



UNIVERSITY OF IDAHO

College of Agriculture

Idaho Recommendations For Insect Control

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How to Use This Bulletin

Only the insects of major economic importance in Idaho are discussed in this bulletin. They are in alphabetical order. Because of the large number of insects involved, only a brief description of the pest, its damage, and the preferred controls are given.

If you don't know the name of the pest, turn to page 71, where you will find an alphabetically arranged Host-Insect 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. Write the Entomologist, University of Idaho, Moscow, for further information concerning any pest. When you ship insects to the University for identification, be sure to pack them so they arrive undamaged.

On pages 68 to 70 you will find an alphabetically arranged list of accepted common and scientific names, should you wish to study other literature on any pest mentioned here.

Be sure and read carefully the section on "Pesticide Residues" on page 66. Because of the Miller Amendment the problem of residues on crops produced for human consumption becomes of greater importance than ever before.

Reprint of an earlier edition

Idaho Recommendations For Insect Control

R. W. PORTMAN and H. C. MANIS*

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 larvae, 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, peas and potatoes, 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 practical 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. On potatoes, treat as recommended for Colorado potato beetle control, and on peas as for pea aphid control.

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 larvae varies from dingy yellow, when very young, to light green when mature. Larvae are readily recognized by a faint white stripe down the back and by a black head. They destroy the tip of the first crop of alfalfa or, when infestations are heavy, defoliate the plants as well as retard the growth of the second crop. Little damage is caused by adult feeding.

Control: When alfalfa first starts to grow in the spring, apply $\frac{1}{4}$ pound of actual dieldrin or heptachlor in 30 to 50 gallons of water per acre using at least 100 pounds pressure; or apply either 20 pounds of 1 $\frac{1}{2}$ percent dieldrin or heptachlor dust per acre. This control practice will kill the adults before they are able to lay eggs.

* Extension Entomologist of the Extension Division and Entomologist of the Idaho Agricultural Experiment Station respectively.

Where early control has not been followed, kill the larvae by treating the hay crop before cutting or by treating the stubble just as soon as the first crop has been removed. Use $\frac{3}{4}$ ounce of actual heptachlor per acre not less than 3 days before cutting. For larvae control in stubble use heptachlor, methoxychlor, DDT, or aldrin.

ANGOUMOIS GRAIN MOTH. The moth varies in color from buff to grayish or yellowish-brown. It is about $\frac{5}{16}$ inch long. Eggs are laid on or near grain. Larvae are white with yellowish-brown heads, and are about $\frac{1}{5}$ inch long when mature. Injury in Idaho is confined to grain in storage. Larvae hollow out the interiors of kernels and pupation takes place inside the kernels. Kernels from which moths have emerged are identified by the circular emergence holes.

Control: Follow the recommendations for the red flour beetle.

ANTS. Many species of ants are troublesome in houses, lawns, gardens, and fruit trees. Before attempting control, it is helpful to locate their nests. Ants in fruit and shade trees are usually attracted by aphids, upon whose sweet secretions they feed. They also kill or drive off the natural enemies of the aphids.

Control: When nests are located, the ant colonies can be completely eradicated by working dust of 5 percent chlordane, $2\frac{1}{2}$ percent aldrin or $1\frac{1}{2}$ percent dieldrin into the mound. In lawns or in tree rows in orchards where definite colonies cannot be located, ant infestations can be controlled by spraying with a mixture containing either 4 pounds of 40 percent chlordane wettable powder, 4 pounds of 25 percent aldrin wettable powder, or 2 pounds of 50 percent dieldrin wettable powder in 100 gallons of water. Otherwise treat the area frequented by the ants. A mixture of $2\frac{1}{2}$ percent chlordane in highly refined oil is excellent for spraying inside the house.

APPLE APHID. This green plant louse feeds on the water sprouts and on tender terminal leaves, curling them badly. The black, shiny eggs are laid on the bark of the smaller branches in the autumn and hatch the following spring just before the bud scales separate. There are many generations in a season.

Control: Where delayed dormant oil sprays are applied for San Jose scale, add 1 pint of 25 percent parathion or 50 percent malathion emulsion in 100 gallons of spray. Malathion used at 1 pound of 50 percent or parathion at 1 pound of 25 percent wettable powder in 100 gallons of water and applied when the buds break will give good control. Where control is not obtained in the spring, use $2\frac{1}{2}$ pounds of actual parathion per acre up to 14 days before harvest, $7\frac{1}{2}$ pounds actual malathion per acre up to 3 days before harvest, or not more than three applications of 2 pounds of actual demeton per acre up to 21 days before harvest.

APPLE LEAFHOPPER. Both the young and the adult forms of two species of leafhoppers feed upon and cause severe injury to the foliage of apple trees. The green-colored species has but one genera-

tion each year; the white-colored species has two. The white apple leafhopper is often a serious pest on prunes. Both species occur in the early spring in the nymphal stage and the injury from each is similar. Injured leaves lose their green color, become dry, and are covered with tiny, light-colored flecks. The injury results from the insects' sucking the sap out of the leaf tissue.

Control: Both species are controlled by spraying with a mixture containing 2 pounds of 50 percent DDT wettable powder in 100 gallons of water. Where DDT sprays are being applied for the control of codling moth, no extra cover sprays are necessary.

ASPARAGUS BEETLE. The adult is a slender beetle about $\frac{1}{4}$ inch long, blue-black in general color with red on the thorax and dark blue wings marked with lemon-yellow and reddish borders. The larvae are dark to olive-gray with black heads and legs. The eggs are arranged in rows of from 6 to 8 scattered over the foliage. They are a brownish color and measure $\frac{1}{16}$ inch in length. The larvae and adults feed on the leaves of asparagus plants and the adults feed on the tender young shoots in the spring.

Control: Spray late in the season with 2 pounds of 50 percent DDT wettable powder in 100 gallons of water or dust with 5 percent DDT at the rate of 30 pounds per acre. DDT can be applied only as a post-harvest treatment.

BARK BEETLES. The most common species are the Douglas-fir beetle, mountain pine beetle and western pine beetle. These stout, cylindrical, brownish to blackish beetles are $\frac{1}{8}$ to $\frac{3}{16}$ inch long. The larvae are grub-like, white to cream in color, and are found beneath the bark and tunnel through the cambium layer. Their presence in the trees is characterized by the boring dust at the bases and pitch tubes on the trunks of the trees. The green foliage of attacked trees turns first to a pale green, then to light yellow, and finally to brown when the trees are dead. They attack mostly mature coniferous trees.

Control: No known control will save trees that have been attacked. Other trees may be protected by felling the infested 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 (WESTERN) The smooth, shiny larvae are pinkish-brown in color. Mature larvae are $1\frac{1}{2}$ 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 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 by ground duster or 30 pounds per acre by airplane duster. 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 BUG. 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 sprays are those containing 5 percent DDT or 2½ percent chlordane in highly refined oil. These can be used to spray mattresses, bedsteads and walls. Dusts containing 5 percent DDT or 2½ percent chlordane can be used in place of the sprays, if preferred.

BET LEAFHOPPER. This sucking insect is only about 1/8 inch long when fully grown and in the spring is pale or yellowish-green in color. It feeds on sugar beet and related plants, on tomato, squash, bean, 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 wild host plant conditions.

Control: The only practical method of protecting plants from the disease carried by this leafhopper is the use of resistant plant varieties 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 too practical from the standpoint of curly-top control.

BET WEBWORM. The moth is slightly more than 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 in color. When disturbed 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 underside of the leaf in rows, often with the eggs overlapping. Larvae vary from light 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 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 lambsquarter 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 undersurfaces of the leaves in June. Apply either 40 pounds of 10 percent toxaphene dust or 10 pounds of 40 percent toxaphene wetttable powder in 100 gallons of water per acre. Endrin used at the rate of 0.3 to 0.4 pounds actual material per acre is very effective. Do not feed beet tops treated with these materials to dairy animals or animals being finished for slaughter. *It is imperative that control be obtained early before extensive damage to beets occurs.*

BIRCH SKELETONIZER. This insect attacks most of the species of birch 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 $\frac{1}{4}$ inch long, slender, and green in color. The larvae feed on the lower surfaces 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: Use malathion or parathion as recommended for apple aphid. These sprays should be applied when the buds commence to break. Use one pint of demeton per acre only at pre-bloom or petal-fall.

BLACK FLIES. Black flies, or punkies as they are often called, are sometimes severe pests of man and animals. 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. The adults are shiny black and the young are reddish-brown.

Control: Use malathion or parathion as recommended for apple aphid. Apply as soon as the insect is observed on the tips of the twigs or foliage.

BLACK VINE WEEVIL. This snout beetle is about $\frac{5}{16}$ inch long, brownish-black in color. The white, legless larvae are about $\frac{3}{8}$ inch long. They live in the soil and feed on the roots of strawberries and many other plants.

Control: The same control measures recommended for the strawberry root weevil are effective.

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 have been recorded. The female black widow spider is entirely black and shiny 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 underside 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 either 4 pounds of 40 percent chlordane or 2 pounds of 50 per cent dieldrin wettable powder in 100 gallons of water.

BLISTER BEETLES. Four species are sometimes injurious to alfalfa and clover hay, seed crops, potatoes, and garden crops. Damage is most likely to occur near margins of fields. At times the beetles will strip the blossoms from plants. The Western spotted blister beetle is the most common. It is from $\frac{1}{2}$ to $\frac{3}{4}$ inch long, of general gray color with small black spots. The ash-gray blister beetle, somewhat smaller than the Western spotted blister beetle is uniformly gray in color. The black punctured blister beetle is about the same size and entirely black in color. Nuttall's blister beetle is green or purplish-blue, varying from $\frac{5}{8}$ to $1\frac{1}{8}$ inches long. Blister beetle larvae live in the ground where some species feeds on grasshopper egg masses. Damage usually occurs in areas where grasshoppers have been numerous the preceding year.

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 or $1\frac{1}{2}$ percent heptachlor dust. Do not feed DDT-treated foliage to livestock. 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 building and nearby shade trees and shrubs where blow flies tend to congregate with materials recommended for housefly control. For control of maggots on sheep, see wool maggots.

BLUEGRASS BILL BUG. Lawn grass is cut off just under the surface of the ground by dull black weevils about $\frac{3}{4}$ inch long and their footless creamy-white, brown-headed grubs. When bill bugs are numerous large areas of the lawn may be killed.

Control: Apply $1\frac{3}{4}$ pounds of 40 percent chlordane wettable powder in sufficient water to cover 1,000 square feet of lawn surface or 10 pounds of $1\frac{1}{2}$ percent dieldrin dust. Then sprinkle the lawn thoroughly.

BOXELDER BUG. This insect is about $\frac{1}{2}$ inch in length, black in color with red markings. It sucks the sap from maple and boxelder trees. Its favorite host plant is the boxelder. When this bug is abundant, it frequently becomes a nuisance within houses.

Control: When bugs collect in numbers on buildings or on trees they may be killed by spraying with a mixture containing either 4 pounds of 50 percent DDT, 4 pounds of 40 percent chlordane, or 2 pounds of 50 percent dieldrin wettable powder in 100 gallons of water. Emulsion sprays may also be used. All boxelder trees should be thoroughly sprayed during the summer to prevent migration to houses.

CABBAGE APHID. These dark green or bluish plant lice, covered with a powdery secretion, sometimes become exceedingly abundant on the leaves and stems of individual cabbage, turnip and other cruciferous 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 5 percent malathion dust at 30 pounds per acre or 6 pounds of 25 percent malathion wettable powder or $1\frac{1}{2}$ pints of 50 percent emulsion concentrate to 100 gallons of water as a spray. Treating in late season is usually unsatisfactory and is unnecessary if early control is maintained.

