Control of Insects on Deciduous Fruits and Tree Nuts in the Home Orchard—Without Insecticides
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Control of Insects on Deciduous Fruits and Tree Nuts in the Home Orchard—Without Insecticides

Prepared by P. H. Schwartz, Jr., SEA entomologist

This bulletin has been prepared especially for home gardeners. It tells how to control insect and mite pests of deciduous fruits and tree nuts in widespread areas of the United States through methods that either exclude the use of insecticides or minimize their use. In certain cases, chemical control measures are necessary to produce an acceptable crop. The following relatively safe chemicals are recommended in these cases: dormant fruit tree oil sprays and paradichlorobenzine.

If methods recommended in this bulletin do not provide adequate control of insect and mite pests, the homeowner is referred to Home and Garden Bulletin No. 190, “Insects on Deciduous Fruits and Tree Nuts In The Home Orchard.” This bulletin also tells how to minimize damage caused by insect pests and how to recognize beneficial insects. It is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

It is not possible to cover all aspects of the subject in a single bulletin. If you need additional information, write to your local extension agent, your State Extension Service, or to the U.S. Department of Agriculture, Washington, D.C. 20250. Include your return address and ZIP code.

If you cannot identify the insects or diseases that are damaging your plants, send specimens of the insects (in a small bottle of rubbing alcohol) to your local extension agent or State Extension Service. You can also send damaged parts of the plants to the same location.

CONTROL PRACTICES WITHOUT CHEMICALS

This bulletin recommends four general control measures for the prevention of insect and mite damage without chemicals.

- *Mechanical control measures involve the use of equipment specifically designed to control insects. For example, the use of screening over plants to protect them from cicada attack.*

- *Physical control measures involve direct action against insects when trouble is evidenced. For example, the destruction by hand of insect egg masses.*

- *Cultural control measures involve the use of ordinary farm practices and, in some cases, farm machinery, long before insect damage becomes apparent.*

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1Plant and Entomological Sciences, Beltsville Agricultural Research Center, Beltsville, Md. 20705
It is the least expensive of all control practices; often, they are merely variations of routine operations necessary to produce the crop. Most homeowners find it difficult to measure their effectiveness.

- Biological control measures involve the use of natural enemies of insects. Many of the insect and mite pests that attack deciduous fruits and tree nuts have natural enemies that help keep them in check or under control. Some examples of these beneficial insects that are important for the homeowner to recognize are: lady bugs, predaceous bugs, parasitic wasps, ant lions and aphid lions, ground beetles, and praying mantids. These beneficial insects are most effective against scales, aphids, and mites. For a list of beneficial insects see page 32.

Physical and mechanical control measures generally give tangible results. They involve the use of specific equipment that would not be used at all were it not for the insects.

Mechanical devices such as fermenting bait traps, light traps, electric traps, and others, have been successfully used for catching and killing a variety of insects.

Traps are used mainly for survey purposes by State and Federal entomologists. They are not particularly effective when used as a control measure against a heavy population of insects.

Traps containing attractants, such as those used to control the Japanese beetle and yellow jackets, have been effective.

The use of low temperatures, or superheating, is not often practical in orchard situations. Insects that inhabit the soil have been destroyed in their overwintering stage by cultivation that exposes them to cold.

Cultural control measures, to be effective, must be employed long before past damage becomes apparent and at the proper stage of development of the insect. A knowledge of the life history and habit pattern of the insect to be controlled is extremely important. A control that is effective against one kind of insect may fail to control a closely related kind because of a difference in habits.

Species of insects that develop in the soil can be destroyed easily if the soil is cultivated when they are in their pupal stage. The plum curculio has been reduced in this manner.

Other insects, such as the grape berry moth, have been controlled by the destruction of their hibernating shelters.

Crop residues such as fallen fruit are a favorite habitat of such pests as the chestnut weevil and the apple maggot. Elimination of this fruit before the insects have gone into the soil helps to reduce the next season’s population.

Many insects winter in surface trash—old boards, brush, fallen leaves, and other vegetation. Cleanup of these materials over the winter can reduce the insect population that will have to be fought the following season.

The breeding of insect-resistant varieties of cultivated plants has become a major weapon against insect attack. For example, Northern Spy and other apple varieties are resistant to root forms of the woolly apple aphid.

Cultural control measures demand the use of high-quality plants that are properly pruned, thinned, and fertilized. Neglect of one or more of these factors may result in crop loss.
Encouraging the increase of the natural enemies of undesirable insects is important to biological control. Birds, for example, are leading predators of insects. Homeowners can attract birds to the orchard in large numbers by building bird houses and bird feeders.

Insect populations can be drastically reduced by diseases. Minute organisms, such as protozoa, fungi, viruses, or bacteria, live on and in the bodies of insects. An example of the practical use of an insect disease is milky disease. Milky disease, which affects the larval or grub stage, has been effectively used to control the Japanese beetle.

**GENERAL FEEDERS**

Some insect pests attack a wide variety of crops. This section outlines their life history and suggests methods to control them. In some instances, non-hazardous chemicals such as mineral oils, dormant fruit tree oil sprays, and paradichlorobenzine are recommended to the homeowner.

**Japanese beetle**

*Description.*—Shiny-green, reddish-brown outer wings; oval; about ½ inch long, ¼-inch wide. Larva: Light brown head; up to 1 inch long.

*Damage.*—Adult attacks foliage. Larva feeds on roots, grasses, and other plants. Beetles are often known to attack the following fruit and nut trees: American chestnut, apple, apricot, black walnut, cherry, crabapple, nectarine, peach, plum, and quince.

*Distribution.*—Southern Maine south to Georgia and westward into Kentucky, Illinois, Michigan, and Missouri.

*What to do.*—To reduce the number of Japanese beetle grubs in the soil, apply milky disease spores to the soil in the form of dust or powder. Application rates vary from 2 to 20 pounds of dust per acre, depending on the method of application, and the time required for sufficient buildup to control the larvae.

Milky disease spore dust is produced commercially and can be obtained from many garden supply stores. If it is not available from your local dealer, consult your county agent for the nearest source of supply.

For more information, see Home and Garden Bulletin 159, “Controlling the Japanese Beetle.” Copies of this publication may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, or from any U.S. Government Printing Office bookstore across the country. Write to Superintendent of Documents for price information. Be sure to include your return address and ZIP code.
Damage from adult beetles may still occur although beetle grubs have been reduced to low levels. To reduce damage caused by adults, use traps baited with a mixture of phenethyl propionate and eugenol. This is an inexpensive method for destroying large numbers of beetles.

Integralure, which is marketed as “Bag-A-Bug,” contains a sex pheromone attractive to Japanese beetle males. Use of traps containing this substance will help reduce the number of adults.

When only a few trees are infested, beetles can be shaken from the trees, caught on plastic or similar ground sheets, and killed by being dumped into a bucket filled with water topped by kerosene. This works best before 7 a.m. when the temperature is low and beetles are sluggish.

At the first sign of beetle infestation, protect small fruit and nut trees from injury by covering them with plastic or cloth netting.

Because beetles are repelled by a white deposit on plants, foliage of fruit and nut trees can be protected by applying hydrated lime. (This application, however, is not always effective in protecting ripening fruit.) A good adhesion on the foliage is obtained by preparing a spray consisting of hydrated lime mixed with aluminum sulfate.

To prepare the spray, dissolve \( \frac{1}{2} \) pound of aluminum sulfate in 10 gallons of water and then add 2 pounds of hydrated lime. During both mixing and spraying keep the mixture agitated; hydrated lime will tend to settle rapidly to the bottom of the container.

Aphids

*Description.*—Tiny: Light green, dark green, or black; bodied; winged or wingless. Cluster on stems and under leaves.

*Damage.*—Cause leaves to curl and thicken, turn yellow, and die. (See p. 7 for color illustration.)

*Distribution.*—Continental United States.

*What to do.*—Most aphids overwinter in the egg stage; eggs are laid on the twigs and bark of the trees. To kill these eggs and prevent a rapid buildup of aphids later in the growing season use a dormant fruit tree oil spray.

Oil sprays should be applied before any pink is visible on the buds or any of the buds begin to break. Dormant oil sprays should not be used when foliage is on the trees—sprays will burn the foliage. Never apply oil sprays when the temperature is higher than 85° F. and lower than 35° F.

If aphids become numerous during the growing season, wash them off the plants with a soap and water solution applied under fairly high pressure.

To control root feeding aphids, such as the woolly apple aphid, regularly loosen and cultivate the soil under the trees to a depth of 1 to 3 inches. Attacks by the woolly apple aphid can be avoided by planting varieties that are resistant. Also, trees that have been kept in a vigorous growing condition will suffer less damage by these insects.

Woolly apple aphids also feed in wounds of trunks and branches. Paint these wounds with some type of wound dressing to prevent attack by aphids.

