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INSECT PESTS OF DECIDUOUS FRUITS IN THE WEST

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**INSECT PESTS
OF DECIDUOUS FRUITS
IN THE WEST**

By E. J. Newcomer

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Agriculture Handbook No. 306

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Agricultural Research Service

UNITED STATES DEPARTMENT OF AGRICULTURE

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INSECT PESTS OF DECIDUOUS FRUITS IN THE WEST

By E. J. NEWCOMER, *collaborator, Entomology Research Division, Agricultural Research Service*

Insects take a toll of many million dollars a year in the deciduous orchards of the West. The annual value of the fruit crops is nearly \$300 million. The cost of combating insect pests and the losses due to infested fruit are estimated at 10 percent of this amount.

Knowledge of the insects and mites found in these orchards—

their life history and habits—is of vital interest to fruit growers. This handbook gives such information about most of the insects and mites found in the orchards west of the Rocky Mountains and the damage they cause. A list of these pests, including the recognized common names and the scientific names, is given on page 53.

APPLE AND PEAR INSECTS

Codling Moth

The codling moth has caused greater losses to apple and pear growers than any other pest. It is present in all the deciduous fruit-growing districts of the West. It was accidentally introduced from Europe into the Eastern States and then transmitted to the Pacific coast.

Type of Injury.—This insect is injurious only in the larval, or worm, stage. The young worms crawl to the fruit nearest them, burrow into it, and produce the familiar wormy apple or pear. Many worms enter through the calyx end, where the calyx protects them and they can easily obtain a foothold; others enter at a point where two fruits touch, or where a leaf touches a fruit; and still others burrow into the exposed side of the fruit. The worm penetrates the skin and within an hour excavates a small cavity. It remains near the surface for a few days and then burrows to the

center of the fruit, usually feeding on the seeds and core. When full grown the worm tunnels to the surface and leaves the fruit. Wormy fruit is of small commercial value, as it will not keep long, and the laws of some States forbid its shipment, except to byproducts plants.

Another form of injury known as the sting is caused by a worm that begins to burrow into the fruit and then dies, usually from feeding on a slow-acting poison spray on the fruit. Large stings may cause the fruit to be classified as culls, and small stings will lower its grade.

Life History.—The codling moth winters as a worm in a cocoon (fig. 1) about three-fourths inch long. The cocoon may be under the loose bark of trees, in cracks and crevices on trunks, attached to the trunk just below the surface of the ground, or in protected places in boxes, sacks, and packing sheds. The worm just about fills the cocoon and is grayish white or pinkish, with a brown head.



F.I. 3195 AND F.I. 3196

FIGURE 1.—Codling moth: A, Larva and pupa in cocoons; B, adult. (Enlarged.)

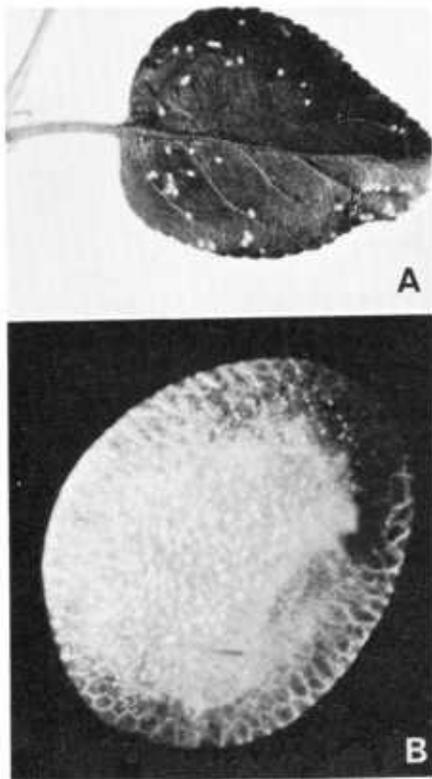
The last brood of worms that leaves the fruit before it is packed and a part of the preceding brood hibernate. In the spring the worms construct exit tubes of silk, transform to pupae, and later to moths, which escape through the exit tubes.

The first moths appear about the time Winesap apple trees are in bloom, and the largest numbers are flying in May or early in June. The moths (fig. 1) are rather inconspicuous, with a wing spread of about three-fourths inch. The front or upper wings are brownish gray, crossed with lines of lighter gray, and have a bronze band at the tip. The hindwings, which are covered when the moths are at rest, are grayish brown. The moths live for about 2 weeks. They lay most of their eggs between sundown and 9 or 10 p.m., but lay few eggs if the temperature is below 60° F. Most of the eggs are laid during the second,

third, and fourth evenings after the moths have emerged, but in the spring, cool weather may prevent egg laying altogether for a week or more.

The eggs (fig. 2) are pearly white, about the size of pinheads, and resemble thin convex disks. A red ring appears in the egg a few days after it is laid. The day before the worm hatches, a black spot, the head of the worm, is easily seen. Most of the first-brood eggs are laid on leaves near the small fruits.

Usually the weather is cool when the first eggs are laid, and the worms do not hatch for 12 to 14 days. As the temperature increases, the inu-



F.I. 4753

FIGURE 2.—Eggs of codling moth: A, On apple leaf (natural size); B, single egg (greatly enlarged).

bation period becomes shorter; the minimum is 4 days. Worms are hatching and entering the fruit for about 5 weeks, and are most numerous during June. They feed in the fruit for about 3 weeks and then leave it and spin cocoons. About 75 percent of them develop into pupae and moths, but the others remain in the cocoons until the following season. The worms that transform pass through the pupal period in about 2 weeks, and the first individuals of the second brood of moths appear early in July.

After this time moths are present in large numbers until cool weather, and the first stormy weather in September usually ends their activities for the season. Many eggs of the second brood are laid on the fruit, and during July and August they ordinarily hatch in 6 or 7 days. The worms often remain in the fruit for more than a month in the fall, and many of them are still there when it is picked. They may leave the fruit before it is packed, and large numbers of cocoons may be found in picking boxes and packing sheds.

The codling moth is sensitive to variations in temperature. In warm localities there is often a partial third generation, but at higher elevations and along the coast there is no third generation and the second generation is smaller than elsewhere. In any locality the yearly abundance of worms varies greatly, as it is dependent on weather conditions. Temperatures of -15° F. or colder kill some of the overwintering worms. Probably the effect of temperature is most evident during May and June, when large numbers of first-brood eggs are laid if the weather is warm, but the number is greatly reduced if it is cold or rainy. Thus an early warm season produces many worms, but a late cool season has the opposite effect.

The fruit grower should therefore study weather conditions as well as conditions in his orchard and plan his spraying schedule accordingly.

San Jose Scale

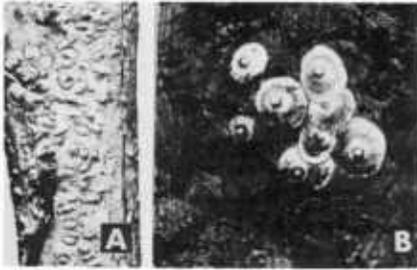
Type of Injury.—The San Jose scale can do more damage than any other insect in the orchards of the West. Besides rendering the fruit unmarketable, it kills the twigs and limbs. If not controlled, it may even eventually kill the tree or at least so weaken it that it is worthless. Actually the San Jose scale does little damage, because control is easy and fruit growers generally know the danger and keep the scale under control.

This insect sucks the plant juices from the twigs and larger branches and from the fruit and foliage. It causes small reddish spots, particularly on the fruit, which often are the first indication that the scale is present (fig. 3). The red discoloration also occurs on scale-infested leaves and in the bark. It cannot be seen on the surface of the bark, but is disclosed by cutting into infested



F.I. 2374

FIGURE 3.—San Jose scales on pear.



F.I. 3428

FIGURE 4.—San Jose scale: A, Bark encrusted with scales; B, scales magnified.

twigs or limbs. The bark is roughened and grayish (fig. 4). If it is scraped, a yellowish liquid appears from the crushed bodies of the insects. Infestations are also manifested by dead twigs scattered about the tree and by the tendency of the leaves on infested branches to remain on the trees during the winter. In irrigated districts, however, leaves often remain on uninfested apple trees for at least a part of the winter.