CABBAGE LOOPER. The adults are moths with a wing expanse of about $1\frac{3}{4}$ inches, and they are active at night. The forewings are brown in color, mottled with gray, and the hindwings are a bronze or brown with white outer margins. The eggs are laid on the underside of the leaf and are yellow to white, rounded and marked with a series of ridges. The full grown larvae are about an inch long, light green in color with two, fine white stripes along the back and another along the sides. In crawling it loops its body. The smaller larvae usually feed first on the outer leaves while the larger worms often bore into the developing heads. They readily attack cabbage and lettuce. There are several generations a year.

Control: Apply either 5 percent DDT, 5 percent chlordane, 5 percent malathion, or $1\frac{1}{2}$ percent dieldrin dust soon after plants are set out. Additional treatments at 7 to 10-day intervals may be necessary to prevent injury. Early control usually eliminates the need for control after the plants commence to form heads. For

control as the plants head use 1 percent rotenone dust or malathion dust or spray up to 3 days before harvest.

CABBAGE MAGGOT. Adults are grey 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 infest the stems of cabbage and cauliflower and the fleshy roots of radish and turnip. Maggots are legless and cream colored.

Control: Dust the soil surface around the base of transplants and newly immersed plants with either 5 percent chlordane, 2½ percent aldrin or 1½ percent dieldrin or heptachlor dust. For field treatments use these dusts at the rate of 20 pounds per acre. Repeat this three times at 7 to 10-day intervals. Sprays are also effective.

CABBAGE SEEDPOD WEEVIL. These are chunky, ash-gray weevils, less than ¼ inch long with dark curved snouts. 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 duff on the surface of the soil in the adult stage. There is only one generation annually.

Control: Application of control measures should be made just before the plants come into full bloom. For control on rape, rutabagas, and turnips, best results have been obtained using 0.4 pounds of actual endrin in 8 to 10 gallons of water per acre by airplane. A second application may occasionally be necessary.

CABBAGEWORM. (IMPORTED) The cabbage butterfly is white and is frequently observed flying about cabbage plants. The elongate yellow eggs are placed singly and on end on the undersides of cabbage leaves, nasturtium leaves, and other plants. The cabbage worm is light green and velvety in appearance, and when mature is about ¾ inch long.

Control: Same as for the cabbage looper.

CARPENTERWORM. These pinkish or white larvae with brown heads sometimes completely kill trees. Mature larvae are about 2½ 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 practical 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 $\frac{3}{4}$ 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 and secretions of the animal's skin. The hair on infested animals becomes rough and spots may be entirely removed by rubbing the affected parts. These lice are usually found on the upper parts of the body in contrast to the position in which the sucking lice are found.

Control: For lactating dairy animals use pyrethrum or rotenone dusts or sprays. Methoxychlor can be used by applying 1 heaping tablespoon of 50 percent wettable powder per animal. Sprinkle and rub in hair lightly by hand. Repeat at 3-week intervals as long as necessary. For beef animals spray with 4 pounds of 50 percent DDT, toxaphene, or 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 400 pounds pressure.

CATTLE GRUBS. Cattle grubs or warbles are the larvae of two different flies, one known as the common cattle grub and the other as the northern cattle grub. Usually they are first noticed in the cattle when bumps as big as the end of the thumb appear on the animals' back during late winter or early spring. The bumps contain the larvae of the fly which have passed through the body of the animal to reach the back, and they 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. The grubs spend approximately nine months in the tissues of cattle before maturing and dropping to the ground.

Control: Rotenone applied as a wash, spray, or dust is an effective control of cattle grubs after they have cut holes through the skin. Treatment at this time serves to reduce the population of the heel flies which produce grubs the following year. Rotenone dust can be applied by a shaker can and lightly rubbed into the grub holes by hand. Animals should be treated at least twice at 30-day intervals starting one month after the first grubs appear in the backs. Systemic materials like Trolene, as a bolus; Dimethoate, as a bolus or injection; and Co-Ral, as a spray, show promise for beef cattle

grub control. Treatment can be made after heel fly season and before grubs appear in the back. These materials must be applied at least 60 days prior to slaughter to prevent residues in meat.

CATTLE SUCKING LICE. Three species of blood sucking cattle lice occur in Idaho. They are the short-nosed, long-nosed and little blue cattle louse. These lice are common pests of cattle and may be considered together since their habits and control are very similar. All these lice are bluish-gray in color. They may be found on the lower part of the body of the animal 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 cause 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 louse.

CHERRY FRUIT FLIES. These black flies are small and are recognized 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. The creamy white maggots feed in the flesh and when mature are about $\frac{3}{4}$ inch long.

Control: Cherry fruit fly control with chemicals is very effective if properly timed with fly emergence. Normally the first flies begin to emerge the last of May. The most accurate timing can be determined by using a "tanglefoot" board. Make the first application as soon as the first fly is found on a trap board. 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.

Methoxychlor-rotenone, parathion-rotenone, and Perthane spray schedules are very effective. Use 3 pounds of 50 percent methoxychlor wettable powder in 100 gallons of water. Follow at 10-day intervals with 3 pounds of 5 percent rotenone wettable powder in 100 gallons of water until the cherries are harvested. Or use 1 pound of 25 percent parathion wettable powder or 1 pint of the emulsifiable concentrate (2-pound material) in 100 gallons of water at 10-day intervals up until 14 days before harvest. Follow at 7-day intervals with 3 pounds of 5 percent rotenone wettable powder in 100 gallons of water through harvest. Or use 2 pounds of 50 percent Perthane wettable powder or 1 quart of emulsifiable concentrate in 100 gallons of water every 10 days up to 2 days before harvest.

Unpicked fruit is a primary source of infestation because it allows the maggots to complete their development and escape into

the ground. Fruits left on the trees, as a result of poor picking or rain damage, or unmarketable fruit left on pollinizer trees permit a build-up in the infestation. Therefore, immediately after completion of harvest a cleanup-spray of parathion, methoxychlor, lead arsenate or Perthane should be applied.

CHERRY WORMS. Heavy infestations of slender, green caterpillars often 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 spray containing 4 pounds of 50 per cent DDT wettable powder in 100 gallons of water. Apply to the trunk and the ground around the base of the tree prior to blossoming.

CHICKEN LICE. There are several species of lice attacking chickens.

Control: Clean house thoroughly and before replacing nest materials apply a spray of 1 quart of 55 percent malathion emulsion in 5 gallons of water. For litter treatment use 1 pound of 5 percent malathion dust per 40 square feet of area. For roost painting add 6.4 ounces of 55 percent malathion emulsion in 1 gallon of water and apply 1 pint of this mixture to 100 lineal feet of roost.

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 1/30 to 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 or use malathion spray given for chicken lice. 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, 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 on hogs.

Control: The treatment used for the control of hog mange 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 a piece of soap the size of a large walnut has been dissolved. Aldrin and dieldrin sprays are also effective.

CICADADS. 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 splinted-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 practical 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, rugs, and upholstered furniture. The moth is light brown and scarcely $\frac{3}{4}$ 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, once or twice each year with 5 percent DDT in highly refined deodorized oil. 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. **Do not use oil sprays on furs.** 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 honeydew that lowers the quality of the seed and makes threshing difficult. 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. At present the systemic insecticides, like demeton used at 4 ounces actual per acre, hold some promise.

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. Damaging infestations have been limited to 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 or about twice the size of the alfalfa weevil. It is chocolate brown in color and has a prominent broad snout projecting downward from the front end of the head. In autumn the adults lay their eggs in punctures made in the stems. Larvae are green, shading to pink at the rear end, and have a white line extending down the middle of the back. The head is brown. Mature larvae are about $\frac{1}{2}$ inch long and are more robust than the alfalfa weevil larvae. Hibernation takes place in both the larval and adult stages. There is one generation annually. Adults and larvae eat notches in the margins of leaves or at times cut off the entire leaf. The damage is most apparent in alfalfa and clover fields during early spring when the weather is cool. The weevil may completely retard plant growth. This insect is never important in years with prolonged wet springs.

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

CLOVER MITE. The clover mite or brown 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 spend 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. Upon 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.

Mites of all stages of development may hibernate in buildings. On warm spring days they will crawl over windows and walls. During the spring and fall they feed on lawn grasses and shrubs. Mid-summer is passed in the egg stage.

Control: On field crops, use controls given for two-spotted spider mite. For control of these mites on dwellings, apply a spray of 2 pounds of 25 percent Kelthane wettable powder in 100 gallons of water to the outside walls, surrounding shrubs, and lawn just as soon as mites become active in the spring. A second application should be made in the fall about the time of the first frost. Remove all grass and broad-leafed trees and shrubs closer than 14 to 18 inches from around buildings and trees. This will discourage all mites from attacking trees and shrubs and hibernating in buildings.

CLOVER ROOT BORER. These tiny brown stubby beetles and small cream-colored grubs tunnel into the larger roots of red clover plants. The resulting damage may kill the plants and open 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 and has a shorter, broader snout. Its color varies from yellowish gray to a brownish black. In summertime adults are frequently found on the foliage and can be mistaken for sweet clover weevils. In early spring the adults and larvae engrave the root and crown surface, and often girdle the root. The larvae are grayish-white, legless, brown-headed grubs about 1/6 inch long. This pest may be found attacking red, white Dutch, and alsike clovers and alfalfa. It is widely distributed in Idaho but has only occasionally been of importance, probably because of the rotation systems followed. An application

of aldrin or heptachlor to the soil surface just prior to the emergence of adult borers shows promise in reducing damage from this pest.

CLOVER SEED CHALCID. These very active little wasps are shiny black in color, about 1/15 inch in length. They emerge in spring at blossom time and lay their eggs inside the seeds before the seeds reach the "dough" stage. Damage is caused by the larvae which eat out the interiors of the developing seeds. Infested seeds are generally blown out with the chaff at threshing time. The larvae complete their growth in 2 to 3 weeks. There are usually two generations annually.

Control: Preventive measures give partial control and, if practiced generally by all growers over a large area, will hold populations of the chalcid fly down so that severe damage will 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. Two applications of 5 percent DDT at 30 pounds per acre applied at the time of full bloom and again 14 days later will prevent excessive injury. Where clipping of the first crop is practiced over a large area, seed produced from the second crop is seldom severely attacked.

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 the 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 of 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 elongate - oval beetle, about 1/10 inch in length, is dark gray in color. It has a long slender beak. The adults hibernate in and around clover fields. This insect prefers to feed on alsike and white Dutch clovers but also will infest ladino clover. Eggs are laid inside the seed pods as they begin to form. Damage is caused by the feeding of the minute larvae or grubs on the developing seeds within the pods. There is but one generation annually.

Control: Effective control can be obtained by applying a dust containing either 5 percent DDT or chlordane, 2½ percent aldrin or heptachlor or 1½ percent dieldrin at 20 pounds per acre when

the first early blossoms have turned brown. Sprays are also effective.

COCKROACHES. Three species are troublesome in Idaho. The German, or common cockroach, is the smallest species, adults being about $\frac{1}{2}$ inch long, light brown in color and marked lengthwise on the back with dark stripes. The oriental cockroach is about 1 inch long and is dark brown or nearly black. These two species thrive in unsanitary surroundings or under conditions where they can find protection in dark, undisturbed areas. The brown-banded cockroach is less than $\frac{1}{2}$ inch long with a cross band of light yellow at the wing base and another further back. The males are more slender and lighter colored than the females. This species hides in living rooms, woodwork, and furniture.

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 2½ percent chlordane spray in deodorized solvent is effective when applied to walls, floors, and other surfaces in places frequented by roaches. Repeat the application if roaches reappear. A 5 percent chlordane dust may be used in place of the spray if desired.