When natural enemies of the aphids are present, aphids can be controlled without additional measures. Check plants carefully to see if a natural control agent, such as the larvae of ladybird beetles is present. Syrphid flies and ant lions are also natural enemies of the aphid.

When the spring is warm, natural enemies are present in sufficient numbers to control aphids. The greatest damage occurs after a cold spring;
aphids increase more rapidly than their natural enemies in a chilly season.

Spider mites

Description.—Reddish, greenish, or browish; very tiny; found on underside of leaves.

Damage.—Make yellow specks and fine webs on leaves; plants and fruit are stunted. (See p. 7 for color illustration.)

Distribution.—Continental United States.

What to do.—Use a dormant fruit tree oil spray to kill overwintering eggs and reduce the population of mites during the growing season. (See aphid section on p. 4 for details in using this method.)

Spider mites, like aphids, can be controlled by their natural enemies. These natural enemies include lady beetles, predatory mites, flower bugs, and predatory thrips. Often, this group is so successful in controlling mite populations that the use of miticides are unnecessary.

If mites become a problem during the growing season, wash them off the plants with a soap and water solution applied under fairly high pressure.

Borers

Adult Shothole borers

Description.—Reddish, greenish, or browish; very tiny; found on underside of leaves.

Damage.—Many species, larva or grub; white and yellowish white, brown; from 1 to 1½ inches long. Adult: Beetles or moths; many sizes; colors varied.

Distribution.—Continental United States.

What to do.—Remove any broken, diseased, or dead limbs; treat all tree wounds promptly. Keep trees in a healthy, growing condition by following recommended cultural practices.

To prevent attacks by the peach tree borer, apply a small amount of paradich-
lorobenzine (PDB) crystals on the soil surface around the trunk of the tree. Encircle the trunk with the crystals; do not come closer to the bark than 1 inch, nor further away than 3 inches. To confine the PDB crystals cover them with several shovelfuls of earth.

The product, Nomate Borer-Gard®, contains a substance similar to the sex pheromones of the lesser peach tree borer and the peach tree borer. It can be used to prevent mating, thereby reducing the number of these pests.

Peach twig borers and oriental fruit moths bore into the growing branch tips of young stone fruit trees. Dieback of the tips indicate the presence of these pests. To prevent further damage and population buildup of these insects, remove the tips of the infested branches and burn.

Some borers, such as the lesser peach tree borer, the greater peach tree borer, flatheaded apple tree borer, attack the tree and feed on the cambium layer. Younger borers can be cut from the tree with a knife. However, care must be taken not to cut away more wood than is necessary. Older borers can be killed by probing with a wire with a hooked tip. Paint over the wound to reduce further damage from insects and diseases.

It is usually not feasible to cut out all larva or grubs from the small holes made by the shothole borer. Some egg laying can be prevented by coating the trunk and large lower limbs with whitewash. Three applications may be necessary—one in early spring, another in mid-summer, and a third in the fall.

Tent caterpillars or webworms

Description.—Adults: White to brown moths; active near lights at night in June and July. Larva: Hairy caterpillars 1 to 2 inches long. Constructs tents of webbing on branches.

Damage.—Feed on leaves, sometimes defoliating trees.

Distribution.—Continental United States.

What to do.—To remove the tents of webbing from branches use a pole that has a cone-shaped brush or several nails on the end of it. Wind the webs on the end of the pole and burn the webs. Do not burn the webs while they are on the tree—injury to the tree may result.

The Eastern tent caterpillar lays it eggs on twigs of the tree during the summer. Eggs are laid in bands around the twigs and cover the twigs with a foamy secretion. This secretion dries to a firm, brown covering that looks like an enlargement of the twig.

Larvae develop inside the egg but do not hatch until spring. These egg masses can easily be removed from the branches and destroyed before they hatch and cause damage.

For more information on this insect, see Home and Garden Bulletin, 178, "Controlling the Eastern Tent Caterpillar." Copies of this publication may be purchased from the Superintendent
Codling moth wormholes in apple.

Injury by apple maggot.

Leaf roller larva damaging apple.

San Jose scale on Golden Delicious.

Aphid injury to apple leaves.

Periodical cicada adult on apple limb.

Scurfy scale on apple twig.

Spider mite damage on apple plant.
Injury by grape berry moth.

Grape flea beetle larva.

Oriental fruit moth damage to peach twig.

Plant bug injury (catfacing).

Lesser peach tree borer larva and injury.

Oriental fruit moth injury on peach.

Plum curculio adult and egg puncture.
Scales

Description.—Tiny, soft-bodied insects that have a waxy covering; crawlers (young) appear in mid-May, move to new feeding sites, moult, and lose their legs; less than 1/8 inch in diameter. (See p. 7 for color illustration.)

Damage.—Suck plant juices; cause discolored (sometimes red) spots on leaves, stems, and the fruit.

Distribution.—Continental United States.

What to do.—Scales, like aphids and mites, can be controlled by a fruit tree oil spray. (See aphid control section on p. 4 for details on using this method.) Scales also have many natural enemies such as parasitic wasps, lady beetles, and mites which are effective in keeping the populations under control.

Scale insects are minute insects which secrete a waxy secretion around their bodies after they have attached themselves to the bark of the tree. This makes them difficult to remove by washing. However, they can be scraped from the bark or twigs and then crushed.

Grasshoppers

Description.—Brown, gray, black, or yellow; strong hindlegs; up to 2 inches long; most are strong fliers.

Damage.—Feed on many kinds of plants; make large ragged holes in leaves; leave comma-shaped bitemarks on leaf edges.

Distribution.—Continental United States; especially troublesome in Central and Northwestern States.

What to do.—Grasshoppers are not generally considered as orchard pests. However, they will migrate to orchards after eating most of the green growth in fields or during periods of drought. When this migration occurs, grasshoppers have been known to completely strip the foliage from trees during July and August.

Several important natural enemies reduce grasshopper populations: Blister beetles, ground beetles, anthomyiid flies and diseases. These insects lay their eggs in the soil near or in egg pods and their larvae have been known to destroy 40 to 60 percent of all grasshopper eggs laid over large areas.

The flesh fly deposits active larvae upon grasshoppers, often while in flight, resulting in high mortality. Threadworms act as internal parasites. Many birds and mammals, as well as predatory insects, feed on grasshoppers.

Grasshoppers choose the dense growth at the edges of fields, roadsides, and fence rows, to deposit their eggs. To reduce the number of grasshoppers in these locations replace broadleafed weeds with perennial grasses. Crested wheat grass serves this purpose well; it grows quickly and discourages egg laying more than native grasses. Many of the young grasshoppers can be destroyed by flooding hay meadows where grasshopper eggs have recently hatched.

For more information see Farmers’ Bulletin 2193, “Grasshopper Control.” Copies of this publication may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, or from any U.S. Government Printing Office bookstore across the country. Write to Superintendent of Documents for price information. Be sure to include your return address and ZIP code.
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Casebearers and Bagworms

*Description* (Casebearers).—Adults: Small gray moths; fringed wings. Larvae: Dark; form cases that are cigar- or pistol-shaped, brown or gray, and up to 3/8 inch long. Overwinter as larvae attached to twigs.

*Description* (Bagworms).—Larva: Brown to dark brown; found on leaves in a conspicuous spindle-shaped case, or bag. Adult female rarely seen.

*Damage*.—Casebearer larvae make many small holes in buds and leaves; bagworm larva eats leaves of fruit trees.


*What to do*.—Remove bags and burn them. For effective control on small trees, or those that can be easily reached, handpick and burn the bags during the winter months. Make sure to burn all the insects removed from the trees; if the bags are left scattered about the ground eggs will hatch and many of the worms will again infest the trees.

Because casebearers and bagworms are generally controlled by their predator and parasite enemies, these pests are rarely numerous enough to cause extensive damage.

Periodical cicadas

*Description*.—Adults: Black; red eyes; reddish-brown legs; wing veins orange except for black “W” pattern near lower edge. Nymphs: White, pale beige, or light yellow; resemble small crayfish. (See p. 7 for color illustration.)

*Damage*.—Adult females damage twigs and limbs when eggs are laid; damaged limbs appear rough and break easily. Nymphs feed on roots and weaken the tree.

*Distribution*.—Eastern United States.

*What to do*.—To protect 1- or 2-year-old orchard trees from this pest, cover them with an open-weave cloth such as heavy cheesecloth or netting.

Place the cloth on the trees when the cicadas begin to appear and leave it on for approximately 5 weeks. Injured wood on large trees can be pruned away the winter after the infestation if little or no pruning was done the year before.

Birds are natural enemies of cicadas. In areas where birds are numerous—near houses, in small open groves—they will substantially reduce the cicada population. Where cicadas are numerous and birds rather few, as in dense woods, the pests will not be materially reduced.

Insects and mites attack cicada eggs; a fungus disease kills some adult cicadas. To reduce chances of the larvae or nymphs affecting the roots of the tree, and to lower future insect populations, prune off all severely affected tree limbs in July and burn them before the cicada eggs hatch.