Although present methods of control are adequate and are keeping the scale in check, an infestation should not be regarded lightly. If spraying is neglected, the scales can become very numerous in a surprisingly short time, as a single female and her progeny may produce several million scales in one season. Laws in some States prohibit the marketing of infested fruit except for making byproducts, and quarantine regulations prohibit the entrance of infested fruit into certain foreign countries.

The San Jose scale is present in practically all the fruit districts of the United States; it was introduced accidentally about 1870 from China. It does most harm to apple and pear, but is at times a serious pest of sweet cherry, peach, and prune. It also attacks other deciduous fruit

trees, as well as nut trees, berry bushes, and many kinds of shade trees and ornamental shrubs, among them the mountain ash, currant, dogwood, elm, gooseberry, hawthorn, lilac, linden, poplar, snowberry, willow, and the ornamental flowering varieties of fruit trees. Many of these plants or trees grow in the gardens or about the houses in fruit-growing districts, and unless they are inspected regularly and sprayed, if infested, they may be troublesome centers of infestation for nearby orchards.

Life History.—The San Jose scale remains in one place during most of its life. Almost all stages may be found on the trees in the fall, but only those scales that are about half grown survive the winter, and in severe winters many of them succumb. Temperatures of -15° to -20° F. kill approximately two-thirds of the half-grown scales, and 90 percent or more are killed if the temperature reaches -25° or -30° .

In the spring the surviving scales continue their growth and mature in May or June. The males develop wings and are active, although they do little flying. The females have no wings. They remain where they develop and produce several hundred very small, louselike, yellowish, active young. These young insects crawl considerable distances during the first few hours of their lives. Often they are carried to other trees by the wind, on the feet of birds, on the clothing of men working in the orchards, or on horses or farm implements. Ordinarily they settle down within a few hours on the bark or on leaves or fruit, insert their long, threadlike beaks into the plant tissue, and begin feeding.

Almost at once they begin to secrete a waxy material, which soon forms a circular, scalelike covering. The covering of the full-grown fe-

male is about the size of a pinhead and grayish, with a dark, central nipplelike projection, whereas that of the male is elongated (fig. 4). Underneath these coverings the delicate, bright-yellow, sac like bodies of the insects may be seen. Growth is completed in about 6 weeks, and there are two or more generations a season.

Oystershell Scale

The oystershell scale is found throughout the West, but occurs most commonly in the more humid regions. It is readily distinguishable from other scale insects by its characteristic shape (fig. 5).

Type of Injury.—The apple is a favorite food plant, but this scale also lives on many other fruit trees, as well as shade trees, ornamental shrubs and plants, and on native trees, such as willow and dogwood. Its damage to the tree and fruit is similar to that of the San Jose scale,

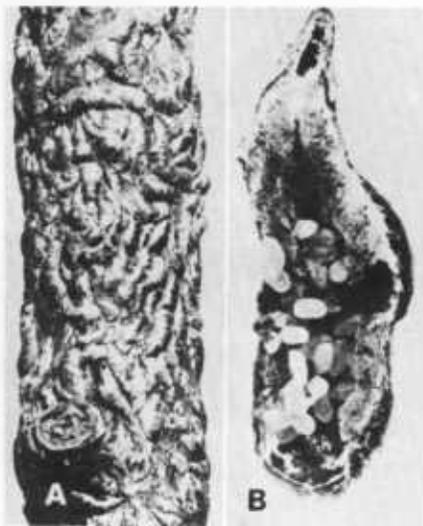
and heavily encrusted trees or limbs may be killed.

Life History.—If the old scales on the bark are turned over during the winter, they will be found filled with small, pearly-white eggs (fig. 5). Often there are nearly 100 eggs beneath a single scale. The eggs hatch shortly after the apple trees bloom, and the minute, whitish young crawl out and settle in a few hours on some living part of the plant. They develop slowly, increasing the size of the scale coverings as they grow. The covering of the female is about one-eighth inch long when completed, dark brownish gray, and shaped somewhat like an oystershell. The covering of the male is smaller and oval, and the mature males emerge from the scales with fully developed wings. The females spend their entire lives beneath the scale coverings, depositing eggs under them in the fall before they die.

Other Scale Insects

The Italian pear scale is found in most of the pear-growing districts of California, but it is not often a major pest. It lives mostly on pear but may also occur on apple. This scale hides in crevices in the bark or under moss or lichens, and it may not be noticed until it begins to affect the tree. Superficially it looks like the San Jose scale, but the soft body of the female is dark reddish purple instead of yellow. It winters mostly as a mature insect.

The olive scale is most prevalent in the San Joaquin Valley of California. It thrives on over 200 species of plants, including olive, peach, plum, nectarine, apricot, and apple. The scale covering is ovate or circular and gray. The insect beneath it is reddish or purple. It does not hide beneath lichens and



F.I. 3602

FIGURE 5.—Oystershell scale: A, Twig encrusted with scales; B, old scale turned over to show eggs. (Enlarged.)

moss as does the Italian pear scale, and it does not infest pear.

The European fruit lecanium infests pear and rarely apple in California. It is hemispherical, about one-fourth inch in diameter, and brown. It occurs chiefly on the twigs. For a description of its habits and life history, see page 43.

The calico scale is also occasionally seen on pear in California. It is similar to the European fruit lecanium, but distinguishable from it by the irregular white lines on its back (fig. 6). Its injury is also similar. The vigor of the trees may be reduced and honeydew will develop, which may injure the fruit.



FIGURE 6.—Calico scales (enlarged).
(Courtesy California Agricultural Experiment Station.)

This scale winters on the twigs as a partly grown insect and reaches maturity in early May. Numerous eggs are laid under the female scale. The crawlers go to the leaves, feeding there during the summer and returning to the twigs in the fall. There is one brood each year.

The cottony maple scale (fig. 7) sometimes becomes rather common on Winter Nelis and d'Anjou pear in the Northwest, but does not seem to thrive on Bartlett, and is very seldom seen on apple. It is primarily a pest of maple, as its name indicates, and also lives on grape, boxelder, blackberry, and a variety of other plants. It is a native of Europe, and came to the United States over 100 years ago. The insect is easily recognized by the cottony egg sac, which the female produces in the early summer and which often remains for some time.



FIGURE 7.—Cottony maple scales on pear twig.

About 3,000 eggs laid in this sac hatch during June and July. The young scales settle on the underside of the leaves, where the male insects mature. The partly grown females, which are oval, flattened, and greenish or yellowish, migrate to the twigs in the fall and hibernate there. They complete their growth in the spring, when they are brown, rather convex, and about one-eighth inch in diameter. The egg sac is formed gradually as the eggs are laid, and the females die when oviposition is completed. There is only one generation a year.

The grape mealybug (fig. 8) lives on various plants, but has been primarily a pest of grapes. It also lives on pear and sometimes on apple and apricot. The eggs are laid early in the fall in a cottony mass on the scaffold limbs. The eggs hatch in the fall, but the young crawlers remain in the cottony protection through the winter. They start feeding early in the spring beneath the scales of the swelling buds. When full grown these insects are about one-fourth inch long and dark purple. They are covered with a white, powdery wax and have slender, white filaments protruding from the body. Oviposition occurs late in June beneath the bark scales and at the base of new growth. This second generation becomes adult by late summer, and some injury may result from honeydew dripping onto the fruit. On pears the mealybugs also crawl into the calyx end, and the feeding there causes a breakdown of the tissues.

Pear Psylla

The pear psylla was first found in the United States in Connecticut in 1832, evidently having come from Europe. It has been a pest of pear east of the Mississippi River for many years, but was not found in



F.I. 1602

FIGURE 8.—Grape mealybug.

the West until 1939. It has now spread to practically all pear-growing districts on the Pacific coast.

Type of Injury.—Injury is limited to pears. Honeydew secreted by these insects runs down over the foliage and fruit, and a sooty fungus grows in it. This causes the skin to become blackened and scorched, and the foliage develops brown spots. Severe infestations may cause partial defoliation of the trees, reducing vitality and preventing the formation of fruit buds. There is now strong evidence that the psylla is associated with the spread of pear decline by injection of a toxin or as a vector of a causative virus or both.