CODLING MOTH. The full-grown larvae are pinkish - white with 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 15 to 20 days after petal fall 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. Do not apply DDT later than 30 days before harvest. The inclusion of an acaracide 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 the perennial canker disease. 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 undersides of leaves. Larvae are brick red with black spots on the sides and have a "humped-back" appearance. They are about $\frac{1}{2}$ inch long. Larvae and beetles feed on the leaves of potato and related plants, often completely defoliating vines.

Control: Treat infested plants with 1 pound of actual DDT, $\frac{3}{4}$ pound dieldrin or heptachlor per acre as dust or spray. Make the application soon after the larvae hatch and begin to feed in the spring and before they have caused appreciable injury. Thorough coverage is very important.

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. Their feeding causes little or no damage to fir trees.

Control: Almost complete protection from gall formation is obtained by spraying the trees with 2 pounds of 25 percent malathion wettable powder in 100 gallons of water. Careful timing of the spray application is necessary. Apply thoroughly just as the buds break. Spray all fir trees in the vicinity.

CORN EARWORM. A large dusky-colored moth deposits eggs on the leaves and silks and larvae hatching from them eat into the ears. Larvae vary from yellowish green to dark green and when mature are about $1\frac{1}{2}$ inches long.

Control: When corn starts to silk apply 10 percent DDT dust at 30 pounds per acre and repeat for three treatments at 3 to 4-day intervals. In commercial plantings the boom of the ground duster should be 4 to 5 feet above ground to prevent breaking the corn stalks. Apply dust in the middle of the day when stalks are limber enough to resist breakage. To prevent mite build up use a 10 percent DDT plus 50 percent sulfur dust mixture. Do not feed treated forage to dairy animals or animals being finished for slaughter.

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 of water in the winter or just before the buds break in the spring. A practical means of control on Virginia creeper, other ornamentals, and shade trees during the summer is to spray with 2 pounds of 25 percent malathion or 4 pounds of 50 percent DDT wettable powder in 100 gallons of water. The summer spray should be applied the last of June or the early part of July just as the young scales hatch from the eggs.

CURRENT 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 the leaves unfold in the spring and before the leaves start to curl. Use 2 teaspoons of 50 percent malathion in 1 gallon of water.

CURRENT FRUIT FLY. In May and June a yellowish-bodied fly about the size of a house fly with green eyes and fine dark cross-bands on the wings lays eggs under the skin of the fruit. The small white maggots about $\frac{1}{4}$ inch long eat inside the berry which turns red and often drops from the plant. When the fruit flies are numerous they may cause complete crop loss. There is but one generation a year.

Control: Thoroughly spray the bushes with 1 pound of 50 percent DDT wettable powder to 100 gallons of water. Application should be made when 80 percent of the blossoms have wilted or fallen and again 10 days later.

CURRENTWORM (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 undersides of the leaves. Larvae are muddy green with black spots excepting in the last stages 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, pyrethrum extract at the rate of 1 part to 400 parts of soapy water, 1 percent rotenone dust, or 1 teaspoon of 50 percent malathion in 1 gallon of water should be used. A second spray of lead arsenate after

the fruit is picked prevents late defoliation and reduces the infestation for the following 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, such as the western army cutworm, migrate over the surface of the soil at night. Others climb plants at night to feed on the foliage. Adults are dusky brown or gray moths that fly at night and are the ones most commonly observed flying around lights in the summertime.

Control: Dusts and sprays applied to the ground about plants are effective when properly timed. Use either 5 percent DDT or chlordane, 10 percent toxaphene, 2½ percent aldrin or heptachlor, or 1½ percent deildrin dust at 30 pounds per acre when injury is first noticed. Sprays should contain either 4 pounds of 50 percent DDT or 40 percent chlordane, 8 pounds of 50 percent toxaphene, 4 pounds of 25 percent aldrin or heptachlor, or 1 pound of 50 percent dieldrin wettable powder in 100 gallons of water. Apply at the rate of 50 gallons per acre in the afternoon or early evening.

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 leaf color is light green, almost yellow. Infested flowers and young fruits darken near the base 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: Plants to be set in new beds should be washed clean of all soil then immersed in a solution of 2 teaspoons of Kelthane emulsion plus ¼ teaspoon of household detergent in 1 gallon of water. The plants should be agitated to insure wetting of all surfaces. For control in established beds apply a spray of 2 pounds of 18½ percent Kelthane wettable powder or 2 pints of the emulsion concentrate per 100 gallons of water at the rate of 200 to 400 gallons per acre. Force spray into crowns and buds of plants. Begin application when new growth starts in the spring. Space application at 10- to 30-day intervals. Do not apply after fruits begin to form. Applications should also be made as post-harvest foliage sprays and to all young non-bearing plants.

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 im-

portance to necessitate control. It attacks cabbage, turnips, and practically all other cruciferae, and some ornamental and green-house plants.

Control: Follow the instructions given under cabbage looper.

DOUGLAS-FIR TUSSOCK MOTH. The caterpillars, when fully grown, are about 1 inch in length and are decorated with brightly-colored tufts of hair. There are two pencils of black hairs, $\frac{1}{4}$ inch in length, directly behind the head and a similar but longer tuft at the posterior end of the body. On the upper side of the first four and last abdominal segments are dense, cream-colored tufts of hairs about $\frac{1}{16}$ inch in length and numerous red spots. The adults are a dull brownish-gray. The females are wingless. There is only one generation each year. The larvae prefer to feed on spruce, fir and Douglas-fir.

Control: The caterpillars are ordinarily controlled by native parasites. Occasionally, when widespread outbreaks occur, chemical control may be necessary. Spray shade trees with DDT as soon as damage is noticed in the tops of the trees. Use 2 pounds of 50 percent DDT wettable powder in 100 gallons of water.

EARTHWORMS. Earthworms or "nightcrawlers" abound in heavy, moist soils that contains considerable organic matter. They are both useful and injurious. They are useful in opening up the subsoil and improving the physical condition of the soil and they provide excellent bait for fishing. However, they often prove objectionable in lawns, golf courses and irrigation ditches where their mounds and tunnels cause considerable damage.

Control: Where control is necessary chlordane or dieldrin can be used. Water the lawn sufficiently to bring the earthworms to the ground surface. Then evenly apply 9 pounds of 5 percent chlordane or $1\frac{1}{2}$ percent dieldrin dust, or 1 pound of 40 percent chlordane or $\frac{1}{2}$ pound of 50 percent dieldrin wettable powder over 1,000 square feet. The wettable powders can be mixed with water and sprayed on. Wash the material into the soil with a liberal watering.

ELM LEAF BEETLE. The beetles are about $\frac{1}{4}$ inch long, yellow or orange, are marked on the back by a black stripe down the center, a black stripe along each edge and two elongated black spots. Eggs are orange and are laid in irregular rows on the undersides of the leaves. The larvae are dark with yellow stripes and prominent body tubercles and are about $\frac{1}{2}$ inch long when fully grown. Beetles eat holes in the leaves and the larvae destroy the leaf tissue on the undersides. Injured leaves turn brown and trees often are completely defoliated. There are from two to three generations annually.

Control: Spray the trees thoroughly with 4 pounds of 50 percent DDT plus 2 pounds of 25 percent malathion wettable powder in 100 gallons of water. Make applications as soon as the first

larvae are found and direct the spray upward to cover the lower surfaces of the leaves. Control of the later generations is usually unnecessary if the first generation is properly controlled.

ENGLISH GRAIN APHID. Numerous small, pale green plant lice may occasionally be found clustered about the bracts of wheat, oat, and barley heads. These aphids produce injury by sucking the sap from the seedhead causing shriveling and shrinking of the newly-formed grain. During cool, wet springs they may become abundant enough to cause some damage.

Control: Chemical control is seldom recommended since this aphid rarely causes more than 1 to 3 percent damage to grain crops. Ordinarily it is held in check by numerous parasites and predators. Where populations average 25 to 30 per head before grain has reached the soft dough stage, control is necessary. Use either 1½ pints of 25 percent parathion emulsion concentrate in 5 gallons of water or 1½ pints of 55 percent malathion emulsion concentrate in 8 to 10 gallons of water per acre.

EUROPEAN EARWIG. The mature earwig is about $\frac{5}{8}$ inch long. The color is dark reddish brown excepting the legs, antennae, and wing-covers which are yellowish brown. The insect is readily recognized by the presence of a so-called pair of forceps on the rear end of the body. Earwigs feed on many kinds of plants and even enter houses where they are obnoxious pests. They are active at night and hide in dark places during the day time.

Control: Earwigs can be very easily controlled by spraying with DDT or dieldrin. Complete protection can be obtained by treating the place where earwigs tend to congregate. Control should begin as soon as the overwintering adults start to emerge from hibernation. By treating early, before the second brood appears, migration to vegetable and flower gardens and fruit trees can be prevented. For best results use 4 pounds of 50 percent DDT or 2 pounds of 50 percent dieldrin wettable powder in 100 gallons of water and apply with a power sprayer at a pressure of at least 400 pounds. See your county extension agent concerning spraying programs in your community if you do not have your own power sprayer. Spray around the foundations of all buildings, along sidewalks and driveways, under shrubs and trees, and wherever earwigs tend to congregate. To prevent migration from adjoining properties into gardens, a 3 to 4-foot strip along the boundaries should be thoroughly sprayed. Although results are not as satisfactory as when the application is made with a power sprayer, some degree of control can be obtained by dusting or hand spraying. In such cases, use a 5 percent DDT dust or 1 pound of 50 percent DDT wettable powder to 4 gallons of water.

EUROPEAN ELM LEAF-CURL APHID. This aphid attacks both elm and currant. The eggs are laid on the elms in the

fall. They hatch in the spring and the young aphids crawl to the buds.

Control: Spray thoroughly early in the spring before leaves have curled and when aphids first hatch. Use 2 pounds of 25 percent malathion or parathion wettable powder or $1\frac{1}{2}$ pints of malathion emulsion concentrate in 100 gallons of water. Thorough application is necessary.

EUROPEAN ELM SCALE. These reddish-brown, plump-bodied sucking insects are fringed with white and are covered with a "mealy" secretion. They occur most abundantly in crevices of bark and on the undersides of limbs. Heavy infestations cause the death of elms.

Control: Satisfactory control is obtained by spraying the trees with dormant-type oil emulsion at the rate of 8 gallons to 92 gallons of water just before the buds burst in the spring. Summer sprays of malathion applied in the crawler stage 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 and apple 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 are 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 either $\frac{3}{4}$ pound of 25 percent EPN, 2 pounds of 25 percent malathion, 1 pound of 25 percent parathion, 2 pounds of 15 percent Aramite, 2 to 3 pounds of 40 percent Sulphenone, 1 to 2 pounds

of 18½ percent Kelthane or 21½ pounds of 25 percent Chlorobenzilate wettable powder in 100 gallons of water. Use these sprays at the rate of 800 gallons per acre on mature trees. In using any of these materials check the container labels for limitations for days before harvest. Several applications during the summer will probably be necessary. It is important to apply early applications since the mites become increasingly difficult to control as the population increases.

EYE-SPOTTED BUD MOTH. The chocolate-brown larvae are about ⅓ 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 undersurfaces of the leaves. There is one generation annually.

Control: Spray with lead arsenate, 3 pounds, 25 percent parathion, 1 pound, or 25 percent malathion, 2 pounds, in 100 gallons of water just as the leaves are showing green in the spring. Pay special attention to the tips of the branches. A calyx spray may be necessary.

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 surfaces of the leaves. Webs are unsightly due to the presence of the black pellets of excrement of the larvae.

Control: Webs should be removed by clipping off the terminal twigs which are enclosed and burning them. They may be burned out of the trees by use of a kerosene-saturated burlap sack fastened to the end of a long pole. Spraying with lead arsenate, DDT or malathion 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 in 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 are 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: Seed treatment gives very satisfactory control. Before planting, treat with 2 ounces of dieldrin, endrin, or heptachlor to 100 pounds of seed.