For more information on this insect, see Leaflet 540, “Periodical Cicadas—17-Year Locusts.” Copies of this publication may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, or from any U.S. Government Printing Office bookstore across the country. Write to Superintendent of Documents for price information. Be sure to include your return address and ZIP code.
Plum curculio

*Description.*—Adult: Small grayish-brown snout beetle; black and white markings; four prominent dark humps on back. Larva: Whitish; brown head; up to 3/8 inch long; legless; slightly curved. (See p. 8 for color illustration.)

*Damage.*—Adult feeds on fruit in spring; makes crescent-shaped cuts in fruit in which to lay eggs. Larva makes tunnels in fruit.

*Distribution.*—East of the Rocky Mountains.

*What to do.*—Fruit damaged by plum curculio usually falls before it is mature. Apples drop during June and July; peaches drop during May and June. It is advantageous to pick up and destroy these dropped fruits and burn them.

Cultivate the soil around the trees during the late spring and early summer to destroy the larvae and pupae in their cells in the earth.

The adult curculio hibernates under leaves or trash in the winter. Destroy all trash under which the beetle might find shelter. Also, clean up other favorite hibernating locations such as overgrown hedges and fences.

Plum curculios are shy and prefer the deep shade when they do their damage. Therefore, prune all trees properly to admit the sun. Fertilizers also help to produce strong, healthy trees.

Natural control of the curculio results from winter mortality, attacks by birds, other predators, and parasites. A small wasp attacks the larvae in the fruit; other parasites attack the eggs. Both the adult curculio and larvae are attacked by fungal diseases.

Leaf miners

*Description.*—Adults: Small, golden-brown moths; silvery markings. Larvae: Small worms; found inside leaves in thread-shaped, trumpet-shaped, or irregular-shaped tunnels.

*Damage.*—Deform leaves and cause dead areas on them.

*Distribution.*—Continental United States.

*What to do.*—Leaf miners have many enemies that help to prevent an injurious population buildup. Several parasites attack the larval stage. Ants often tear open the cases of the leaf miners to eat the enclosed caterpillars or pupae.

To prevent serious attacks by leaf miners, pick damaged leaves from the tree. Pick fallen leaves from the ground and burn them to destroy the young larvae in them; this will prevent attacks by future generations.

Plant bugs or stink bugs

*Description.*—Adults: Brown, green, or black; sometimes have markings; shield-shaped; up to 5/8 inch long and 3/8 inch wide. Nymphs: Resemble adults but are smaller. Give off a foul odor.

*Damage.*—Suck sap and weaken the plants; bugs and fruit do not develop normally (called catfacing) and sometimes drop. (See p. 8 for color illustration.)

*Distribution.*—Continental United States; most prevalent in the South.

*What to do.*—Most stink bugs overwinter as adults in sheltered places such as fence rows, roadsides, ditch banks, and other locations where weeds are abundant. Wherever practical, reduce stink bug populations by destroying the weeds where these bugs hibernate in winter and late spring.

Weed clearance is also valuable in controlling the tarnished plant bug. This
pest feeds on twigs and prevents new growth. The tarnished plant bug usually lays its eggs in the stems of herbaceous and cultivated plants and in weeds.

To control tarnished plant bugs, stink bugs, and other plant bugs, and reduce their numbers, clear weeds from areas around trees, destroy fruit that has been infested, and prune away damaged twigs.

**INSECT AND MITE PESTS OF DECIDUOUS FRUITS**

**Apple**

The production of apples without using insecticides is made difficult chiefly by insect pests that attack the fruit. These pests are generally the most difficult to control when using conventional insecticides. They are even more difficult and sometimes impossible to control without chemicals. Therefore, the home gardener who does not wish to use chemical insecticides may have to learn to tolerate a certain amount of insect damage, not only for apples but for nearly every other fruit or tree nut crop.

The most difficult insects in apple production to control without chemicals are: the codling moth, the apple maggot, and, occasionally, the redbanded leaf roller and plum curculio.

**Apple and thorn skeletonizer**

*Description.*—Adult: Overwinters as small dark-brown moth; lays eggs in early spring. Larva: Caterpillar; feeds on underside of leaves; later constructs shelters on upper surface of leaves by drawing leaves together with silken webbing.

*Damage.*—Leaves become a mass of webbing and grass.

*Distribution.*—Continental United States.

*What to do.*—The apple and thorn skeletonizer is not a serious pest of apple. It is only occasionally numerous enough to cause economic damage. For the most part, this insect is controlled by predators and parasites; other methods of control are generally not required. When the insects are present in the home orchard, they can be hand-picked from the leaves and destroyed.

**Apple maggot**

*Description.*—Adult: Black fly; white bands on abdomen; green eyes; ¼ inch long; lays eggs in apples. Maggot: Yellowish white; up to 3/8 inch long.

*Damage.*—Burrows into fruit, distorts the shape, and causes it to rot and drop prematurely. (See p. 7 for color illustration.)

*Distribution.*—Dakotas to New England and southeastern Canada; south to Arkansas, Ohio, and Georgia; uncommon in southern parts of its range.

*What to do.*—Apple maggot—one of the most serious insect pests of apple—either ruins the fruit entirely or makes it too unappetizing for consumption. Heavily infested fruit will be reduced to a brown, rotted mass filled with yellowish, legless maggots. When fruit is slightly infested, there is no external indication of the maggots within. However, when the fruit ripens, burrows made by the maggots show as dark lines under the fruit’s skin.

Apple maggot causes fruit to drop before it is mature. Larvae in dropped fruit can mature to adult maggots that will reinfest the fruit on the trees. For this reason, it is important to pick up
and burn the fruit soon after it has dropped.

**Apple red bug**

*Description.*—Adult: Orange-red; dark markings; up to ¼ inch long. Nymph: Bright red; smaller than adult.

*Damage.*—Punctures fruit causing spots and deformation.

*Distribution.*—North Central and Northeastern States.

*What to do.*—Apple red bugs pass the winter in the egg stage. These eggs are laid in the bark of branches of the trees and in the bark pores. The eggs hatch early in spring.

When light to moderate infestations of red bugs are found during the season, the next season’s generation can be controlled by using a dormant fruit tree oil spray. This spray, like the one used for aphids, will kill the overwintering eggs.

**Cankerworms**

*Description.*—Adults: Males are gray moths; females are wingless, plump, and gray. Larvae: Slender, light- to dark-brown “measuring worms”; yellowish stripe on sides. Eggs laid on branches or twigs; larvae feed on leaves for 3 to 4 weeks, drop to the ground, and pupate. Overwinter as eggs or pupae.

*Damage.*—Chew on the leaves, cause defoliation, and weaken the tree.

*Distribution.*—Northeastern United States, North Carolina, Missouri, Montana, Colorado, Utah, California, and Texas.

*What to do.*—Cankerworms generally occur in cycles. Their destructive period usually lasts from 3 to 5 or more years before natural enemies and climatic conditions succeed in bringing about a reduction in numbers. This reduction may last for 10 or more years.

Birds are the most effective natural enemies of cankerworms. Over 40 kinds of birds—especially chickadees, thrushes, and warblers—feed on caterpillars, their eggs, and egg-laden female moths.

Cultivate around the trees in the middle of the summer in order to expose pupae (who live in earthen cells or cocoons near the surface) to birds and other enemies. This will help reduce next year’s population of cankerworms.

Natural enemies of the larvae (or caterpillars of cankerworms) are predatory sucking bugs, ground beetles, and several parasites.

Wingless female moths crawl up trunks of trees to lay their eggs. To prevent them from climbing up the trunk, erect a simple mechanical barrier. Construct the barrier by tightly wrapping a band of cotton batting several inches wide around the trunk.

Tie the batting tightly with string near the bottom edge and the upper portion of the band. Turn the upper portion of the batting down over the lower to form a funnel-shaped barrier. These cotton bands should be fluffed up after frequent rains or they will lose their effectiveness.

Another simple mechanical barrier used about the trunk consists of a strip of mosquito wire netting. The netting should be at least as fine as 16 wires to the inch and should be 14 inches wide.

Tack the netting to the tree so that it fits tightly near the top and is held out a half inch, or more, at the bottom. Nails driven into the tree or spiral springs can be used to accomplish this.

In badly infested trees, female cankerworms that accumulate under this barrier should be crushed each
night. Therefore, it is sometimes necessary to remove and empty these barriers. 

When constructing barriers, smooth all rough places on the bark and fill them to prevent the moth from crawling under the edge of the bands. Effectiveness of the barriers depends on their proper application and maintenance during the insect's active period.

Sticky bands such as flypaper wrapped around the trunks of trees will perform as well as wire netting or cotton batting. First, the sticky material is applied to a band of tarred or other heavy paper 6 to 8 inches wide. Then the paper is tacked or tied around the trunk and all rough places filled with cotton. Whenever necessary, keep the bands sticky with fresh applications.