Life History.—Adult pear psyllas (fig. 9) have somewhat the appearance of miniature cicadas, with transparent wings sloping over the body. They are about one-tenth inch long and dark reddish brown. They can fly away suddenly from where they are resting, giving the impression that they have jumped. Hibernation is in the adult stage in crevices in the bark or under leaves on the ground. The adults may become active at any time when the temperature is above 40° F.

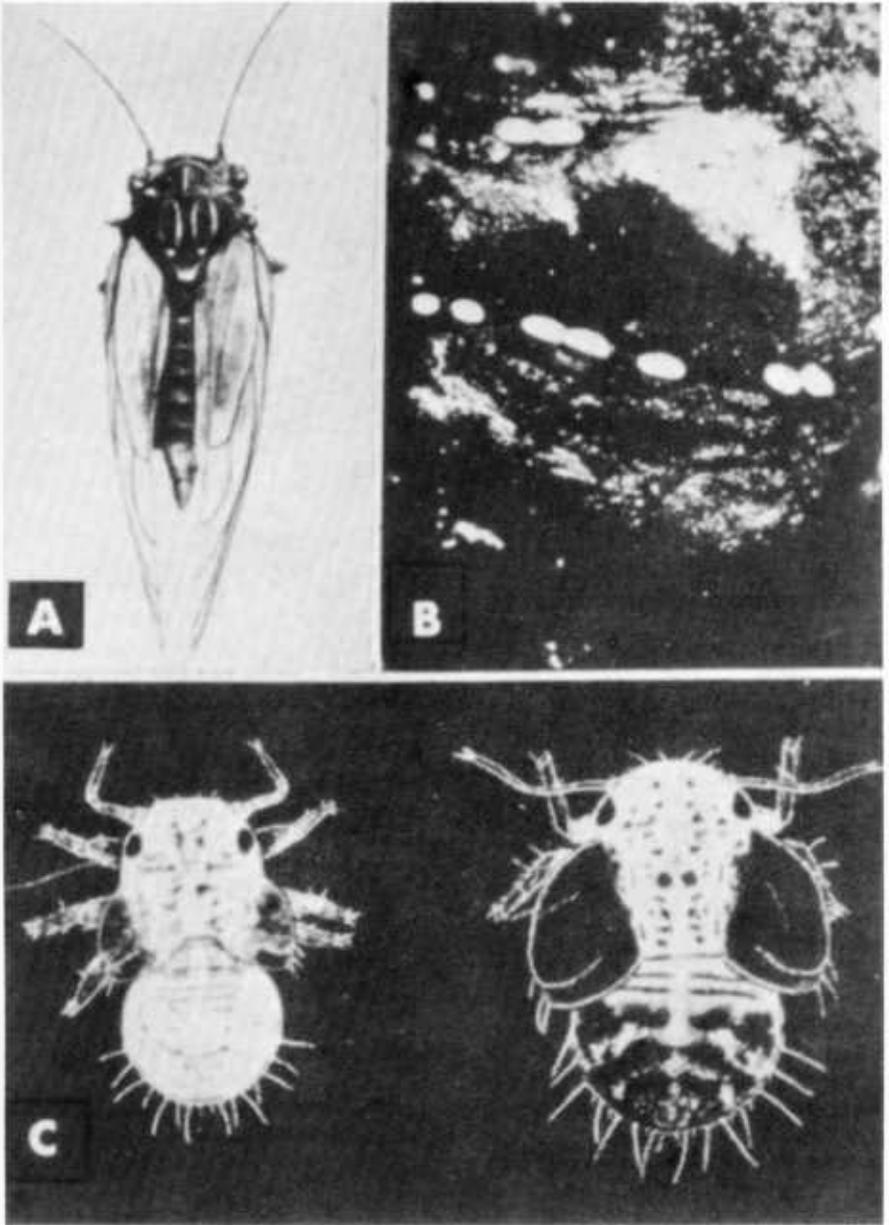


FIGURE 9.—Pear psylla : A, Adult ; B, eggs ; C, large nymphs. (Courtesy New York Agricultural Experiment Station.)

The elongated, whitish or yellow eggs (fig. 9) are deposited in March, or sometimes even earlier, in the small crevices about the buds. After the foliage is out, many of the eggs are laid on the leaves. Each female may produce as many as 500 eggs. They hatch in 10 to 30 days.

The young nymphs migrate to the axil of the leaves and to the leaves themselves to feed. The nymphs (fig. 9) are yellowish and flattened, and soon cover themselves with the honeydew they secrete. They go through five immature stages, becoming greenish as they grow larger and finally brownish black in the last, or "hard-shell," stage (fig. 10).

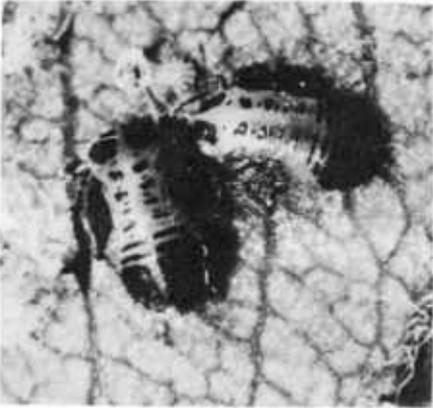


FIGURE 10.—"Hard-shell" stage of pear psylla.

Often these hard shells congregate in large numbers on the water sprouts and other tender growth. There are three to five generations a year, each one lasting about 30 days. The psylla thrives best in cool weather. Adequate control is often difficult, and any treatment must be carefully timed and thoroughly applied.

Orchard Mites

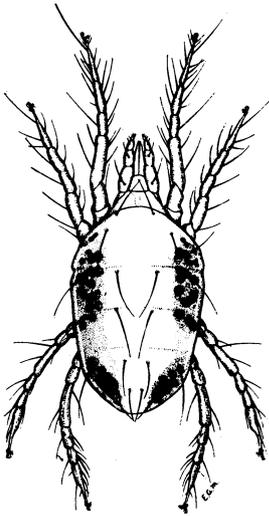
Type of Injury.—Orchard mites or red spiders do great damage to

apple and pear trees, much of it difficult to measure. They feed by withdrawing the contents of the leaf cells, including the chlorophyll, and thus cause a whitening or mottling of the leaves, which finally become browned or bronzed. In nonirrigated orchards complete or partial defoliation frequently results. The leaves of pear, particularly d'Anjou, Winter Nelis, and Bosc, often brown and dry up during the first extremely hot weather in the summer. Although this condition is probably due chiefly to the inability of the tree to supply moisture fast enough during the sudden onset of hot weather, it may be aggravated by a severe infestation of mites, since they remove large quantities of moisture from the leaves. As the trees manufacture their food supply largely in their leaves, any foliage injury will reduce the vitality of the tree and consequently the size of the fruit, even if it does not cause the leaves to drop off.

Life History.—Six important species of mites infest orchards in the West. Two are of European origin and the others are native.

The McDaniel spider mite (fig. 11) is at times the most serious pest the grower has to combat. The webbing it spins often collects dust and gives the foliage a dry, dusty appearance. This species winters as an adult in leaves and trash on the ground. In the spring the surviving mites migrate into the trees, first attacking the foliage nearest the ground and gradually extending their operations over the entire tree.

The mites are usually greenish or yellowish while feeding, often with two dark spots on the body. The eggs, which are almost colorless, are laid in the webbing. The young resemble the adults, except for the newly hatched mites, which have only six legs instead of eight. They develop from egg to adult in a week



F.I. 6511

FIGURE 11.—Adult of McDaniel spider mite (greatly enlarged).

or 10 days, and there are several generations a year. The mites can therefore become exceedingly numerous in one season. Late in July or in August, particularly if the infestation is severe and the mites are crowded, many of the adults cease feeding, become reddish or orange, and migrate to their hibernating places. Since this migration is downward, many of them collect around the calyx end of apples, where they spin webbing that takes on the appearance of cellophane.

This species thrives on many kinds of fruit trees and also on a milkweed (*Asclepias*) and other weeds that grow in the orchards, but it is especially injurious to apple. The Pacific spider mite occurs in orchards, mostly in California, and is similar in appearance and habit to the McDaniel mite.