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 recognized 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, or 2 pounds of 25 percent malathion 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. The spray should contain 8 gallons of oil 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. A lead arsenate or DDT spray can be applied as soon as the buds begin to break. Use 4 pounds of lead arsenate or 2 pounds of 50 percent DDT wettable powder in 100 gallons of water.

GARDEN SYMPHYLID. These tiny centipedes feed on the tender roots of 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 symphylids in soil through shipments of plants from infested areas. Greenhouse soil can be freed of an infestation by sterilizing with steam or heat.

For garden and field soils satisfactory commercial control can be obtained with an application of parathion, D-D Mixture, Vapam, Nemagon, ethylene dibromide, or Telone. Satisfactory results depend upon good seed bed preparation, proper timing, and proper application. Since most of the symphyllids are within the top 12 inches of soil during mid-July and August, best results are obtained by applying these materials during this period. Before the application is made, the soil should be thoroughly worked and free of all clods. Parathion should be evenly applied to the soil to a depth of at least 8 inches. The fumigant should be injected into the soil to a depth of 8 inches and the surface immediately compacted to prevent rapid escape of the gas.

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 and 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 dehydrated 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 larvae 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.

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 either a 5 percent DDT, $2\frac{1}{2}$ percent aldrin, or $1\frac{1}{2}$ percent dieldrin 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 upon 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 or burying all trash and leaves found 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 grain or feeds and cause them to sweat. A disagreeable odor can readily be detected when feed or grain is infested.

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 red 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 red 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 surface 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 respond

to the same control methods. Eggs are laid in the ground in pods containing from about 15 to 100 eggs each. The pods are found 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: Sprays and baits give excellent control of grasshoppers. Use either 2 to 4 ounces of actual aldrin or heptachlor per acre as dusts or sprays. Do not feed treated crops or allow pasturing until 10 days after treatment. Sprays are particularly effective when applied on succulent growth along roadsides, railroad rights-of-ways canal banks and field margins or to such crops as rank-growing alfalfa or corn. 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 field. 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. However, it seldom becomes abundant enough on potatoes to cause injury by its feeding.

Control: Dormant oil emulsions applied as a delayed dormant spray are fairly effective in control. The addition of 1 pint of 25 percent parathion emulsion concentrate in 100 gallons of the oil emulsion spray increases its effectiveness. If the dormant spray is lime-sulphur, it should be delayed until just before the buds open and $\frac{3}{4}$ pint of 40 percent nicotine sulphate or pyrethrum extract added to each 100 gallons of dilute spray. Parathion used at the rate of 1 pound of 25 percent or 2 pounds of 25 percent malathion wettable powder in 100 gallons of water is also effective. In Idaho the control of this aphid on potatoes to prevent the spread of leafroll is not recommended.

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: Use the same methods and materials recommended for the control of the Say stink bug.

GREENHOUSE LEAF TIER. This insect is named for 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 1/16 inch long. They are readily observed while resting on the underside of the leaves. If numerous, they rise in small white clouds when disturbed. The young are less than 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 parathion as recommended for greenhouse thrips. For control on house plants use 1 teaspoonful of malathion emulsifiable concentrate to 1 gallon of water.

HOG LOUSE. The hog louse is a sucking louse. It is a large, bluish-gray louse nearly 1/4 inch long when mature. The lice torment the hogs by piercing the skin and thus causing the animal to rub. The skin becomes thick, cracked, tender, and sore and the animals become restless and unprofitable.

Control: One application of either 4 pounds of 50 percent DDT or 50 percent toxaphene wettable powder in 100 gallons of water

will give effective control with one application. The control recommended for hog mange is also very effective. Do not slaughter treated animals for at least 30 days following 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 in other places. If unchecked they may spread until they cover the entire animal. The skin becomes thickened, wrinkled, and scurfy. 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. Do not slaughter treated animals for at least 30 days following application.

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

Control: Good control can be obtained by the application of a spray containing 2 pounds of 25 percent malathion wettable powder in 100 gallons of water. Apply when the leaves commence to form.

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 1 percent rotenone or spray the leaves with 50 percent DDT wettable powder at the rate of 1 pound in 25 gallons of water. Dusts containing DDT are also effective.

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: Use demeton at the rate of 8 ounces in 100 to 200 gallons of water per acre. Do not apply later than 21 days prior to harvest. Demeton is also effective against the two-spotted spider mites.

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 rest on the backs of cattle all summer long. They crawl down between the hairs on the withers, back or belly and suck blood.

Control: For lactating dairy animals use pyrethrum dust or spray. Methoxychlor can be used by applying 1 heaping tablespoon of 50 percent wettable powder per animal. Sprinkle and rub in hair lightly by hand. Repeat at 3-week intervals as long as necessary. For beef animals spray with 4 pounds of 50 percent DDT, toxaphene, or methoxychlor or 2 pounds of 25 percent lindane wettable powder in 100 gallons of water. Repeat the application 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 beef 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 and each of its wings bears a dark band. The abdomen is curved underneath in a characteristic manner. 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 mid-air between the forelegs and then darts at the chin or throat to lay its eggs and flies 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 area 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.

HORSE FLIES. Several flies which may be called horse flies belong to a group known as tabanids. 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. Pyrenone sprays give about 8 hours protection.

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 larger 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: This louse is controlled in the same way as biting lice on beef cattle.

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 out thinly where it is exposed to sunshine and rapid drying. Spray the outside and inside surfaces of all out-buildings and the outside surface of the house with a suspension spray containing either 4 pounds of 50 percent DDT or methoxychlor 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 methoxychlor or $\frac{1}{2}$ pound of 25 percent lindane wettable powder in 8 gallons of water. Do not spray manure or bedding with these insecticides. 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 the methoxychlor or pyrethrum spray. Two or more treatments may be necessary during the season.

Where control cannot be obtained with the above materials, use 2 gallons of 50 percent malathion emulsion or 2 gallons of 25 percent Diazinon emulsion plus 20 pounds of sugar or 2 gallons of corn syrup in 100 gallons of water. Wettable powders may also be used. These sprays can be used for spot sprays or as residual sprays for the outside and inside of all buildings. They are satisfactory for use inside of dairy buildings.

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 whitish or greenish in 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 red 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 winter in the adult stage in grass and weeds at the margins of fields and elsewhere. They emerge early in the spring and produce at least 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 appearances 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 20 pounds of 5 percent DDT dust per acre.

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 red 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: Apply controls as recommended for apple aphid.

LEAF CUTTER BEES. These wild bees cut large, circular holes in the margins of the leaves of rose, Virginia-creeper, lilac, green ash and other plants, causing an unsightly, ragged appearance. They are very valuable and efficient pollinizers.

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 craneflies, 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. Where potatoes will be grown in known infested areas it is suggested to plow the field early in the fall turning under all plants reducing the attractiveness of the field to the egg laying crane flies.

LESSER APPLEWORM. The appearance and feeding habits of the appleworm and the codling moth larvae are very similar and many times confused. The appleworm larvae are smaller, feed nearer the surface of the fruit and may pupate within the fruit. The adults are pale, rusty-red in color with the front wing crossed by three fine, interrupted, irregular, pearl - blue lines. The basal one is double in front. The life history of this pest is very similar to that of the codling moth, there being from one to three generations each season.

Control: The appleworm is controlled by the same measures used for the codling moth.

LESSER CLOVER LEAF WEEVIL. The adults are deep greenish or blue-green in color with shiny black heads and beaks. The wing covers of newly emerged adults are light brown 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. Where two-spotted spider mite is also a problem use 20 pounds of 5 percent DDT dust plus 50 percent sulfur. One application is enough.

LETTUCE APHID. Pale green 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 are heavily infested. A combination of honeydew 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: Apply 1 percent TEPP or parathion, or 4 percent malathion dust at the rate of 30 pounds per acre when populations approach 4 or 5 aphids per 1-inch seed-tip. Sprays of these materials can also be used.

LIMA-BEAN POD BORER. These 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. No satisfactory control is known.

LYGUS BUGS. There are several species of insects which are called lygus bugs. At least three of the species are quite common in Idaho on a wide variety of crop plants. These insects puncture the seeds of beans and alfalfa with their mouthparts causing distortion and shriveling. In addition they cause blossom drop in alfalfa and beans, decreased yield of alfalfa hay and seed, and injury to many vegetable, fruit and other 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 or 10 percent toxaphene dust at the rate of 30 pounds per acre on seed crops such as alfalfa and small clovers. Make the first application when there is an average of four lygus bugs—adults and nymphs—per 180-degree sweep of a 15-inch diameter 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. Where two-spotted spider mites are also a problem use a 5 percent DDT or 10 percent toxaphene plus 50 percent sulphur dust mixture at 30 pounds per acre or apply one of the new acaracides as recommended under two-spotted spider mite control. When fields are in bloom protect the pollinating insects by applying controls only in the early morning or late evening. Do not feed treated forage to lactating dairy cattle or livestock being finished for slaughter.

MEADOW SPITTLEBUG. Adults are mottled, light tan to dark brown and somewhat resemble robust leafhoppers. Nymphs are normally hidden in masses of spittle and vary in color from yellow to green depending upon their age. The white eggs are laid in rows between the sheaths and stems or in cracks of the stems or stubble of plants near the soil surface. The over-wintering eggs commence hatching in early spring and the nymphs reach the adult stage in 45 days. Adults are present through the summer. Both the adults and nymphs feed on a variety of plants, however, serious damage usually occurs to perennial plants such as strawberry, nursery, and legume forage crops. Feeding produces stunting of growth, shortening of internodes, dwarfing, rosetting, general loss of vitality and low yield. There is only one generation each year.

Control: Plowing under any crop which harbors overwintering eggs will eliminate the nymphal damage to new plantings. Fall treatment of strawberries during early September to kill adults before many eggs are laid eliminates the necessity of a spring treatment for killing the nymphs. For control on alfalfa and clovers apply 1 pound of actual heptachlor, 1½ pounds of actual methoxychlor, or 1¼ pounds of actual malathion per acre in May. Emulsion sprays are preferred. Controls applied for lygus on seed alfalfa at the bug stage are also quite effective.

MEALYBUGS. These small, sluggish, white, soft-bodied insects cluster on the undersides of leaves or in leaf axils. They vary in size up to about ¼ 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 practical control on house plants is to spray with 1 teaspoon of 50 percent malathion emulsion in 1 gallon of water. Make the treatment when the infestation is first noticed and repeat weekly until control is established.

MEALY PLUM APHID. This bluish-green plant louse covered with a white, powder-like secretion becomes exceedingly abundant on the undersurfaces of the leaves early in the spring. It pro-

duces large quantities of honey-dew, a sticky secretion, that drops on the uppersurfaces of the leaves and fruit.

Control: Spray thoroughly with 1 pound of 25 percent parathion or 2 pounds of 25 percent malathion wettable powder or $\frac{1}{2}$ to 1 pint of 20 percent TEPP emulsion in 100 gallons of water. One to two applications at 10-day intervals may be necessary. Dusts of these materials have given satisfactory control.

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

Control: Follow recommendations for control of the red 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 buds 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 of the second and third generation 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 spray for San Jose scale, infestations of mineola are light. A spray containing 2 pounds of 50 percent DDT wettable powder per 100 gallons of water or 10 percent DDT plus 2 percent oil dust applied at the white-tip stage of cherry blossoms has given very good control.

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. Malathion at 2 pounds of the 25 percent wettable powder per 100 gallons of water shows promise in the control of this scale.

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 congregating and moving in bands. 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. 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, chlordane or aldrin 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 consult your county agent or write for information to the University of Idaho Agricultural Experiment Station, Moscow.