Climbing cutworms

Description.—Moths that have dark-gray, marked forewings, and lighter hind wings; attracted to lights. Larvae: Rounded, soft bodied, and smooth; up to 1-1/4 inches long; curl up tight when disturbed; feed at night.

Damage.—Feed on buds before leaves form.

Distribution.—Continental United States.

What to do.—The same measures used to control the cankerworm—wire netting, cotton bands around the tree, and sticky trap barriers—are also effective in controlling the climbing cutworm.

Codling moth

Description.—Adult: Grayish-brown moth; brown wingtips; wingspan ½ to ¾ inch. Larva: White or pink; brown head; up to ½ inch long. Overwinters as larva in a cocoon under bark scales, debris, or litter on the ground. Larva found in fruit near core.

Damage.—Causes wormy apples and blemishes, or "stains" on the skin. (See p. 7 for color illustration.)

Distribution.—Continental United States.

What to do.—The codling moth, the most destructive pest of apples, is also one of the most difficult to control. The codling moth is responsible for the "wormy apple" and can infest close to 100 percent of the apples on trees. This insect pest is found in other fruits related to apples, such as the crabapple, peach, walnut, almond, and pear.

Codling moths have several generations a year. Earlier generations tend to cause less damage than subsequent generations.

Larvae almost invariably hibernate in tough-skinned cocoons under loose pieces of bark, crevices in trees, or in nearby fences or other suitable shelter. When no better place is available, larvae will spin their cocoons at the base of a smooth-bark tree or in cracks in the ground.

Codling moths lay eggs mostly on the upper and under surfaces of the leaves, although a few may be found on the fruit and branches. Eggs of the codling moth are parasitized by a minute wasp, Trichogramma, and they are attacked
by mites. The larvae also have several parasites.

Over a dozen species of birds are known to feed on this pest. The downy woodpecker, nuthatch, and chickadee destroy great numbers of hibernating larvae.

In spite of this array of enemies, the codling moth remains the most destructive insect preying on apples.

To create a substitute location for the larvae to spin their cocoons and pupate, band the trunks of trees by tying 6-inch strips of burlap or cardboard around them. These bands can be placed around the trunk or around large branches. Check these locations in the fall for larvae; kill the larvae you find by crushing them.

To reduce this insect population further, scrape away loose bark from the trees and collect bark found on the ground. Clean up all debris in the immediate area that may provide shelter.

### Eye-spotted bud moth

**Description.**—Adult: Gray; pale-beige band on forewings. Larva: Brown; black head; up to ½ inch long.

**Damage.**—Eats buds, blossoms, and leaves and spins webs around them. Reduces fruit production. Injury to terminal shoots causes a lush, bushy growth.

**Distribution.**—Continental United States.

**What to do.**—Examine young trees for bud moth damage in May; dead, brown leaves are evidence of infestation by this pest. Nests can be destroyed by removal from the trees or they can be crushed on the tree to kill the enclosed caterpillars or pupae.

Several parasites and predators such as *Trichogramma* and ground beetles help to control this insect. Birds also feed on the caterpillars. Mud dauber wasps sometimes store them in their shells where they are used as food for their grubs.

### Green fruitworms

**Description.**—Greenish or greenish-white caterpillars that look like climbing cutworms (p. 14); up to 1-1/4 inches long; larvae have white or yellow stripe on each side.

**Damage.**—Eat leaves and make large holes in fruit.

**Distribution.**—Northern United States.

**What to do.**—Green fruitworms do most of their damage to young fruit in May. However, some fruitworms continue to damage fruit until the middle of June.

During the first week of June most of the caterpillars attain their full growth. This is the time when they burrow into the soil beneath the trees to a depth of from 1 to 3 inches and construct an earthen cell.

About the middle of September, the moths emerge from these cells and go into hibernation in sheltered nooks. Some pupae, however, do not become moths until early the following spring.

When this insect reaches the caterpillar stage it can be handpicked from small trees and destroyed. Because of the insect’s large size as a caterpillar (up to 1-1/4 inches long) it can be easily identified.

To prevent further damage to the fruit, thoroughly cultivate the ground under the trees to a depth of 1 to 4 inches. This will destroy the caterpillars in their earthen cells. Cultivation reduces the number of adult moths that
Leafhoppers

Description.—Adults: Many colors—green, brown, yellow or striped; wedge-shaped; up to 1/8 inch long; fly quickly when disturbed. Nymphs: Similar to adults, but smaller; crawl sideways like crabs.

Damage.—Cause leaves to curl or roll downward, crinkle, and turn yellow or reddish brown.

Distribution.—Continental United States.

What to do.—Young trees are the most seriously infested by leafhoppers. The insects usually attack the undersides of the leaves. Control should be directed toward the young nymphs; adult leafhoppers often escape by flying away when disturbed.

To control young trees infested by leafhoppers, dip the tips of affected branches into a pail containing a soap solution using 1 pound of soap to every 8 gallons of water. Dipping, which kills some of the young leafhoppers, should be done in the latter part of June and again one month later. This is the period when the maximum number of nymphs will be found on the trees. Many adult leafhoppers can be captured as they fly away by placing a shield covered with a sticky substance close to the tree.

Leaf rollers

Description.—Adults: Brown moths; light markings on wings; wingspan ¾ inch. Larvae: Pale yellow or dirty green; brown or black heads; up to ¾ inch long. Light yellow, green, or grayish eggs laid on branches in masses of 10 to 15; red-banded leaf roller has broad reddish-brown band across wings. (See p. 7 for color illustration.)

Damage.—Larvae feed on buds, fruit, and leaves; web leaves together to form a tent; eat irregular holes in leaves and fruit.

Distribution.—Continental United States; red-banded leaf roller in eastern United States and west to the Mississippi Valley.

What to do.—A number of parasites and predators attack the leaf rollers. Toads eat many caterpillars that drop from the trees; birds also prey upon the caterpillars.

Since this insect overwinters in the egg stage, and deposits its eggs on the twigs and bark of the trees, it is possible to control the first brood by spraying with a dormant fruit tree oil spray such as the one used on aphids.

The larva of this insect has a habit of folding over the leaves, hence its name: leaf roller. These folded leaves can be pinched by hand to destroy the caterpillars, or they can be picked and burned. This will help reduce the numbers infesting the trees.

Apply these methods early in the season to reduce subsequent generations later on during the summer.

Red-humped caterpillar and yellow-necked caterpillar

Description.—Both insects have yellow and black stripes on body; up to 2 inches long; when disturbed, raise both ends to form a “U.” Red-humped caterpillar: Red head; bright-red hump on the back near the head. Yellow-necked caterpillar: collar of bright yellow just behind the head.
Pear psylla damage.

Pear leaf blister mite damage.

Casebearer larva and case.

Hickory shuckworm larva.

Pecan weevil adult.

Black pecan aphid damage.

Walnut caterpillar larvae feeding on leaflet.

Cherry fruit fly maggots and damage.
BENEFICIAL INSECTS

Lady beetle larva.

Lady beetle adult.

Lacewing.

Syrphid fly adult.

Aphid lion larva.

Syrphid fly larva.
**Damage**.—Young larvae skeletonize leaves; older larvae eat entire leaf.

**Distribution**.—Continental United States.

**What to do**.—Because these insects habitually cluster in large numbers on the branch where they are feeding, they can—if the branch is within reach—be destroyed by hand. Control is similar to that accorded the tent caterpillar and webworm; remove the branch and crush or burn the caterpillars on the ground.

### Rust mites

**Description**.—Very tiny; brown in winter and white or pale beige in summer; become active when new growth starts.

**Damage**.—Cause fruit and leaves to turn uniform reddish-brown.

**Distribution**.—Continental United States.

**What to do**.—These mites cause brownish blisters to appear on the underside of the leaves. They also cause fruit buds to turn brown and flare open during the winter.

When they attack leaves they cause blisters that are commonly 1/8 inch wide; the blisters may be massed together and nearly cover the underside of the leaf surface. The mites are small—less than 1/125 of an inch in size—and can be seen with a magnifying glass.

Mites enter bud scales in August or September and overwinter. This burrowing under the fruit bud scales produces weak flowers and emaciated fruit.

When leaf blisters are serious, control blister mites by spraying with fruit tree oil sprays (as for control of aphids). To kill the mites, spray thoroughly, especially in the bud areas.

**Treehoppers**

**Description**.—Wedge-shaped; have sharp corners; adults are as long as 3/8 inch.

**Damage**.—Eggs laid in branches and twigs cause roughened bark and stunt growth of branches.

**Distribution**.—Continental United States.

**What to do**.—Treehoppers are usually abundant in areas where there are weeds, grassy growth, or cover crops (such as alfalfa) near the fruit trees.

