100 gallons of water and is applied at the rate of 100 gallons per acre. A 5 percent DDT or chlordane dust is used at the rate of 20 pounds per acre. The treatment should be made as soon as the tips of the plants have a general ragged appearance. Treatment of the first crop prevents further damage to both the first crop and to the second crop. Present available information indicates that there is no danger to the health of livestock when they are fed forage having normal

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trees before the insects have reached maturity, removing and burning the bark and slash and allowing the trunks of the trees to dry.

**BEAN CUTWORM.** The smooth, shiny larvae are pinkish-brown in color. Mature larvae are fully  $1\frac{1}{2}$  inches in length. During the daytime the worms rest in a curled position underneath clods or leaves. At night they climb the bean plants and feed on the pods and developing seeds. This cutworm will feed on several varieties of green beans and on large lima beans but seems to prefer pintos. Most injury occurs when vines are heavy and in fields that have sandy soil.

**Control:** This cutworm can be readily controlled by applying 5 percent DDT dust at the rate of 20 pounds per acre. Bean fields should be checked closely during the first two weeks of August and the dust applied as soon as any injury to pods is noticed.

**BED BUGS.** Bed bugs are widely distributed in Idaho. Their wingless bodies are ovate and very flat and reddish brown in color. Ordinarily they are found only in dwellings of man but have been known to infest chicken houses.

**Control:** Complete eradication is obtained by the application of DDT or chlordane dusts or sprays. The most satisfactory spray is one containing 5 percent DDT or chlordane in highly refined oil. This can be used to spray mattresses, bedsteads and walls. Dusts containing 5 percent DDT or chlordane can be used in place of the spray if preferred.

**BEET LEAFHOPPER.** This sucking insect is only about  $\frac{1}{8}$  inch long when fully grown and in the spring is pale or yellowish-green in color. It feeds on sugar beets and related plants, on tomato, squash, beans, spinach and many other plants. It winters in the adult stage. The insect breeds on mustards, Russian thistle and other plants in desert areas, abandoned dry farms and waste places from whence the adults migrate to beet fields during the spring and early summer. It transmits a disease known as curly-top. The size of the population and the severity of the disease vary from year to year, the variation depending to a large extent on climatic and native host plant conditions.

**Control:** The only practical method of protecting plants from the disease carried by this leafhopper is the use of resistant strains where they are available. Tomatoes may be grown under covers until they are large enough to withstand the effects of the disease. Growing two plants in each hill will also help. For details on making and using covers see your county extension agent or write to the Idaho Agricultural Experiment Station, Moscow, Idaho. DDT dusts and sprays are effective in controlling the beet leafhopper but are not practical from the standpoint of curly-top control.

**BEET WEBWORM.** The moth is slightly more than  $\frac{1}{2}$  inch in length and when at rest, with the wings folded over the body, is triangular in outline. The moth is delicate gray or brown. When dis-

turbed it takes wing, making jerky, zigzag flights. Eggs are pearly white or yellowish, flat, about the size of a small pinhead and are laid on the under leaf surfaces in rows, often with the eggs overlapping. Larvae vary from light green to dark green and have a characteristic darker line down the middle of the back with a row of dark circles on either side. When fully grown they are about  $\frac{3}{4}$  inch long. There are two generations annually. They winter in the pupal stage in the soil and the moths appear in the latter part of May or early June. Larvae are most abundant from the last of June to about the middle of July. When abundant, they completely defoliate sugar beets and other related plants as well as alfalfa and many other cultivated plants.

**Control:** Webworms breed on many kinds of weeds, especially lamb's-quarter and Russian thistle. These weeds should not be allowed to grow near or in fields where beets are planted. Beets should be inspected often and sprayed or dusted as soon as eggs or tiny larvae are found on the under surfaces of the leaves in June. Spray infested fields thoroughly with lead arsenate or calcium arsenate in water at the rate of 8 pounds per acre. To the spray add a spreader at the rate of  $\frac{1}{2}$  pound to each 100 gallons of liquid. The spreader greatly increases the adherence of the liquid to the beet foliage. Paris-green may be used at the rate of 4 pounds per acre. A practical means of control is to use hand or power dusters and apply calcium arsenate dust diluted with 3 pounds of hydrated lime or diatomaceous earth to 1 pound of poison at the rate of from 15 to 20 pounds of the mixture per acre. Dusting has the advantage of using, cheap, simple equipment. Calcium arsenate is low in cost, and hand dusters can be put into operation very quickly. DDT and chlordane sprays and dusts are very effective if properly applied. *It is imperative that control be obtained early before damage to beets occurs.*

**BIRCH SKELETONIZER.** This insect attacks most of the species of birches and alder. The moth is a tiny one with a wing expanse of about  $\frac{3}{8}$  inch, bright brown in color and the forewings crossed with three diagonal silvery bars. The head is white. The larvae are about  $\frac{1}{4}$  inch long, slender, and green in color. The larvae feed on the lower surface of the leaves.

**Control:** It is attacked by many species of parasites and therefore control is seldom necessary. Lead arsenate may be applied at the rate of 4 pounds in 100 gallons of water when injury becomes apparent.

**BLACK CHERRY APHID.** This large, shiny, black plant louse curls terminal foliage of cherry trees and excretes a sticky honeydew on leaves and fruit. It winters in the egg stage on the trees. Eggs hatch about the time buds burst in the spring. There are several generations annually on cherry trees.

**Control:** Spray with nicotine sulphate or pyrethrum extract,  $\frac{3}{4}$  pint, and dormant-type oil emulsion, 1 gallon to 99 gallons of water, just as the buds are breaking, or add the nicotine sulphate or pyre-

thrum extract to the dormant oil or lime-sulphur sprays. Parathion and tetraethyl pyrophosphate sprays give effective control of this aphid when used at the concentration recommended for control of orchard mites.

**BLACK FLIES.** Black flies, or punkies as they are often called, are sometimes severe pests of horses and mules. These insects breed in streams and spend the entire larval period in swiftly running water. The adults emerge from the water in large numbers to attack animals.

**Control:** No practical control is known.

**BLACK PEACH APHID.** This plant louse winters on the roots and migrates to the twigs about the time buds are swelling. Adults are shiny black; young are reddish brown.

**Control:** Spray with 40 percent nicotine sulphate as for "apple aphid" as soon as the insect is observed on the tips of the twigs or on foliage.

**BLACK VINE WEEVIL.** This snout beetle is about 5/16 inch long, brownish black in color. The white, legless larvae are about 3/8 inch long. They live in the soil and feed on the roots of strawberry and many other plants.

**Control:** The same control measure as recommended for the strawberry root weevil is effective, but the bait should be applied just after the date when berries from annual varieties are all harvested.

**BLACK WIDOW SPIDER.** The black widow spider is more poisonous than any other spider found in the United States. Painful and serious systemic disturbances may result from its bite but very few cases of death due to the attack of the spider have been recorded. The female black widow spider is entirely black and shining on the upper surface of the body. On her underside she usually has one or more red spots near the posterior tip of the abdomen and an hour-glass shaped red or orange mark on the lower central part of the abdomen. The immature spiders and adult males usually have yellowish markings on the upper side of the abdomen. The males are smaller than the females.

**Control:** The black widow spider is widely distributed in nature and, therefore, its eradication is impossible. The removal of materials which harbor the spiders is recommended. Spray the places where the spiders are found. Use 4 pounds of 40 percent chlordane wettable powder in 100 gallons of water. Undiluted creosote oil can also be used. Creosote oil kills the spiders which it strikes and repels others. The spiders and their eggs may be crushed and thus eliminate a mild infestation.

**BLISTER BEETLES.** Three species are sometimes injurious to cultivated crops, especially near the margins of fields. The spotted blister beetle is the most common. It is from 1/2 to 3/4 inch long, of general gray appearance with small black spots. The ash-gray

blister beetle, somewhat smaller than the spotted blister beetle, is uniformly gray in color. Nuttall's blister beetle is green or purplish blue, varying from about  $\frac{5}{8}$  inch to  $1\frac{1}{8}$  inches long. Larvae live in the ground, some of them feeding on grasshopper egg masses, and infestations usually occur in areas where grasshoppers have been numerous.

**Control:** Control is not often necessary, but occasionally it pays to prevent injury especially around the edges of sugar beet, alfalfa, and potato fields. Dust the infested plants and beetles thoroughly with a 5 percent DDT dust. A 1 percent rotenone dust is also effective.

**BLOW-FLIES.** This group of flies includes the so-called blue-bottle, greenbottle, flesh, and black blow-flies. They are moderately large flies varying in color from light gray to black. Some species are metallic green or blue. The larvae or maggots are primarily scavengers in habit, feeding on dead animals, garbage, excrement and other refuse. Three species are known to infest the soiled wool of sheep. These are commonly known as wool maggots.

**Control:** All dead animals, garbage, and other refuse should be destroyed by burning or burying. Manure should not be allowed to accumulate. Sanitation will help to prevent a buildup of blow flies. Spray all buildings with DDT or lindane as for the control of the house fly and, in addition, spray all nearby shade trees and shrubs where blow flies tend to congregate.

**BOXELDER BUG.** This insect is about  $\frac{1}{2}$  inch in length, black in color with red markings. It sucks the sap from boxelder trees. When this bug is abundant, it frequently becomes a nuisance in dwellings.

**Control:** When bugs collect in numbers on buildings or on trees they may be killed by spraying with a mixture containing 4 pounds of 50 percent DDT or 40 percent chlordane wettable powder in 100 gallons of water.

**BRONZE BIRCH BORER.** This is a flatheaded borer which is often a serious pest of birches and especially of the white or paper birch. The first symptom of attack is a browning of the tips of the upper branches. Death of the tree usually follows. The larvae are about  $\frac{1}{2}$  inch long, white, and quite slender with a slight enlargement near the anterior end and with two brownish projections near the posterior end. The adults are greenish-bronze beetles with rather blunt heads and slender, pointed bodies. The larvae bore in the inner bark and the sapwood of the host.

**Control:** During the winter cut out and burn all infested parts of the tree.

**BROWN MITE.** The brown mite or clover mite is commonly found on prunes and sometimes does serious injury. This species is distinguished from the European red mite by its rusty brown color, larger size, and flattened back. The two front legs are much longer than the others and extend straight out in front. The mites

pass the winter in the egg stage and lay the summer eggs on the leaves. The eggs are bright red, spherical, and smooth, although when highly magnified appear to be lightly dusted with a fine granular substance. With the naked eye they cannot be distinguished from the red mite egg. On hatching in the spring, the mites attack the developing fruit buds and, when infestations are heavy, will so injure the buds and blossoms that much fruit fails to set. The foliage may be injured during the spring and early summer but usually not later since the mites decrease rapidly in numbers with the arrival of high temperatures.

**Control:** Control of this mite in orchards is the same as that recommended for the control of European red mite. In lawns and on field crops this mite can be controlled by the application of dusting sulphur at the rate of 25 pounds per acre.

**BULB MITE.** This white, eight-legged creature is about  $1/32$  inch long. It is usually found in colonies on roots or bulbs or in decaying vegetable matter, always away from the light. It injures many kinds of bulbs and breeds continuously in greenhouses or wherever moisture and temperature are high.

**Control:** Plant bulbs on ground that has been kept well aerated and cultivated and free from decaying vegetable matter. Burn all soft or decayed bulbs. Store bulbs at a temperature of about  $35^{\circ}$  F. Before planting, immerse all infested bulbs for 10 minutes in 40 percent nicotine sulphate,  $2\frac{1}{2}$  teaspoonfuls to 1 gallon of water at a temperature of  $110^{\circ}$  F., or in a 2 percent formalin solution for the same time and at the same temperature.

**CABBAGE APHID.** These dark green or bluish plant lice, covered with a powdery secretion, sometimes become exceedingly abundant on the under sides of leaves of individual cabbage plants. From these they later spread to other plants in the field.

**Control:** When fields are generally infested dust the entire area as soon as the aphids are observed. Use 1 to 3 percent tetraethyl pyrophosphate dust at the rate of 30 pounds per acre. Treating in late season is usually unsatisfactory and is unnecessary if early control is maintained.

**CABBAGE CURCULIO.** These are chunky, ash-gray weevils, about  $1/8$  inch long with short snouts. They overwinter as adults in the fields, in the soil and underneath duff. The adults appear in April or May and feed on the leaves and stems of cabbage, turnip, rape, mustard, radish and related plants. The white, brown-headed grubs or larvae feed within the stems.

**Control:** This insect has never been a serious pest in Idaho. Light infestations have always been found associated with infestations of the cabbage seedpod weevil. No satisfactory control is known.

**CABBAGE MAGGOT.** Adults are gray flies resembling the house fly but are smaller. The flies deposit their eggs on the soil near the stems of the plants, and the maggots hatching from them in-



fest the stems of cabbage and cauliflower and the fleshy roots of radish and turnip. Maggots are cream colored.

**Control:** Apply 5 percent chlordane dust to the soil surface around the base of each plant. Make the application as soon as the plants are set out and repeat with a second and third application at 10- to 12-day intervals. A mixture containing 1 quart of 40 percent chlordane emulsion in 50 gallons of water is effective when applied to the hills. The mixture should be applied at the rate of about 4 ounces per plant.

**CABBAGE SEEDPOD WEEVIL.** This weevil resembles somewhat the cabbage curculio but is slightly smaller in size and grayish-black in color. The larvae, found only in the seed pods, are white and grub-like with light brown heads. The larvae feed on the developing seeds of turnip, rape, mustard, radish, and related plants. This insect overwinters in the soil in the adult stage. There is only one generation annually.

**Control:** Application of control measures should be made just before the seed field comes into full bloom. Best results have been obtained with a 1 percent gamma isomer benzene hexachloride dust applied at the rate of 30 pounds per acre. A second application may occasionally be necessary.

**CABBAGE WORM (Imported).** The cabbage butterfly is white and is frequently observed flying about cabbage plants. The yellow eggs are placed singly and on end on the under sides of cabbage leaves, nasturtium leaves, and other plants. The cabbage worm is light green and velvety in appearance, and when mature is about  $\frac{3}{4}$  inch long.

**Control:** Apply 5 percent DDT or chlordane dust when worms first appear. Control should begin as soon as larvae are first noticed and continued until heads begin to form. If necessary, 1 percent rotenone dust can be applied after the heads begin to form.

**CARPENTERWORM.** These pinkish or white larvae with brown heads sometimes completely kill trees. Mature larvae are about  $2\frac{1}{2}$  inches long. The large dark gray moths deposit their eggs in the early summer in cracks or crevices of bark or near wounds or the openings of old burrows. As soon as the young larvae hatch, they begin boring into the trees and feed and grow inside the wood for nearly 3 years. Injury is especially severe in the region of the main crotch on the trunks of cork elm trees.

**Control:** Cutting and burning trees in the winter kills the larvae and prevents the escape of moths to infest other trees. Larvae often may be dug out of the trunk by means of a sharp chisel and the wound then disinfected. Sometimes it is practicable to clean out the burrow as well as possible, force into it a small amount of calcium cyanide-linseed oil mixture, and plug the entrance with mud or putty. The mixture is made by stirring fine granular calcium cyanide into linseed oil until it has the consistency of thick paint.

Another method is to inject carbon disulphide into the burrows by means of a small oil can.

**CARPET BEETLES.** Woolen goods, carpets, and furs, and occasionally food materials are eaten by larvae of the carpet beetles. These larvae are dark brown and quite hairy. They are about  $\frac{1}{4}$  inch long when mature and sluggish in movement. The adults are small, blackish, hard-shelled beetles.

**Control:** See directions for control of the clothes moth.

**CATTLE BITING LOUSE.** Cattle biting lice do not feed on the blood but rather on the scales of the animal's skin. They cause the hair to become rough and spots may be entirely removed by rubbing the affected parts. These lice are found on the upper parts of the body in contrast to the position in which the sucking lice are found.

**Control:** Dust or spray the infested parts thoroughly with DDT, lindane, methoxychlor, toxaphene or chlordane. Use 5 percent DDT, 1 percent lindane, 5 percent chlordane, 10 percent toxaphene or 5 percent methoxychlor dust. Roughen the hair slightly to allow the dust to penetrate to the lice. Sprays should contain either 4 pounds of 50 percent DDT, 4 pounds of 40 percent chlordane, 4 pounds of 50 percent toxaphene, 4 pounds of 50 percent methoxychlor or 2 pounds of 25 percent lindane wettable powder in 100 gallons of water. Best results are obtained when the sprays are applied at a pressure of 400 pounds. Use only the methoxychlor dust or spray on milking animals.

**CATTLE GRUBS.** Cattle grubs are the larvae of two different flies, one known as the common cattle grub and the other as the northern cattle grub. They are first noticed in the cattle when bumps as big as the end of the thumb appear on the animals' backs during late winter or early spring. They are commonly known as cattle grubs in this stage. The bumps contain the larvae of the fly which have passed through the body of the cow to reach the back, and have therefore done their damage before they are noticed. The hairy flies, about as large as honeybees, chase the cows in the pasture while depositing their eggs on the hair of the lower extremities. The tiny larvae which hatch from these eggs burrow into the skin of the cow and migrate through the body to the back where the grubs form a cyst.

**Control:** Cattle grubs can be controlled only after they have cut holes through the skin. Treatment at this time serves to reduce the population of heel flies which would produce grubs the following year. Rotenone applied as a wash, spray, or dust is the most effective control. The wash is prepared by making a paste of 12 ounces of derris powder and adding this to 1 gallon of water. Apply this with a sprinkler jar and brush it in thoroughly with a stiff-bristled brush. A spray is prepared by adding  $7\frac{1}{2}$  pounds of finely ground derris root (5 percent rotenone) to 100 gallons of water. The spray should be applied with a power sprayer at a

pump pressure of 400 pounds. Commercial preparations of liquid rotenone can be used in place of the above materials for both the spray and the wash. Use as recommended by the manufacturer but do not add sulphur. A dust is made by thoroughly mixing 1 pound of finely ground derris powder with 2 pounds of pyrophyllite. The dust is applied from a shaker can and lightly rubbed in by hand. Animals should be treated two or three times at 30-day intervals starting 1 month after the first grubs are noticed in the back.