The two-spotted spider mite occurs throughout the West, and it infests a great many plants or trees, including alfalfa, vegetable crops, berries, melons, deciduous fruit and nut trees, flowering plants, and

weeds. In appearance it is similar to the McDaniel spider mite, and is scarcely distinguishable from that species without microscopic examination. It may have two rather definite black spots on the back, which may sometimes cover most of the body, and its color may vary from yellowish or pale green to reddish. Its habits and life history are similar to those of the McDaniel spider mite.

The yellow spider mite is particularly injurious to apple and pear in the Hood River and Rogue River Valleys of Oregon. It also occurs elsewhere but is not often a serious pest. These spider mites are smaller than the others and are pale yellow or green with a few dark spots. They tend to congregate along the midribs and larger veins of leaves. The eggs are spherical and translucent. Wintering females are bright lemon yellow.

The European red mite lays bright-red overwintering eggs on the twigs and branches of fruit trees. When numerous, these eggs are very noticeable as reddish patches on the bark. They are also found in the calyx end of mature apples (fig. 12). These eggs hatch just before the blossoms open. The mites feed on the foliage, usually on the underside, and spin very little webbing. They are more easily seen than the other spider mites; they are velvety or brownish red, with conspicuous, whitish, curved spines on the back. During the summer the eggs are laid on the leaves, and there are seven or eight generations a season. This species is seldom found on anything except deciduous fruit and nut trees.

The brown mite (fig. 13) also winters in the egg stage. The eggs are slightly larger than those of the European red mite, but not distinguishable from them with the naked eye. They hatch about a week ear-

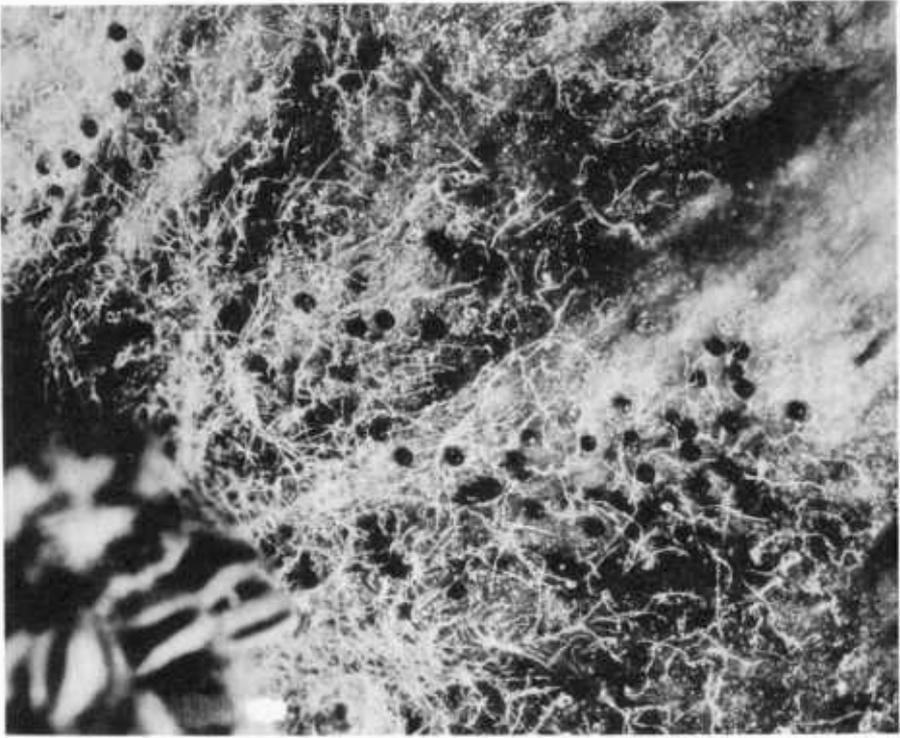


FIGURE 12.—Winter eggs of European red mite in calyx end of apple (enlarged).

ier. Otherwise the habits and life history of the two species are much alike. The brown mites spin no webbing. They usually congregate in roughened places on the twigs and branches during the day and migrate to the leaves at night to feed. This habit of feeding at night and the lack of webbing make them rather inconspicuous, and usually the whitening of the leaves caused by their feeding is the first evidence of their presence. The adults are dull reddish or greenish and are flatter and have longer legs than the European red mites. They are found chiefly on deciduous fruit trees.

Pear Leaf Blister Mite

Type of Injury.—The pear leaf blister mite is a common pest of

pear and sometimes of apple throughout the West. It produces small galls or blisters on the leaves, and it also lives in the buds and in the skin of the fruit. At first the leaf galls are greenish or reddish, but later they turn brown and cause dead areas. These areas may be distinguished from apple scab by the small round holes on the under-surface of the leaf approximately in the center of each blister (fig. 14).

Since the mites begin feeding in the leaves before they are fully opened, the new leaves show the blisters at once. If the mites are numerous, many of the leaves later dry and drop off. The fruit of the apple is more seriously affected than that of the pear. It is attacked when it is young, and the injuries cause mature fruit to be russeted or

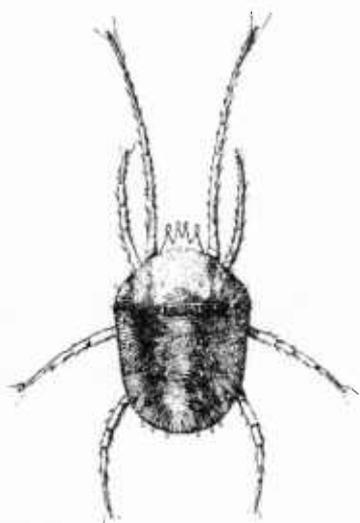


FIGURE 13.—Adult of brown mite (greatly enlarged).

deformed and sometimes to crack open. The mites also injure and deform the blossoms.

Life History.—The adult mites winter under the scales of fruit and leaf buds. They are less than one-hundredth inch long. Under a lens they appear as elongated, whitish, wormlike creatures, with four legs near the head end (fig. 14). Often hundreds of them can be found in a single bud. In warm spring weather when the buds begin to swell, the mites lay eggs in them, and the young burrow into the unfolding leaves and form the characteristic blisters. They feed entirely within the blisters, and a succession of generations develops, practically out of reach of sprays. With the approach of cold weather, the mites migrate to the buds, where they hibernate beneath the scales.

Rust Mites

The apple rust mite is very small and not unlike the pear leaf blister mite. It feeds on the undersurface of apple leaves, giving them a rusty

appearance. It also causes the leaves to roll lengthwise. The fruit may be attacked and become russeted.

This mite is so small it can scarcely be seen with the naked eye. Under a lens it is found to be shorter and more triangular than the pear leaf blister mite. Instead of producing blisters, this mite feeds on the leaf surface during the growing season and hibernates in the buds and in crevices on the bark. In California there is a second species known as Bailey's apple rust mite, which has the same habits.

The pear rust mite is very similar to the species on apple. It may cause the leaves to turn brown, particularly on young trees, but the chief

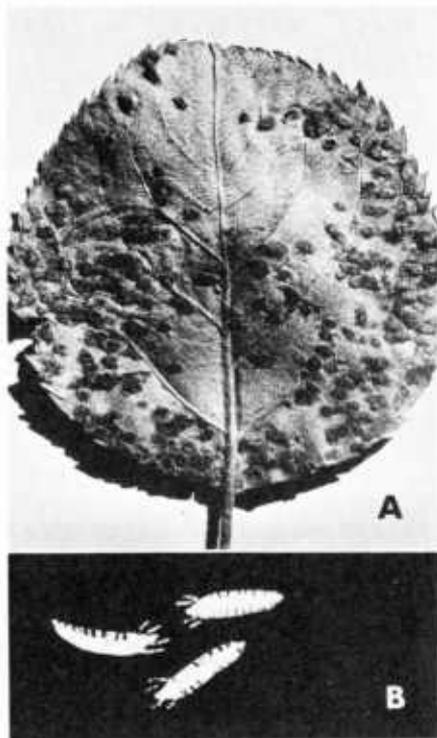


FIGURE 14.—Pear leaf blister mite: A, Infestation on apple leaf; B, adults (greatly enlarged).

injury comes from its feeding on the fruit. Heavy infestations will cause the pears to become entirely russeted.