To reduce the numbers of this pest, cut down all weeds or grassy growth near the fruit trees. Keep areas around the home clear of growth. Fruit tree oil sprays (as for control of aphids) can be used to kill the overwintering eggs of the treehopper.

**Aphids.** (See p. 4.)

**Bagworm.** (See p. 10.)

**Casebearers.** (See p. 10.)

**Fall Webworm.** (See p. 6.)

**Flatheaded Appletree Borer.**

(See p. 5 under Borers.)

**Grasshoppers.** (See p. 9.)

**Japanese Beetle.** (See p. 3.)

**Periodical Cicadas.** (See p. 10.)

**Roundheaded Appletree Borer.**

(See p. 5.)

**Scales.** (See p. 9.)

**Shothole Borer.** (See p. 5 under Borers.)

**Spider Mites.** (See p. 5.)

**Tent Caterpillar.** (See p. 6.)

**Unspotted and Spotted Tentiform Leafminers.** (See p. 11.)

**Plum Curculio.** (See p. 11.)

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**Cherry**

The insect pests of great concern to the cherry grower are plum curculio, cherry fruit fly, aphids, pear slugs, and...
scales. Cherry trees are also vulnerable to attack by tent caterpillars, peachtree borer, and the lesser peachtree borer. Most wormy cherries in the United States are caused by either the plum curculio or cherry fruit flies.

**Cherry fruit fly**

*Description.*—Adults: Black, yellow bands around body; wings marked with dark bands; about ½ as large as a house fly. Maggots: white; legless; up to ¼ inch long. (See p. 17 for color illustration.)

*Damage.*—Adult females make small slits in fruit in which to lay eggs. Larvae begin to feed near pit; pit separates from the pulp very easily. Later, cherry shrivels on one side, pulp looks decayed, and small holes appear in the skin.

*Distribution.*—Continental United States.

*What to do.*—After larvae development is completed within the cherries, larvae drop to the ground and change to pupae in the soil. Cherry varieties that are harvested early are likely to contain larvae. Therefore, to control this pest, destroy infested fruit and cultivate the area around the trees.

Pick and destroy all cherries that look damaged on the trees. Either burn dropped cherries or collect them for disposal in an incinerator.

Traps reduce the number of adult flies before they lay their eggs in the fruit. Traps may be made by coating a small piece of wood (about 6 x 8 inches) with a sticky substance such as Tanglefoot or TacTrap. At the bottom of the board attach a small jar or bottle filled with ammonium carbonate. Punch a few holes in the jar lid so the fumes of the bait can get into the air.

Suspend several of these traps in the lower limbs of the tree. For full effectiveness, clean the “sticky” board of flies and other debris at periodic intervals and renew the “sticky” substance used whenever necessary.

**Cherry fruitworm**

*Description.*—Adult: Small grayish-black moth; wingspan about ¼ inch. Larva: Whitish-pink worm; black head; up to 3/8 inch long.

*Damage.*—Larva bores into fruit and feeds on pulp, causing rough, brownish areas in the pulp and on the skin.

*Distribution.*—Northwestern United States.

*What to do.*—The cherry fruitworm spends the winter as a full-grown larva in a silken cocoon, tunneled inside the pruned stub of a dead twig, under bark, or debris on the ground. The larva pupates in May and the adult emerges approximately one month afterward.

To control this pest, prune away all dead branches and twigs and burn them to kill overwintering larvae. Cleanup of bark and debris on the ground during the winter months will reduce cherry fruitworm populations in the spring.

Pick and destroy all damaged fruit, and keep the area under the tree clean of dropped fruit.

Place bands of cardboard around the trunk of the tree as described for control of the codling moth. Remove these bands periodically and examine them for the presence of the silken cocoon of the cherry fruitworm. Destroy these cocoons whenever they appear and renew or replace the bands around the tree when necessary.
**Rose chafer**

*Description.*—Gray or tan beetle; reddish-brown head; long legged and slender; \(\frac{1}{2}\) long.

*Damage.*—Feeds on foliage, buds, flowers, and fruit.

*Distribution.*—Eastern United States.

*What to do.*—The best method of controlling this insect is to thoroughly cultivate areas around trees where eggs may have been deposited.

Cultivation is most effective if carried out during May or early June when the rose chafer is in the pupal stage. Control the rose chafer when it first appears; after it is established it is very difficult to drive away or kill.

During the 4 or 5 weeks that the adult insects are present, protect choice fruits by covering them with cheesecloth. Adults can be handpicked from the trees and destroyed by crushing or by being placed in a pail containing water with kerosene.

Do not feed the rose chafer to poultry because they may be poisoned and killed by toxic substances in this insect.

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**Black Cherry Aphids.** (See p. 4.)

**Peach Tree Borer.** (See p. 5.)

**Pear Thrips.** (See p. 27.)

**Rust Mites.** (See p. 5.)

**Japanese Beetle.** (See p. 3.)

**Pear Slug.** (See p. 27.)

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**Periodical Cicada.** (See p. 10.)

**Plum Curculio.** (See p. 11.)

**Scales.** (See p. 9.)

**Shothole Borer.** (See p. 5.)

**Spider Mites.** (See p. 5.)

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**Grape**

Insect damage to grapes in the United States varies considerably in different regions and from year to year. Grapes are subject to attack by many kinds of insects. Only a few of the insects most economically damaging are discussed in this bulletin.

For additional information on grape insects, see Farmers' Bulletin 1893, "Control of Grape Diseases and Insects in the Eastern United States." Copies of this publication may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, or from any U.S. Government Printing Office bookstore across the country. Write to the Superintendent of Documents for price information. Be sure to include your return address and ZIP code.

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**Gall makers**

*Description.*—Live inside swellings (galls) on leaves and stems. Larvae: Tiny; greenish yellow, yellow, orange, or reddish.

*Damage.*—Cause unsightly swellings on leaves and canes and weaken the plant.

*Distribution.*—Continental United States.

*What to do.*—A variety of insects and mites make galls on leaves and stems. These pests are generally subject to
attack by natural enemies such as parasites and predators.

If galls become a serious problem on grapes, prune out the infested leaves and canes and burn them before the insect emerges. This will prevent the buildup of subsequent generations. Some grape varieties are resistant to certain insect gall makers. Plant these resistant varieties whenever possible. Consult your local county agricultural agent or State extension specialist for resistant varieties adapted to your local area.

**Grape berry moth**

*Description.*—Adult: Brown moth; wingspan \(\frac{1}{2}\) inch; appears in late spring or early summer. Larva: Active, greenish caterpillar; up to 3/8 inch long; constructs cocoon from leaves in June or July; in the fall the cocoon falls to the ground.

*Damage.*—Larva feeds on blossoms and developing fruit, and later on pulp and seeds. (See p. 8 for color illustration.)

*Distribution.*—Eastern United States.

*What to do.*—There are 3 effective cultural control methods for grape growers in areas where the grape berry moth occurs.

The first method involves soil clearance late in the summer and 30 to 45 days before harvest. Clear the soil from the row centers into a low ridge under the grape trellis using a grape hoe, disk, or plow.

Make the ridge flat and wide and let it remain during the winter. Cocoons of the grape berry moth tend to accumulate on the surface; make the row centers almost level and—if you wish—seed them to a winter cover crop.

If the ridge is too high and narrow, grape roots may be injured by deep hoeing in the spring when the ridge is thrown back into the center row. If soil is not thrown far enough under the grape trellis clean hoeing will be difficult in the spring.

In addition, surface water tends to stand under the trellis if a depression remains there over the winter. Early in the spring, before the moths begin to emerge, pull the soil ridge with the cocoons on the surface from under the trellis and move it into the center rows. Then bury the cocoons and compact the soil covering them. Since rains help to seal in the cocoons the soil around the vines should be almost level.

Complete these cultural operations at least 15 days before the average day of grape bloom. Do not cultivate until at least 15 days after grape bloom.

The second cultural control method involves keeping the vineyard soil level during the winter. In the spring, throw a low ridge of soil under the grape trellis to cover the weeds and cocoons. Till the soil so that it forms a smooth, compact covering over the cocoons. Spring rains help to seal the soil.

If soil and sod growth do not cover the cocoons compactly many grape berry moths will emerge through openings between the layers of sod.

Complete this cultural operation at least 15 days before the grape blooms. The row centers may be cultivated during the spring and summer, if desired, but do not remove the ridge of soil under the trellis until 15 days after grape bloom or later.

The third cultural control method is employed after fall harvest. During this period make a low, flat, compact ridge of soil under the grape trellis so that the berry cocoons are tightly covered.

Make the row centers almost level with a slight depression in the middle.
Do not dig too deeply or there will be injury to grape roots, poor vine growth, reduced yield, and improper soil surface drainage. No further cultivation is necessary in the fall.

In the spring, throw back the soil ridge into the row centers 15 days after the grape bloom. Turn under the row centers so the vineyard is level. When this method is used fall cultivation is usually completed too late for seeding in a winter cover crop. In any event, a spring cover crop can be grown.