**CENTIPEDES.** These tiny centipedes feed on the tender roots of greenhouse plants and when numerous eat off the new growth as fast as it is formed. They also eat into the stems near the ground and into the roots, causing small wart-like growths and allowing the entrance of disease organisms.

**Control:** Control is extremely difficult. Care should be exercised to prevent introduction of centipedes in soil from out of doors or to prevent bringing them in with shipments of plants. The soil can be freed of an infestation by sterilizing with steam or heat. DDT and chlordane applied as dusts or sprays have given some degree of control.

**CHERRY FRUIT FLIES.** Flies are small, brownish and are distinguished by having dark bands at intervals across their wings. They emerge from the ground in June or July and fly about in the sun for a few days before beginning to lay eggs. Eggs are inserted through the skin into the flesh of the cherries. Larvae develop to maturity inside the cherries. The maggots are white and when mature are about  $\frac{1}{4}$  inch long.

**Control:** When following a dust schedule use 5 percent methoxychlor at 40 pounds per acre when flies first appear. Follow in 10 days with  $\frac{3}{4}$  percent rotenone dust and repeat every 7 days until after harvest. When following a spray schedule use 3 pounds of 50 percent methoxychlor wettable powder in 100 gallons of water when flies first appear. Follow in 10 days with a spray containing 3 pounds of 5 percent rotenone powder or  $1\frac{1}{2}$  quarts of rotenone extract in 100 gallons and repeat every 7 days until after harvest. The post-harvest treatment should never be left out of either schedule. Use 3 pounds of lead arsenate plus a sticker in 100 gallons of water and thoroughly cover the trees. Make the application as soon after harvest as possible.

Cherry fruit fly control is very effective if properly timed. Normally, the first flies begin to emerge the last of May. The most accurate timing can be obtained by using an ammonium carbonate bait trap. Make the first application as soon as flies begin to emerge and repeat at 7- to 10-day intervals through harvest. An application made immediately following cherry harvest is absolutely essential. Applications should be repeated following heavy showers. Treatment will kill the adult flies before they deposit their eggs. There is no known method of control after the eggs are laid. Trees adjoining cherry trees should also be treated. Allow

no cherries to remain on the trees after picking time. This prevents the escape of any maggots to reinfest the next year's crop. Maggots do not mature until after the date cherries should be harvested. Culls and waste fruits should be destroyed by burning or cooking.

**CHERRY WORMS.** Heavy infestations of slender, green caterpillars occur in cherry orchards during the harvest period. These caterpillars or larvae can be readily distinguished from fruit tree leafroller larvae by their green heads and shields. Eggs are deposited on the leaves in masses. The larvae are primarily leaf feeders. Many however, migrate to ripe cherries and make side entries or enter at the stem end. They hibernate as partially grown larvae in the soil and duff and migrate back to the trees in the spring to complete their development.

**Control:** Use a dust containing 5 or 10 percent DDT or a spray containing 4 pounds of 50 percent DDT wettable powder in 100 gallons of water. Apply to the trunk and the ground around the base of the tree prior to blossoming. A heavy application of  $\frac{3}{4}$  percent rotenone dust applied immediately before harvest will help reduce the infestation.

**CHICKEN LICE.** There are several species of lice attacking chickens. All but head lice may be controlled in the same manner.

**Control:** Use nicotine sulphate applied on perches either by painting or by a fine line poured from the can. Apply just before roosting time. Repeat in 2 weeks to kill the newly hatched lice. A 5 percent DDT dust on the fowls will control all species of lice. To apply, hold the fowl over a shallow pan and sift the powder through the feathers over all parts of the head and body.

**CHICKEN MITE.** These mites live in the cracks about the chicken house in the daytime and crawl upon the fowls at night or when nesting. The adults are  $\frac{1}{30}$  to  $\frac{1}{40}$  inch long, grayish in color, but when filled with blood are bright red to nearly black.

**Control:** Thoroughly clean the poultry house and spray it thoroughly with 8 pounds of 50 percent DDT wettable powder in 100 gallons of water. One treatment each year will control these pests.

**CHORIOPTIC MANGE OF HORSES.** Chorioptic mange or symbiotic scabies, commonly known as foot mange, is caused by a mite. It lives on the surface of the skin and produces lesions. The lesions of this mite are usually confined to the lower parts of the limbs around the foot and fetlock. The infested animals paw and kick and rub the infested foot with another foot or may try to bite the infested parts. Some of the hair comes out and the skin becomes hardened and thickened similar to sarcoptic mange.

**Control:** The treatment used for the control of sarcoptic mange on hogs is effective against this mite.

**CHRYSANTHEMUM GALL MIDGE.** The adult is a very small fly, resembling a mosquito in appearance except that its body is

yellowish or orange. Eggs are laid on tender shoots and new growth. When a maggot emerges from the egg it crawls over the surface of the leaf for a time, then eats into it causing a gall formation in which it continues to live and grow. Infestations are detected by the hard, blister-like galls on the leaves or stems.

**Control:** Pick and destroy infested leaves as soon as they are observed. Spray infested plants at intervals of about 10 days, using 1 teaspoon of 40 percent nicotine sulphate to  $\frac{3}{4}$  gallon of water in which has been dissolved a piece of soap the size of a large walnut.

**CICADAS.** Cicadas sometimes injure apple trees by laying their eggs in the small branches. In depositing the eggs, the female raises the wood beneath the bark until it extrudes in splinter-like pieces and the injury may so weaken the branches that they break off. These insects are commonly known as "locusts" and are readily identified by the shrill singing of the males on hot summer days.

**Control:** No control method is known.

**CLOTHES MOTH (Webbing).** The webbing clothes moth is a serious pest on substances made from animal hair, wool or feathers and annually causes heavy loss in woolen clothing, furs and upholstered furniture. The moth is light brown and scarcely  $\frac{1}{4}$  inch in length. It flits about in an erratic manner and but brief glimpses of it are had in the evening or at night. It avoids bright light. Moths deposit their eggs on substances which will later be used as food by the larvae. As soon as the eggs hatch the young larvae seek out protected places in the folds of wool and furs, or in the interior of upholstered furniture and immediately begin to feed. Fully grown larvae are somewhat less than  $\frac{1}{4}$  inch long with creamy white bodies and brown heads. Only the larvae cause damage.

**Control:** Spray the entire surface of all closet walls, particularly around the baseboards and edge of the floor, at 3-month intervals with 5 percent DDT in deodorized light mineral solvent. Sweaters and other woolens which are to be stored for several months in dresser drawers may be protected by spraying the drawers thoroughly with small amounts of 5 percent DDT spray. The garments also may be lightly dusted on both sides with 5 percent DDT dust. Furs may be lightly dusted with DDT. The powder can be easily shaken out before the furs are worn. Carpets and rugs can be treated with 5 percent DDT dust. Sprinkle the dust liberally under the carpet on top of the pad. When carpets or rugs are cleaned with suction cleaners, the DDT will not only protect the back of the carpet but will be pulled up slowly into the nap. DDT spray can also be applied to the surface of carpets and rugs. Upholstery can be treated in the same manner as carpets. The oils used in the DDT spray may be inflammable and the proper precautions should be taken to keep the spray away from fire or flame.

**CLOVER APHID.** Clover aphids are small green or pink plant lice that may become very abundant in clover blossoms. They secrete a sticky honey-dew that lowers the quality of the seed. They often greatly reduce the yield.

**Control:** Probably the best means of avoiding loss is to produce seed from the second crop. Clip the first crop when the infestation becomes heavy, remove the hay as quickly as possible and allow the field to remain without water until the plants are dry—about 10 days in good sandy loam soil. If the sun is hot and the ground dry, good control on second crop clover is attained. The aim is to clip the first crop as late as possible and yet be assured of maturing seed on the second crop.

**CLOVER BUD CATERPILLAR.** The adults are moths about  $\frac{1}{4}$  inch long and are dark brown in color. When the wings are folded, a crescent-shaped patch of silver scales is quite noticeable. The larva, or caterpillar, is about  $\frac{5}{16}$  inch long when fully grown. It ranges in color from white to green and has a buff-colored head. It feeds on the leaf buds and florets of alsike, ladino, white Dutch and red clover, destroying the leaves, floral parts and young seed pods. It is a native insect, infesting some of the wild clovers. It seems to prefer alsike clover to other varieties. It does not feed on alfalfa or sweet clover. It has caused damage in only the clover seed producing area of the Clearwater river drainage in northern Idaho.

**Control:** Heavy applications of DDT dust show some promise in the control of the larvae. No satisfactory control is known.

**CLOVER LEAF WEEVIL.** The adult weevil is about  $\frac{1}{4}$  inch long, light brown and has a prominent snout projection forward from the front end of the head. Eggs are inserted in punctures in the stems in autumn. Larvae are green, shading to pink at the rear end and are marked by a white line lengthwise of the middle of the back. Mature larvae are about  $\frac{1}{2}$  inch long. Hibernation takes place in both larval and adult stages. There is one generation annually. Adults and larvae eat notches in the margins of leaves.

**Control:** Control is rarely necessary. When infestations develop use the same control as recommended for the lesser clover leaf weevil.

**CLOVER ROOT BORER.** Tiny brown beetles and small cream-colored grubs bore into the roots of red clover forming tunnels, killing plants, and opening the way for entrance of disease organisms.

**Control:** The clover root borer is of little importance where stands are maintained for only one seed crop year. It is advisable to rotate land to other crops after one clover seed crop has been produced in areas where this insect is troublesome.

**CLOVER ROOT CURCULIO.** This beetle somewhat resembles the alfalfa weevil but is smaller, blacker and has a shorter and

broader snout. It is widely distributed in Idaho but has been of comparatively little importance, probably because of the rotation and irrigation systems followed.

**CLOVER SEED CHALCID.** Damage is caused by larvae of a tiny "fly" which eats out the interiors of forming seed. Eggs are deposited inside the seeds before they reach the "dough" stage. Infested seeds have tiny holes in them, and many of them are so light that they are blown out with the chaff at threshing time.

**Control:** Preventive measures give partial control, and if practiced generally by all growers over a large area would hold populations of the chalcid fly down so that severe damage would rarely occur. Destroy volunteer alfalfa and clover plants near seed fields in the spring and destroy late-seeding plants in the fall. Prevent infestation from chaff piles by feeding or burning them prior to the first of May. Thoroughly cultivate seed fields in the autumn to destroy shattered seeds by burying them to a depth of at least 2 inches. The practices outlined for the clover aphid also reduce chalcid fly injury. There is some indication that the application of DDT and other chlorinated hydrocarbons will give control if the application can be properly timed.

**CLOVER SEED MIDGE.** This is a very delicate insect resembling a mosquito, which deposits its eggs on the flower heads. Larvae are pink in color and feed inside the individual florets causing them to "blast" before seed is formed. Loss to clover seed producers in some of the warmer areas of Idaho is heavy during certain seasons.

**Control:** Pasture or closely clip the spring crop to prevent first brood larvae from becoming adults. Cut the first crop about 2 weeks before the larvae become mature. The procedure outlined for clover aphid offers some measure of prevention.

**CLOVER SEED WEEVIL.** This tiny, robust, elongate-oval beetle is grayish-brown in color. Its head is short and equipped with a long, narrow beak. It overwinters as an adult in clover fields and their margins and adjacent grassy and weedy areas. This insect prefers to feed on alsike and white Dutch clovers but will also infest ladino and red clovers. Most of the damage is caused by the larvae or grubs feeding on the developing seeds.

**Control:** No satisfactory control is known. Some degree of control has been obtained by the application of DDT and chlordane. Considerable experimental work is necessary, however, before definite control recommendations can be made.

**COCKROACHES.** Two species are troublesome in Idaho. The German, or common cockroach, is the smaller species, adults being about  $\frac{1}{2}$  inch long, light brown and marked lengthwise on the back with dark stripes. The oriental cockroach is about 1 inch long, dark brown or nearly black. Both species thrive in unsanitary surroundings or under conditions where they can find protection in dark, undisturbed areas.

**Control:** Make conditions for their breeding and protection as unfavorable as possible. Fill cracks around baseboards and cupboards with crack filler and putty. Prevent accumulation of grease, lint, or trash in dark corners and behind cupboards. Eliminate leaking pipes or drains which furnish moisture favorable for breeding. A 5 percent chlordane in deodorized solvent is effective when applied to walls, floors, and other surfaces in places frequented by roaches. Repeat the application if roaches reappear. Use 5 percent chlordane dust in place of the above material if you wish.

**CODLING MOTH.** The full-grown larvae are pinkish-white, have brown heads and are about  $\frac{3}{4}$  inch long. They overwinter under loose bark on trees, among prop piles, wood piles, boxes, and trash in or bordering orchards and in packing and storage sheds. There are from one to three generations annually in Idaho, depending on the location. Eggs are deposited on fruit or foliage.

**Control:** DDT is superior to any presently known insecticide for the control of codling moth on apples and pears. No calyx spray is necessary. Use 2 pounds of 50 percent DDT wettable powder in 100 gallons of water for the first cover spray. Apply prior to egg hatching. A second cover spray containing 1 pound of 50 percent DDT wettable powder in 100 gallons of water should be applied 20 days later. If necessary, a third spray at the same concentration as the first cover spray should be applied 20 days after the second treatment. The need for the second and third applications will depend on the degree of infestation, weather, and other factors. Minimum dosages and applications necessary for control should be used to minimize the build up of DDT in the soil. Do not apply DDT later than 30 days before harvest. The inclusion of a miticide in all DDT applications is usually necessary. Effective control is dependent upon thoroughness of application. The use of DDT for codling moth control may be expected to result in an increase of the population of woolly apple aphids which will in turn increase damage from perennial canker. Lead arsenate may be used by those wishing to avoid the complications arising from the use of DDT.

**COLORADO POTATO BEETLE.** Adults are plump, about  $\frac{3}{8}$  inch long, and are marked lengthwise on each wing cover by five black and five yellow lines. They hibernate in the soil during the winter. There are two generations annually, but only the first generation appears to be of economic importance in Idaho. Eggs are yellow or orange and are deposited in clusters on the under sides of leaves. Larvae are brick red with black spots on the back and have a "humped-back" appearance. They are about  $\frac{1}{2}$  inch long. Larvae and beetles feed on potato and related plants, often completely defoliating vines.

**Control:** Treat infested vines with a 5 percent DDT dust applied at the rate of 20 pounds per acre. Make the application soon after the larvae hatch and begin to feed in the spring and before they have caused appreciable injury.



**CONFUSED FLOUR BEETLE.** This insect feeds upon a variety of products, including grains, flour, starchy materials, and many other foods. The adult is an elongate, reddish-brown beetle about 1/7 inch long. The larvae are brownish white and somewhat flattened. All stages of the insect may be found in infested material at any time of year.

**Control:** The most practical means of protection is to keep all containers free of particles of grain, flour and other foods. Make sure that each time a new supply is placed in them that they are first cleaned out. Precaution should be taken that flour or other grain products do not collect beneath bins. A practical safeguard is to keep flour in the bag in the bin and keep the top of the bag rolled tightly shut. The insects cannot gain access through tightly woven sacking-cloth. An additional safeguard is to spray beneath and on the outside of bins and pantry shelves. When it is necessary to clean up an infestation in the house, infested foods should be destroyed or heated for a period long enough to insure their reaching a temperature of 140° F. This may be done by placing them in the oven. Bins and drawers may be washed with scalding hot water and then dried, or they may be heated over a stove or in an oven. After cleaning up an infested house, all surfaces should be sprayed with 5 percent DDT or chlordane in a deodorized solvent. Grain bins and storage elevators should be cleaned and treated before harvest. Old grain and seed should be removed and the bins and floors swept and then sprayed with 4 pounds of 50 percent DDT wettable powder in 100 gallons of water. Special care must be taken to spray behind bin linings and behind partitions. Fumigation of farm and commercial granaries and elevators is sometimes necessary. It is best to fumigate with a non-inflammable commercial fumigant such as ethylene dichloride-carbon tetrachloride or carbon disulphide-carbon tetrachloride mixture. Follow the directions of the manufacturer in applying these mixtures. For special instructions on the use of other fumigants write to the Idaho Agricultural Experiment Station, Moscow, Idaho.

**COOLEY SPRUCE GALL APHID.** The Cooley spruce gall aphid or the Douglas-fir aphid is grayish green or purplish blue and is covered with a white powdery substance. It passes the winter in the immature form clustered in crevices of the stems about the bases of the buds. As soon as tree growth starts in the spring, the aphids settle at the bases of the developing branch buds and cause the formation of the "pineapple" galls which stunt the growth of spruce trees and cause an unsightly appearance.

**Control:** Almost complete protection from gall formation is obtained by spraying the trees with nicotine sulphate 1 pint, hydrated lime or soap 4 pounds, and water 100 gallons. Laundry soap or soap chips 10 pounds in 100 gallons of water may also be used, or lime-sulphur, 1 gallon to 40 gallons of water or with dormant-type oil emulsion, 1½ gallons to 98½ gallons of water. Make applications in late fall or early spring.

**CORN EARWORM.** A large dusky-colored moth deposits eggs on the silks and larvae hatching from them eat into the ears. Larvae vary from yellowish green to dark green and when mature are about 1½ inches long.

**Control:** Satisfactory control can be obtained in home gardens or on small plantings by dusting corn ears with 5 or 10 percent DDT dust at 7- to 10-day intervals. The first application should be made about 4 days after the silks emerge. The application of DDT dust to commercial plantings offers some degree of control when 10 percent DDT dust is applied at the rate of 30 pounds per acre. Two or three applications will probably be necessary.

**COTTONY MAPLE SCALE.** This brown, oval, soft scale is found in the winter on the bark of maples and many other kinds of trees and bushes. In June the insects become covered with large masses of a white cotton-like substance beneath which the eggs are found. The heavily infested branches of trees may be killed or the leaves turned yellow.

**Control:** Spray with dormant-type oil emulsion at the rate of 4 gallons to 96 gallons water in the winter or just before the buds burst in the spring. A practical means of control on Virginia creeper and other ornamentals is to spray the vines with summer-type oil emulsion—1 part to 99 parts of water—when the young scale insects are unprotected. This is shortly after they hatch from the eggs, or usually the last of June or the early part of July.