Woolly Apple Aphid

Type of Injury.—The woolly apple aphid occurs in practically all apple-growing districts. It attacks the roots as well as the upper part of the trees. Above ground it is found chiefly on the trunks, limbs, and twigs, in wounds caused by pruning or cultivating implements, and wherever the bark is tender (fig. 15). Twigs become somewhat swollen and knotted from its attacks. The aphids are occasionally found on the fruit stems and in the calyx end of apples. In the arid, sandy areas of the Northwest, roots are not often injured; the injury is usually to exposed roots. In the coastal sections and in California, particularly in heavy soil that may crack, the aphids penetrate to the roots, causing swellings and deformities (fig. 16) that may hinder the growth of the tree.



F.I. 3363

FIGURE 15.—Aerial colony of woolly apple aphid.



F.I. 4178

FIGURE 16.—Nodular apple roots resulting from attack by woolly apple aphid.

The colonies of aphids appear as bluish-white, woolly patches, which are composed of the reddish insects covered with woolly masses of wax. When the aphids are numerous, this waxy material, which contains some honeydew excreted by the insects, hangs in festoons, smears the fruit, and makes picking a disagreeable job. In districts where the perennial canker disease occurs, aphids feeding above ground apparently prevent the healing of cankers.

Life History.—The woolly apple aphid hibernates on the roots of apple trees, and many of those on the upper part of the trees also survive in mild climates or during mild winters. Infestations above ground may thus come from wintering forms already present there or from migrants from the roots. Heavy infestations are likely to follow mild winters. The aphids multiply rapidly, and new colonies are established by winged forms flying to other apple trees or by young aphids carried from tree to tree by the wind or other means. The parasite *Aphelinus mali* (Haldeman) would effectively control the woolly apple aphid if it were not for the insecticides that are applied to control other pests. But often the parasites

develop rapidly in the fall after spraying has been completed, and they may then reduce the infestation of aphids to a low point.

Rosy Apple Aphid

Type of Injury.—The rosy apple aphid feeds only on apple and on its alternate summer host, the plantain or ribgrass. It curls the leaves, particularly those on the fruit spurs, and infests the young fruit, causing it to become stunted and distorted (fig. 17). These aphid-injured apples do not thin out normally during the June drop, and in the fall, clusters of them are often conspicuous, especially on the lower and inner parts of the trees. At times they are numerous enough to reduce the marketable crop. This aphid was probably introduced from Europe.

Life History.—The rosy apple aphid winters in the egg stage on apple trees, and the eggs hatch in

the spring when the buds begin to swell. The young start feeding in the unfolding fruit buds, causing the leaves to curl as they develop. Several generations a year are produced on the apple, and they feed on the leaves and the fruit. The species may be distinguished by its purplish or rosy-brown color and by its habit of curling the leaves and deforming the fruit. As the weather becomes warmer, brownish-green winged individuals develop and migrate to the plantain. Most of the aphids have left the apple trees by early July. They do not migrate to other apple trees, and therefore trees not bearing winter eggs remain free of infestation. On the plantain several generations of yellowish-green aphids occur, and in the fall winged forms again develop and fly back to the apple trees, where they produce a wingless generation of aphids. These aphids deposit eggs on the twigs, in the axil of the buds, and in crevices in the bark. At first the eggs are pale green but later become shiny black.



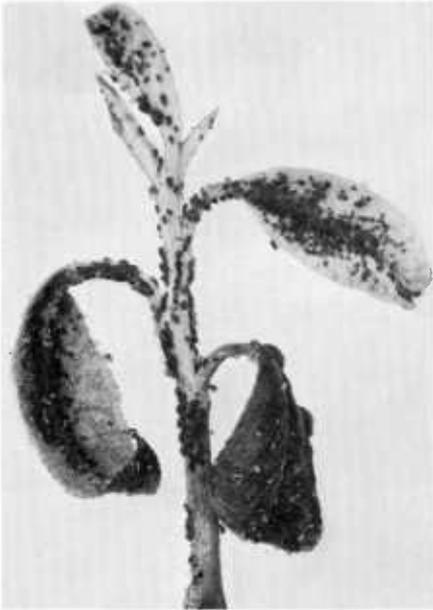
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FIGURE 17.—Apples stunted by rosy apple aphid.

Apple Aphid

Type of Injury.—The apple aphid, formerly known as the green apple aphid, lives on apple throughout the year and feeds mostly on the succulent terminal twigs (fig. 18), curling the leaves and stunting the growing shoots. It is thus injurious chiefly to nursery stock and to young trees, although it sometimes becomes sufficiently numerous on bearing trees to hinder normal growth. It occasionally infests pear trees. This aphid, which came from Europe, is now found in the United States wherever apples are grown.

Life History.—The apple aphid winters in the egg stage in the same manner as the rosy apple aphid, although the eggs are more likely to be found on water sprouts than on



F.I. 3974

FIGURE 18.—Apple aphids on apple foliage.

other parts of the tree. The eggs hatch at about the same time as do those of the rosy apple aphid, and there may be from 9 to 17 generations a year. Young and adults are green with black legs, and some have yellowish heads. Some of the adults are winged, and these migrate to other apple trees, thus spreading the infestation during the season. The eggs are green when deposited in the fall, but later become glossy black.

Other Aphids

The apple grain aphid lives on grains and grasses during most of its active life, but goes to apple in the fall to deposit its winter eggs. These eggs are not easily distinguished from those of the two preceding species. They hatch early in the spring, and the first generation lives on apple and then migrates to grasses. The adults differ from those of the apple aphid by having

dark bands across the body. This species is particularly troublesome in Colorado.

In the coastal districts and interior valleys of California, and sometimes elsewhere, several other species of aphids may be found on pear. The green peach aphid is light green, the melon aphid is usually dark green, and the bean aphid is black. They feed primarily on the new growth of the trees, curling the leaves, stunting the growth, and producing honeydew. This may drip onto the fruit and cause some russetting. These aphids, which feed primarily on other plants, may live on pear only a month or so, and therefore they do not ordinarily cause much damage.

The woolly pear aphid lives on the roots of pear. It does not ordinarily do much harm, but a heavy infestation could affect the vigor of the trees. There are other causes for lack of vigor, but this pest should be considered as a possible cause if trees are not growing normally. Winged forms develop in the fall and deposit eggs on elm trees. The young emerge in the spring and feed on the leaves, causing them to be deformed and gall-like. Winged adults develop in June and July and fly to pear trees, where they deposit young on the trunks. These migrate to the roots, completing the cycle. Wingless forms also inhabit the pear roots, at least in California the year around.

Pear Thrips

The pear thrips occurs in most fruit-growing regions of the West. It was at one time one of the most important insect pests of pear in California, and it can cause severe injury if not held in check. The injury occurs in two ways. Adult thrips, which are almost black, emerge from the soil in the spring

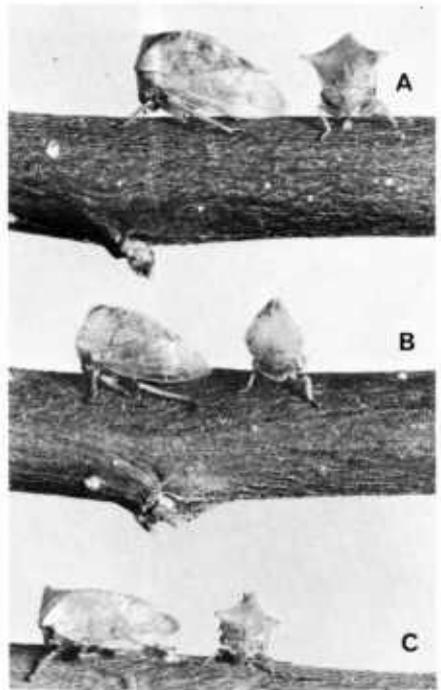
and feed in the opening buds, causing them to drop. Later, the larvae, which are white, feed on the developing fruit, russeting or scarring the skin. For information on the life history and appearance of this pest, see page 46.

There are several other species of thrips attacking apple and pear. These include the bean thrips in California and the flower thrips in the Northwest.