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 an aldrin, dieldrin or heptachlor solution for 10-20 minutes. Use 2 ounces of the 25 percent emulsion in 4 gallons of water.

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 malathion 2 pounds of 25 percent wettable powder or 1 pint of 50 percent emulsion in 100 gallons of water will control the infestation. Additional treatments may be necessary to hold the aphids in check.

OBLIQUE-BANDED LEAF ROLLER. This insect is common in greenhouses. The tiny green larvae with black heads 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 trees and shrubs spray or dust with DDT. Use 2 pounds of 50 percent DDT wettable powder in 100 gallons of water or a 5 percent DDT dust. On fruit trees use 2 pounds of 50 percent DDT plus 1 pound of 25 percent parathion wettable powder in 100 gallons of water at pre-bloom and shuck stages.

ONION MAGGOT. The small, grayish fly deposits her eggs on the onion stem near the soil line or in cracks in the soil around the base of the 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 three generations annually.

Control: Practice clean sanitation by removing all onions from the field and destroy by burning or burying. For commercial bulbs or seed bulbs use a furrow-type treatment of 25 pounds of 4 percent Diazinon dust or 20 pounds of 5 percent endrin granules per acre. Apply these materials into the furrow with the seed. When the onion seedlings emerge dust with 10 percent DDT, $2\frac{1}{2}$ percent aldrin, $1\frac{1}{2}$ percent dieldrin, or $1\frac{1}{2}$ percent heptachlor at the rate of 25 to 30 pounds per acre or their equivalent as a spray.

For green bunching onion treat the seed prior to seeding with dieldrin and then after emergence only with DDT. To treat the seed use 1 ounce of actual dieldrin in a suitable fungicide wettable powder slurry and apply to each 1 pound of seed. After emergence apply 10 percent DDT dust at the rate of 25 to 30 pounds per acre or its equivalent as a spray.

Surface treatments for onions should be applied at 7 to 10 day intervals, paying particular attention to ditch banks and fence rows. Always re-treat after rains to maintain this barrier.

ONION THRIPS. They are 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 either $1\frac{1}{2}$ percent dieldrin, $2\frac{1}{2}$ percent heptachlor or 10 percent DDT dust at the rate of 20 to 30 pounds per acre. Two to four applications may be necessary during the season. Sprays of these materials may also be used.

For control on seed onions all the above insecticides can be used prior to blooming. To prevent the excessive loss of pollinators and other beneficial insects use 10 percent DDT dust at 30 pounds per acre after the seed heads come into bloom.

ORIENTAL FRUIT MOTH. The adult is a small grayish-brown moth with a wing span of approximately $\frac{1}{2}$ inch. This insect

winters as a fully-grown larva in a cocoon upon the tree or in trash on the ground. 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 or parathion sprays effectively reduce oriental fruit moth injury. Apply the first spray at petal fall and the second 12 to 14 days later. If bait traps indicate increased moth activity later in the season make a third application. Use 2 pounds of 50 percent DDT or 1 pound of 25 percent parathion wettable powder in 100 gallons of water. These materials may be used in combination at the rate of 2 pounds of DDT and $\frac{1}{2}$ pound of parathion in 100 gallons of water. Where DDT is used alone the addition of an acaracide in the second and third applications should be made to prevent the build up of mites.

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 emulsion used at the rate of 5 gallons to 95 gallons of water is 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 one application of a spray mixture containing 2 to 3 pounds of 50 percent DDT wettable powder in 100 gallons of water. Make the application when the first young are observed crawling over the bark. The young usually commence hatching shortly after the apple trees bloom.

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 obtained 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. Large 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 and garden peas use 5 percent malathion dust. For field peas use either 1 percent parathion or 5 percent malathion at 25 pounds per acre. For airplane spraying use 20 ounces of actual malathion or 8 ounces of actual parathion in 5 gallons of water per acre. Thorough coverage is essential. Weather conditions and stage of plant maturity at the time an infestation develops should be taken into consideration when deciding on the need for control. If there is an average of 30 aphids per sweep or 5 per tip at the time of bloom and the weather is cool and moist, controls should be applied immediately. Higher populations are necessary at later stages of plant development to justify control measures.

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 seed 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 every 7 days until weevils are no longer found.

Weevils are readily controlled on field and canning peas by using 5 percent DDT dust applied at 20 pounds per acre. When applying DDT sprays by aircraft use 1 pound of actual DDT in 5 gallons of water per acre. More than 1 application may be necessary. Phosphate sprays applied for pea aphid will also control the pea weevil.

PEACH TREE BORER (WESTERN). These clear-winged moths deposit their eggs on the trunks 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 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. Dilute 3 volumes of the stock emulsion with 7 volumes of water and use $\frac{1}{4}$ to $\frac{1}{2}$ pint of this dilution for each 2- to 3-year-old tree; dilute 2 volumes of stock with 3 of water and use $\frac{1}{2}$ 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 of the 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. Do not make treatments in hot weather or in heavy wet soils.

Spraying the trunks of peach trees during August and September with 8 pounds of 50 percent DDT or 1 pounds of 50 percent dieldrin wettable powder in 100 gallons of water will prevent infestations.

PEACH TWIG BORER. These are uniformly brown - colored larvae with black heads and the first segment of the body 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: Use a delayed dormant spray containing 2 percent dormant oil plus 3 pounds of lead arsenate or 2 pounds of 50 percent DDT wettable powder in 100 gallons of spray. Spraying with 2 pounds of 50 percent DDT plus 1 pound of 25 percent parathion wettable powder in 100 gallons of water may be used as an alternative program. An application of lime-sulfur as used for San Jose scale will give excellent control on peaches, but this material may be injurious to apricots. For pre-bloom or shuck sprays use 2 pounds of 50 percent DDT plus 1 pound of 25 percent parathion wettable powder in 100 gallons of water. Lead arsenate 4 pounds to 100 gallons of water plus a spreader gives a high degree of control if applied just after 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 misshaped, 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 $3\frac{1}{2}^{\circ}$ Baumé. 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 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 or dieldrin can be used as a summer spray. Use 1 pound of 25 percent parathion or $\frac{1}{2}$ pound of 50 percent dieldrin wettable powder in 100 gallons of water. Make two applications 1 month apart. Do not apply parathion within 14 days of harvest or dieldrin within 35 days of harvest.

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 late summer 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: In early spring before the buds begin to open spray with 1 part lime-sulphur to 9 parts of water. About the last of May or the first of June the first crawlers may be seen. About 10 days after the first crawlers are observed spray the infested trees with 4 pounds of 50 percent DDT wettable powder in 100 gallons of water. Malathion used at the rate of 2 pounds of 25 percent wettable powder per 100 gallons of water also will control the crawlers.

POPLAR and WILLOW BORER. Injury by this borer may be suspected where there are dead patches of bark, irregularly cracked open or where openings in the bark contain moist sawdust mixed with fine splinters. The burrows beneath the bark are irregular in direction and sometimes girdle the tree. The boring is done by a yellowish, fleshy, footless grub with a pale-brown head. They grow to be about $\frac{1}{2}$ inch long. The adults are active throughout the growing season and are about $\frac{1}{4}$ inch long, thick-bodied, with a roughened punctured surface and a stout curved beak projecting downward from the head. The body is sooty-brown color with a large patch of conspicuous light grey on the end of the wing covers.

Control: Remove and burn all badly infested limbs and small trees. A penetrating oil emulsion sprayed or wiped on the affected parts of the tree during the first period of warm weather

in the spring will kill the larvae, as they are then close to the bark surface. Neighboring willow, alder, poplar and birch trees may be protected by spraying them with 4 pounds of lead arsenate in 100 gallons of water several times in July and August.

POWDER-POST BEETLES. The adults of most of the species are small, ranging from 1/12 to 1/5 inch in length. They are hardshelled, brownish beetles with sculpturing on body and wings. The larvae resemble small white grubs ranging from 1/8 to 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 brushcoated 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 undersides 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 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. The eggs are laid in rows, in small punctures on the undersides of the leaves. They move from shoot to shoot or plant to plant as defoliation becomes complete. The mature larva passes the winter in the soil.

Control: Spray with 8 tablespoons of 25 percent DDT emulsion in 3 gallons of water or dust with 5 percent DDT just before the blossoms appear. After the blossoms have appeared, dust with 1 percent rotenone.

RED 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 the 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 home safeguard is to keep flour in a 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. Bins and drawers may be washed with scalding hot water and then dried. After cleaning up an infested house, all surfaces should be sprayed with pyrene-water mixture or 5 percent DDT in a deodorized solvent.

Grain bins and storage elevators should be cleaned and treated before harvest. Good housekeeping is the simplest and best preventative. Clean the storage by removing all old grain and by sweeping the ceilings, walls, and floors. An industrial-type vacuum sweeper is very effective for this cleaning. Then spray the interior with 10 pounds of 50 percent methoxychlor wettable powder in 25 gallons of water. Special care must be taken to spray behind bin linings and behind partitions. Add pyrene grain or wheat protectant dust as grain is put in bins. Either of these materials will protect the grain from infestation for about 18 months. 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.

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

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

Control: Spray with 1 teaspoon of 50 percent malathion emulsion per gallon of water. 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: 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. DDT dusts and sprays are also effective.

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 undersurfaces of the leaves. Injury is caused by both adults and young.

Control: Spray as for the control of the rose aphid or dust or spray with DDT. Leafhoppers migrate from non-sprayed plants and it will be necessary to repeat the application to keep the 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. Recommendations for rose aphid control should help reduce the infestation.

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: Malathion or DDT dusts or sprays are very 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. For spring and summer control follow the recommendations listed for the apple aphid.

RUST MITE. The rust mite is so 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 1 pound of 25 percent parathion wettable powder in 100 gallons of water. Apply as soon as the 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° Baumé) for each 100 gallons of water. A mixture containing 1 gallon of oil and 3 gallons of lime-sulphur in 94 gallons of water has given satisfactory control of San Jose scale and blister mite.

Spray while the plants are completely dormant. A pre-pink spray of 1 pound of 25 percent parathion wettable powder in 100 gallons of water gives effective control. Excellent control of San Jose scale also can be obtained by spraying with 2 pounds of 50 percent DDT wettable powder in 100 gallons of water during the crawler stage.

SARCOPTIC MANGE MITES. The mites which cause sarcoptic or common mange of horses and swine are small white or yellowish parasites. The adults will measure about 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 on 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 infestation 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. Do not slaughter swine within 30 days after treatment.

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

Control: Follow control measures recommended for the red flour beetle.

SAY STINK BUG. The adults are $\frac{3}{8}$ inch in length and vary in color from green in spring and summer to a reddish brown in the fall. They are readily distinguished by the four small white to pale orange spots at the points of the shield in the middle of the back. Winter is spent as adults near the ground surface and under plant cover. Several weeks after leaving the winter shelter the eggs are laid on the undersides of leaves of weed host plants. The nymphs have the appearance of the adults but are smaller and without wings. There are probably from one to three generations each year. As the summer progresses the adults fly to the summer host plants, such as wheat, other grains and alfalfa, sucking the sap from the seed. Infestations averaging over one bug per head of wheat must be controlled to prevent loss in seed yield.

Control: The application of $\frac{1}{2}$ pound actual parathion or 5 pounds actual chlordane per acre as an emulsion spray is very effective. Twenty-five pounds of 2 percent parathion dust or 35 pounds of $1\frac{1}{2}$ percent dieldrin dust per acre are also effective.

Do not use chlordane or dieldrin on alfalfa.

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 crack-case oil. Repeat treatment in about a month if necessary.