The third method is employed least of these mentioned. However, it can serve as a temporary substitute for the first method when that method is impractical or when it is desirable to have a ridge of soil under the trellis during the winter.

Grape flea beetle

**Description.**—Adult: Shiny, dark greenish-blue jumping beetle; about ¼ inch long. Larva: Light-brown grub; black spots; up to 3/8 inch long. (See p. 8 for color illustration.)

**Damage.**—Feeds on buds and new leaves.

**Distribution.**—Eastern two-thirds of the United States.

**What to do.**—A satisfactory method of collecting the adult grape flea beetle is to jar them from the vines on which they are feeding into pans containing a little kerosene or onto sheets saturated with motor oil. The best time to do this is on bright, sunny days when the beetles are most active—beetles are hard to find on raw, cold days.

When alarmed, beetles feign death and drop at the slightest jar. They will fall for some distance when the vines are shaken and the trellis jarred.

As a rule, flea beetles cause the most damage to grapes grown near wood lots, hedge rows, or waste land in which they hibernate. Eliminate these conditions wherever practical.

In early fall, beetles go into hibernation under fallen leaves and other rubbish, especially in waste fields and nearby wood lots. Clean up or treat these areas to make beetles less numerous.

Adult flea beetles do their greatest damage when they feed at the tender hearts of buds just beginning to burst. During warm weather, each beetle may destroy several buds; in this way they cause a loss of fruit and foliage out of all proportion to the amount of tissue actually consumed.

Although grubs or larvae may be numerous enough to badly riddle the foliage, their actual injury to the vine tends to be negligible.

Fall cleanup of the area around grape vines (as recommended for control of the grape berry moth) will also help to control flea beetles.

Grape mealybug

**Description.**—Whitish with a cottony-white coating; about ¼ inch long when full grown. Crawlers (young) present in early spring and again in early summer; secrete honeydew on which a sooty mold develops.

**Damage.**—Sucks plant juices and weakens plant. Fruit and leaves made unsightly by honeydew and mold.

**Distribution.**—Continental United States.

**What to do.**—Grape mealybugs are particularly vulnerable to biological control methods and to natural enemies such as lady beetles and other parasites.
If natural enemies do not control the mealybugs, they can be washed off the grape vines with water.

Therefore, when the appearance of mealybugs is noted by the presence of honeydew secretions, or a white cottony-like coating, take measures to reduce their numbers and bring them under control. On small vines, it may be easier to just crush them with the fingers. On larger vines, you can obtain fairly satisfactory control by spraying the plants with water to wash them off the leaves.

**Grape phylloxera**

*Description.*—Resembles an aphid. Adult: Orange or yellowish brown; red eyes; winged; up to 1/16 inch long. Young: On foliage is yellowish, is soft bodied, and lives inside gall or swelling; on roots is oval and pale green or brown.

*Damage.*—Forms galls (swellings) on leaves and sucks juices from roots; vines are stunted and sometimes die.

*Distribution.*—Continental United States.

*What to do.*—Control this insect by using resistant varieties. To prevent damage to roots graft European grapes on resistant rootstocks native to the eastern United States. When galls appear on the leaves from the foliage form of phylloxera, infested leaves can be picked and destroyed. (This method is outlined under Gall Makers on p. 21.)

**Grape rootworm**

*Description.*—Adult: Hairy, brown beetle; ¾ inch long. Larva: White; brown head; hairy; curved.

*Damage.*—Adult makes chain-like pattern of holes in leaves. Larva eats small roots, eats pits in larger roots, and weakens the plant. A heavy infestation of larvae can kill a plant.

*Distribution.*—Continental United States.

*What to do.*—The pupae of this insect is found in the soil. To destroy many of the pupae, cultivate the soil around vines (as recommended for the grape berry moth) up to the time when the adult grape rootworm emerges in late June.

Where this insect is a pest, keep the vines in a healthy condition as much as possible by proper pruning, fertilization, and cultivation. It is much easier to control the rootworm in a well-cared-for vineyard than in one that has been neglected.

If your vines are seriously infested by the adult rootworm, place a plastic sheet or similar covering under the vines and jar the vines to drop the pests. Then dump the beetles into a pail of kerosene and water to kill them.

Grapevine Aphid. (See under Aphids, p. 4.)

Redbanded Leafroller. (See p. 16.)

Rose Chafer. (See p. 21.)

European Fruit Lecanium. (See under Scales, p. 9.)

Climbing Cutworm. (See p. 14.)

Grape Leafhopper. (See p. 16.)

Japanese Beetle. (See p. 3.)

Spider Mites. (See p. 5.)

**Peach and Apricot**

The most important pests of peach and apricot are the oriental fruit moth, the plum curculio, and borers.

**Green June beetle**

*Description.*—Adult: Green beetle; body somewhat flattened; 1 inch long.
Larvae: White grub that crawls on its back; up to 1-1/2 inches long.

Damage.—Adult feeds on leaves and fruit of peaches; larva feeds on roots of grasses.

Distribution.—Southern United States, and north to Long Island and southern Illinois.

What to do.—Do not leave piles of grass clippings or manure near lawns or near peach and apricot trees. These piles attract beetles as sites for egg laying.

If you see evidence of beetle infestation on your lawn, thoroughly wet the lawn in the evening. This wetting will bring beetle grubs to the surface where they can be destroyed. V-shaped troughs or flower pots sunk in the soil surface have proved effective in trapping the larvae.

To trap large numbers of adult beetles in peach orchards, use bait pails that contain any one of the following: fermenting malt extract, molasses, geraniol, or caproic acid. Adult beetles can also be handpicked on peach trees as they appear and then destroyed.

Oriental fruit moth

Description.—Adult: Inconspicuous gray moth; wingspan ½ inch. Larva: pink worm; brown head; up to ½ inch long.

Damage.—Bores into twigs and new shoots and kills them; bores into stem end of fruit and eats the pulp. Sometimes fruit does not show damage. Increases trees’ susceptibility to disease. (See p. 8 for color illustration.)

What to do.—In many areas, early maturing varieties of peach and apricot may be planted; these varieties can often be picked before this pest attacks the fruit. This method is successful even in areas where the insect is abundant.

Cultivate the soil around infested trees to a depth of 1 to 4 inches 1 to 3 weeks before blooming time. This cultivation will kill many of the overwintering larvae in the soil.

When the fruit moth becomes a serious pest, apply a dust impregnated with a light grade mineral oil. (Be sure that the oil has a viscosity of 100.) A formula that has been successful includes the following: sulphur, 60 percent; 300-mesh talc, 35 percent; light grade mineral oil, 5 percent. The percentages given are to be measured by weight.

This dust should be applied at 5-day intervals beginning about 20 days before the peaches are picked. Oil dusts, such as the one given here, act as irritants and not as poisons.
Aphids. (See p. 4.)
Leafrollers. (See p. 16.)
Lesser Peachtree Borer, Peachtree Borer, and Peach Twig Borer. (See under Borers on p. 5.)
Rose Chafer. (See p. 21.)
Stinkbugs. (See p. 11.)
Tarnished Plant Bug. (See p. 11.)
American Plum Borer. (See under Borers on p. 5.)
Climbing Cutworm. (See p. 14.)
Grasshoppers. (See p. 9.)
Japanese Beetles. (See p. 3.)
Spider Mites. (See p. 9.)
Periodical Cicada. (See p. 10.)
Plum Curculio. (See p. 11.)
Scales. (See p. 9.)
Shoothole Borer. (See under Borers on p. 5.)

The most injurious insects that attack the pear are the codling moth, San Jose Scale, pear psylla, and, in some regions, pear thrips.

**Pear midge**

*Description.*—Adult: Tiny fly that resembles a mosquito. Larva: Pale-beige or pale-orange maggot.

*Damage.*—Lays eggs in swelling buds; maggot feeds inside young fruit, and causes it to be deformed and to drop prematurely.

*Distribution.*—Northeastern United States.

*What to do.*—Infested fruits can be easily distinguished by their deformed size and shape. Before the middle of May, when the larvae emerge, collect this fruit and destroy it by burning or by placing it in the trash for pickup.

A thorough job of shallow cultivation during June and July will destroy a large number of the larvae and the pupae before they emerge as adults and attack the fruit.

**Pear psylla**

*Description.*—Adult: Dark reddish-brown; transparent wings that slope over the body; 1/8 inch long. Young: Yellowish; flattened; covered with honeydew; as it grows becomes greenish or brownish-black.

*Damage.*—Skin of the fruit becomes scarred, blackened with sooty mold that grows on the honeydew. Brown spots appear on the leaves. This insect also spreads diseases of fruits. (See p. 17 for color illustration.)

*Distribution.*—Continental United States.