**CURRANT APHID.** This plant louse, varying from yellowish to pinkish and dark green, winters in the egg stage on the twigs of the new growth. Eggs are glossy black. They hatch soon after the first leaves unfold. The aphids cluster on the tips, curling the leaves and causing them to turn red and drop.

**Control:** Spray as soon as aphids are noticed in the spring and before the leaves curl. Use 40 percent nicotine sulphate or pyrethrum extract, 1 teaspoon to ¾ gallon of water in which has been dissolved a piece of soap the size of a large walnut.

**CURRANTWORM (Imported).** The adult sawflies emerge when the currant leaves first unfold. At that time, they lay white, elongate eggs end-to-end in rows along the veins on the under sides of the leaves. Larvae are muddy green with black spots excepting in the last stage when they are uniformly light green. There are two generations annually. Larvae of the first generation do most of the injury. They pupate beneath leaves and trash. Leaves may be stripped from an entire plant.

**Control:** Spray the bushes thoroughly with lead arsenate 2 pounds to 100 gallons of water when fruit is beginning to set. If control is necessary after fruit is formed, use pyrethrum extract at the rate of 1 part to 400 parts of soapy water or a rotenone dust. A second spray of lead arsenate after the fruit is picked prevents late defoliation and reduces the infestation for the succeeding year.

**CUTWORMS.** These smooth, shiny, gray to black worms rest in a curled position in the daytime just below the surface of the ground. They feed mostly at night and cut the plants off at the surface of the ground. Some species, as the western army cutworm, migrate over the surface of the soil at night. Others climb plants at night to feed on foliage, such as on grape and prune. Adults are dusky brown or gray moths that fly at night and are the ones most commonly observed around lights in the summer-time.

**Control:** Scatter poisoned bran bait (directions for preparation are on page 62) around plants to be protected or sow it broadcast over the field. In the case of crops planted adjacent to weedy areas, the field margins may be protected from cutworm attack by scattering the poison bait over the surface of the ground in the area to be protected. Make applications just after planting time and before the young plants appear above the surface of the ground. Where cutworms are holding back the growth of alfalfa and irrigation water is available, control usually is obtained by flooding the field heavily. Poisoned bran mash is effective in alfalfa fields which cannot be heavily irrigated. Bait should be applied in the evening. For climbing cutworms spray or dust with DDT or chlordane.

**CYCLAMEN MITE.** The adult female cyclamen mite overwinters in the crowns of strawberries. It emerges in the spring at about the time plant growth starts. Newly emerged adults are pale-amber colored but darken as they become older. Infested plants are dwarfed, and the leaves appear to be held close together and near the ground. The general color is light green, almost yellow. Infested flowers and young fruits darken near the bases of the sepals and often turn black and die. The leaves are very small, their surfaces crinkled, rolled, and malformed. Discolored areas may appear before or after the leaves unfold and the spots turn brown and die.

**Control:** No satisfactory method of control of mites on plants in an established bed has been found. Plants to be set in new beds should be immersed in water heated to 110° F. for 30 minutes. The temperature should not vary more than 1 degree. The water should be agitated to insure uniform temperature throughout the treating tank. Strawberry beds should be rotated every 2 or 3 years.

**DIAMONDBACK MOTH.** The adult of this insect is a small, light gray moth. The tiny, green, tapering larvae riddle the leaves and spin light webs about themselves on the upper surfaces of the leaves. This species is only occasionally of sufficient importance to necessitate control. It attacks cabbage, turnips and practically all other cruciferae, and some ornamental and greenhouse plants.

**Control:** Follow the instructions given under "imported cabbage worm."

**DOUGLAS-FIR TUSSOCK MOTH.** The caterpillars, when fully grown, are about 1 inch in length and are decorated with brightly-

oil emulsion at the rate of 2 gallons to 98 gallons of water may also be used.

**EUROPEAN PEACH SCALE.** This brown, hemispherical scale adheres to the smaller branches. The insect under the scale sucks the sap and devitalizes the trees. This insect is of relatively little importance in Idaho.

**Control:** European peach scale is readily controlled by the dormant oil emulsion or lime-sulphur sprays used in the control of San Jose scale.

**EUROPEAN RED MITE.** The European red mite or fruit mite attacks deciduous fruit trees and is especially injurious to prune in southwestern Idaho. The mites cause injury by removing chlorophyll and sap from the leaves, reducing the vitality of the tree with a consequent reduction in size and quality of fruit, and a weakening of buds. The mites are very small, oval in shape and are a bright red to dark brownish red or orange. The eggs are bright red, spherical or onion shaped with a whitish stripe at the top. The winter is passed in the egg stage on the bark, especially on the spurs and around the smaller crotches which often appear red from the egg masses. In the spring the newly hatched mites migrate to the leaves where they feed and multiply rapidly during the summer, there being about six generations in a season. The eggs of the summer generations are laid on the leaves. This mite spins but very little webbing on the leaves.

**Control:** Control is obtained by killing the overwintering eggs with a dormant oil spray, using 4 gallons of dormant oil emulsion in 96 gallons of water. Should the dormant spray be omitted, control in the summer may be obtained by the application of parathion spray. Use 25 percent parathion wettable powder at the rate of  $\frac{1}{2}$  pound in 100 gallons of water. Increase the rate to  $\frac{3}{4}$  pound if only the 15 percent material is available. Three applications during the summer will probably be necessary. Parathion sprays should not be applied less than 30 days before harvest because of the possible residue. It is important to apply early applications of parathion for control since the mites become increasingly difficult to control as the population increases. Tetraethyl pyrophosphate has shown definite promise for the control of this mite. This material should be used with as much precaution as parathion.

**EYE-SPOTTED BUD MOTH.** The chocolate-brown larvae are about  $\frac{1}{3}$  inch long when mature. Larvae hibernate in small cocoons on the bark and in the spring eat the leaf and blossom buds, especially of prune. They frequently tie buds together with silk. Moths appear in mid-summer and deposit their eggs singly or in clusters on the under surfaces of the leaves. There is one generation annually.

**Control:** Spray with lead arsenate, 3 pounds to 100 gallons of water, just as leaves are showing green in the spring. Pay special attention to the tips of branches.

**FALL WEBWORM.** Fall webworms attack many kinds of fruit trees and native shrubs. Their presence is detected by loosely woven, dirty white webs which enclose the foliage on the ends of the branches. Webs enclose many pale yellow, black spotted, quite hairy caterpillars which feed upon the surface of the leaves. Webs are unsightly due to the presence of the black pellets of excrement of the larvae.

**Control:** Webs are readily removed by clipping off the terminal twigs which are enclosed in them and burning them. They may be burned out of the trees by the use of a kerosene-saturated burlap sack fastened to the end of a long pole. Spraying with lead arsenate or DDT or dusting with calcium arsenate controls them where infestations are extensive.

**FALSE CHINCH BUG.** They are small, brown to black, flat-bodied bugs that suck sap from the leaves. When numerous, they cause leaves to wilt, turn brown and become crisp. They usually attack cultivated crops only in weedy areas or after weeds in adjacent fields dry up following drought periods in the summer.

**Control:** Destroy weeds and do not plant crops susceptible to injury near waste or weedy areas. Plow under weeds the fall before fields are to be planted and destroy weeds in the early spring to prevent breeding of bugs which later migrate to cultivated crops. When hordes are migrating into cultivated crops they may be controlled by the application of 20 pounds of 5 percent DDT dust per acre.

**FALSE WIREWORMS.** These are yellow, shiny worms measuring about 1 inch in length at maturity. They destroy planted kernels and sprouts of dry-farmed wheat both in the early spring and the late fall. Adults are large black beetles readily recognized by their habit of "standing on their head" when disturbed. Adults feed on wheat, various grasses, and weeds. Adults emerge in August, winter in protected places, and deposit their eggs in the soil the following spring. Larvae hatch in May and continue to feed and grow in the soil until mid-summer of the following year when they pupate. It requires 2 years to complete the life cycle. A smaller species also occurs in dry-farmed areas and predominate in certain localities. Its life cycle is quite similar and it responds to the same control measures as those for the larger species.

**Control:** Beetles eat poisoned bran bait freely and are cheaply controlled by its use. See page 62 for preparation. Scatter the bait along fence rows, roadsides, among rocks and in waste places where beetles congregate. Make applications about September 15 on two successive years. The application of 20 pounds of 5 percent DDT or chlordane dust has given some promise as a control.

**FIREBRAT.** This insect lives in warm, moist places in dwellings and sometimes causes damage by eating paper products and book bindings. Adults attain a length of about  $\frac{1}{2}$  inch and are recog-

nized by two long antennae and three long appendages on the rear of the body. They move quickly.

**Control:** Use the same methods and materials recommended for cockroach control.

**FLEAS.** Adult fleas are very spiny, wingless insects, greatly flattened from side to side, with long legs fitted for jumping. They are light to dark brown in color. The slender, white larvae live in the bedding of animals where they feed upon any available organic matter. While cat and dog fleas usually are found on their respective hosts, they will also attack humans.

**Control:** Dust or spray dogs with DDT. The animals' sleeping quarters should be cleaned thoroughly and then treated with DDT. Use a 5 percent DDT dust or a spray containing 4 pounds of 50 percent DDT wettable powder in 100 gallons of water. Do not treat cats with DDT. For the control of fleas on cats use 1 percent rotenone dust applied at frequent intervals.

**FOLLICULAR MANGE MITES.** These mites are common on dogs and sometimes attack hogs. They live in the hair follicles. The skin becomes red and inflamed and small hard pimples, ranging in size from that of a pinhead to lumps as big as marbles, form and discharge a yellowish, cheesy pus.

**Control:** The same treatment as recommended for the control of sarcoptic mange mites on hogs is effective.

**FOREST TENT CATERPILLAR.** These caterpillars collect in dense masses on branches of trees. They are dusky brown with a fine yellowish-brown stripe down the back and on each side. They may attain a length of about 2 inches when mature. They often strip the foliage from native trees and from fruit trees. Their eggs are deposited in a complete ring around the smaller twigs and are closely cemented together. There is one generation annually.

**Control:** Spray with lead arsenate, 3 pounds to 100 gallons of water, or 4 pounds of 50 percent DDT wettable powder in 100 gallons of water.

**FOUR-SPOTTED TREE CRICKET.** This cricket closely resembles the snowy tree cricket but is found more generally on plants with pithy stems such as raspberries or grapes. Eggs are deposited through the bark and into the central pith and are laid in series. The life history is similar to that of the snowy tree cricket.

**Control:** In the spring, prune out canes containing eggs. Weeds and other plants may harbor the eggs and should also be destroyed. In severe infestations in berry patches, spray the plants heavily with lead arsenate, 2 pounds to 100 gallons of water, as soon as the berry crop is harvested. This reduces the infestation the following year.

**FRUIT TREE LEAF ROLLER.** Moths are a little less than  $\frac{1}{2}$  inch long, fawn colored or rusty brown, and have a prominent light spot on the outer margins of the wings. They appear in mid-

summer and lay their eggs in irregular flat masses on the bark. Eggs are entirely covered with a grayish cement-like substance. Larvae hatch about the time the buds begin to open and are quite active, crawling backward about as well as forward and often may be observed hanging from the tree by a thread. The caterpillars roll the leaves, eating ragged irregular holes in them and in extreme cases completely defoliate the trees.

**Control:** Spray the trees thoroughly with dormant-type oil emulsion to kill the eggs before they hatch. Spraying should be done before the buds begin to burst. In severe cases use the emulsion at the rate of 8 gallons to 92 gallons of water. One half of that dosage is sufficient in cases of light infestations or where orchards are being regularly sprayed with oil for San Jose scale control. When dormant oil sprays alone are not effective, 4 pounds of lead arsenate may be added to the dormant oil spray or a lead arsenate spray can be applied immediately following petal fall.

**GARDEN SLUG.** These are slimy, shiny, dark green or gray creatures resembling snails. They injure strawberries where the berries come in contact with the ground.

**Control:** Commercially prepared baits containing metaldehyde give very satisfactory control. The bait should be placed in very small piles about a foot apart and near the plants to be protected or near the hiding places of the slugs. Moisture causes the bait to be less effective; therefore, the piles should be protected from rains or irrigation water. A dust composed of dehydrated copper sulphate and lime gives excellent control and is cheaper than metaldehyde baits but it must be applied at night. Use 1 part of dehydrated copper sulphate to 10 parts of hydrated lime and mix thoroughly. Apply the dust in the evening after dark when most of the slugs are out feeding. No application should be made on wet nights or when rain threatens. One pound of the dust is sufficient to cover from 200 to 300 feet of row or an area of about 30 square feet.

**GLADIOLUS THRIPS.** The gladiolus thrips is a very small, slender insect measuring about 1/16 inch long. It feeds on the corms, leaves, buds and flowers of the gladiolus. The larva and pupa are lemon yellow and are found mostly in the leaf sheath or the buds. The eggs are deposited within the tissues of the host plant. Only from 11 to 13 days are required in mid-summer for development from the egg to the adult. The adult overwinters in Idaho in the corms only.

**Control:** Reduce corm infestation at harvest by cutting off the tops, but avoid shaking the thrips over the corms during the process. Remove the corms from the field as soon as possible after topping. Place the corms in tight bags and dust them thoroughly with 5 percent DDT dust. During the summer the thrips can be controlled by dusting the plants with a 5 percent DDT dust.

**GOOSEBERRY FRUITWORM.** The larva is about 3/4 inch long

when mature and has a black head. Larvae eat into gooseberries in the spring. Infested berries usually color prematurely and dry up on the bushes or fall to the ground. Larvae make their way into the ground where they pupate and pass the winter in this stage.

**Control:** Infestations can be kept low by carefully removing and burning all trash and leaves beneath and around the bushes in the autumn and thoroughly cultivating around the bushes in the fall and early spring to destroy the overwintering pupae. A high degree of control is attained by spraying the bushes with powdered derris containing 5 percent rotenone at the rate of 4 pounds in 100 gallons of water just as the worms begin to web the berry clusters together. One percent rotenone dust will also give control.

**GRAIN MITES.** These tiny, grayish-white, soft-bodied creatures are commonly called grain or flour mites. They are microscopic in size and have numerous long hairs on their legs and backs. The adult mites have eight legs. They are often found in stored grains or feeds. When present in large numbers, they cause the grain to sweat and a disagreeable odor can readily be detected.

**Control:** Screening, fanning and drying the grain will reduce grain mite infestations to the point where no injury will take place. Fumigation, as recommended for the confused flour beetle, will give control.

**GRANARY WEEVIL.** This mahogany-brown beetle is slightly more than  $\frac{1}{8}$  inch long, and has a head that is prolonged into a slender snout. The beetles feed upon grain and grain products and the grubs live inside the kernels of grain.

**Control:** Use the same methods and materials recommended for the control of the confused flour beetle.

**GRAPE LEAFHOPPER.** This sucking insect is only about  $\frac{1}{8}$  inch long when mature and varies in color from yellowish green to red. Adults fly but nymphs are wingless. Adults hibernate and then make their way to grape leaves about June 1. They deposit their eggs on the under surfaces of the leaves. The young leafhoppers hatching from these eggs feed on the under surfaces of the leaves until they reach the adult stage, sometime in July. A second generation develops in the late summer. Injury is caused by both adults and young. A discolored area develops around each feeding puncture and when leafhoppers are abundant the entire leaf may become discolored and have a scorched appearance.

**Control:** Adults and nymphs are easily controlled by the application of a spray containing 2 pounds of 50 percent DDT wettable powder in 100 gallons of water. Where DDT is used for the control of other insects infestations do not usually develop.

**GRASSHOPPERS.** Grasshoppers eat the foliage, blossoms, seeds and fruits of many crops. Several species are of economic importance in the state, all having similar life habits and responding to the same control methods. Eggs are laid in the ground in pods



containing from about 15 to 100 eggs each. The pods are inserted in the soil at depths varying from very shallow to about 3 inches. Eggs are laid most abundantly in firm ground or sod along ditches, roadsides, fence rows and waste places. Eggs are surrounded by a protective secretion and in their position in the ground are not greatly influenced by climatic conditions. Young 'hoppers hatch in the spring as soon as the soil surface becomes warm.

**Control:** Chlordane and toxaphene dusts, sprays or baits give excellent control of grasshoppers. These insecticides give quicker and better initial control and continue to kill longer than the standard sodium fluosilicate bait. They are particularly effective when applied as sprays or dusts on succulent growth along roadsides, railroad right-of-ways, canal banks and field margins or to such crops as rank-growing alfalfa or corn. Apply sprays containing 2½ pounds of 40 percent chlordane wettable powder or 3 pounds of 50 percent toxaphene wettable powder in 100 gallons of water at the rate of 100 gallons per acre. When using dusts apply 5 percent chlordane at 25 pounds per acre or 10 percent toxaphene at 20 pounds per acre. Slightly lower dosages are effective against newly hatched grasshoppers. In alfalfa and clover seed fields and in grain crops, gardens, etc., where grasshoppers are migrating in from wasteland, control can be obtained by treating the margins of the fields. Chlordane or toxaphene can be used in any wet-bait formula containing bran and sawdust. A dry bait consisting of coarse bran impregnated with an oil solution of chlordane or toxaphene has been used very successfully in controlling grasshoppers on range land. Ten pounds of dry bait per acre is equivalent to 20 pounds of wet bait. The dry bait can be prepared at any time and stored until needed. For preparing dry and wet baits write for information to the Idaho Agricultural Experiment Station, Moscow, or consult your county agent.

**GREEN PEACH APHID.** This green plant louse injures new growth and curls terminal foliage. It winters in the egg stage. Eggs are black and shiny and are deposited in crevices in the bark and around the bases of buds. Eggs hatch just before the buds open in the spring. This aphid is an important carrier of potato leafroll virus. However, it seldom becomes abundant enough on potatoes to cause injury by its feeding.

**Control:** Dormant-type oil emulsion applied just before the buds open is fairly effective in control. If the dormant spray is lime-sulphur it should be delayed until just before the buds open and ¾ pint of 40 percent nicotine sulphate or pyrethrum extract added to each 100 gallons of dilute spray. Parathion used at the rate of ½ pound of 25 percent wettable powder in 100 gallons of water is also effective. To control this aphid on potatoes use 5 percent DDT dust at the rate of 20 to 40 pounds per acre. The rate per acre will depend on the size of the plants. Three or more applications during the season may be necessary.