Treehoppers

Type of Injury.—Young orchards containing alfalfa or clover cover crops are subject to the attacks of several species of treehoppers. The most injurious are the buffalo treehopper, the green clover treehopper, and the dark-colored treehopper (fig. 19). The injury consists of wounds and scars made by the female when laying her eggs in the bark of the trees (fig. 20). The female cuts slits, which are roughened and ragged or clean-cut, depending on the species. The injury rarely extends more than 6 or 8 feet above the ground, and young trees are most often attacked. Frequently the growth of such trees is seriously retarded. Injury is practically confined to the current season's growth and to 1-year-old wood, but the old scars persist for some years. Apple and pear are most subject to injury, although peach, cherry, plum, and quince are occasionally affected.

Life History.—The whitish cylindrical eggs of the treehoppers are about one-tenth inch long, and from 6 to 20 of them are placed side by side in each slit, with the ends usually visible. They are deposited from July to September and hatch the following April or May. The young, or nymphs, drop to the ground and feed chiefly on alfalfa, where they are most often found in



F.I. 9078

FIGURE 19.—A, Buffalo treehopper; B, green clover treehopper; C, dark-colored treehopper. (Enlarged.)

the center of the crowns. Growth is completed in July. The adult insects are about three-eighths inch long, grayish or greenish, and triangular, and the commoner species have projecting pronotal horns, suggesting the appearance of a buffalo.

Leafhoppers

Type of Injury.—The leafhoppers, like orchard mites, are sucking insects feeding only on the foliage of apple. They withdraw the chlorophyll and other cell contents, leaving the foliage whitened or mottled. Slight foliage injury by leafhoppers and mites is of no consequence, but as soon as the foliage is reduced below the amount required for the crop, the fruit and buds are directly affected. The



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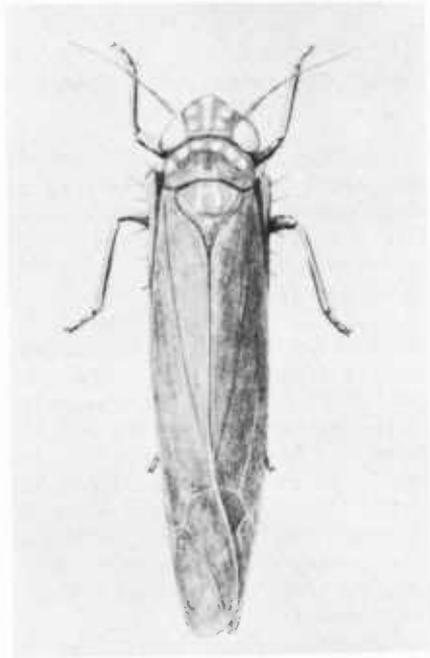
FIGURE 20.—Apple twig scarred by green clover treehoppers in laying eggs.

fruit fails to reach normal size, and the buds are weakened so that they may not set fruit the next season. It is therefore important to prevent extensive injury.

Life History.—The rose and apple leafhoppers are prevalent in the Pacific Northwest and may also be found in California. Both are native to the United States. The more common and important of these is the rose leafhopper, a slender, active, whitish insect about one-eighth inch long. It winters in the egg stage in the bark of the trees. The eggs hatch in April and early May, and the small white hoppers begin to feed at once on the new foliage, remaining in the pubescence

of the underside of the leaves. Growth is attained in 3 to 6 weeks, and the adults live for 2 months. Eggs are laid in the tissue of the leaves from May to July, and hatch in about a month. The second brood of young thus appears late in July and in August, and adults are present again from August to November. These lay wintering eggs in the bark of the young wood, where they appear as small raised blisters.

The apple leafhopper (fig. 21) has only one generation a year, beginning with the wintering eggs, which are usually laid in the bark of wood 2 or 3 years old. The eggs hatch in April or May. The young, which are light green instead of white, feed in the same manner as do the rose leafhoppers. The green adults appear in May and some are still present in July. Most of the



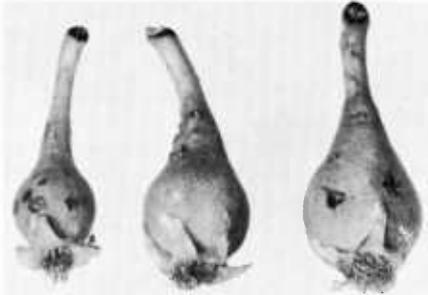
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FIGURE 21.—Adult of apple leafhopper (greatly enlarged).

eggs are deposited in June and July, and these remain in the bark until the following April. As it has only a single generation annually, this leafhopper does not become so numerous as the white species.

Sucking Bugs

Lygus bugs sometimes cause considerable injury to pear (fig. 22) and Delicious apple, particularly in the Northwest. For a description of these bugs, see page 36.

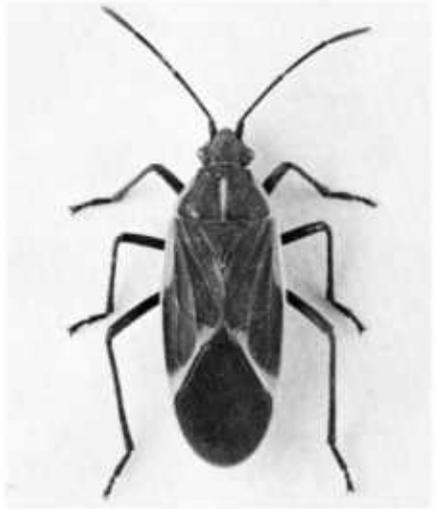


F. I. 428

FIGURE 22.—Young pears injured by lygus bugs.

Boxelder bugs (fig. 23) are flat and black with red lines and are about one-half inch long. Occasionally clusters of these bugs will be found feeding on the maturing fruit of apple and pear, chiefly in the vicinity of boxelder trees. The adults hibernate in swarms in crevices of trees and buildings. The young, which hatch from eggs laid in the spring, feed on the boxelder trees. These trees are of two kinds—those that bear seeds and those that do not—and only the latter should be planted, as the bugs live mostly on the former. Seed-bearing trees near orchards should be removed.

Conspicuous stink bugs (fig. 24) are about one-half inch long, shield shaped, gray brown, covered with small black dots, and with yellow



M & A 12045

FIGURE 23.—Adult of boxelder bug (enlarged).

or red antennae. They feed on fruits, mostly pears, but also to some extent on apricots, plums, and peaches. This may cause some of the fruit to drop, but the chief damage comes from the formation of dry, corky areas under the skin where feeding has occurred. These bugs overwinter as adults. They lay white barrel-shaped eggs in clusters on various broadleaved plants, on which the young feed. These young are at first black and white, later becoming yellow or brown. The new brood of adults appears by mid-June, and from then until harvest may be found feeding on the fruit. Several other species of stink bugs occasionally cause similar injury.

The apple lacebug is a pest of apples in Washington and Oregon. The young and adults feed on the lower surface of the leaves, usually in groups. They dot the leaves with black spots of excrement, and as the insects suck the juices, the leaves become yellowed and eventually drop. The adults are about one-



FIGURE 24.—Adult of consperse stink bug. (Courtesy California Agricultural Experiment Station.)

eighth inch long, grayish, flattened, and with lacelike wings. Eggs are laid on the leaves, and there are probably two or more generations annually.

Fruit-Tree Leaf Roller

Type of Injury.—The fruit-tree leaf roller feeds primarily on apple, but also on most of the other deciduous fruit trees. The small caterpillars feed on the unfolding leaves, webbing them together and forming a protection for themselves. This webbing often covers the blossom buds, causing considerable injury by preventing normal blooming. As the caterpillars become larger, they roll up one or more large leaves and include some of the fruit in the webbing, making a sort of nest. They feed within this, eating large, irregular holes in the fruit and foliage. In extreme cases they practically defoliate the trees and cause a total crop loss.

In regions where much spraying

is done for the codling moth and the San Jose scale, the fruit-tree leaf roller has not been an important pest, but occasionally very serious outbreaks have occurred elsewhere and may occur again. In the past the insect has periodically become of prime importance, remained so for a few years, and then subsided into relative unimportance. It is a native insect, which originally fed on the foliage of several wild plants.