SEED CORN MAGGOT. These cream - colored maggots are found in the soil in potato seed pieces and the seeds of beans, corn and other crops, 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: 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 remain free from injury. For seed treatment, use two ounces of actual aldrin, dieldrin or heptachlor per 100 pounds of seed. Always include a fungicide when treating seed with an insecticide.

SHEEP BOT FLY. Sheep shake their heads, stamp their feet, and crowd together, holding their noses to the ground, especially in bare dusty places. They may also 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 inflammation 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 animal.

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. The systemic materials listed under cattle grubs show promise for sheep bot fly control.

SHEEP KED. The sheep ked, sometimes called louse fly or sheep-tick, is not a true tick like the Rocky Mountain wood tick, but is 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 ked 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 1/4 inch long and is covered with short, spiny hairs. "Nits" are nearly round, chestnut brown, egg-like objects that are found in the wool especially about the neck, inside the thighs and

along the belly. These are the pupal stage of the insect, not the eggs.

Control: Sheep keds are best controlled by treating sheep in the fall before the advent of cold weather. Fall treatment prevents the heavy buildup of sheep keds 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 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.

SHOT-HOLE BORER. The shot-hole borer is sometimes found working in prune, peach, cherry, and apricot trees, especially in years following wide-spread frost injury to trees. During the winter this borer is in the grub or larval stage in the inner bark. The overwintering grubs are about $\frac{1}{8}$ inch long, pinkish white in color. They change to pupae in the spring and a little later the adults emerge. The beetles are $\frac{1}{10}$ inch long, half as wide, very blunt at either end and black in color. On emerging, the beetles seek out trees in an unhealthy condition in which to lay their eggs. The bark of infested trees is perforated with numerous small "shot-hole" openings from which the insect gets its name. Beneath the bark are found many small winding, sawdust-filled galleries that usually girdle the infested part. Death of the branch or tree follows an infestation, but beetles rarely are the primary cause of the death of a tree. This insect almost invariably confines its attacks to diseased and dying trees, or trees with poor vitality.

Control: It is advisable to prune out all infested branches, as well as all diseased and dead wood and burn it. Cultural practices should be resorted to in order to get trees into vigorous growing condition. Chemical control can be applied to help prevent infestations and to help eliminate infestations that have already developed. Spray thoroughly the trunks and branches of trees with either two pounds of 50 percent DDT or 1 pound of 25 percent parathion wettable powder in 100 gallons of water during mid-September or when the peak of adult activity is observed.

SNOWBALL APHID. These are bluish plant lice that attack the leaves early in the spring, causing curled, deformed leaves and small, inferior blossoms. Winter is passed in the egg stage. Newly hatched aphids attack the terminal leaves early in the spring. Injury is all caused early, for aphids fly away later and do not return to the snowball until autumn.

Control: Spray snowball bushes when buds begin to break with 1 teaspoon of 50 percent malathion emulsion per gallon of water.

SNOWY TREE CRICKET. These green or yellowish "crickets" occur most numerous on prune trees. Eggs are deposited in the bark on the undersides of medium-sized branches in the fall. They hatch about June 1. Feeding is generally confined to the leaves until about July 25 or when the first prunes begin to show color. Crickets then attack the fruit, eating holes of various sizes into it. The first adults develop about the middle of July, after which time males may be heard chirping in unison in infested trees. There is one generation annually.

Control: Spray with 2 pounds of lead arsenate plus 1 pound of a spreader in 100 gallons of water. A spreader should be used with sprays to prevent spotting of fruit. Treatment should be made between July 15 and August 1. One application completely protects the fruit and so reduces the population that spraying is not necessary again for several years.

SOWBUG. These grayish, fat-bodied, fringed, slow - moving creatures attain a length of about $\frac{1}{2}$ inch. They may be found near the ground under trash, leaves, or bits of manure. They are very common in greenhouses and basements where conditions are moist. They cause injury by feeding on tender stems or leaves near the ground.

Control: Spray with 4 pounds of 50 percent DDT or 2 pounds of 50 percent dieldrin wettable powder in 100 gallons of water. Spray thoroughly all places where sowbugs are found.

SPINACH LEAF MINER. White or yellowish maggots mine within the leaves of spinach, beets, chard and many weeds, causing blasted spots or blister-like blotches. The grayish two-winged flies of the maggot appear in April or May and may be found throughout the season.

Control: Sugar beets usually outgrow the infestation. Parathion at $\frac{1}{2}$ pint of 25 percent emulsion or malathion at $\frac{1}{2}$ pint of 50 percent emulsion in 50 gallons of water per acre is effective. For aircraft application, use the same amount of emulsion concentrate in 5 gallons of water per acre.

SPOTTED ASPARAGUS BEETLE. The adults are reddish-orange or tan with 12 prominent black spots scattered over the wing covers. The eggs are greenish in color and are glued singly, on their sides, to the leaves. Adults feed especially on young shoots. Injury is similar to that produced by the asparagus beetle. The orange-colored larvae do little damage since they feed almost entirely on the fruits or berries.

Control: Follow the recommendations given for control of the asparagus beetle. Gathering and destroying the berries by burning will give control in gardens.

SQUASH BUG. Adult squash bugs are pale or dark grayish brown on the back and the protruding margins of the abdomen are orange or alternately striped with orange and brown. The

length of the body is about $\frac{5}{8}$ inch. Eggs are yellow to brown in color and are laid in clusters on the undersides of the leaves. The young are pink to gray and are often covered with a whitish powder. Both adults and young suck the sap and cause plants to wilt or die.

Control: Hand-picking of nymphs and eggs is quite effective on a few plants. Practical control can be obtained by four applications of pyrethrum dust or spray. The first application should be made about a week after the first overwintering adults are found on the vines. The remaining applications should be made at 10 or 12-day intervals. The spray or dust should be directed along the runners and at the base of the plants. The spray mixture should contain 1 part of emulsifying agent and 2 parts of pyrethrum extract in 1000 parts of water. The dust mixture should contain 0.2 percent pyrethrins. The application of 5 percent DDT or chlordane dust to the soil in a ring around the base of each plant will give very good control if applied early in the season before the plants start to runner. Do not apply DDT or chlordane to the plants.

STABLE FLY. Stable flies, to the casual observer, appear to be very much like the common house fly, but in reality they are quite different in that they feed by piercing the skin of their host to suck blood. They attack many animals, including man. They annoy the animals by their biting. This insect breeds in manure as does the common house fly.

Control: Since the flies breed in manure which is moist the 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. This will prevent the adults from depositing eggs and the larvae from completing their development. Spray as recommended for house fly control.

STONEFLY. This species is black with red and yellow markings and measures between $\frac{1}{2}$ and $\frac{3}{4}$ inch long. Nymphs 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 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 ROLLERS. 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 either 3 pounds of lead arsenate, 4 pounds of 50 percent DDT wettable powder, 2 pounds of 25 percent malathion wettable powder or 1 pound of 25 percent parathion wettable powder in 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: Infestations can be prevented by applying heptachlor, chlordane, aldrin or dieldrin to the soil before setting out new strawberry beds. These materials can be applied to the soil surface as dusts, granules or sprays and then worked in to the top 3 to 6 inches of soil by disking. Use chlordane at the rate of 10 pounds actual per acre and aldrin, dieldrin, and heptachlor at the rate of 5 pounds actual per acre.

For small garden plots, use either 5 percent chlordane, 2 $\frac{1}{2}$ percent aldrin, dieldrin, or heptachlor dusts at the rate of 5 pounds per 1000 square feet. Sprays and dusts applied thoroughly to the ground about the crowns of the strawberry plants in established beds have also given control.

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. 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 $\frac{1}{4}$ inch long, black with transparent white wings except for a black area on the front margin. The maggot is white and about $\frac{1}{4}$ 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: Seed and soil treatments give satisfactory control. Use 8 ounces of actual aldrin, dieldrin or heptachlor per 100 pounds of seed. Mix the insecticide with the seed before planting. As a soil treatment, apply either 3 pounds of actual aldrin, dieldrin, or heptachlor per acre and work into the soil to a depth of 3 inches prior to planting.

SWEETCLOVER WEEVIL. The crescent-shaped holes eaten in leaves of sweet clover in the spring following hibernation and in the fall before hibernation are characteristic of adult feeding. Under extreme population conditions the stems may be etched and the whole leaf, with exception of the midrib may be consumed. Seedling sweet clover is often killed, while well established plants generally outgrow the injury. In the absence of sweet clover, alfalfa may be attacked and severely injured. The adult is a small, dark-gray snout beetle, about $\frac{3}{16}$ inch in length, which is difficult to distinguish from the clover root curculio. They are sometimes very difficult to see as they fall to the ground and "play possum" when disturbed.

Control: Apply control measures as soon as injury is first noticed. Use 5 percent DDT dust at 30 pounds per acre. Aldrin, dieldrin, or heptachlor at $\frac{1}{2}$ pound actual per acre applied in early spring is also effective.

TERMITES. These so-called "white ants" destroy foundation timbers and woodwork in buildings. 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 every day from infested timbers to their nest in the ground in covered runways.

Control: When termites are discovered thoroughly inspect the building to determine the extent of damage. All infested support timbers should be replaced with pentachlorophenol-treated lumber. The soil around piers and both sides of the foundations should be treated with either DDT, chlordane, or pentachlorophenol, forming a barrier to kill the termites as they attempt to pass through the treated soil. Cracks and crevices in the foundation used as runways by the termites should be sealed. For detailed instruction in termite control consult your county agent or write to the University of Idaho Agricultural Experiment Station, Moscow.

THISTLE APHID. These red or green plant lice curl the leaves of plums and prunes in the early spring and form sticky honeydew. 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 either 1 pound of 25 percent parathion wettable powder or 1 pound of 50 percent malathion wettable powder in 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. Dusting with 5 percent DDT 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 tree 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 or parathion.

TURNIP APHID. Turnip aphids are small, soft-bodied, green or green and black insects. Some of them have wings, others are wingless. They attack turnip, 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.

TWO - SPOTTED SPIDER MITE COMPLEX. The two-spotted spider mite complex in Idaho apparently includes the two-spotted mite, the Pacific mite and several other species that are difficult to distinguish apart.

These mites vary in color from lemon yellow to a yellowish green and have similar habits and life histories. They overwinter in the soil and debris on the ground as adults. In the early spring they migrate to the growing plants. They attack many kinds of fruit trees, bush fruits, field crops and ornamentals. They spin dense webs on the leaves, especially on the undersides and feed beneath the webs, which also protect 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 plants or crop may be done in a very short time.

Control: For control on fruit trees use the summer sprays recommended for European red mite. These mites can be controlled on field crops such as beans, clover, and potatoes by dusting the infested plants with dusting sulphur at the rate of 25 pounds per acre just as soon as the mites are noticed. Aramite dust also can be used on these crops. Chlorobenzilate and Kelthane can be used on seed crops of alfalfa, clovers, and beans and on potatoes where crop residues will not be fed to lactating dairy animals or animals being finished for slaughter. Control becomes more difficult the longer treatment is delayed.

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 yellow-jackets, 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: Early in the season treat the plants thoroughly with 5 percent DDT or 2½ percent aldrin dust. Begin dusting while plants are in hot beds or immediately after they are set out, or when they appear above the surface in seeded fields. For later treatments use 1 percent rotenone or 5 percent malathion dust.

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: To protect plants from adult feeding, apply the same controls as for Western Black flea beetle. To protect potato tubers from larval injury, apply DDT, aldrin or heptachlor to soil surface and work thoroughly into the top 3 to 4 inches.

WESTERN RASPBERRY FRUITWORM. Adult beetles, which are light brown in color and approximately ⅛ 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 ¼ 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 5 percent rotenone wettable powder 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 1½ 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 appli-

cation of a 5 percent DDT dust at the rate of 20 pounds per acre. Do not feed treated forage to lactating dairy animals or animals being finished for slaughter.