**GREEN PLANT BUG.** This plant bug, or stink bug, is about  $\frac{1}{2}$  inch long and is colored bright green. It sometimes seriously injures the heads of standing wheat by destroying the developing kernels.

**Control.** No practical method of control is known. Spring burning of weeds and trash in infested fields and weedy roadsides will reduce the numbers of the bugs.

**GREENHOUSE LEAF TIER.** This insect is named from its habit of spinning light webs enclosing leaves in the web. It causes injury by destroying the under surfaces of the leaves. The larva is light green marked by lengthwise light stripes. It is quite active, moving either backward or forward and often lowers itself on a silken thread.

**Control:** Where only a few plants are infested the affected parts can be pinched off and destroyed. Heavy infestations can be controlled by the application of commercially prepared pyrethrum-rotenone mixtures. Follow the directions of the manufacturers in applying these mixtures. Spraying or dusting with lead arsenate when the infestation first starts also gives control. Spray with lead arsenate at the rate of 1 pound to 25 gallons of water or dust with a mixture of 6 parts of fine dusting sulphur and 1 part of lead arsenate. Parathion aerosol bombs, commercially prepared, give effective control. Follow the directions of the manufacturers in using the bomb.

**GREENHOUSE THRIPS.** These small, narrow-bodied insects vary in color from yellow to brown or almost black. They injure both leaves and blossoms of many greenhouse plants. They have mouth parts fitted for piercing and scraping the leaf surface and for sucking the exuding sap. Injured leaves or petals become covered with whitish or silvery blotches which later run together causing dead areas. There are many generations annually and infestations breed up so rapidly that injury develops suddenly.

**Control:** Two applications of parathion 7 days apart will give control. Use commercially prepared aerosol bombs and follow the directions of the manufacturers. Sprays or dusts containing DDT, toxaphene, benzene hexachloride, and chlordane are also effective.

**GREENHOUSE WHITEFLY.** The tiny, four-winged, white, powdery adults are about  $\frac{1}{16}$  inch long. They are readily observed while resting on the under side of the leaves. If numerous they rise in small white clouds when disturbed. The young are less than  $\frac{1}{25}$  inch long. They are oval, flat, scale-like and pale green in color. Fine waxy threads of various lengths radiate from the body. Adults and young both feed on the leaves, sucking the juices. Injured plants turn yellow, wilt, and may die.

**Control:** Use the control recommended for greenhouse thrips.

**HOG LOUSE.** The hog louse is a sucking louse. It is a large, bluish-gray louse nearly  $\frac{1}{4}$  inch long when mature. The lice torment the hogs by piercing the skin and thus cause the animal to

rub. The skin becomes thick, cracked, tender, and sore and the animals become restless and unprofitable.

**Control:** Use the same control as recommended for control of hog mange. One application of 4 pounds of 50 percent DDT wettable powder or 50 percent toxaphene wettable powder in 100 gallons of water will also give effective control with one application.

**HOG MANGE.** Hog mange is caused by the sarcoptic mange mite. The mites are white or yellowish parasites about 1/50 inch long. They are not readily visible to the naked eye unless placed on a black background. The general form of the body is more nearly round than oval and the bluntly round head is as broad as long. The mites excavate egg burrows in the outer skin. The young mites feed in the burrows and when mature make new burrows. Lesions are usually first visible on the neck and shoulders or around the head but they may start on other places. If unchecked they may spread until they cover the entire animal. The skin becomes thickened, wrinkled and surfy. The animals lose weight.

**Control:** Spray thoroughly at a pump pressure of 400 pounds with a mixture containing 2 pounds of 25 percent lindane wettable powder in 100 gallons of water. One application is usually all that is necessary.

**(HOLLYHOCK) APHID.** These dark red plant lice cluster on buds and leaves causing them to wilt and wither and often preventing blossoming.

**Control:** Spray with 40 percent nicotine sulphate or pyrethrum extract 1 teaspoon to  $\frac{3}{4}$  gallon of water in which is dissolved a piece of soap the size of a large walnut. Make applications as soon as the first aphids are observed and repeat if necessary. Promising control has been obtained by the application of a spray containing 4 pounds of 50 percent DDT wettable powder in 100 gallons of water.

**HOLLYHOCK BEETLE.** This oval-shaped beetle is about  $\frac{3}{8}$  inch long. The head and thorax are black; wing-covers are yellow to orange with irregularly shaped black lines extending lengthwise. Beetles severely damage the leaves of hollyhocks, especially those near the soil. They may be found underneath leaves or trash beneath injured plants.

**Control:** Dust with rotenone or spray the leaves with lead arsenate or calcium arsenate at the rate of 1 pound to 25 gallons of water. Sprays or dusts containing DDT are effective in control.

**HOP APHID.** These yellowish green or black aphids mainly overwinter in the egg stage on plum and prune. Wingless, spring forms develop on plum and prune. As soon as winged forms appear in early summer they migrate to hops which are the chief summer host.

**Control:** Nicotine sulphate or pyrethrum sprays will give con-

trol. Use 1 pint of 40 percent nicotine sulphate or pyrethrum extract to 100 gallons of water. Tetraethyl pyrophosphate and parathion sprays give satisfactory control.

**HOP LOOPER.** The grayish-brown moth is between  $\frac{1}{2}$  and  $\frac{3}{4}$  inch long. The mouth parts project forward from the head resembling a snout. Caterpillars are pale green, about  $\frac{5}{8}$  inch long when mature. They feed on the leaves of ornamental hops, causing a ragged, unsightly appearance.

**Control:** Dust the vines with pure calcium arsenate or lead arsenate, or spray with lead arsenate, 3 pounds to 100 gallons of water. Apply when the first holes are observed in the leaves and repeat 2 or 3 weeks later if necessary.

**HORN FLY.** The horn fly is a close relative of the stable fly, and its harmful effect on cattle is similar. It pierces the skin to suck the blood, causing pain and annoyance, and interferes with the feeding and resting of the cattle so that they lose weight and drop in milk production. They are small flies, about half as big as the house fly or the stable fly, and hover over the backs of cattle all summer long. They crawl down between the hairs on the withers, back or belly and suck blood.

**Control:** Spray the animals thoroughly with DDT, chlordane or methoxychlor. The spray should contain either 4 pounds of 50 percent DDT wettable powder, 4 pounds of 40 percent chlordane wettable powder, or 4 pounds of 50 percent methoxychlor wettable powder in 100 gallons of water. Use only the methoxychlor spray on producing dairy animals. Repeat the applications as soon as flies begin to reappear.

**HORSE BITING LOUSE.** Horse biting lice are not often severe pests of horses, but they occasionally become sufficiently numerous on horses to cause severe irritation and itching. Horses will often rub, bite, stamp, kick and otherwise manifest extreme uneasiness in an effort to relieve themselves of the irritation. The coat becomes roughened and frequent rubbing destroys the hair in patches, often causing bruises or wounds in the skin. The lice usually are found on the sides of the neck, around the flank and on the jaw. They are found on all parts of the body in severe infestations. The eggs are attached to the individual hairs on the body and require about 8 or 10 days to hatch.

**Control:** Use the same control as recommended for lice on cattle.

**HORSE BOT FLIES.** Three species of bot flies attack horses. The horse bot fly, while depositing its eggs, does not annoy the horse as much as the other two species. The body of the female is covered with bands of black and yellow hair. Each of its wings bears a dark band. The abdomen is curved under in characteristic shape. The fly hovers about the horse while attempting to deposit eggs. The eggs are glued to hair on the inner sides of the knees and on the outsides of the forelegs, on the shoulders, belly, neck and

flank. The throat bot fly moves more rapidly than the horse bot fly and usually poises in midair between the forelegs and then darts at the chin or throat to lay its eggs and fly rapidly away. The nose bot fly is even more rapid in its movements than the throat fly. The female darts at the lip, deposits an egg, and then flies away only to return in a few seconds to repeat her annoying process.

**Control:** Several things can be done to protect horses from the attack of the egg-laying bot flies. No known repellants are entirely effective. A mixture of equal parts of pine tar and lard applied to the areas where the flies lay the eggs is effective for about 4 days in keeping the flies from laying their eggs. The use of blankets or nets tends to aid the animals in fighting away the bot flies. The best treatment for ridding the animals of bots is the administration of carbon disulphide. The carbon disulphide is prepared in capsule form. It should be administered only by a veterinarian, for if the capsules are not properly administered or are broken during the process, death of the animal is likely to result. The greatest efficiency in the use of the treatment is obtained during the winter months, preferably in December or January, or after the eggs have all hatched and the larvae have entered the animal. The treatment should be made 30 days after the bots have appeared in the mouth. Sprays containing DDT or chlordane have not been effective.

**HORSE FLIES.** Several flies which may be called horse flies belong to a group known as tabanids. These insects are notorious as tormenters of horses on pasture and in the harness. They are blood suckers and in piercing the skin to obtain the blood they greatly annoy horses. They also attack other livestock and man. Besides being pests, horse flies have been shown to be carriers of certain diseases of animals such as anthrax, anaplasmosis of cattle, and certain trypanosome diseases.

**Control:** Little is known of how to control these pests on domestic livestock, but the best protective method is to prevent attack of the insects by mechanical protection of horses. The application of wettable powder sprays containing DDT, chlordane and benzene hexachloride give some degree of control. These sprays have protected horses for one to two days after treatment.

**HORSE SUCKING LOUSE.** One species of sucking louse is found on horses. It may be distinguished easily from the horse biting louse in that it is large and has a long, pointed head. The biting louse has a short, rounded, blunt head. The eggs are attached to the hairs, usually close to the skin, and hatch in from 11 to 20 days. These lice spend their entire lives on the horses and will live only a few days when removed.

**Control:** They are controlled in the same way as the horse biting louse.

**HOUSE FLY.** This loathsome insect breeds in all kinds of filth

and garbage. It is a filth and disease carrier. Its presence is indicative of filth some place nearby.

**Control:** Burn, bury, or dispose of garbage immediately. Keep garbage cans covered. Protect foods by screening. Keep stables clean. Haul manure away at least once a week and spread it where it is exposed to sunshine. Spray the outside and inside surfaces of all out-buildings and the outside surface of the house with a suspension spray containing 4 pounds of 50 percent DDT wettable powder or 2 pounds of 25 percent lindane wettable powder in 100 gallons of water. Best results are obtained when the spray is applied at a pressure of 400 pounds. When using hand sprayers use a mixture containing 1 pound of 50 percent DDT or  $\frac{1}{2}$  pound of 25 percent lindane wettable powder in 8 gallons of water. In addition to spraying the outside of the house, the inside walls and ceilings should be sprayed with 5 percent DDT in a highly refined deodorized oil base. When spraying the inside of dairy barns or dairy processing plants use 2 pounds of 25 percent lindane wettable powder in 100 gallons of water. Two or more treatments may be necessary during the season. The new insecticide, dieldrin, looks very promising for the control of flies where DDT is ineffective.

**INDIAN-MEAL MOTH.** The adult moth is about  $\frac{1}{2}$  inch long. The base of the forewing is grayish white and the tip half is reddish brown. Larvae are of a general white color and are  $\frac{1}{3}$  to  $\frac{1}{2}$  inch long when fully grown. The larvae feed upon a great variety of food materials. Infested material is often webbed together and fouled with dirty silken masses.

**Control:** Control is the same as for the confused flour beetle.

**INTERMOUNTAIN POTATO LEAFHOPPER.** The adult leafhoppers are slender, wedge-shaped, pale green insects about  $\frac{1}{8}$  inch long. The nymphs are smaller than the adults and wingless. They overwinter in the adult stage in grass and weeds at the margins of fields and elsewhere. They emerge early in the spring and produce one full generation on weed hosts before migrating to potato fields. Both adults and nymphs feed upon the leaves of the host plant. Their feeding causes a speckled, white-stippled appearance of the leaves, especially the lower ones. These insects do not cause severe damage to potatoes and are not responsible for early maturity of potato vines.

**Control:** Experimental work definitely shows that control of this insect is unwarranted. It is readily controlled, however, by the application of 25 pounds of 5 percent DDT dust per acre.

**LACE BUGS.** These small, flat, sucking insects feed on the lower surfaces of leaves of many plants. The head and body frequently are completely hidden by the lace-like covering of the thorax and the wings. This lace-like covering is often nearly transparent, showing many veins. Adults are about  $\frac{1}{8}$  inch long. The young are darker in color, often covered with spines, and do not resemble

the adults. Injured leaves show light flecked areas and quantities of dark pellets of excrement.

**Control:** Spray with 40 percent nicotine sulphate or with pyrethrum extract at the rate of 2 teaspoons to 1 gallon of soapy water. Direct the spray so that it will hit the insects in flight and so it also will cover the lower surfaces of the leaves.

**LARDER BEETLE.** The brown, hairy larva of the larder beetle is occasionally found in woolen fabrics and in food materials. It is sluggish of movement. The beetle is about  $\frac{1}{4}$  inch long, black in color, with a wide, pale yellow band running cross-wise on the wing covers.

**Control:** Where this insect is found in woolen fabrics use the same treatment as recommended for the control of clothes moths. For control in food materials follow the recommendations given for the confused flour beetle.

**LEAF-CURL PLUM APHID.** The first forms of this plant louse which appear in the spring are deep red or brownish red with brown bands cross-wise on the back. The young from these are uniformly pale green. Overwintering eggs on the bark hatch in the spring before the fruit buds of prune show signs of swelling. When leaves appear they are severely curled from the effects of the feeding of this aphid. Several generations develop on peach, prune, or plum trees before leaving for other plants.

**Control:** Add  $\frac{3}{4}$  pint of 40 percent nicotine sulphate or pyrethrum extract to each 100 gallons of dormant lime-sulphur or oil emulsion sprays and make the application just before the blossom buds open in the spring. This aphid can also be controlled by thoroughly spraying the trees with a mixture containing  $\frac{1}{2}$  pound of 25 percent parathion wettable powder in 100 gallons of water. One to 3 applications at 10-day intervals may be necessary.

**LEAF CUTTER BEES.** These wild bees cut large, circular holes in the margins of the leaves of rose, Virginia creeper, lilac, and other plants, causing an unsightly, ragged appearance.

**Control:** Spray the bushes with lime-sulphur 1 part to 40 parts of water, to repel the bees. Make the first application when damage is first observed and repeat if necessary later in the season.

**LEATHERJACKETS.** These tough, slate colored, tapering larvae may usually be identified by the scalloped "hood" at the rear end of the body. They are the larvae of crane flies, insects that resemble huge mosquitoes. They sometimes feed on strawberries and root crops near the surface of the ground and rest shallowly in the soil in protected places beneath trash.

**Control:** Cultivate the soil thoroughly near the plants and eliminate debris. Examine under leaves, hand-pick and destroy larvae. Scatter poisoned bran mash (directions for preparation, page 62) over the surface of the ground and closely around plants.

**LEGUME BUGS.** There are several species of insects which are

called legume bugs. Three of the species are found most commonly in Idaho. These insects cause puncturing of bean and alfalfa seeds, blossom drop in alfalfa and beans, decreased yield of alfalfa hay and seed as well as injury to many other garden and field crops. The adults are about  $\frac{1}{4}$  inch long, of general flat angular shape and are quite active. They have a small blackish or yellowish triangular area on their backs and in front of the wings, on which is usually a greenish V-shaped mark.

**Control:** Use 5 percent DDT dust at the rate of 30 pounds per acre on seed crops such as alfalfa and red clover. Make the first application when there is an average of four to five lygus bugs—adults and nymphs—per sweep of an insect sweep net. On alfalfa this will be about the time when there are a few scattered blooms throughout the field. A second and third application may be necessary. Chlordane and toxaphene dusts will also give satisfactory control.

**LESSER CLOVER LEAF WEEVIL.** The adults are deep greenish or blue-green in color with shiny black heads and beaks. Newly emerged adults are brownish in color. The larvae are whitish at first but soon change to brownish white. The larvae feed on the buds and often do considerable damage. The cocoons may be found on the ground or in the clover head.

**Control:** Clover grown on fertile soil and well watered is not usually attacked. Clover on poor, dry soils may be severely attacked. When infestations develop, apply 20 pounds of 5 percent DDT dust as soon as injury is noted. One application is enough.

**LETTUCE APHID.** Pale, greenish-yellow plant lice occasionally become abundant on lettuce being grown for seed. They cause injury by sucking the sap from the growing plants and causing a reduction in seed yield. Probably the greatest economic loss, however, comes from the inability to thresh the seed from heads which have been heavily infested. A combination of honey-dew produced by the aphids and the latex that exudes from the feeding punctures gums up the seed heads so badly that it makes harvesting the seed impossible.

**Control:** There is no satisfactory control known. Some degree of control has been obtained by the application of tetraethyl pyrophosphate and parathion sprays and dusts. Considerable experimental work is necessary before definite control recommendations can be made.

**LIMA-BEAN POD BORER.** The small gray moths have a broad white band and an ochreous band across the forewings. They are quite active and appear in the early spring. The caterpillars vary from white to pale green or red and attain a length of about 1 inch. They commonly infest the green pods of many legumes in which they eat out large portions of the seeds. Most varieties of beans, peas, and the pods of locust and wild vetch may be attacked. There



is only one generation a year. This insect is seldom present in large numbers in Idaho.

**Control:** There is no satisfactory control for this insect.

**MEALYBUGS.** These small, sluggish, white, soft-bodied insects cluster on the under sides of leaves or in leaf axils. They vary in size up to about  $\frac{1}{4}$  inch long. They suck the juices from the stems and leaves, discoloring and deforming the foliage.

**Control:** In greenhouses, use parathion in an aerosol form as recommended for other greenhouse insects. Make two applications at 10-day intervals. Probably the most practicable control on house plants is to spray with nicotine sulphate or pyrethrum extract at the rate of 1 teaspoon to  $\frac{3}{4}$  gallon of water, adding 2 teaspoons of summer-type oil emulsion. Make the treatment before infestations build up to any extent and repeat applications until control is established.