Life History.—The fruit-tree leaf roller winters in the egg stage. The eggs are laid during June and July in masses of 100 or more. They are rather inconspicuous, oval, grayish or brownish patches, nearly one-fourth inch long, on the limbs, twigs, and trunks of the trees. The eggs hatch as soon as the buds begin to open. The caterpillars are active, crawling backward about as rapidly as forward, and often drop to the ground on a thread if disturbed. They become full grown in June. At that time they are about three-fourths inch long, green, and with black heads. They transform to brown pupae in the rolled-up leaves, and the moths emerge about 10 or 12 days later. These are a little larger than codling moths. The expanded wings measure about three-fourths inch across. They are rusty brown, with several irregular yellowish bands across them. There is one generation a year.

Oblique-Banded Leaf Roller

The oblique-banded leaf roller has two generations a year; a brood of caterpillars appears in May and June and another in July and August. The habits and appearance of the caterpillars are similar to those of the fruit-tree leaf roller. However, the moths are slightly larger and cinnamon brown, with a darker oblique band across each forewing.

This species is usually less injurious than the fruit-tree leaf roller to apple and other deciduous fruit trees.

Orange Tortrix

In the coastal fruit-growing districts of California, surface injury to fruits of apple and pear is sometimes seen, which is caused by the feeding of an insect larva. This is the orange tortrix, primarily a pest of citrus. For a description of the appearance and habits of this insect, see page 32.

Tent Caterpillars

Type of Injury.—Tent caterpillars are found on apple in California and in the coastal areas of the Northwest. They appear in May and June, constructing tents of webbing in the crotch or about the smaller twigs and leaves of the trees. They feed voraciously during the day, devouring all the leaf tissue except the midribs, and retire at night to the tents or collect in masses on the larger limbs. These caterpillars occur sporadically and in some years are numerous enough to defoliate not only fruit trees but wild growth and shade trees as well.

Life History.—The insect winters in the egg stage. The eggs are laid in masses surrounding the twigs, each mass containing several hundred eggs covered with a frothy, waterproof material. The young caterpillars appear about the time the apple buds begin to open. The group hatching from a single egg mass constructs a small silken nest or tent, and as the caterpillars grow this nest is enlarged to provide adequate protection for the colony. The caterpillars are somewhat hairy, tawny brown, and with a row of blue spots flanked by orange spots along the back. When full grown they are nearly 2 inches long. As

the caterpillars become larger they tend to scatter, and their cocoons may be spun in various sheltered places, such as under loose bark, in curled leaves, or under projecting eaves of nearby buildings. The cocoons are tightly woven of yellow silk, surrounded with a loose mass of silk. The moths emerge in June or July and soon deposit the wintering egg masses.

Fall Webworm

Although the habits of the fall webworm are somewhat similar to those of the tent caterpillar, the two insects can be easily distinguished. The fall webworm appears late in July and constructs a loose, unsightly nest of webbing about several twigs (fig. 25). These nests are extended as the caterpillars grow and often enclose entire branches. The caterpillars feed within the webs, devouring the leaves and fruit. When full grown the caterpillar is about $1\frac{1}{4}$ inches



F.I. 3963

FIGURE 25.—Nest of fall webworm.

long, covered with long, whitish hairs, and has a dark band along the back. It constructs a flimsy, brown cocoon in trash on the ground. From this cocoon the moth emerges in the following summer. The moth is usually pure white or spotted with dark dots. It lays pale-green eggs in a flat mass on a leaf, covering them with white hairs from its body. The eggs hatch in about 10 days. There is only one brood annually. The insect occurs on over a hundred different fruit and shade trees in Idaho, California, and the area west of the Cascade Range.

Tussock Moths

The rusty tussock moth and the western tussock moth are leaf-feeding insects occurring chiefly in California and west of the Cascade Range. The first species winters in the egg stage in dry leaves or on tree trunks or twigs. The caterpillars appear in April. They subsist mainly on the foliage, but occasionally damage the fruit, and may be found on shrubs and a great variety of deciduous fruit and shade trees. They feed for a month or more, and when full grown are about 1 inch long, hairy, blackish or bluish, and have several thick tufts of hairs along the back (fig. 26). The male moth has rusty-brown wings, but the female is wingless. She deposits her eggs in a mass on the cocoon from which she emerged. A second brood of caterpillars appears late in July and produces moths in September. These in turn deposit the wintering eggs. The western tussock moth has similar habits, except it has a single brood each year. The eggs laid in July hatch the following spring. Special control is seldom necessary, since sprays applied for other leaf-feeding caterpillars keep

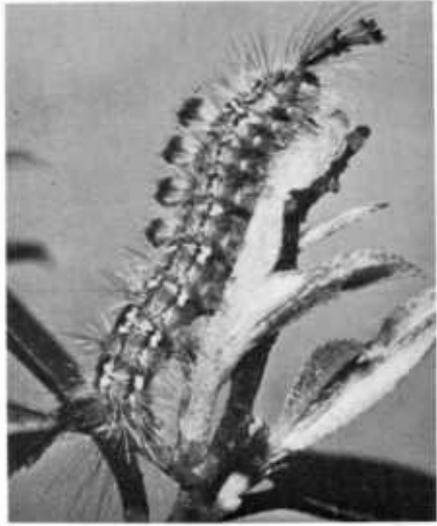


FIGURE 26.—Caterpillar of tussock moth.

these insects in check. Many of the egg masses may be found and destroyed when the trees are pruned.

Other Caterpillars

The red-humped caterpillar may occasionally feed gregariously on apple and pear in midsummer. The caterpillars are reddish with dark tubercles and longitudinal lines of white, brown, red, and black. The head and fourth segment, which is humped, are bright red. Hibernation is in the pupal stage in the ground. The moths emerge in the spring and lay masses of pearly-white eggs on the leaves.

The yellow-necked caterpillar occurs on apple, pear, quince, cherry, and many shade and forest trees, mostly in California. Its habits are similar to those of the preceding species. The caterpillars are black with four yellow longitudinal stripes, long whitish hairs, and a bright-yellow or orange neck. When disturbed they characteristically raise both ends of their body.

Cankerworms, sometimes called measuring worms, are about an inch long when mature and green with yellow stripes. There are two species, each with only one generation. The spring cankerworm winters in the pupal stage and the fall cankerworm winters in the egg stage. These worms are found chiefly in California on the same kind of fruits and trees as the yellow-necked caterpillar.

Sometimes smooth green worms, an inch or so long, will be found eating large holes in developing apples or pears (fig. 27). These are the green fruitworms. They are most often seen during May and June. The fruit that is attacked may drop off, or if the cavities are shallow, they heal over and result in russeted scars. When the worms are full