*What to do.*—Spray with a fruit tree oil spray (such as the one used on aphids) as the buds swell. This will kill many of the newly-hatched nymphs. Clean all trash away from the base of pear trees; hibernating psyllas like to shelter in these locations.

During the fall and winter, scrape the rough bark from the trunk and large branches of the trees to render them less attractive as hibernating quarters. This scraping will make it easier to reach the insects when you spray during the dormant season.

Use a dull hoe when scraping and take care not to injure the living wood. This work is best done during damp weather when the rough bark comes off more easily.

When psyllids are abundant, great numbers will be scraped off with the bark. When this occurs, it is advisable to collect and burn the scrapings.
**Pear slug**

*Description.*—Adult: Shiny-black sawfly; about ½ inch long. Larva: Olive green, dark green, or black; resembles a snail or slug; up to ½ inch long.

*Damage.*—Larva feeds on the upper surface of leaves, retards growth and development of fruit, and weakens the tree.

*Distribution.*—Continental United States.

*What to do.*—Handpick the larvae from the leaves and destroy them by crushing them or by placing them in a pail containing kerosene. If large numbers of slugs are present on the trees, treat the trees with 1 or 2 applications of lime (calcium hydroxide) diluted with water and dusted on the leaves. The slugs can be washed from the foliage with a strong stream of water.

**Pear Thrips**

*Description.*—Adult: Black; about 1/16 inch long; feathery wings. Nymph: White; resembles adult. Overwinters 5 to 7 inches deep in soil inside a small cell.

*Damage.*—Attacks buds in early spring; buds shrivel and turn brown. Lays eggs in blossoms and causes fruit to drop.

*Distribution.*—Far western United States.

*What to do.*—In late summer and early fall, serious infestations of this pest can be greatly reduced by a thorough, deep cultivation to a depth of more than 4 inches around the trees. This cultivation will kill the last-stage nymphs.

As the buds are opening, spray the trees with an application of thick whitewash. Make the whitewash by diluting 80 pounds of quick-lime in 100 gallons of water per application. Strain this mixture before using.

When adult thrips appear on the buds, spray the trees thoroughly with a dormant oil such as the one recommended for aphids.

Where thrips are abundant, use a second application of the spray at the cluster bud stage of the fruit. The type of oil used for oil sprays must not be injurious to the foliage. Therefore, use a type of oil recommended for summer use.

**Syneta leaf beetle**

*Description.*—Adult: Pale-brown or yellowish beetle; about 1/4 inch long. Larva: Small grubs; plump, curved body.

*Damage.*—Adult scars and deforms fruit; occasionally feeds on fruit stems and causes fruit to drop. Grub burrows into ground and feeds on tree roots.

*Distribution.*—Pacific Coast, New York, Pennsylvania, and Maryland.

*What to do.*—To control this pest, on small trees, place large plastic sheets under the tree and then suddenly jar the tree. This will cause many of the adult beetles to drop. They then can be readily collected on the sheet and destroyed.

Wait for cool weather to shake the trees; beetles are more sluggish at these times. In warm weather, beetles tend toward quick flight when disturbed.

To destroy the pupae, cultivate around the trees in the early spring. Cultivate to a depth of approximately 4
inches and thoroughly break up the soil. Exercise caution during cultivation so tree roots are not injured, thus weakening the tree.

Aphids. (See p. 4.)
Codling Moth. (See p. 14.)
Forbes Scale and San Jose Scale.
   (See under Scales on p. 9.)
Pear Leaf Blister Mite. (See p. 5.)
Climbing Cutworms. (See p. 14.)
Fruitworms. (See p. 15.)
Grasshoppers. (See p. 9.)
Pear Rust Mite. (See p. 19.)
Periodical Cicada. (See p. 10.)
Plum Curculio. (See p. 11.)
Roundheaded Appletree Borer.
   (See under Borers on p. 5.)
Scurfy Scales. (See under Scales on p. 9.)
Shothole Borer. (See under Borers on p. 5.)
Spider Mite. (See p. 5.)
Treehoppers. (See p. 19.)

The most troublesome enemies of plums and prunes are the plum curculio, San Jose scale, and borers. The plum curculio is the insect primarily responsible for wormy plums and prunes, and is difficult to control without the use of insecticide applications.

All of the insects affecting plums have been discussed previously. Therefore, the insects will be listed here with reference to the page where a more complete description can be found:

American Plum Borer. (See under Borers on p. 5.)
Eyespotted Bud Moth. (See p. 15.)
Oystershell Scale. (See under Scales on p. 9.)
Peachtrea Borer. (See under Borers on p. 5.)
Peach Twig Borer. (See under Borers on p. 5.)
Plum Curculio. (See p. 11.)
Plum Rust Mite. (See p. 19.)
Spider Mite. (See p. 5.)
Lesser Peachtrea Borer. (See under Borers on p. 5.)
Shothole Borer. (See under Borers on p. 5.)

INSECT AND MITE PESTS OF TREE NUTS

Chestnut

For reference to insects affecting chestnuts, see the following:

Mites. (See under Spider Mites on p. 5.)
Weevils. (See p. 29.)

What to do.—Eggs laid in nuts can be killed before they hatch into grubs by holding chestnuts that have just dropped from the tree at 120° F for 20 minutes.

Pecan

Many kinds of insects attack pecan trees and threaten the nut crop. Some insects damage bark or heartwood, others tunnel into or girdle the branches and cause them to break off; still others attack the buds, leaves, and nuts.

Some of these insect pests are present throughout the growing season; others are present a shorter period in either early or late fall.

It is often a waste of time and money to apply control measures to trees that are in a low state of vigor because of insufficient care, inadequate soil ferti-
lity, or crowding. Certain cultural practices will promote tree vigor, stimulate fruiting, and help minimize the damage caused by some pests.

**Hickory shuckworm**

*Description.*—Adult: Inconspicuous dark moth. Larva: Pale beige or grayish white; brownish head; up to 3/8 inch long. (See p. 17 for color illustration.)

*Damage.*—Larva tunnels inside nuts and destroys the kernels. After shells harden, larva tunnels into shucks. Causes nuts to drop and be poorly filled, shucks to stick to nuts, and shells to be stained badly.

*Distribution.*—Southeastern United States, west to Texas.

*What to do.*—Reduce infestation of this insect by picking up all nuts that drop prematurely and by gathering all pecan shucks at harvest. The shucks should be promptly burned or otherwise destroyed. The use of one blacklight trap for every three trees will help to reduce the hickory shuckworm.

**Pecan bud moth**

*Description.*—Adult: Small gray moth; blackish-brown patches on front wings. Larva: Yellowish green; dark-brown head and neck; up to 5/8 inch long.

*Damage.*—Larva feeds on leaves and terminal buds, bores into young nuts in the spring, and infests shucks in the fall.

*Distribution.*—Southeastern and south-central United States.

*What to do.*—Properly cultivate and fertilize young trees to keep them in a strong and healthy condition. Vigorously growing trees are better able than slow growing ones to withstand attacks of the pecan bud moth. Control of this insect is seldom necessary in bearing orchards.

**Pecan phylloxera**

*Description.*—Small and soft-bodied; resembles an aphid.

*Damage.*—Causes galls or swellings that develop around the insects. In late May or early June galls split open and release the insects.

*Distribution.*—Southeastern and south-central United States.

*What to do.*—Some varieties of pecan are resistant to the formation of galls caused by this insect. For resistant varieties suitable for planting in your area consult your local county agent or State agricultural experiment station specialist.

Spray susceptible trees in the dormant season with fruit tree oil spray (as applied to aphids). Do not use this spray when there is any indication of green on the trees or after the buds begin to break. Also, do not use fruit tree oil spray when the temperature is below 40° F.

**Pecan weevil**

*Description.*—Adult: Brownish beetle; 1/2 inch long; long beak. Larva: Whitish grub; up to 1/2 inch long; about 1/8 inch in diameter. (See p. 17 for color illustration.)

*Damage.*—Causes immature, soft-shelled nuts to drop. Eats kernels of hard-shelled nuts and causes shucks to stick to shells.

*Distribution.*—Southeastern United States.

*What to do.*—Most larvae emerge from nuts before the nuts begin to fall. Collect the larvae on large plastic sheets placed beneath the trees. Destroy the larvae before they can burrow into the soil.

To further suppress these pests, collect all the nuts when they begin to fall.
They should be gathered daily and stored in a metal container with a tight-fitting lid so that none of the larvae emerging from the nuts can escape. In order to reduce the weevil population to a tolerable level, destroy the newly-emerged larvae for a period of 3 to 4 consecutive years.

Late maturing varieties of pecan, such as Success, Teche, Mobil, and Van Deman, are not attacked if some of the early maturing varieties are present in the vicinity; the pecan weevil tends to feed on the early-maturing varieties.

Injury to trees can be reduced by 50 percent if the weevils are gathered by lightly jarring the tree limbs. Begin this control method about the first or second week in August. Spread sheets under the trees; jar limbs lightly 2 or 3 times to dislodge the weevils. A padded pole or a pole with a metal hook bolted to one end can be used to accomplish this.