**MEALY PLUM APHID.** This bluish-green plant louse covered with a white, powder-like secretion becomes exceedingly abundant on the under surfaces of the leaves early in the spring. It is accompanied by heavy honey-dew, a sticky secretion that drops on the upper surfaces of the leaves.

**Control:** Spray thoroughly with  $\frac{1}{2}$  pound of 25 percent parathion wettable powder in 100 gallons of water. One to two applications at 10-day intervals may be necessary. Dusts and sprays containing tetraethyl pyrophosphate have given satisfactory control.

**MEDITERRANEAN FLOUR MOTH.** Larvae of the Mediterranean flour moth are nearly  $\frac{3}{4}$  inch long when mature, are whitish and have dark heads. They spin silken threads and form tunnels in the flour or other cereal products. Adults are dark gray moths that may be found in flour mills or dwellings throughout the year.

**Control:** Follow the recommendations for the confused flour beetle.

**MINEOLA MOTH.** Fully grown larvae are slightly more than  $\frac{1}{2}$  inch long. They are a red-brown color, being uniformly darker from the middle of the side of the body upward than from the middle of the side downward. Legs are black and the head light brown. Partially grown larvae winter in heavy webs on the bark, become active about the time prune blossoms begin to swell and enter the blossom buds. Larvae pupate in the soil. Moths deposit their eggs singly on the under surface of the leaves. Part of the insects have but one generation annually. Others pass through a second generation while some of them have three generations annually. Newly hatched larvae enter the fruits. Larvae feed only in flower buds or in the fruit, never on leaves.

**Control:** There is some evidence that where lime-sulphur is used annually as the dormant San Jose scale spray, infestations of mineola are light. The best means of direct control yet found is to spray with dormant-type oil emulsion 4 gallons, water 96 gallons and  $2\frac{2}{3}$

pints of pyrethrum extract (oil extract containing 2.15 grams pyrethrins per 100 ml.) Mix oil emulsion and water as for oil spray and then add pyrethrum. In home-made emulsions, or with the tank-mix, first combine the pyrethrum with the oil and then emulsify. Make applications when the prune buds swell and show green at the tips and just before they begin to show white.

**MONTEREY PINE SCALE.** The adult Monterey pine scale is a large semi-globular reddish brown or black, smooth, shiny species which occurs at the bases of the needles on the tips of the twigs of Monterey and other pines. It produces large quantities of honey-dew and often seriously injures young trees. Closely related species occur on spruces and firs.

**Control:** No control is known.

**MORMON CRICKET.** Adults are dark brown to black and from  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches long. They are wingless. As the nymphs grow they begin moving. Migrating bands often are of large size and frequently reach cultivated fields. Mormon crickets are general feeders, but their food preference is distinctly for some of the native plants and they do not often cause serious damage to cultivated crops.

**Control:** Dry bait consisting of coarse bran or rolled wheat impregnated with an oil solution of toxaphene gives very effective control when applied at the rate of 10 pounds of dry bait per acre. The dry bait can be prepared at any time and stored until needed. For preparing dry baits write for information to the Idaho Agricultural Experiment Station.

**MOURNING-CLOAK BUTTERFLY.** The large, spiny caterpillars are black, marked with white and red dots. They occur in groups and defoliate individual branches on cork elm, poplar trees, and others. They are rarely of much importance.

**Control:** Clip off and destroy infested branches, or if the infestation is severe, spray with 4 pounds of 50 percent DDT wettable powder in 100 gallons of water when the caterpillars make their appearance.

**NARCISSUS BULB FLY.** The bulbs of narcissus and other plants fail to grow when attacked by the narcissus bulb fly. The bulbs become soft and the outer scales of the bulbs often have brown scars upon them. The large, whitish or yellowish-white maggots feed upon the plant tissues inside the bulb. The adult fly is a shiny, yellow-and-black, hairy fly about the size of a small bumble bee. The eggs are laid in the bases of the leaves or in the necks of the bulbs.

**Control:** Treat bulbs by submerging them in water held at a temperature of  $110^{\circ}$  to  $111^{\circ}$  F. for  $2\frac{1}{2}$  hours. Infested bulbs may be sorted out and destroyed at the time of taking them from the field. The bulbs may be treated by fumigation with paradichlorobenzene. The fumigant is placed in the bottom of an airtight box

at the rate of 4 ounces per cubic foot of space in the box. The thoroughly dried bulbs may be arranged in trays in the box and left to fumigate about 6 days after which they should be removed and well aired.

**NORWAY - MAPLE APHID.** The Norway - maple aphid is a rather large, hairy and yellowish-green aphid with brown markings. The eyes are reddish and the antennae are long and hairy. These aphids cluster in numbers along the veins of the undersides of the leaves. They secrete large quantities of honey-dew. In severe infestations the leaves develop brown blotches, become wrinkled and stunted, and eventually fall off.

**Control:** Thorough spraying with nicotine sulphate or pyrethrum extract, 1 pint to 100 gallons of water to which has been added 4 or 5 pounds of powdered soap will do much to check the aphids. Take care to spray the undersides of the leaves. A spray containing piperonyl butoxide in combination with pyrethrum has given effective control of this aphid.

**OBLIQUE - BANDED LEAF ROLLER.** This insect is common in greenhouses. The tiny green larvae feed for a short time as miners in the leaf but later come to the lower surface. The adult moth is a little over an inch long, reddish-brown in color with the front wings crossed by three distinct dark brown bands.

**Control:** The use of a parathion aerosol bomb in a greenhouse will give effective control. Follow the directions of the manufacturers in using the bomb and make two applications at 10-day intervals. Where this insect is a pest on raspberries spray or dust with DDT just before blooming. Use 1 pound of 50 percent DDT wettable powder in 100 gallons of water and apply at the rate of 200 gallons per acre. Use a 5 percent DDT dust at the rate of 50 pounds per acre.

**ONION MAGGOT.** The small, grayish fly deposits her eggs on the onion plant. Larvae are small, legless maggots, nearly white in color, and when full-grown are about  $\frac{3}{8}$  inch long. Maggots eat into the bulbs, causing them to die. Pupation takes place in the soil and winter is normally passed in the pupal stage. Maggots are able to survive the winter in onion bulbs left in the field or in cull piles. There are two generations annually.

**Control:** Apply 5 percent DDT or chlordane dust to the soil surface along the onion row. Make the first application as soon as the onions are up and repeat with a second and third application at 12-day intervals. In commercial onion fields, apply DDT or chlordane at the rate of 20 pounds per acre. Use a duster with row-crop nozzle attachments and direct one nozzle over each bed.

**ONION THRIPS.** Tiny yellow or brown insects that hide in "crotches" of the plants and in the soil in the daytime and feed on the plants at night or in cloudy weather. Injured leaves assume a silvery appearance and become crisp and dry.

**Control:** On commercial onions use emulsion sprays containing 1 pound of chlordane, toxaphene, or DDT. When using commercially prepared emulsions, follow the directions of the manufacturers. On seed onions, use 10 percent chlordane, toxaphene or DDT dust at the rate of 40 pounds per acre. Two to four applications may be necessary during the season.

**ORIENTAL FRUIT MOTH.** The adult is a small grayish-brown moth with a wing span of approximately  $\frac{1}{2}$  inch. This insect overwinters as a fully-grown larva in a cocoon upon the tree or in the trash beneath. The fully-grown larva is slightly smaller than the codling moth and may be distinguished from the peach-twig borer larva by the more reddish-brown color. There are three to four generations annually in Idaho. Nearly all orchard fruits are attacked by this pest. Peach twigs and fruits, however, are preferred to those of apricot, apple, pear, and cherry. Injury to twigs and fruit is similar to that caused by the peach-twig borer.

**Control:** Proper timing and thorough application of DDT sprays effectively reduce oriental fruit moth injury. Apply the first spray in July when the second brood larvae begin entering the green fruit. Make the second application about 4 weeks before harvest when the fruit becomes sufficiently mature to allow direct entry of young larvae. This period will vary with the variety. Use 2 pounds of 50 percent DDT wettable powder in 100 gallons of water for the first cover spray and not over  $1\frac{1}{2}$  pounds for the second cover spray. The addition of a miticide in the second cover spray may be necessary.

**OYSTERSHELL SCALE.** These are tiny sucking insects that become fixed on the bark of fruit trees. As they grow they cover themselves with a brown secretion resembling an oyster shell in shape. There is only one generation each year. Eggs are deposited under the shell and hatch shortly after the apple trees bloom. The young insects soon fix themselves on the bark where they suck the sap. They appear as tiny yellow specks on the bark before they are covered with their secretion.

**Control:** Dormant-type oil emulsions used at the rate of 5 gallons to 95 gallons of water are preferable when infestations are severe. In lighter infestations lime-sulphur at the strength used for San Jose scale gives commercial control when used annually. Very effective control of the young may be obtained by two applications of a spray mixture containing two to three pounds of 50 percent DDT wettable powder in 100 gallons of water. Make the first application in the calyx and the second at the time of the first cover spray.

**PACIFIC MITE.** The Pacific mite is a pest of the apple in Idaho but may occur rarely on prunes. This mite has been called the two-spotted mite or common red spider. The two-spotted mites and red spiders attacking other plants are different species. The Pacific mite is pale lemon-yellow in color and has irregularly-shaped dark spots on the back. It hibernates in the soil and migrates into

the tree in the spring. Aside from its color and markings, it is recognized readily by the fact that it spins a dense web, especially on the under sides of the leaves beneath which it feeds. Eggs and all forms of the mite are protected during the summer by this web. Injured leaves become dry and leathery, turn red or brown and often fall prematurely. The size and quality of the fruit is seriously impaired. The orchardist should carefully examine his trees every few days in the spring after the foliage is out and be prepared to spray as soon as the first mites are found on the leaves and before they have an opportunity to form heavy webbing. Since the mites make their way upward from the soil, the lower leaves are infested first, and the infestation spreads upward as the season advances.

**Control:** Use a parathion spray as recommended for summer control of the European red mite. Apply spray before infestation becomes severe.

**PAINTED-LADY.** The butterflies have a wing expanse of approximately 2 inches, the wings are mottled with brown, orange and white spots. The spiny caterpillars are dull brown or black with a pale yellow stripe on each side. They commonly feed on thistles and other weeds, but, when numerous, may be found on many cultivated crops.

**Control:** Control measures are seldom necessary. Control can be had by the application of 5 percent DDT dust at the rate of 20 pounds per acre. Sprays containing 4 pounds of 50 percent DDT wettable powder or 4 pounds of lead arsenate in 100 gallons of water also will give control. Sprays should be applied at the rate of 80 to 100 gallons per acre.

**PEA APHID.** Green plant lice occasionally become very numerous on first-crop alfalfa and frequently on sweet peas and garden and field peas. They cause injury by sucking the sap from growing plants causing foliage and blossoms to wilt and shrivel. Severely injured plants turn yellow and dry up.

**Control:** For sweet peas, garden peas and field peas use 5 percent DDT dust containing sulphur or 1 to 2 percent oil applied at 40 pounds per acre. Application should be made as soon as infestation is noticed.

When first-crop alfalfa is severely attacked, it should be closely clipped immediately and quickly removed from the field, and the field kept dry until after new growth starts.

Clipping the alfalfa close late in the fall or grazing it after the last crop is cut prevents heavy infestations from developing.

**PEA WEEVIL.** This small gray-brown beetle lays its eggs on the outsides of the pods. Grubs eat into the peas where they mature and pupate. Most of the adults emerge from the peas in the fall, but some of them remain in the seeds until the following spring. Weevily peas are readily recognized by the large, circular emergence holes. Adults fly long distances. Some of them hibernate in trash

in the field, in old pea vines, in cracks in fence posts and under bark of posts and trees. There is one generation annually.

**Control:** Garden peas can be completely protected by dusting with 5 percent DDT dust. One or more applications may be necessary. The first dusting should be made as soon as the young pods begin to form and repeated in 12 to 14 days.

Weevils are readily controlled on field and canning peas by using 5 percent DDT or 1 percent rotenone dusts applied at 20 pounds per acre. More than one application may occasionally be necessary.

**PEACH TREE BORER.** The clear-winged moths deposit their eggs on the trunk of peach and prune trees near the ground. When larvae hatch, they make their way into the trunk just below or slightly above the soil surface. They feed and grow in the trunk or roots beneath the ground, frequently completely girdling and killing the trees. Masses of semi-transparent gum exude from holes made by the larvae. Larvae are light yellow, have a light brown head, and when mature are about 1 inch long. There is one generation annually.

**Control:** Smooth the ground around the base of the tree, lowering the level as little as possible. Spread a narrow ring of paradichlorobenzene entirely around, about 2 inches away from the trunk, cover with 4 inches of soil and pat down. Use  $\frac{1}{2}$  ounce of paradichlorobenzene for young trees,  $\frac{3}{4}$  ounce for trees 5 years old or older. The best results are obtained by making the application about September 15 after most of the eggs have been laid. Mounds should be leveled down to the general soil surface the following spring to prevent moths from laying their eggs high on the tree trunks. Applications may be made in the spring if the borers are causing severe injury and it is necessary to obtain protection. Fall applications make it unnecessary to apply spring control and eliminate the injury caused by overwintering borers.

Treatment should not be made when the soil temperature is likely to fall below 60° F. for the first 2 weeks after application. Infestations in the trunk and crotches may be treated by painting the affected parts with a solution of 1 pound of paradichlorobenzene in 2 quarts of cottonseed oil.

Ethylene dichloride also gives excellent control. Stock emulsion is prepared by adding 9 gallons of ethylene dichloride to 1 gallon of potash fishoil soap, emulsifying, then adding water to make 18 gallons. This stock emulsion is diluted before use with water according to the age of the tree. Use 3 volumes of the stock emulsion to 7 of water,  $\frac{1}{4}$  to  $\frac{1}{2}$  pint for 2- to 3-year-old trees; 2 volumes of stock to 3 of water,  $\frac{1}{2}$  pint for 4- to 5-year-old trees; and  $\frac{1}{2}$  pint of a half and half mixture for older trees. Apply by wetting the soil immediately surrounding the tree. The lower part of the trunk should receive some material during treatment.

Propylene dichloride emulsion gives excellent control at one-half the strength of ethylene dichloride emulsion. No serious injury

will occur where ethylene or propylene dichloride have been mixed properly, applied properly, and used properly at standard recommended strengths. Spraying the trunks of peach trees during August and September with DDT tends to prevent infestation.

**PEACH TWIG BORER.** These are uniformly brown-colored larvae with a black head; the first segment of the body is black. The mature larva is slightly less than  $\frac{1}{2}$  inch long and has the appearance of having light and brown stripes alternating cross-wise of the body. There are two generations annually. The overwintering generation hibernates beneath the bark in the crotches of the branches and emerges about the time peaches bloom. These larvae attack the terminal twigs, killing and deforming them. A second generation bores into the fruits and is the principal cause of "wormy" peaches.

**Control:** Spray with 2 percent dormant oil plus lead arsenate or spray with lime sulphur as for San Jose scale. Oil sprays are not effective unless used in combination with lead arsenate. Lead arsenate, 4 pounds to 100 gallons of water, plus a spreader gives a high degree of control if applied just past full bloom.

**Pear Leaf Blister Mite.** These nearly microscopic, pink-colored mites live beneath the bud scales of apple and pear during the winter. They emerge early in the spring and begin feeding inside the leaves before they are fully opened. They cause little blisters which are at first light green or red but which later turn to rusty brown. In late summer severely infested leaves are red and dry in appearance, and whole areas in the leaves are killed. Injured fruits are misshapen, rough, and russeted. Many generations develop in a season all of them within the leaf tissue where they are not successfully reached by sprays.

**Control:** This mite is readily controlled any time during the dormant season with lime-sulphur spray testing  $3\frac{1}{2}^{\circ}$  Baume. A combination of 1 percent dormant oil and 3 percent lime-sulphur will give satisfactory control. Spraying should be done before the leaves begin to unfold.

**PEAR PSYLLA.** The pear psylla recently has been introduced into the Pacific Northwest, and until this introduction, it was known only east of the Mississippi river. The adults are dark, reddish-brown, four-winged insects about  $\frac{1}{10}$  inch long. The nymphs are much smaller, broad, active and yellow and are found on the fruit and leaves during the growing season. The adult psylla overwinters under the bark of trees or in other sheltered places about the orchard. The insect attacks pear and quince. The leaves on heavily infested trees turn brown and often drop; the fruit drops prematurely or is undersized and of poor quality. Both the leaves and fruit of badly infested trees will be covered with honey-dew which is generally covered with a black fungus later in the season.

**Control:** Spray thoroughly with oil emulsion or miscible-oil sprays applied at strengths as for San Jose scale. Spraying should

be done when the leaves fall, or just before growth starts in the spring. Parathion can be used as a summer spray. Use  $\frac{1}{3}$  pound of 25 percent parathion wettable powder in 100 gallons of water. Make two applications one month apart.

**PEAR SLUG.** Sticky, shiny, olive-green or nearly black larvae move little and destroy the upper leaf surface, causing leaves to turn brown and become crisp. One generation attacks the foliage in the early spring and another in the fall.

**Control:** Spray with 2 pounds of 50 percent DDT wettable powder in 100 gallons of water or dust the foliage lightly with 5 percent DDT dust. One application in the spring as soon as injury begins to be noticeable is sufficient. Another application in the fall may be necessary for control of the second brood. A 1 percent rotenone dust is also effective.

**PINE NEEDLE SCALE.** Needles of pines sometimes are dotted with white specks. These are the scaly coverings of tender-bodied sucking insects. The purplish eggs of the insects may be found beneath the scales in the winter. The young appear some time in May and are red. They may be readily observed crawling about on the needles.

**Control.** Spray the infested trees with 4 pounds of 50 percent DDT wettable powder in 100 gallons of water about 10 days after the first crawlers are observed. This will be about the last of May or the first of June.

**POWDER-POST BEETLES.** The adults of most of the species are small, ranging from  $\frac{1}{12}$  to  $\frac{1}{5}$  inch in length. They are hard-shelled brownish beetles with sculpturing on body and wings. The larvae resemble small white grubs ranging from  $\frac{1}{8}$  to  $\frac{1}{3}$  inch in length. They have an unusually large head end. The powder-post beetles attack well-seasoned wood and reduce the wood to fine powder. Generation after generation develops in the dry wood with little external evidence of damage until structural timbers collapse or furniture and finish are completely ruined.