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 turn yellow 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 10-lined June 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 carrot beetle adult is a large, red beetle measuring from about $\frac{1}{2}$ to $\frac{3}{4}$ inch long. The 10-lined June beetle is brownish gray with 10 white lines running lengthwise on the back. Adults are often attracted to lights in the summertime and make loud buzzing noises when in flight.

Control: Pull affected plants and destroy grubs to prevent them from attacking adjacent sound plants. Injured plants are detected by their wilted appearance. Avoid planting crops susceptible to white grub injury on recent broken sod. Where necessary to grow such crops, apply 15 pounds of actual DDT per acre to the soil surface and thoroughly work into a depth of 6 to 8 inches prior to planting. To control white grubs on golf courses and in lawns follow the recommendations for blue grass bill bug control or use DDT at the rate of 1 pound of 50 percent DDT wettable powder 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 wind-breaks. 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: Thoroughly spray the infested trees with either 1 pint of 50 percent malathion emulsion or 2 pounds of 50 percent malathion wettable powder in 100 gallons of water as soon as the infestation is noticed.

WIREWORMS. These shiny, yellow, hard worms bore into planted seeds of corn and 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 drying period is prolonged. Alfalfa is the key crop in wireworm control rotations. The high populations of wireworms usually decrease after each succeeding year of a good stand 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 pupal cases, thus destroying many wireworms. Seeding should follow plowing.

DDT when thoroughly mixed with the soil to a depth of 6 to 8 inches will slowly kill off the wireworms and prevent reinfestation for a period of at least 9 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. Aldrin, dieldrin, or heptachlor used at 5 pounds per acre mixed to a depth of 6 to 8 inches of soil will give immediate kill of wireworms and prevent reinfestation for at least 5 years. Work these insecticides into the soil as directed above.

Where light infestations of wireworms occur, seed treating with aldrin, dieldrin, or heptachlor prevent seed and seedling injury.

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 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. Do not slaughter cattle or sheep within 30 days of treatment.

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 lousen, thus causing raw, open wounds, in which the whitish maggots are found.

Control: Destroy all dead animals by burning or burying them deeply, since blow flies attack wool chiefly after they have become abundant by breeding in carcasses. 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 with 1 pound of 25 percent parathion or 2 pounds of 25 percent malathion wettable powder in 100 gallons of water. Emulsion formulations of these materials may also be used. 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 mouthparts, use a dust prepared by mixing 1 part of *lead arsenate* with 3 parts hydrated lime. Mix the lime and arsenical thoroughly. Any dust not used should be labeled conspicuously and placed out of reach of children and animals. Lead arsenate is 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.

CHLORINATED HYDROCARBONS. These synthetic insecticides are now being extensively used because of the large number of insects each controls, their safeness to plants, and their long residual action. The usefulness varies with each material. *Aldrin* is very effective in the control of root maggots, and root weevils. *Benzene hexachloride* and *lindane* are very effective in the control of animal parasites. Lindane contains only the gamma isomer of BHC and has less of the disagreeable odor associated with BHC making it more pleasant to handle. Neither BHC nor lindane should be used for soil or foliage treatment in areas where potatoes, corn, peas, beans or similar crops will be produced since these crops may acquire undesirable off-flavors.

Ants, grasshoppers, cockroaches, and blue grass bill bugs are controlled by *chlordane*. *DDT* and *methoxychlor* will control a large number of insects but are ineffective against mites, cattle grubs and many species of aphids. *Dieldrin* readily controls the alfalfa weevil, root maggots and onion thrips. Root maggots, narcissus bulb fly, and alfalfa weevil are controlled by *heptachlor*. *Toxaphene* is effective against the beet webworm, cutworms, wood ticks, and grasshoppers. *Endrin* is effective against beet webworm and onion maggot. *Chlorobenzilate* and *Kelthane* are effective miticides. These materials may be used as dusts, water suspension sprays, emulsion sprays or in a highly refined deodorized oil base. *When inhaled or ingested in large quantities, these insecticides may cause toxic effects. Keep them out of the reach of children. Forage or other feeds that have been treated should not be fed to milking animals or animals being fattened for slaughter.*

FUMIGANTS. These are gaseous poisons. *Ethylene dichloride-carbon tetrachloride* or *carbon disulfide-carbon tetrachloride* mixtures are used to control stored grain insects. These materials are highly satisfactory fumigants. Follow the precautions and direc-

tions of the manufacturer closely. *Ethylene dichloride*, *propylene dichloride* and *paradichlorobenzene* are used to control peach tree borers.

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

ORGANIC PHOSPHATES. These compounds are related to the poisonous war gasses. Their use is very effective in the control of mites and many of the aphids. *Parathion*, *demeton*, *EPN* and *TEPP*, are very dangerous to handle as concentrates. *Extreme care should be used in handling these materials 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. In case the concentrates should spill on the clothing remove the article immediately and wash the contaminated area of the body with soap and water. At the first signs of nausea, dizziness, headache, or constriction of the chest muscles consult a doctor immediately. Atropine is an antedote for organic phosphate poisoning. Malathion is also effective in mite and aphid control. Unlike the others, it is relatively safe to handle. Diazinon is effective for aphid and housefly control and is moderately safe to handle. These materials have a short residual action and there is some fumigative action at the time of application. They can be obtained as dusts, wettable powders, or as emulsion concentrates.*

All the organic phosphates are extremely toxic to honeybees and other pollinators and should never be used when these insects are working in blooming crops.

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. Pentachlorophenol is toxic to plants and care should be used in applying it to soil in the vicinity of trees and shrubs.

PETROLEUM OILS Oils derived from sedimentary rocks are very effective contact insecticides and are primarily used for insects attacking trees and shrubs. Highly refined oils are used as summer sprays and the less refined oils as dormant sprays. They may be used in combination with lead arsenate, lime-sulphur, sulphur, and pyrethrum, and as carriers of DDT, pyrethrum, and other insecticides. The type of oil will depend upon the insect to be controlled, the host plant, and the time of year the application is to be made.

PLANT DERIVATIVES. *Pyrethrum* is obtained from chrysanthemum flowers and as a freshly prepared dust is very effective in squash bug control. When combined with oil emulsion as a spray it is used to control many insects attacking fruits and ornamentals. *Rotenone* is an extract of derris or cubé roots and is effective for cattle grub control. *Nicotine sulphate* is prepared from tobacco and like the other plant derivatives it is used in the control of many vegetable and fruit pests. It should be used only when the

temperatures are above 70° F. These materials can be purchased as dust or spray concentrates. They lose their effectiveness rapidly when exposed to sunlight and leave no poisonous residues on the plants. *Pyrenone* is a mixture of pyrethrum and a synergist. It is used extensively as a dust in the control of stored grain insects; and, as a spray prepared from the emulsion concentrate, it may be used in the control of hornflies and the chlorinated hydrocarbon-resistant housefly on dairy animals.

SULPHUR COMPOUNDS. *Sulphur* and its compounds are among the most important acaricides. Sulphur may be obtained as a dust or wettable powder and may be used to control two-spotted spider mites and rust mites. It is also used as a carrier in many dust mixtures. Dusting sulphur is irritating to the skin and mucous membranes and is highly inflammable. It may cause some burning and bleaching when applied to fresh blossoms during periods of high temperatures. *Lime-sulfur* is effective in the control of most scale insects. It can be used in combination with dormant oils for the control of scale insects. Four pounds of dry lime-sulphur are equivalent to 1 gallon of liquid lime-sulphur. Do not apply lime-sulphur after or before the application of dormant oil spray. *Aramite* and *Sulphenone* are sulphur compounds and are very effective in the control of most mites attacking crops and fruit. They can be purchased as dusts, emulsion concentrates or wettable powders.

Insecticide-Fertilizer Mixtures

For many years Idaho farmers have mixed 10 pounds of actual DDT with the amount of dry fertilizer desired per acre. By disking, plowing, and disking the insecticide and fertilizer are thoroughly mixed into the soil to a depth of 6 to 8 inches. Although this method of wireworm control and fertilizer application has been done in the spring, fall application seems to be preferred. It has proved to be a very practical way to apply insecticides for wireworm control.

The application of liquid insecticides mixed with liquid ammonia and applied with injection equipment or through farm irrigation systems is not recommended for use in the control of soil-inhabiting insects. Only by thoroughly mixing an insecticide with the soil to the depth specifically required can satisfactory control be obtained.

Pesticide Residues

The Miller Amendment to the Federal Pure Food, Drug, and Cosmetic Act sets up new procedures for establishing residue tolerances of all pesticides on raw agricultural commodities. This new residue law is designed to permit the effective use of pesticides in the production of food without hazard to the consumer.

Residue tolerances have been established for most of the pesticides and only those having established tolerances or those that are exempt from a tolerance should be used by growers. It is very important that the users of pesticides follow carefully the recommendation given on the label and in official publications as to dosage, timing, number of applications, and crops on which the material can be applied.

Residue tolerances vary according to the specific crop or commodity, and to the pesticide used. For example, methoxychlor has a tolerance of 14 p.p.m. on fruit, 100 p.p.m. on alfalfa, 2 p.p.m. on wheat, 3 p.p.m. in the fat of meat, and 0 p.p.m. in milk, while malathion has a tolerance of 8 p.p.m. on fruit, wheat and alfalfa; 4 p.p.m. in the fat of meat; and 0 p.p.m. in milk. In addition to the variations that occur in tolerances established for specific pesticides on various crops there is the matter of "time before harvest" when a pesticide can be applied without danger of exceeding the tolerance. Careful timing of spray and dust applications, therefore, becomes imperative.

There are a number of factors that influence the amount of pesticide that will stay on a crop. The chemical itself will determine to a great extent the rate of vaporization, hydrolysis or chemical breakdown, or loss in other ways. The interval between the last application and harvest will have a great effect on the loss through weathering. Multiple applications of the same chemical may build up persistent and excessive residues. Systemic pesticides particularly build up in the plant with repeated applications. Here the spray schedule that determines the number of times the chemical is applied to the crop is at least as important as the dosage rate.

The type of formulation has a great influence on the amount of pesticide that will remain on the harvested crop. In general, the highest residues result from the use of emulsifiable concentrates and wettable powders, with dusts contributing the lowest and/or easiest to remove of the residues.

Growers who follow the approved directions for application and good agricultural practices should not, under normal conditions, have a problem with pesticide residues. Use pesticides only as directed, on the **crops** specified, in the **amounts** specified, and at the **times** specified. Insofar as possible, control insect pests and disease early in the season, and **never** use a persistent or otherwise questionable material late in the season.

Control recommendations given in this bulletin are for the most part based upon research and observations of entomologists of the University of Idaho Agricultural Experiment Station and cooperating agencies. They are the most practical and economical means known at present to reduce damage from pests. An effort has been made to suggest practices that will not result in excessive residues. Nevertheless, all tolerances are subject to change from time to time and unusual local conditions may affect the amount of residue; therefore, following these recommendations does not guarantee absence of excessive residues.