To kill dislodged weevils, collect them from the sheets and put them in a pail or bucket containing kerosene. If the weather is dry, few weevils will be dislodged. Wait until rain softens the ground before attempting the jarring procedure. Jarring should be continued until about September 15. Gather and destroy all premature nuts to prevent the weevils from emerging and burrowing into the soil.

Spittlebugs

*Description.*—Adult: Brown or gray markings; wedge-shaped; jump or fly quickly when disturbed. Young: Pinkish, orange, yellow, or yellowish green; up to 3/16 inch long; produce masses of white froth or spittle.

*Damage.*—Young suck juices from buds, shoots, and nut clusters and cause trees to be stunted and distorted.

*Distribution.*—Northern Florida, the Gulf Coast, and parts of Kentucky and Illinois.

*What to do.*—Light infestations of spittlebugs do not cause sufficient damage to make control necessary.

Twig girdler

*Description.*—Adult: Brown beetle; about ½ inch long. Larva: White, legless grub.

*Damage.*—Adult girdles (cuts a ring of bark) about twigs which kills them. Adult lays eggs in dead portion of twig.

*Distribution.*—Southeastern and south-central United States.

*What to do.*—To prevent or reduce future damage, gather and burn all severed branches in late fall, winter, or early spring. Spring is the period when the eggs and grubs are in the twigs. Gather all loose branches lodged in the trees, those on the ground, and those from infested nearby trees such as hickory and persimmon. Avoid planting pecans near wood lots which are sources of infestation.

Aphids. (See p. 4.)
Fall Webworm. (See p. 6.)
Leafminers. (See p. 11.)
Pecan Leaf Casebearer and Pecan nut Casebearer. (See p. 10 under Casebearers and Bagworms.)
Stinkbugs. (See p. 11.)
Walnut Caterpillar. (See p. 31.)

Walnut

There are over 300 species of insect and mite pests that occur on black and English walnut in the United States.
However, only a few of these pests are a major problem.

**Curculios**

*Description.*—Adults: Beetles; ¼ inch long; long curved snouts; prominent humps and ridges on wing covers. Larvae: White, legless worms; brown heads; up to ½ inch long. Resemble the pecan weevil.

*Damage.*—Adults feed on newly formed nuts and new foliage. Females lay eggs in nuts and cause nuts to drop before they mature.

*Distribution.*—Continental United States.

*What to do.*—Collect all of the prematurely dropped nuts and burn them immediately to destroy the developing larvae.

**Walnut caterpillar**

*Description.*—Adult: Brown moth; wingspan about 2 inches. Larva: Black caterpillar; white hairs; raises both ends of body when disturbed; up to 2 inches long. (See p. 17 for color illustration.)

*Damage.*—Feeds in groups on the leaves and causes defoliation.

*Distribution.*—Most of the eastern United States, and west to Kansas.

*What to do.*—This insect has a habit of forming a mass on a tree trunk where it molts. When the homeowner observes this peculiar phenomenon, he can destroy large numbers by crushing them.

Do not burn the insects on the trees as this may seriously injure the trees.

Caterpillars are gregarious in their feeding habits; they like to feed in groups on the leaves. Therefore, they can be destroyed readily when they mass on the leaves in much the same way as they can be crushed on the tree.

**Walnut husk maggot**

*Description.*—Adult: Pale yellow fly; brown eyes; stiff brown hairs on abdomen; transparent wings that have dark stripes. Larva: White or pale-beige maggot; up to ¼ inch long.

*Damage.*—Maggot feeds in husk of maturing nuts and reduces the quality of the kernels.

*Distribution.*—Continental United States.

*What to do.*—Nature often assists the nut grower by causing this fly to emerge early or late in the season. The female fly cannot lay its eggs successfully until the walnut husk becomes soft. During July and August, unsuccessful egg laying attempts have been observed on eastern black walnuts that were sound and without blemish. However, eggs have been found in mid-August in husks that have naturally or mechanically-induced abrasions.

Husk maggot problems on the eastern black walnut can be greatly reduced by selecting late maturing varieties. Consult your local county agricultural agent or State agricultural extension specialist for varieties best suited to your area.

Larvae which hatch from eggs laid after September 20 in the latitude of Maryland are no problem because they will not mature.

Pick all infested nuts from the trees and off the ground and destroy them before the larvae have an opportunity to escape into the soil.

**Walnut lace bug**

*Description.*—Fragile; resembles a fly; lacy wings; ¼ inch long.

*Damage.*—Sucks plant juices; leaves turn gray and yellow and nuts are
What to do.—To deal with a serious infestation, wash this pest off the leaves with a strong spray of soap and water solution. Pick up leaves that have dropped prematurely and destroy them.

Aphids. (See p. 4.)
Codling Moths. (See p. 14.)
Mites. (See p. 5.)
Scales. (See p. 9.)

BENEFICIAL INSECTS

Some insects cause no damage to plants and are beneficial to man. They destroy other insects that are injurious to fruits. Learn to recognize these beneficial insects, and avoid destroying them. Following are descriptions of a few of the important beneficial insects.

Ant lion (doodlebug)
Description.—Brown; rough; sickle-shaped jaws; up to ½ inch long. Lives at bottom of conical shaped pit in sand.
Benefit.—Feeds on ants and other insects.
Distribution.—Many parts of the United States; most abundant in the South.

Aphid lion (lacewing)
Description.—Adult: Gauzy green wings; yellow eyes; fragile; hair-like antennae; deposits eggs singly on stalk. Larva: Yellowish, or mottled red or brown; long, narrow body that tapers at both ends; large, sickle-shaped jaws; prominent, projecting hairs; about 3/8 inch long. (See p. 18 for illustration.)
Benefit.—Larva feeds on aphids, mealybugs, scales, thrips, and mites.
Distribution.—Continental United States.
Ground beetles

Description.—Adults: Usually dull black or brown; long, oval bodies; narrow heads; usually found on ground under stones or loose trash; hide by day and are active at night; run rapidly when disturbed. Larvae: Slender, flattened bodies that taper slightly at the tail; two spines or bristles at hind end.

Benefit.—Feed on caterpillars and other insects.

Distribution.—Continental United States.

Lady beetles

Description.—Adults: Shiny red or tan; some have black spots; oval; about ½ inch long. Larvae: Blue, orange, or gray; carrot-shaped; warty; 1/16 to 1/4 inch long. (See p. 18 for color illustration.)

Benefit.—Feed on aphids, spider mites, scales, and mealybugs.

Distribution.—Continental United States.

Minute pirate bugs

Description.—Adults: Generally black, marked with white spots or streaks; oval; flat; about 1/16 inch long. Nymphs: Similar to adults; yellowish brown. Found on flowers and under loose bark.

Benefit.—Feed on small insects and on mites; feed on eggs and larvae of many kinds of insects.

Praying mantids

Description.—Green; green wings that have brown front edges; large abdomens; slender thoraxes; wedge-shaped; movable heads; large front legs that have spines for grasping prey; 2-1/2 to 5 inches long. Eggs laid in fall in masses on shrubs or tall grass, and covered with froth that hardens. Young hatch in spring; resemble adults, but are wingless.

Benefit.—Young feed on aphids and other small insects. Adults feed on many kinds of larger insects.

Distribution.—Continental United States; most numerous in the Northeast.

Spiders and mites

Description.—Range in size from orb-weaving black-and-yellow garden spiders and large hunting spiders that have leg spreads of 2 inches or more to very tiny predaceous mites. Some spiders have hairy bodies and legs; others are smooth and shiny; they are black, brown, yellow and black, or gray. Predaceous mites are gray or pinkish gray. Some spiders construct webs for snaring prey; others run or jump to capture prey.

Benefit.—Suck body juices of other insects. Large web-spinning spiders attack large flying and crawling insects; small hunting and jumping spiders
attack small insects—flies, beetles, caterpillars, aphids, and leafhoppers. Predaceous mites feed on spider mites, cyclamen mites, aphids, and thrips, and on larvae and eggs of many kinds of insects.

*Distribution.*—Continental United States.

**Syrphid flies**

*Description.*—Adults: Bright yellow and black; 1/4 to 3/8 inch long; hover above flowers and plants. Larvae: Resemble slugs; brown, gray, or mottled. (See p. 18 for color illustration.)

*Benefit.*—Larvae eat insects; single larva can eat one aphid per minute.

*Distribution.*—Continental United States.

**Wasps**

*Description.*—Vary widely in size, color, and general body structure; some are parasites; others, predators.

*Benefit.*—Tiny parasitic wasps lay eggs in bodies of insects; developing larvae kill the hosts. Large predaceous wasps—well known to every gardener—sting caterpillars to paralyze them, and feed them to their young.

*Distribution.*—Continental United States.
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