**Control:** Wood severely damaged should be replaced with sound material. Lightly infested wood should be heavily sprayed or brush-coated with pentachlorophenol, kerosene or a mixture composed of 9 parts of turpentine to 1 part of kerosene. Best results are obtained by making two or three applications. Pentachlorophenol should be used as a 5 percent solution. Windows and doors should be kept open to provide air circulation during the time of application.

**RASPBERRY CANE MAGGOT.** Young canes from 1 to 3 feet in length are attacked by this insect. The canes suddenly wilt and have a purple discoloration appearing at the point of attack. The maggot enters the cane, bores downward a few inches and then completely girdles the shoot.

**Control:** Remove and burn all of the injured canes as soon as



observed in the spring to protect next year's young shoots. No chemical control has been developed for this pest.

**RASPBERRY ROOT BORER.** The adult is a clear-winged moth with a black body crossed by four narrow yellow bands. Eggs are deposited on the under sides of the leaves and larvae hatching from them make their way beneath the bark just below the ground level or under flakes of bark at the bases of stems. The following spring they tunnel beneath the bark of stems and roots, often girdling them and causing wilting stems or dying plants. They continue to grow until the next spring when they are nearly 1 inch long. They pupate in their tunnels. The life cycle is 2 years.

**Control.** Cut out all infested canes close to the crown as soon as an infestation is found and burn immediately. Spray 2 weeks after the first eggs are noticed on the leaves with a highly-refined white oil emulsion containing 83 percent actual oil. The emulsion is used at the rate of 1 part to 150 parts of water. A second spray should be applied 2 weeks after the first.

**RASPBERRY SAWFLY.** The lower leaves are skeletonized in June by spiny green "slugs" which hatch from eggs laid in the late spring in rows in small punctures in the undersides of the leaves. They move from shoot to shoot or plant to plant as defoliation becomes complete. The adult passes the winter in the soil.

**Control:** Spray with calcium arsenate 2 ounces, hydrated lime 8 ounces, and water 3 gallons just before the blossoms appear, or dust with 1 percent rotenone just after the blossoms have appeared.

**RED SPIDER (COMMON).** The common red spider in Idaho apparently includes more than one species and they have not yet been fully described. The common red spiders vary in color from lemon yellow to a yellowish green. During the migration period the mites become red or orange. The common red spider winters in the soil as an adult and migrates to the growing plants in the early spring. It attacks many kinds of fruit trees, bush fruits, field crops and ornamentals. It spins a dense web on the leaves, especially on the undersides. It feeds beneath the web which also protects the eggs and young forms. There are several generations annually. Injured leaves become dry and leathery, turn red or brown in color and often fall prematurely. Severe damage to the plant or crop may be done in a very short time.

**Control:** Spray fruit trees thoroughly with  $\frac{1}{2}$  pound of 25 percent parathion wettable powder in 100 gallons of water. Two or three sprays may be necessary. The best means of controlling the red spider on field crops such as beans, corn, clover and potatoes, is by dusting the infested plants with dusting sulphur at the rate of 25 pounds per acre just as soon as the mites are noticed. Control becomes more difficult the longer the application is delayed.

**ROSE APHID.** This pink- or green-colored plant louse frequently covers stems, buds and young leaves and secretes a sticky honey-

dew. It frequently severely injures plants by sucking the sap. There are many generations annually.

**Control:** Spray with 40 percent nicotine sulphate or pyrethrum extract, 1 teaspoonful to 1 gallon of water, in which is first dissolved a piece of soap the size of a large walnut. It is important to make applications as soon as the first aphids appear. Applications should be repeated as often as necessary.

**ROSE CURCULIO.** This red, snout-beetle is about  $\frac{1}{2}$  inch long. It causes injury by puncturing the flower buds so that the petals, when they unfold, are riddled with holes.

**Control:** Hand pick the beetles on or beneath the plants. Spray with Bordeaux mixture 6-6-50 to repel the beetles, making the first application when the first flower buds are developing. Keep the new buds covered with spray as they form.

**ROSE LEAFHOPPER.** This slender, sucking insect is only about  $\frac{1}{8}$  inch long. It is greenish-yellow or pale yellow. Injured leaves are identified by the flecking and mottling which occurs around the leaf punctures. Severely infested leaves become crisp and dry. The young are wingless, delicate creatures, and are found on the under surfaces of the leaves. Injury is caused by both adults and young.

**Control:** Spray as for the control of the grape leafhopper or dust with 5 percent DDT dust. Leafhoppers migrate from non-sprayed plants, and it may be necessary to repeat the spray application to keep rose bushes in good appearance.

**ROSE SCALE.** Snow-white, nearly circular scales are found on the canes. This insect is rarely injurious.

**Control:** Spray with lime-sulphur, 1 gallon to 10 gallons of water, during the dormant season.

**ROSE-SLUG (BRISTLY).** Slimy, green, slug-like worms feed upon the leaves, skeletonizing them. Infested leaves turn brown, as though severely burned. The adult is a shiny black sawfly, slightly larger in size than the common housefly.

**Control:** Spray or dust with pyrethrum or rotenone when the slugs are seen, either in early spring or late fall. Calcium arsenate and DDT dusts or sprays are also effective.

**ROSY APPLE APHID.** Pink or purplish plant lice roll apple leaves severely and cause dwarfed, misshapen fruits. Their attack is not restricted entirely to the new leaves and tender growth. Several generations develop in the spring. The winter is passed in the egg stage on the bark of apple trees. Eggs hatch in the spring about the time that buds begin to swell.

**Control:** The rosy apple aphid must be controlled early in the spring before the leaves begin to curl. Some degree of control is obtained by the use of the regular dormant spray of oil emulsion or lime-sulphur as for San Jose scale if the application is made just

before the buds burst. Better control results if nicotine sulphate or pyrethrum extract is used at the rate of 1 pint in 100 gallons of either the oil emulsion or lime-sulphur spray mixtures. Parathion used at the rate of  $\frac{1}{2}$  pound of 25 percent wettable powder in 100 gallons of water will also give control.

**RUST MITE.** The rust mite is so extremely small that it scarcely can be seen with the naked eye. Where the infestation is heavy, as many as four to five thousand mites have been counted on a single leaf. The injury from the mites causes the leaves to curl lengthwise. After severe injury early in the season and prolonged hot weather in July and August, the foliage becomes dry and crisp and turns brown. Mite-injured trees have the appearance of suffering from drought. This foliage injury causes sunburn, and a reduction of the size and quality of the fruit. The mites feed during the spring and early summer and disappear soon after the first high temperatures in July. It is usually at about this time that injury becomes evident and it is then too late to spray for control.

**Control:** Spray with  $\frac{1}{2}$  pound of 25 percent parathion wettable powder in 100 gallons of water. Apply as soon as mite infestation begins to develop and repeat if necessary.

**SAN JOSE SCALE.** These are tiny yellow insects that fix themselves on the bark or fruit of many kinds of fruit trees, shade trees, bush fruits, and ornamentals. They increase rapidly and kill the plants by sucking the sap. As the tiny insects grow, they cover themselves with an ash-gray secretion or scale nearly circular in outline. There are several generations each year.

**Control:** San Jose scale is controlled by oil-emulsion sprays using dormant-type oil emulsion at the rate of 4 gallons to 96 gallons of water, or by lime-sulphur at the rate of not less than 10 gallons of liquid lime sulphur (testing 32° Baume) for each 100 gallons of spray. A mixture containing 1 percent oil and 3 percent lime-sulphur has given satisfactory control of San Jose scale and blister mite. Four pounds of completely dissolved dry lime-sulphur of good quality is equivalent, chemically, to 1 gallon of 32° Baume liquid lime-sulphur. Spray while the plants are completely dormant. Excellent control of San Jose scale can be obtained by spraying with 4 pounds of 50 percent DDT wettable powder in 100 gallons of water during the crawler stage.

**SARCOPTIC MANGE MITE.** The mites which cause sarcoptic or common mange of horses and swine are small white or yellowish parasites. The adults will measure about  $\frac{1}{50}$  inch in length. They are not readily visible to the naked eye unless placed on a black background. The general form of the body is more nearly round than oval and the bluntly rounded head is as broad as it is long. The mites penetrate the upper layer of the skin and excavate burrows in which eggs are laid. The young mites feed in the burrow and when mature begin new burrows and lay more eggs. In the early stages of this type of mange, lesions are first visible in the

neck and shoulders or around the head, but they may start on the breast, flanks, sides or other parts of the trunk. From those parts the mange may spread until it covers the entire body. The presence of the mites causes itching and great irritation and the skin becomes inflamed and swollen so that small nodules are formed around and over the burrows. Later, vesicles are formed which break and discharge serum and as the serum dries small scabs are formed. The hair over the affected part stands erect or may fall out. As the disease develops the skin becomes more or less bare in irregular-shaped patches and is generally thickened and thrown into folds.

**Control:** Spray all animals with 2 pounds of 25 percent lindane wettable powder in 100 gallons of water. Thorough coverage of the animals is essential. Best results can be obtained by spraying at a pump pressure of 400 pounds. One application thoroughly applied will result in a complete cleanup of infested animals. This treatment will also control lice.

**SAW-TOOTHED GRAIN BEETLE.** This beetle is a common household pest. It is reddish brown, about  $\frac{1}{8}$  inch long and derives its name from the notched fringe on each side of the body. The grub is yellowish white and marked on each segment of the body by a darkened area.

**Control:** Follow control measures recommended for the confused flour beetle.

**SCALY - LEG MITE.** Scaly-leg is caused by small mites burrowing into the skin on the legs and feet of poultry.

**Control:** Dip feet of affected birds in crude petroleum or used crank case oil. Repeat treatment in about a month if necessary.

**SEED-CORN MAGGOT.** These cream-colored maggots are found in potato seed pieces and seed beans in the soil, particularly during cold, wet springs. They frequently injure planted beans, killing the plants entirely or causing light stands or a condition known as "baldhead."

**Control:** No direct control method is known. If the spring is wet and cold, delay seeding until warm weather prevails. The flies which lay their eggs on the soil are known to be attracted by the presence of freshly decaying organic matter. It is best to turn under in the autumn the manure or green cover to be used as fertilizer rather than to do it in the spring before planting. Satisfactory stands are obtained by replanting infested fields as soon as it is determined the first planting will be unproductive. By that time most of the maggots have developed and the second planting usually remains free of injury.

**SHEEP BOT FLY.** Sheep shake their heads, stamp their feet, and crowd together, holding their noses to the ground, especially in bare dusty places; or run away with their noses held low, in an effort to escape the fly which deposits its larvae in the nostrils of the sheep. The presence of the larvae in the nostrils causes in-

flammation and a copious catarrhal discharge. The excess of mucus together with the dust drawn into the nostrils causes labored breathing. The presence of the maggots in the head may cause thinness and weakness in the animals.

**Control:** The bedding-out method of range sheep management followed in Idaho leave the larvae behind and is responsible for the practical absence of nose grubs in range sheep in this state. Tall growing pastures should be provided for farm flocks.

**SHEEP - TICK.** The sheep tick, louse, fly or ked as it is sometimes called, is not a true tick but an insect. It is a degenerate fly which has lost its wings. It feeds by crawling about through the wool and thrusting its sharp mouth-parts into the flesh to suck blood. It causes the sheep to rub, bite, and scratch at the wool, thus spoiling the fleece. When abundant, the animals are unthrifty and unprofitable. The sheep tick spends its entire life on the animal. Two stages are readily found on the sheep at all seasons of the year; the adults and the "nits." The adult is brown, wingless, about  $\frac{1}{4}$  inch long and is covered with short, spiny hairs. "Nits" are nearly round, chestnut brown, egg-like objects that are glued to the hair especially about the neck, inside the thighs and along the belly. These are the pupal stage of the insect, not eggs.

**Control:** Sheep ticks are best controlled by treating sheep in the fall before the advent of cold weather. Fall treatment prevents the heavy buildup of sheep ticks during the months of November, December, January, and February when infestations are normally the heaviest. The spray should contain 4 pounds of 50 percent DDT wettable powder and 1 pound of 25 percent lindane wettable powder in 100 gallons of water. Range sheep can best be treated by using a spray boom equipped with 10 to 20 nozzles. A 2-nozzle, hand-operated spray gun can be used to spray small farm flocks. Apply the spray at a pump pressure of 500 pounds.

**SHORT - NOSED AND LONG - NOSED CATTLE LICE.** These lice are both common pests of cattle and may be considered together since their habits and control are very similar. Both of these lice are bluish gray in color. They may be found on the lower parts of the body of the cow, between the legs, on the belly and on the escutcheon. They injure cattle by sucking blood. These lice do not migrate much on the body of the animals, but usually stay in one small area after they have found a suitable feeding place. Severe infestations cause cows to lose weight and fall off in milk production. Irritation from the lice causes the animals to attempt to rub and bite the affected parts, resulting in hair removal and, in severe cases, broken skin and scab formation.

**Control:** Same as for cattle biting lice.

**SHOT - HOLE BORER.** The shot-hole borer is sometimes found working in prune, peach, cherry, and apricot trees, especially in years following widespread frost injury to trees. During the winter this borer is in the grub or larval stage in the inner bark. The over-

control suggested is the frequent disposal of the manure during the fly season by distributing it on the fields where it will dry out quickly, thus preventing the adults from depositing eggs. Spray as recommended for house fly control.

**STONEFLY.** This species is black with red and yellow markings and measures between  $\frac{1}{2}$  inch and  $\frac{3}{4}$  inch long. Larvae live in streams and emerge in the early spring leaving their cast skins on rocks and bushes. Occasionally the flies make their way to apricot and peach trees and cause severe injury by eating holes in the forming fruits and into the fruit buds.

**Control:** Control probably can be obtained by spraying the trees with lead arsenate or DDT as soon as the insects appear on the trees.

**STRAWBERRY CROWN MOTH (WESTERN).** Adults are black, clear-winged moths varying in length from about  $\frac{1}{2}$  to  $\frac{3}{4}$  inch. They are marked across the body by from two to four yellow bands. The caterpillars are whitish or pink with a brown head and when mature are about  $\frac{4}{5}$  inch long. They kill strawberry plants by working in and destroying the crown and so weaken other plants that they reduce the yield.

**Control:** No satisfactory control is known.

**STRAWBERRY LEAF ROLLER.** The small, green caterpillars feed on the upper leaf surfaces, first rolling the leaves together and feeding within. Leaf surfaces are so badly destroyed that leaves turn brown and dry, and in heavy infestations fruits fail to mature. Moths appear in the spring and deposit their eggs on the under surfaces of the leaves. There are probably two generations annually in Idaho, but only the first generation is of economic importance.

**Control:** Spray the plants heavily with lead arsenate, 3 pounds to 100 gallons of water, before the caterpillars begin to roll the leaves. This is shortly after the moths begin flying, or about the time the plants are blossoming.

**STRAWBERRY ROOT WEEVIL.** These dark brown to black snout beetles are about  $\frac{1}{4}$  inch long. They hibernate under leaves or trash, appear in early summer, and lay eggs for the succeeding generation. Adults feed at night. Besides attacking strawberries, they kill the terminal buds of raspberry canes and probably injure other plants. The small, white, brown-headed larvae live in the soil and seriously injure or kill strawberry plants by feeding on the roots.

**Control:** Apply about 1 tablespoon of poisoned bait in the crown of each plant when about 75 percent of the weevils in the soil have changed to the adult stage. This is approximately 3 weeks before the final harvesting of annual-bearing varieties. Grind apple waste or pomace or dried apples through a meat grinder and then mix with it calcium arsenate at the rate of 5 pounds to 95 pounds of

ground apple. Adults feed on this bait, and are killed before they deposit eggs, thus insuring protection of the next year's crop. If apple pomace is not available an effective bait may be prepared by mixing 50 pounds bran with 5 gallons water, 10 pounds sugar and 5 pounds calcium arsenate. Substitute 2½ gallons of molasses for the sugar if you choose. Commercially prepared baits are available for immediate use.

**SUGAR - BEET ROOT APHID.** Small yellow plant lice are commonly found on the roots of lettuce, sugar beets, beets and many weeds. These aphids produce masses of fine cottony-looking waxy threads toward the end of their bodies. These cottony threads appear like white mold on the roots of the plants. The aphids overwinter as eggs on the bark of poplar trees and as wingless females on the roots of herbaceous plants. Migration to beets and other cultivated host plants occurs in the summer. Feeding reduces the size and quality of beets and causes plants to wilt on warm days.

**Control:** Destroy all weed hosts in the vicinity of the crop to be protected. Where it is possible, irrigate during July and August about every 10 days to prevent the soil from cracking around the base of the plants. Frequent irrigation will help control the aphids and increase the yield.

**SUGAR - BEET ROOT MAGGOT.** The adult sugar-beet root maggot is a fly about ¼ inch long, black with transparent white wings except for a black area on the front margin. The maggot is white and about ¼ inch long. All of the injury is caused by the maggot which feeds upon the taproot and rootlets beneath the ground surface. Feeding causes the sap to flow, soaking the ground surrounding the beet, and the injured areas turn black. If the maggot cuts off the tip of the taproot, the plant will die.

**Control:** No control is known. Watering the beets freely during late June and July is thought to keep the maggots feeding so high on the roots that no serious damage will result.

**TERMITES.** These so-called "white ants" occasionally destroy foundation timbers and woodwork in Idaho. They work in the dark, avoiding the light, and often their presence is unsuspected until injured timbers collapse. The species commonly destructive in Idaho maintain a ground connection and the insects travel back and forth from infested timbers in covered runways.

**Control:** Where timbers are found to be infested, destroy the covered runways and blow sodium fluosilicate into the runways in the wood. To do this, bore ¼ inch holes in the infested timbers at 3- to 6-foot intervals so that the holes cut through the termite galleries and from one-half to three-quarters through the wood. Use a dust gun with a spout that fits tightly into these holes. Treat the ground at the bases of these runways with sodium fluosilicate. The material mentioned is extremely poisonous to humans, and must be handled with care. Immediately after handling the poison the hands should be washed. Wherever possible, re-

place old wooden foundations with concrete and in the construction of new buildings use concrete foundations, or, if wood must be used, the most permanent known practical method of treating it is to use coal-tar creosote or pentachlorophenol. For detailed instructions in termite control consult your county agent or write to the University of Idaho Agricultural Experiment Station.