List of Insects

- Alfalfa caterpillar
Colias philodice eurytheme Bdvl.
- 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 spp.
- Black horse fly
Tabanus atratus F.
- Black peach aphid
Anuraphis persicae-niger (Smith)
- Black vine weevil
Brachyrhinus sulcatus (F.)
- Black widow spider
Latrodectus mactans (F.)
- Blister beetles
Epicauta fabricii (Lec.)
Epicauta puncticollis (Mann.)
Epicauta normalis Werner
Lytta nuttalli Say
- Bluebottle flies
Calliphora erythrocephala (Meig.)
Calliphora latifrons Hough.
Calliphora ilea Wlk.
Calliphora vomitoria (L.)
- Blue grass billbug
Calendra parvula (Gyll.)
- Boxelder bug
Leptocoris trivittatus (Say)
- Bristly rose-slug
Cladius isomerus Nort.
- Brown-banded roach
Supella supellectilium (Serv.)
- Cabbage aphid
Brevicoryne brassicae (L.)
- Cabbage looper
Trichoplusia ni (Hbn.)
- Cabbage maggot
Hylemya brassicae (Bouche)
- Cabbage seedpod weevil
Ceutorhynchus assimilis (Payk.)
- Carpenterworm
Prionoxystus robiniae (Peck)
- Carpet beetles
Anthrenus scorphulariae (L.)
Attagenus piceus (Oliv.)
- Carrot beetle
Ligyrus gibbosus (Deg.)
- Cat flea
Ctenocephalides felis (Bouche)
- Cattle biting louse
Bovicola bovis (L.)
- Cattle sucking lice
Haematopinus eurystrernus (Nitz.)
Linognathus vituli (L.)
Solenopotes capillatus Enderlein
- Cherry worms
Pandemis spp.
- Chicken lice
Menacanthus stramineus (Nitz.)
Cuculotogaster heterographus (Nitz.)
Goniocotes hologaster Nitz.
Menopon gallinae (L.)
- Chicken mite
Dermanyssus gallinae (Deg.)
- Chrysanthemum gall midge
Diarthronomyia chrysanthemii (Ahlb.)
- 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.)
- Cooley spruce gall aphid
Chermes cooleyi Gill.
- Corn earworm
Heliothis zea (Boddie)
- Cottony maple scale
Pulvinaria innumerabilis (Rathv.)
- Currant aphid
Capitophorus ribis (L.)
- Currant fruit fly
Epochra canadensis (Leow.)
- Cutworms
Agrotis ypsilon (Rott.)
Amathes c-nigrum (L.)
Chorizagrotis auxiliaris (Grote)
Pseudaletia unipuncta (Haw.)
Peridroma margaritosa (Haw.)
- Cyclamen mite
Steneotarsonemus 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
Heremocampa pseudotsugata McD.
- Earthworms
Lumbricus terrestris L.
Helodrilus caliginosus Savigny
- Elm leaf beetle
Galerucella 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
Metatetranychus ulmi (Koch)
- Eye-spotted bud moth
Spilonota ocellana (D. & S.)
- Fall webworm
Hyphantria cunea (Drury)
- False cinch bug
Nysius ericae (Schill.)
- False wireworms
Eleodes extricata (Say)
Eleodes hispilabris (Say)
- Firebrat
Thermobia domestica (Pack.)
- Forest tent caterpillar
Malacosoma disstris Hbn.
- Four-spotted tree cricket
Oecanthus nigricornis quadripunctatus Beut.
- Fruit tree leaf roller
Archips argyrospila (Wlkr.)
- Garden symphylid
Scutigera immaculata (Newport)
- Garden slugs
Deroceras reticulatum (Muller)
Limax spp.
- German cockroach
Blattella germanica (L.)
- Gladiolus thrips
Taeniothrips simplex (Mor.)
- Gooseberry fruitworm
Zophodia convolutella (Hbn.)
- Grain mite
Acarus siro L.
- Grainy 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 sylvorum Meig.
- Greenhouse leaf tier
Udea rubigalis (Guen.)
- Greenhouse thrips
Heliethrips haemorrhoidalis (Bouche)
- Greenhouse whitefly
Trialeurodes vaporariorum (Westw.)
- Hog follicle mite
Demodex phylloides Csokor
- Hog louse
Haematopinus suis (L.)
- Hog mange mite
Sarcoptes scabiei suis Gerlach
- Hollyhock beetle
Calligrapha signioidea (Lec.)
- Hop aphid
Phorodon humili (Schr.)
- 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 currant worm
Nematus rebesii (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 spp.
Osmia spp.
- Leatherjackets
Tipula spp.
- Lesser apple worm
Grapholitha prunivora (Walsh)
- Lesser clover leaf weevil
Hypera nigrirostris (F.)
- Lettuce aphid
Macrosiphum barri Essig
- Lima-bean pod borer
Etiella zinckenella (Treit.)
- Lygus bugs
Lygus elisus Van D.
Lygus hesperus Kngt.
Lygus desertus Kngt.
- Meadow spittlebug
Philaenus leucophthalmus (L.)
- Mealybugs
Pseudococcus spp.
- Mealy plum aphid
Hyalopterus arundinis (F.)
- Mediterranean flour moth
Anagasta kuhniella (Zell.)
- Mineola moth
Mineola scitulella Hulst.
- Monterey pine scale
Physokermes insignicola (Craw.)
- Mormon cricket
Anabrus simplex Hald.
- Mountain pine beetle
Dendroctonus monticolae Hopk.
- Mourning-cloak butterfly
Nymphalis antiopa (L.)
- Narcissus bulb fly
Lampetia equestris (F.)
- Northern cattle grub
Hypoderma bovis (L.)
- Norway maple aphid
Periphyllus lyropictus (Kess.)
- Nose bot fly
Gasterophilus haemorrhoidalis (L.)
- Nuttall blister beetle
Lytta nuttallii 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.)
- Painted-lady
Vanessa cardui (L.)
- Pea aphid
Macrosiphum pisi (Harr.)
- Pea weevil
Bruchus pisorum (L.)
- Peach tree borer (Western)
Sanninoidea exitiosa graefi (Hy. Edw.)
- 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)
- Poplar and willow borer
Sternochetus lapathi (L.)
- Powder-post beetles
Lyctus spp.
- Raspberry cane maggot
Pegomya rubivora (Coq.)
- Raspberry root borer
Bembecia marginata (Harr.)
- Raspberry sawfly (Western)
Monophadnoides rubi (Harr.)
- Red flour beetle
Tribolium castaneum (Hbst.)
- Rocky Mountain wood tick
Dermacentor andersoni Stiles
- Rose aphid
Macrosiphum rosae (L.)
- Rose curculio
Rhynchites bicolor (F.)
- Rose leafhopper
Edwardsiana rosae (L.)
- Rose scale
Aulacaspis rosae (Buoché)
- Rosy apple aphid
Anuraphis roseus Baker
- Rust mite
Eriophyes oleivorus (Ashmead)
- San Jose Scale
Aspidiotus perniciosus Comst.
- Saw-toothed grain beetle
Oryzaephilus surinamensis (L.)
- Say stink bug
Chlorochroa sayi Stal
- Scaly-leg mite
Knemidokoptes mutans (R. & L.)
- Seed corn maggot
Hylemya cilicrura (Rond.)
- Shaft louse
Menopon gallinae (L.)
- Sheep bot fly
Oestrus ovis L.
- Sheep ked
Melophagus ovinus (L.)
- Shot-hole borer
Scolytus rugulosus (Ratz.)
- Snowball aphid
Anuraphis viburnicola (Gill.)
- Snowy tree cricket
Oecanthus niveus (Deg.)
- Sowbug
Porcellio laevis Koch
- Spinach leaf miner
Pegomya hyoscyami (Panz.)
- Spotted asparagus beetle
Crioceris duodecimpunctata (L.)
- Squash bug
Anasa tristis (Deg.)
- Stable fly
Stomoxys calcitrans (L.)
- Stoneflies
Taenipoteryx nigripennis Banks
Taenipoteryx pacifica Banks
- Strawberry leaf rollers
Ancylics comptana fragariae (W. & R.)
Anacampsis fragariella Busck
- Strawberry root weevil
Brachyrhinus otatus (L.)
- Striped horse fly
Tabanus lineola F.
- Sugar-beet root aphid
Pemphigus betae Doane
- Sugar-beet root maggot
Tetanops myopaeformis (Roeder)
- Sweetclover weevil
Sitona cylindricollis Fahr.
- Termite (Western)
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 quinque maculata (Haw.)
- Treehoppers
Ceresa basalis Walk.
Ceresa stimulea (VanD.)
Heliria rubidella (Ball)
Stictocephala wickhami VanD.
- Turnip aphid
Rhopalosiphum pseudobrassicae (Davis)
- Two-spotted spider mite complex
Tetranychus spp.
- Virginia-creeper leafhopper
Erythroneura ziczac (Walsh)
- Wasps, hornets and yellowjackets
Polistes fuscatus aurifer Sauss.
Polistes fuscatus variatus Cr.
Vespa diabolica (Sauss.)
Vespa maculata L.
Vespa pennsylvanica (Sauss.)
- Webbing clothes moth
Tineola bisselliella (Hum.)
- Western bean cutworm
Loxagrotis albicosta (Sm.)
- Western black flea beetle
Phyllotreta pusilla Horn
- Western Cherry fruit fly
Rhagoletis cingulata indifferens Curran
- Western pine beetle
Dendroctonus brevicornis Lec.
- Western potato flea beetle
Epitrix subcrinita (Lec.)
- Western raspberry fruitworm
Byturus bakeri Barber
- Western strawberry crown moth
Synanthedon rutilans (Hy. Edw.)
- Western yellow-striped armyworm
Prodenia praefica Grote
- Wheat stem maggot
Meromyza americana Fitch
- White apple leafhopper
Typhlocyba pomaria McA.
- White-lined sphinx
Celerio lineata (F.)
- Willow aphids
Chaitophorus viminalis Monell
Peterocoma bicolor Oest.
- Wireworms
Ctenicera inflata (Say)
Limonius californicus Mann
Limonius canus Lec.
Ludius inflatus (Say)
- Winter tick
Dermacentor albipictus (Pack.)
- Woolly apple aphid
Eriosoma lanigerum (Hausm.)
- Zebra caterpillar
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European red mite	24	Black vine weevil	7
Fall webworm	25	DOG	
Green peach aphid	30	Dog fleas	26
Mineola moth	39	Dog follicle mite	26
Peach tree borer (western)	43	ELM	
Peach twig borer	45	Carpenterworm	10
Pear-slug	46	Elm leaf beetle	22
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Clover mite	16	Garden symphyliid	27
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Cabbage looper	9	Clover mite	16
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Cabbageworm (imported)	10	False chinch bug	25
Corn earworm	19	False wireworms	25
Cutworms	21	Grasshoppers	29
European earwig	23	Green plant bug	30
False chinch bug	25	Mormon cricket	39
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Lygus bugs	37	Mourning-cloak butterfly	40
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DOSAGE DILUTION TABLE

When the control gives only the quantity of insecticide needed for 100 gallons, use this table to find amount needed for 1 quart, 1 gallon or 3 gallons.

100 gal.	3 gal.	1 gal.	1 quart
5 lb.	10 tbl.	3¼ tbl.	2½ tsp.
4 lb.	8 tbl.	3 tbl.	2 tsp.
3 lb.	6 tbl.	2 tbl.	1½ tsp.
2 lb.	4 tbl.	4 tsp.	1 tsp.
1 lb.	2 tbl.	2 tsp.	½ tsp.
½ lb.	1 tbl.	1 tsp.	¼ tsp.
5 gal.	1¼ pt.	13 tbl.	3¼ tbl.
4 gal.	1 pt.	10 tbl.	2½ tbl.
3 gal.	1½ cups	8 tbl.	2 tbl.
2 gal.	1 cup	5 tbl.	4 tsp.
1 gal.	8 tbl.	3 tbl.	2 tsp.
1 qt.	2 tbl.	2 tsp.	½ tsp.
1 pt.	1 tbl.	1 tsp.	¼ tsp.

TABLE OF EQUIVALENTS

3 teaspoons = 1 tablespoon	16 fluid ounces = 1 pint
2 tablespoons = 1 fluid ounce	2 cups = 1 pint
16 tablespoons = 1 cup	8 pints = 1 gallon

One gallon contains approximately 800 teaspoons, therefore
1 teaspoon per gallon = 1:800 dilution