**THISTLE APHID.** These red or green plant lice curl the leaves of plums and prunes in the early spring and form sticky honey-dew. Heavy infestations are extremely injurious and cause a heavy drop of small prunes.

**Control:** Infestations are of little economic importance in orchards where a dormant oil spray is applied early in March for San Jose scale. After the foliage is out, spray with 25 percent parathion wettable powder at the rate of  $\frac{1}{2}$  pound to 100 gallons of water. Make applications just as the leaves are appearing and before curling of the leaves takes place.

**TOMATO HORNWORM.** This large green worm, having a "horn" on the rear end of the body, rarely occurs in numbers, but a few of them may cause heavy defoliation. The adult is known as a hawk moth and is one of the species frequently observed late in the evening feeding in the blossoms of many kinds of plants. It suggests a humming bird in the way it hovers and feeds in flowers.

**Control:** Hand-pick and destroy the caterpillars, or, in extreme cases, spray with calcium arsenate, 2 pounds to 100 gallons of water. Dusting with 5 percent DDT dust gives very satisfactory control.

**TREEHOPPERS.** Treehoppers cause injury to many kinds of fruit trees and ornamentals. The injury is caused by the wounds and scars made by the female in laying eggs in the bark of trees. The scars may be long longitudinal slits crescent-shaped or roughened and ragged appearing, depending on the species of treehoppers making them. Egg slits are made in the current season's growth or in year-old wood but old scars persist for several years. Injury is most severe in young orchards having alfalfa or clover crops or in orchards which are very weedy. Injury may be especially severe around the edges of orchards where willows or weeds are allowed to grow.

**Control:** Clean cultivation is the most practical method of control. It should be followed in old orchards for a season or two to cut down the infestation and should be practiced generally in young orchards until trees are well established. The success of this treatment depends on the fact that treehoppers feed only on cover crops or weeds and only go to the trees to lay eggs. Many twigs containing eggs may be pruned off during the winter and burned to prevent emergence of young treehoppers. Many of the eggs are killed by spraying the trees thoroughly with dormant-type oil emulsion at the rate of 5 gallons to 95 gallons of



water before the buds burst in the spring. Control on cover crops can be obtained by spraying or dusting with DDT.

**TURNIP APHID.** Turnip aphids are small, soft-bodied, green or green and black insects. Some of them have wings, others are wingless. They attack turnips, mustard, radish and related crops causing the leaves to curl or the stems to wilt. Heavily infested plants die.

**Control:** Same as for cabbage aphid control.

**(VIRGINIA CREEPER) LEAFHOPPER.** These sucking insects are extremely abundant and injurious to Virginia creeper in many parts of Idaho. Adults are about  $\frac{1}{8}$  inch long, yellow and marked by a brown zigzag line lengthwise on each wing. Injured leaves are at first marked by light flecks. As injury progresses, the flecking becomes more general and severely injured leaves assume a white, parched appearance. In the late summer, severely damaged vines are more or less defoliated.

**Control:** Control measures recommended for the grape leafhopper are very effective.

**WASPS, HORNETS AND YELLOWJACKETS.** These are medium to large, red and yellow insects with black or brown markings and bands. They are commonly called yellowjackets, hornets, or paper wasps. These wasps build large paper nests from wood fiber. The nests can be found suspended from trees, bushes, rafters and other objects or in large holes excavated in the ground. Ordinarily, wasps are considered beneficial since they destroy large numbers of insect pests. They do, however, cause some damage to ripe fruits and are often troublesome about canneries, drying sheds, and in dwellings.

**Control:** No satisfactory method of control is known. Some degree of control can be obtained by finding their nests and then destroying the colony. Nests can be sprayed with an oil spray containing 5 percent DDT or chlordane. The application of a spray containing 4 pounds of 50 percent DDT wettable powder or 40 percent chlordane wettable powder in 100 gallons of water will give some degree of control when applied in attics, underneath eaves, and other such places.

**WESTERN BLACK FLEA BEETLE.** This tiny, shiny, black beetle is easily recognized by its habit of hopping when disturbed. It eats holes in leaves of cabbage, radish and related vegetables or injures plants in hotbeds or shortly after planting.

**Control:** Dust the plants thoroughly with 5 percent DDT dust. Begin dusting while plants are in hotbeds or immediately after they are set out, or when they appear above the surface in seeded fields. Repeat applications when necessary. A 1 percent rotenone dust will also give excellent control.

**WESTERN POTATO FLEA BEETLE.** This insect resembles the western black flea beetle. It eats holes in the leaves of young

potato and tomato plants, causing leaves to turn brown and become crisp.

**Control:** Apply the same control measures as for the western black flea beetle.

**WESTERN RASPBERRY FRUITWORM.** Adult beetles, which are light brown in color and approximately  $\frac{1}{8}$  inch long, appear early in the spring and feed on the young leaves and newly opened buds at the tips of the canes. The small brown and white grubs, hatching from these eggs, bore into and feed upon the berries making them unfit for food. When full-grown the grubs are approximately  $\frac{1}{4}$  inch long.

**Control:** Three applications of a 1 percent rotenone dust at weekly intervals, beginning 10 days after the first blossoms appear, give good control. Two pounds of derris powder, containing 5 percent rotenone, in 100 gallons of water, may be used as a spray.

**WESTERN YELLOW - STRIPED ARMYWORM.** This large, velvety-black cutworm is readily distinguished by the two prominent bright yellow stripes on its sides and the reddish-black coloration underneath. This armyworm when mature measures  $1\frac{1}{2}$  to 2 inches in length. The adults are large, grayish-brown moths. These cutworms are general feeders and occasionally become serious pests on alfalfa, potatoes, and sugar beets.

**Control:** Since this insect is heavily parasitized, outbreaks seldom occur. Very effective control can be obtained by the application of a 5 percent DDT dust at the rate of 20 pounds per acre.

**WHEAT STEM MAGGOT.** Wheat attacked by the wheat stem maggot in the fall takes on a dark appearance and is stunted, with thickened stiff leaves. The pale green maggots work on the inside of the lower part of the stem or crown of the plant. In the summer the injured wheat dies out and the heads and the upper parts of the straw become whitened shortly after the heads begin to fill. The lower parts of the plants are green.

**Control:** No practical method of control is known. Late seeding sometimes reduces the amount of injury.

**WHITE GRUBS.** These are larvae of the June bugs, the 10-lined beetle and the carrot beetle. They are large, brown-headed grubs that eat the roots of plants below the soil surface. Grubs usually are found in a curled position when dug out of the ground. The adults are large, red beetles measuring from about  $\frac{1}{2}$  to  $\frac{3}{4}$  inch long. The 10-lined beetle is grayish with 10 black lines running lengthwise on the back. Adults are often attracted to lights in the summertime and make loud buzzing noises when in flight.

**Control:** Avoid planting crops susceptible to white grub injury on recently broken sod. Pull affected plants and destroy the grubs to prevent them from attacking adjacent sound plants. Injured plants are detected by their wilted appearance. To control

white grubs on golf courses and in lawns use 1 pound of 50 percent DDT to each 1,000 square feet. The DDT can be mixed with water and sprayed onto the turf or used dry. When used dry it is best to mix the DDT with sand, soil or fertilizer and distribute the mixture with a lawn fertilizer spreader. Wash into the turf immediately with a hose or sprinkler.

**WHITE - LINED SPHINX.** The large moths feed at dusk on the nectar of many kinds of flowers, hovering about the flowers like humming birds. Caterpillars attain a length of 3 inches and may be either green or nearly black. They have a horn at the rear end of the body. The horn and the head are orange or yellow. They are general feeders but have been occasionally injurious to alfalfa and wheat in Idaho.

**Control:** This species is so heavily parasitized that it rarely becomes injurious and probably never in successive seasons in the same locality. Alfalfa fields may be cut as soon as infestations become heavy. The attack soon subsides and later injury is not probable.

**WILLOW APHIDS.** Large reddish-brown plant lice occasionally become abundant on willows grown for shade and windbreaks. These aphids are numerous on native willows almost every year. Heavy infestations are unsightly and may weaken the trees. The honey-dew produced by these aphids is very attractive to ants.

**Control:** No satisfactory control is known. Thoroughly spraying the infested trees with a spray containing 1 pint of pyrethrum extract or nicotine sulphate in 100 gallons of water will help reduce the infestation.

**WIREWORMS.** These shiny, yellow, hard worms bore into planted seeds, corn, beans, potato seed pieces, potato tubers, root crops and the underground portions of many other plants. The loss caused by them is enormous and is steadily increasing in the irrigated sections of Idaho. The adults are slender brown or black, hard-shelled beetles known as click beetles from their habit of springing into the air and making a clicking noise when they are placed on their backs. Wireworms live in the soil several years before transforming to adults. Adults are present for but a short time in the spring during mating and egg-laying. The inaccessibility of the larvae in the soil renders control difficult.

**Control:** Avoid the use of clovers in crop rotations on land infested with wireworms. Soil dryness is harmful to wireworms and will kill them if the dry period is prolonged. Alfalfa is the key crop in wireworm control rotations. The high populations of wireworms usually decrease after each succeeding year of alfalfa. If the stand becomes thin or weedy it should be plowed up after 3 years but in most cases alfalfa can be used for 4 years in the rotation. The last year in alfalfa the field should not be watered. Alfalfa should be followed with the crop to be used in

the rotation which is most susceptible to wireworm damage such as potatoes. The next year include less susceptible crops such as sugar beets, beans or corn. These crops should be followed in turn with small grains and then the field should be returned to alfalfa. The alfalfa should not be seeded with the grain but should be sowed alone after the grain harvest. The stubble should be plowed during the first ten days of August to break up the pupa cases, thus destroying many wireworms. Seeding should follow plowing.

DDT when thoroughly mixed with the soil to a depth of 8 inches will slowly kill off the wireworms and prevent reinfestation for a period of at least 5 years. Apply DDT to the soil surface at the rate of 10 pounds of actual DDT per acre and then follow by disking, plowing and cross-disking. Planting can follow immediately. Ethylene dibromide applied at the rate of 10 gallons of 40 percent concentrate per acre is very effective. Apply the solution to a depth of 8 inches by machine or in furrow ahead of the plowshare. Seal the soil surface immediately by harrowing or disking lightly. Delay planting at least 7 days.

**WOOD TICKS.** The most common tick infesting livestock in Idaho is the Rocky Mountain wood tick. This tick is active during spring and early summer. It infests horses, cattle, sheep and other livestock. Another tick found infesting cattle, horses and mules during winter is known as the winter tick. Both these ticks are bloodsuckers. Heavy infestations greatly weaken the animals making them susceptible to disease and easy prey for predators. Losses in range sheep during the spring are often quite high.

**Control:** Wood ticks can be readily controlled by treating infested animals with a spray mixture containing 2 pounds of 25 percent lindane or 12 pounds of 50 percent toxaphene wettable powder in 100 gallons of water. Spray the animals thoroughly and pay particular attention to the areas around the withers, neck, head, and ears. Use a pump pressure of 400 to 500 pounds in order to penetrate the heavy hair coat on horses and cattle and the heavy fleece on sheep.

**WOOL MAGGOTS.** When the wool of sheep becomes soggy from warm rains or soiled with urine and feces or blood from wounds or lambing, certain blowflies are attracted to the animal and deposit their eggs in the dirty wool, most commonly about the rump or near wounds. The maggots feed upon the wet wool and the adjacent skin, causing the latter to fester and the wool to become putrid and loosen, thus exposing the inflamed raw flesh with the whitish maggots tunnelling in it.

**Control:** Since the flies attack wool chiefly after they have become abundant by breeding in carcasses, the control measures are to destroy all carrion by properly burning or burying it deeply. Spray animals thoroughly with a mixture containing 1 pound of 25 percent lindane and 4 pounds of 50 percent DDT

wettable powder in 100 gallons of water to prevent infestations.

**WOOLLY APPLE APHID.** This purplish plant louse clusters on "water sprouts," in crevices or wounds in the bark or on the roots of apple trees and is covered by a white, "woolly" secretion. In Idaho it overwinters on elm in the egg stage. One complete generation is produced on elms before the aphids migrate to apples. This generation produces curled leaves and leaf rosettes on elm trees.

**Control:** Spray infested apple trees thoroughly about the middle of June with a solution composed of 1 pint of 40 percent nicotine sulphate, 1 gallon of summer-type oil emulsion and 99 gallons of water. The oil and nicotine may be added to one of the first-brood codling moth cover sprays. The spray solution must be applied with sufficient pressure to drive it through the woolly covering and to the aphids beneath. Parathion will give good control when used at the rate of 1 pound of 25 percent material to 100 gallons of water. For control on elms follow the recommendations given for control of the European elm leaf-curl aphid.

**ZEBRA CATERPILLAR.** These black-and-yellow striped caterpillars feed in colonies. They are found first in clusters and defoliate single plants before spreading to others.

**Control:** Destroy colonies on the leaves or spray as for cabbage worm.

## *Insecticides*

**ARSENICALS.** For the control of insects with chewing mouth-parts, use a dust prepared by mixing 1 part of either calcium arsenate, lead arsenate or paris green with 3 parts hydrated lime. Calcium arsenate is preferable if available. Mix the lime and arsenicals thoroughly. Any dust not used should be labeled conspicuously and placed out of reach of children and animals. Calcium or lead arsenate are used at the rate of 1 ounce per gallon of water for spraying. One-half ounce of soap, casein spreader, or powdered milk is usually added to wet waxy leaves such as beets. Keep the mixture agitated while spraying. The application of arsenicals to leafy vegetables that are to be eaten is not recommended.

**CARBON DISULFIDE — CARBON TETRACHLORIDE MIXTURE.** Carbon disulfide has been used extensively by itself for the fumigation of farm stored grains. However, it is highly inflammable. The addition of carbon tetrachloride to carbon disulfide materially reduces the fire hazard and makes a highly satisfactory fumigant for general use. Commercial mixtures are available for immediate use. Follow directions carefully when using any fumigant.

**CHLORDANE.** Grasshoppers, alfalfa weevils, ants and several other insects are readily controlled with chlordane. It can be obtained as a dust, a wettable powder, an emulsion or in a highly refined deodorized oil base. Follow precautions given for DDT when using chlordane.

**DDT.** This material is effective for the control of a large number of insects. However, it is ineffective against spider mites, cattle grubs, grasshoppers and many species of aphids. It can be used as a dust, a water suspension spray, an emulsion spray or in a highly refined deodorized oil base. *DDT may cause toxic effects if ingested or inhaled in large quantities. DDT mixed with oil or in emulsion form should not be permitted to remain in prolonged contact with the skin. Forage or other feeds that have been treated with DDT should not be fed to milking animals or animals being fattened for slaughter.*

**ETHYLENE DIBROMIDE.** Wireworms and other soil-inhabiting insects are effectively controlled with ethylene dibromide. Commercial preparations containing 40 and 85 percent ethylene dibromide are readily available. Follow the manufacturer's recommendations in handling and applying these concentrates.

**ETHYLENE DICHLORIDE.** When using ethylene dichloride emulsion for the control of peach tree borer be sure to obtain a freshly prepared stock emulsion that has not separated. Dilute the stock emulsion with water before using, according to the age of the tree. Dilute 3 parts stock emulsion with 7 of water

and use  $\frac{1}{4}$  to  $\frac{1}{2}$  pint for 2-to 3-year-old trees. Dilute 2 parts stock emulsion with 3 of water and use  $\frac{1}{2}$  pint for 4- to 5-year-old trees. Use  $\frac{1}{2}$  pint of a half and half mixture for older trees.

**ETHYLENE DICHLORIDE — CARBON TETRACHLORIDE MIXTURE.** Commercially prepared mixtures of ethylene dichloride and carbon tetrachloride are available for immediate use. These mixtures make highly satisfactory fumigants for general use. Carefully follow the manufacturer's directions in handling and applying.

**LIME-SULPHUR.** Most scale insects are effectively controlled with lime-sulfur. It can also be used in combination with dormant oil for the control of scale insects on fruit trees. This combination should contain 1 percent actual oil and 3 gallons of lime-sulfur per 100 gallons of spray. Lime-sulfur can be purchased as a liquid or in dry form. Four pounds of dry lime-sulfur are equivalent to 1 gallon of liquid lime-sulfur. Do not apply lime-sulfur before or after the application of a dormant oil spray.

**LINDANE.** This is a refined form of benzene hexachloride containing only the gamma isomer. Lindane is available chiefly as a 25 percent wettable powder. It lacks most of the disagreeable musty odor of other benzene hexachloride formulations and is, therefore, much more pleasant to handle. Lindane is especially effective in the control of animal parasites. It is not necessary to use it at a strength greater than 2 pounds per 100 gallons of water. Precautions listed under DDT should be followed in using lindane. In addition, do not use lindane in the soil or on crops such as potatoes, corn, peas, beans, carrots, and many other root crops.

**METALDEHYDE.** Garden slugs are effectively controlled with metaldehyde bait. These baits are sold on the market under various trade names. Metaldehyde alone is difficult to obtain.

**NICOTINE SULPHATE SPRAY.** The standard 40 percent nicotine sulphate solution is usually used at the rate of 1 teaspoonful in 1 gallon of water. One ounce of soap (a heaping tablespoonful) should first be dissolved in each gallon of water for best results. Nicotine sulphate sprays are effective against most soft-bodied insects but should not be used when temperatures are below 70° F.

**PARATHION.** When it is necessary to use parathion in commercial orchards for the control of mites and aphids use only as a spray. It can be purchased as a 15 or 25 percent wettable powder. Aerosols are the most practical for use in control of greenhouse pests. *Do not use parathion later than 30 days before harvest. Do not use parathion at concentrations stronger than recommended. Extreme care should be used in handling the powder concentrate during the mixing process. Operators should wear goggles, gloves and a gas mask. Remove clothing and bathe thoroughly at the end of each operational period. At the first signs of nausea,*

*dizziness, headache or constriction of the chest muscles consult a doctor. Atropine is an antidote for parathion poisoning.*

**PENTACHLOROPHENOL.** This material is used primarily as a wood preservative. Pentachlorophenol is recommended for the treatment of soil and wood in the control of termites. It has a slight odor. For soil treatment, dissolve at the rate of 2½ pounds of pentachlorophenol in either 1 gallon of pine oil or 2 gallons of an alkyl naphthalene. Dilute further with mineral spirits, naphtha or fuel oil to make 7 gallons. Apply this mixture at the rate of 2 quarts for each cubic foot of soil to be treated. Wood should be treated in the manner used for preserving it. Pentachlorophenol is toxic to plants and care should be used in applying it to soil in the vicinity of trees and shrubs.

**POISONED BRAN BAIT.** False wireworms and cutworms can be controlled with a poisoned bran bait. The following formula will bait ⅓ to ½ acre.

Bran (free from shorts).....	5 pounds
Water to moisten.....	1 to 2 quarts
Sodium fluosilicate .....	4 ounces

The bran and sodium fluosilicate are first mixed thoroughly and the water added. Use only enough water so that the bait will be wet, but when pressed in the hands will still fall apart readily. The bait will not spread well if too moist. The bait should be applied in the evening for cutworms.

**PROPYLENE DICHLORIDE.** Peach tree borer can be effectively controlled by using propylene dichloride emulsion in the same way as ethylene dichloride. Satisfactory results can be obtained by using it at one-half the strength recommended for ethylene dichloride emulsion.

**PYRETHRUM DUST.** Two kinds of pyrethrum dust are available commercially. One is a mixture of finely ground pyrethrum flowers and an inert carrier. The other consists of an inert carrier coated with pyrethrum extract. This concentrate is mixed with a diluent to make up a dust of the desired strength. For squash bug control the content of active ingredients (pyrethrins) should be 2 percent. For less resistant insects it may be less. Pyrethrum, like rotenone, loses its effectiveness rapidly when exposed to sunlight.

**PYRETHRUM SPRAY.** Several commercial sprays are available which contain pyrethrum extract. Directions will be found on the containers for making proper dilutions.

**ROTENONE-BEARING DUST.** Commercial dusts containing ¾ to 1 percent rotenone are used to control many insects. Rotenone dusts lose their effectiveness very rapidly when exposed to sunlight. They leave no poisonous residues and are, therefore, safe to use on vegetables within 2 or 3 days before harvest.



**ROTENONE SPRAY.** Sprays containing rotenone are very effective in the control of many garden pests. Rotenone sprays are used extensively in the control of cattle grubs and lice and in the control of cherry fruit flies. Sprays are prepared from ground derris powder, containing 5 percent rotenone, or from an emulsion containing rotenone extract. Rotenone sprays leave no poisonous residues.

**SULFUR.** Dusts and sprays containing sulfur are widely used as insecticides and fungicides. Sulfur is also useful as a carrier and as an additional killing agent in many dust mixtures. It can be obtained as a wettable powder or as dusting sulfur. It is highly recommended for the control of red spider mites, clover mites and rust mites on field crops. Sulfur is irritating to the skin and mucuous membranes and in dust form is highly inflammable. Sulfur may cause some burning and bleaching when applied to plants during periods of high temperatures.

**TETRAETHYL PYROPHOSPHATE.** Orchard mites and aphids have been successfully controlled with tetraethyl pyrophosphate, although many times results have been erratic. It is available as a spray or as a dust. Tetraethyl pyrophosphate is highly toxic to man and animals and some plants. It is disagreeable to apply and loses its toxicity in a few hours when exposed to air or water. Precautions recommended under parathion also apply to tetraethyl pyrophosphate.

**TOXAPHENE.** Grasshoppers are readily controlled by baits, dusts and sprays containing toxaphene. It can be obtained as a dust, wettable powder or as an emulsion. The dust most commonly recommended contains 10 percent toxaphene. Precautions given under DDT also apply to this chemical.

## List Of Insects

- Alfalfa caterpillar  
*Cotias philodice eurytheme* Bdl.
- Alfalfa looper  
*Autographa californica* (Speyer)
- Alfalfa weevil  
*Hypera postica* (Gyll.)
- Angoumois grain moth  
*Sitotroga cerealella* (Oliv.)
- Apple aphid  
*Aphis pomi* Deg.
- Apple leafhopper  
*Empoasca maligna* (Walsh)
- Ash-gray blister beetle  
*Epicauta fabricii* (Lec.)
- Asparagus beetle  
*Crioceris asparagi* (L.)
- Bean cutworm  
*Loxagrotis albicosta* (Sm.)
- Bed bug  
*Cimex lectularius* L.
- Beet leafhopper  
*Circulifer tenellus* (Baker)
- Beet webworm  
*Loxostege sticticalis* (L.)
- Birch skeletonizer  
*Bucculatrix canadensisella* Chamb.
- Black blow flies  
*Phormia regina* (Meig.)  
*Phormia terrae-novae* (R.D.)
- Black cherry aphid  
*Myzus cerasi* (F.)
- Black cherry fruit fly  
*Rhagoletis fausta* (O.S.)
- Black flies  
*Simulium* sp.
- Black horse fly  
*Tabanus atratus* F.
- Black peach aphid  
*Anuraphis persicae-niger* (Smith)
- Black vine weevil  
*Brachyrrhinus sulcatus* (F.)
- Black widow spider  
*Latroctes mactans* (F.)
- Bluebottle flies  
*Calliphora erythrocephala* (Meig.)  
*Calliphora latifrons* Hough.  
*Calliphora lilea* Wlk.  
*Calliphora vomitoria* (L.)
- Boxelder bug  
*Leptocoris trivittatus* (Say)
- Bristly rose-slug  
*Cladius isomerus* Nort.
- Bronze birch borer  
*Agrius anxius* Gory
- Bulb mite  
*Rhizoglyphus echinopus* (F. & R.)
- Cabbage aphid  
*Brevicoryne brassicae* (L.)
- Cabbage curculio  
*Ceutorhynchus rapae* Gyll.
- Cabbage maggot  
*Hylemya brassicae* (Bouche)
- Cabbage seedpod weevil  
*Ceutorhynchus assimilis* (Payk.)
- Carpenterworm  
*Prionoxystus robiniae* (Peck)
- Carpet beetle  
*Anthrenus scrophulariae* (L.)
- Carrot beetle  
*Ligyris gibbosus* (Deg.)
- Cat flea  
*Ctenocephalides felis* (Bouche)
- Cattle biting louse  
*Bovicola bovis* (L.)
- Cherry fruit fly  
*Rhagoletis cingulata* (Loew)
- Cherry worms  
*Pandemis* sp.
- Chicken body louse  
*Eomenacanthus stramineus* (Nitz.)
- Chicken head louse  
*Cuclotogaster heterographus* (Nitz.)
- Chicken mite  
*Dermanyssus gallinae* (Deg.)
- Chrysanthemum gall midge  
*Diarthronomyia hypogaea* (Loew)
- Clover aphid  
*Anuraphis bakeri* (Cowen)
- Clover bud caterpillar  
*Grapholitha conversana* Wlsm.
- Clover leaf weevil  
*Hypera punctata* (F.)
- Clover mite  
*Bryobia praetiosa* Koch
- Clover root borer  
*Hylastinus obscurus* (Marsh.)
- Clover root curculio  
*Sitona hispidula* (F.)
- Clover seed chalcid  
*Bruchophagus gibbus* (Boh.)
- Clover seed midge  
*Dasyneura leguminicola* (Lint.)
- Clover seed weevil  
*Miccotrogus picirostris* (Fab.)
- Codling moth  
*Carpocapsa pomonella* L.
- Colorado potato beetle  
*Leptinotarsa decemlineata* (Say)
- Common cattle grub  
*Hypoderma lineatum* (DeVill.)
- Confused flour beetle  
*Tribolium confusum* Duv.
- Cooley spruce gall aphid  
*Chermes cooleyi* Gill.
- Corn earworm  
*Heliothis armigera* (Hbn.)
- Cottony maple scale  
*Pulvinaria titis* (L.)
- Currant aphid  
*Capitophorus ribis* (L.)
- Cutworms  
*Agrotis ypsilon* (Rott.)  
*Amathes c-nigrum* (L.)  
*Chorizagrotis auxiliaris* (Grote)  
*Cirphis unipuncta* (Haw.)  
*Peridroma margaritosa* (Haw.)
- Cyclamen mite  
*Tarsonemus pallidus* Banks
- Diamondback moth  
*Plutella maculipennis* (Curt.)
- Dog flea  
*Ctenocephalides canis* (Curt.)
- Dog follicle mite  
*Demodex canis* Leydig
- Douglas-fir beetle  
*Dendroctonus pseudotsugae* Hopk.

- Douglas-fir tussock moth  
*Hemerocampa pseudotsugata* McD.
- Eearthworms  
*Lumbricus terrestris* L.  
*Helodrilus caliginosus* Savigny
- Elm leaf beetle  
*Galeructella xanthomelaena* (Schr.)
- English grain aphid  
*Macrosiphum granarium* (Kby.)
- European earwig  
*Forficula auricularia* L.
- European elm leaf-curl aphid  
*Eriosoma ulmi* (L.)
- European elm scale  
*Gossyparia spuria* (Mod.)
- European peach scale  
*Lecanium persicae* (F.)
- European red mite  
*Parateranychus pilosus* (C. & F.)
- Eye-spotted bud moth  
*Spilonota ocellana* (D. & S.)
- Fall webworm  
*Hyphantria cunea* (Drury)
- False chinch bug  
*Nysius ericae* (Schill.)
- False wireworms  
*Eleodes extricata* (Say)  
*Eleodes hispilabris* (Say)
- Firebrat  
*Thermobia domestica* (Pack.)
- Fluff louse  
*Goniocotes hologaster* Nitz.
- Forest tent caterpillar  
*Malacosoma disstria* Hbn.
- Four-spotted tree cricket  
*Oecanthus nigricornis quadripunctatus* Beut.
- Fruit tree leaf roller  
*Archips argyrospila* (Wlkr.)
- Garden slug  
*Limax* sp.
- German cockroach  
*Blattella germanica* (L.)
- Gladiolus thrips  
*Taeniothrips simplex* (Mor.)
- Gooseberry fruitworm  
*Zophodia convolutella* (Hbn.)
- Grain mite  
*Acarus siro* (L.)
- Granary weevil  
*Sitophilus granarius* (L.)
- Grape leafhopper  
*Erythroneura comes* (Say)
- Grasshoppers  
*Aulocara elliottii* (Thos.)  
*Camnula pellucida* Scudd.  
*Dissosteira carolina* (L.)  
*Melanoplus bivittatus* (Say)  
*Melanoplus femur-rubrum* (Deg.)  
*Melanoplus mexicanus mexicanus* (Sauss.)  
*Melanoplus packardii* Scudd.
- Green peach aphid  
*Myzus persicae* (Sulz.)
- Green plant bug  
*Chlorochroa uhleri* Stal
- Greenbottle flies  
*Lucilia illustris* Meig.  
*Lucilia sericata* (Meig.)  
*Lucilia sylvicorum* Meig.
- Greenhouse leaf tier  
*Phylctaeia rubigalis* (Guen.)
- Greenhouse thrips  
*Heliothrips haemorrhoidalis* (Bouche)
- Greenhouse whitefly  
*Trialeurodes vaporariorum* (Westw.)
- Hog follicle mite  
*Demodex phylloides* Csokor
- Hog louse  
*Haematopinus adventicium* Neum.
- Hog mange mite  
*Sarcoptes scabiei suis* Gerlach
- Hollyhock beetle  
*Calligrapha sigmoidea* (Lec.)
- Hop aphid  
*Phorodon humuli* (Schr.)
- Hop looper  
*Hypena humuli* (Harr.)
- Horn fly  
*Siphona irritans* (L.)
- Horse biting louse  
*Bovicola equi* (L.)
- Horse bot fly  
*Gasterophilus intestinalis* (Deg.)
- Horse sucking louse  
*Haematopinus asini* (L.)
- House fly  
*Musca domestica* L.
- Imported cabbage worm  
*Pieris rapae* (L.)
- Imported currantworm  
*Nematus ribesii* (Scop.)
- Indian-meal moth  
*Plodia interpunctella* (Hbn.)
- Intermountain potato leafhopper  
*Empoasca filamenta* DeLong
- Larder beetle  
*Dermestes lardarius* L.
- Leaf-curl plum aphid  
*Anuraphis helichrysi* Kalt.
- Leaf cutter bees  
*Megachile* sp.  
*Osmia* sp.
- Leatherjackets  
*Tipula* sp.
- Legume bugs  
*Lygus elisus* Van D.  
*Lygus hesperus* Knegt.
- Lesser clover leaf weevil  
*Hypera nigrirostris* (F.)
- Lettuce aphid  
*Macrosiphum barri* Essig
- Lima-bean pod borer  
*Etiella zinckenella* (Treit.)
- Long-nosed cattle louse  
*Linognathus vituli* (L.)
- Mealybugs  
*Pseudococcus* sp.
- Mealy plum aphid  
*Hyalopterus arundinis* (F.)
- Mediterranean flour moth  
*Ephestia kuehniella* Zell.
- Mineola moth  
*Mineola scitulella* Hulst.
- Monterey pine scale  
*Physokermes insignicola* (Craw.)
- Mormon cricket  
*Anabrus simplex* Hald.
- Mountain pine beetle  
*Dendroctonus monticolae* Hopk.
- Morning-cloak butterfly  
*Nymphalis antiopa* (L.)
- Narcissus bulb fly  
*Lampetia equestris* (F.)
- Northern cattle grub  
*Hypoderma bovis* (Deg.)

- Norway maple aphid  
*Periphyllus lyropictus* (Kess.)
- Nose bot fly  
*Gasterophilus haemorrhoidalis* (L.)
- Nuttall blister beetle  
*Lytta nuttalli* Say
- Oblique-banded leaf roller  
*Archips rosaceana* (Harr.)
- Onion maggot  
*Hylemya antiqua* (Meig.)
- Onion thrips  
*Thrips tabaci* Lind.
- Oriental cockroach  
*Blatta orientalis* L.
- Oriental fruit moth  
*Grapholitha molesta* (Busck)
- Oystershell scale  
*Lepidosaphes ulmi* (L.)
- Pacific mite  
*Tetranychus pacificus* McG.
- Painted-lady  
*Vanessa cardui* (L.)
- Pea aphid  
*Macrosiphum pisi* (Kltb.)
- Pea Weevil  
*Bruchus pisorum* (L.)
- Peach tree borer  
*Sanninoidea exitiosa* (Say)
- Peach twig borer  
*Anarsia lineatella* Zell.
- Pear leaf blister mite  
*Eriophyes pyri* (Pgst.)
- Pear psylla  
*Psylla pyricola* Foerst.
- Pear-slug  
*Caliroa cerasi* (L.)
- Pine needle scale  
*Phenacaspis pinifoliae* (Fitch)
- Powder-post beetles  
*Lyctus* sp.
- Raspberry cane maggot  
*Pegomya rubivora* (Coq.)
- Raspberry root borer  
*Bembecia marginata* (Harr.)
- Raspberry sawfly  
*Blennocampa rubi* (Harr.)
- Red spider (common)  
*Tetranychus telarius* L.
- Rocky Mountain wood tick  
*Dermacentor andersoni* Stiles
- Rose aphid  
*Macrosiphum rosae* (L.)
- Rose curculio  
*Rhynchites bicolor* (F.)
- Rose leafhopper  
*Typhlocyba rosae* (L.)
- Rose scale  
*Aulacaspis rosae* (Bouche)
- Rosy apple aphid  
*Anuraphis roseus* Baker
- Rust mite  
*Eriophyes oleivorus* (Ashmead)
- San Jose scale  
*Aspidiotus perniciosus* Comst.
- Saw-toothed grain beetle  
*Oryzaephilus surinamensis* (L.)
- Scaly-leg mite  
*Cnemidocoptes mutans* (R. & L.)
- Seed-corn maggot  
*Hylemya cilicrura* (Rond.)
- Shaft louse  
*Menopon gallinae* (L.)
- Sheep bot fly  
*Oestrus ovis* L.
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*Melophagus ovinus* (L.)
- Short-nosed cattle louse  
*Haematopinus eurysternus* (Nitz.)
- shot-hole borer  
*Scolytus rugulosus* (Ratz.)
- Snowball sphid  
*Anuraphis viburnicola* (Gill.)
- Snowy tree cricket  
*Oecanthus niveus* (Deg.)
- Snowbug  
*Porcellio laevis* Koch
- Spinach leaf miner  
*Pegomya hyoscyami* (Panz.)
- Spotted asparagus beetle  
*Crioceris duodecimpunctata* (L.)
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*Epicauta maculata* (Say)
- Squash bug  
*Anasa tristis* (Deg.)
- Stable fly  
*Stomoxys calcitrans* (L.)
- Stoneflies  
*Taenipoteryx nigripennis* Banks  
*Taenipoteryx pacifica* Banks
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*Ancylics comptana fragariae* (W. & R.)
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- Striped horse fly  
*Tabanus lineola* F.
- Sugar-beet root aphid  
*Pemphigus betae* Doane
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*Tetanops aldrichi* Hendl
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*Reticulitermes hesperus* Banks
- Ten-lined June beetle  
*Polyphylla 10-lineata* (Say)
- Thistle aphid  
*Anuraphis cardui* (L.)
- Throat bot fly  
*Gasterophilus nasalis* (L.)
- Tomato hornworm  
*Protoparce quinquemaculata* (Haw.)
- Treehoppers  
*Ceresa basalis* Walk.  
*Ceresa stimulea* (Van D.)  
*Heliria rubidella* (Ball)  
*Stictocephala wickhami* Fab.
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*Polistes fuscatus aurifer* Sauss.  
*Polistes fuscatus variatus* Cr.  
*Vespula diabolica* (Sauss.)  
*Vespula maculata* L.  
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*Tineola bisselliella* (Hum.)
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*Phyllotreta pusilla* Horn
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*Dendroctonus brevicomis* Lec.
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*Epitrix subornita* (Lec.)
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