F.I. 3391

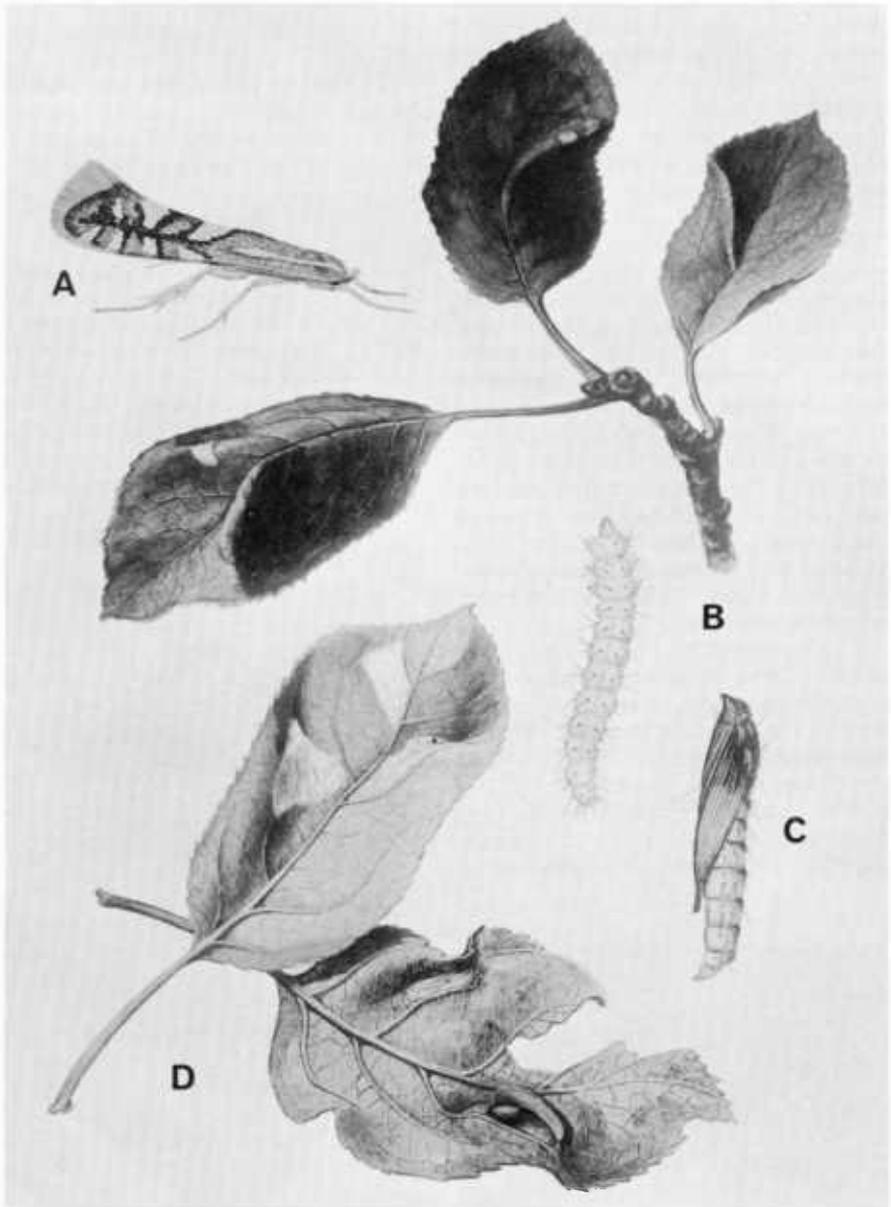
FIGURE 27.—Green fruitworm feeding on apple.

grown, they make cells in the ground, where they transform to brown pupae in a manner similar to that of the cutworms. The moths emerge late in the fall or early in the spring and lay eggs singly on the trees. Control measures are not often needed.

In western Oregon and in the Hood River Valley the apple leaf miner may be found in leaves of apple and wild hawthorn. It constructs blotchlike mines in the leaf between the large veins and causes the leaf to become somewhat misshapen. The adult is a very small, silvery moth, which lays eggs on the leaves. The young worm burrows between the upper and lower leaf surfaces, forming the mine. When full grown it pupates within the mine, and the moth emerges soon after. There are two or more broods a season. In the fall the worms make silken hibernacula in the mines, where they spend the winter in the fallen leaves. This pest is of minor importance. Any cleaning up or cultivation that destroys or buries the leaves late in the fall would prevent many of the moths from emerging the following spring.

In northern California the tentiform leaf miner (fig. 28) attacks pears, skeletonizing the leaves. At times more than half the leaf tissue may be destroyed, which would prevent the fruit from attaining normal size. The habits of this insect are similar to those of the apple leaf miner, except there are four generations a year.

The serpentine or apple fruit miner is more of a curiosity than a pest. The adult is a very small moth, the young of which form winding whitish mines just under the skin of the apple. The mines are also occasionally found on prunes. This insect occurs so rarely that control measures are not necessary.



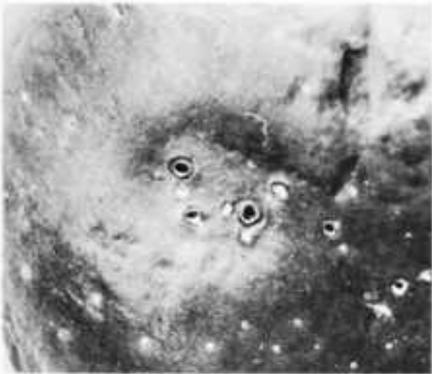
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FIGURE 28.—Tentiform leaf miner: *A*, Adult; *B*, larva; *C*, pupa; *D*, injury to pear foliage.

The apple leaf trumpet miner sometimes causes a trumpet-shaped injury on apple foliage in western Oregon. This pest is of minor importance. Any cultivation that destroys or buries the leaves late in the fall would prevent many of the moths from emerging in the spring.

Another larva that injures the foliage of apple and pear in the western parts of Oregon and Washington is the apple-and-thorn skeletonizer. It also feeds on cherry and hawthorn. The adult is a small dark-brown moth, which hibernates and deposits eggs early in the spring. The small caterpillars feed on the underside of the leaves first; later they feed on the upper surface and construct shelters by drawing the leaves together with silk. The injured leaf becomes a mass of webbing and frass. There are several generations a year.

The eye-spotted bud moth occurs in California, Montana, Idaho, eastern Washington, and the region west of the Cascade Range in Washington and Oregon. The injury to the fruit, which is caused by the larvae, consists of irregular surface feeding or a series of small holes in the skin (fig. 29). It is seldom of



F.I. 5805

FIGURE 29.—Holes in apple made by larvae of eye-spotted bud moth.

any great importance on apple. For further information, see page 47.

Climbing cutworms occasionally attack apple and pear, but are more injurious to peach. For a description of these insects, see page 32.

Pear-Slug

Type of Injury.—The pear-slug feeds on the foliage of pear and cherry, skeletonizing the leaves by eating the upper surface (fig. 30). The larvae are slimy and sluglike, olive green or almost black, and about one-half inch long when full grown. When they are numerous, the entire tree becomes brown, as



F.I. 3075

FIGURE 30.—Pear-slug and its injury to leaf (enlarged).

though swept by fire. This damage should be prevented, as the reduced leaf surface seriously interferes with the growth of the fruit and with the development of fruit buds. This insect is widely distributed in the United States. It originated in Europe.

Life History.—The adults are glossy black four-winged flies and about one-fifth inch long. They are known as sawflies, because they cut slits in the upper surface of the leaves, in which the eggs are laid.

The eggs in the leaves look like small blisters. The young slugs hatch in a week or two and feed almost entirely on the upper surface, usually avoiding any leaves that may have been attacked by aphids or blister mites. Just after molting, the slugs are yellow, but they soon secrete a slime that gives them the characteristic black or olive-green color. Their bodies are somewhat enlarged in front and taper behind. The slugs complete their growth in less than a month, drop to the ground, and form cells in the soil, within which they transform to adults in a couple of weeks. The second brood of slugs appears on the trees in August, and when full grown they spend the winter in earthen cells from which the adult sawflies emerge the following spring.

Syneta Leaf Beetle

Type of Injury.—The syneta leaf beetle seldom injures apples, but may reduce the pear crop 50 percent or more. The injury consists of scars and deformities on the fruit caused by the beetles when feeding. The beetles also chew the fruit stems and cause some of the fruit to drop. Practically all the injury is done during April and May.

Life History.—The life history of the beetle is discussed on page 42.

California Pear-Slug

Type of Injury.—Holes one-fourth inch or more in diameter are sometimes found in pear leaves in late April or in May. A close examination will usually show a green worm stretched along the edge of each hole, feeding on the leaf (fig. 31). This is the California pear-slug, which occurs throughout the Pacific Northwest and in California.

Life History.—The adult insects are sawflies similar in appearance to those of the pear-slug, but somewhat more slender and with some yellowish markings. They emerge from the ground early in April and cut slits in the lower surface of the partly unfolded leaves, in which the eggs are laid. The wounds often cause the leaves to become deformed. The small green worms hatch in 10 days or 2 weeks and feed on the leaves. There is only one generation a year.

Dock Sawfly

In Washington, apples are occasionally found in the fall with round holes in them resembling those made by full-grown codling moth larvae. If the fruit is cut open, a bright-green worm may be seen inside (fig. 32). This is the larva of the dock sawfly, an insect that has come from Europe. The young worms feed entirely on dock and related plants. When full grown they search for suitable places in which to transform to adults. Usually they burrow into the dry, hollow, or pithy stems of plants. But if apples are nearby, and particularly if they are hanging low in the cover crop, the worms may burrow into the apples instead of the plant stems. The injury caused by this insect is ordinarily negligible.

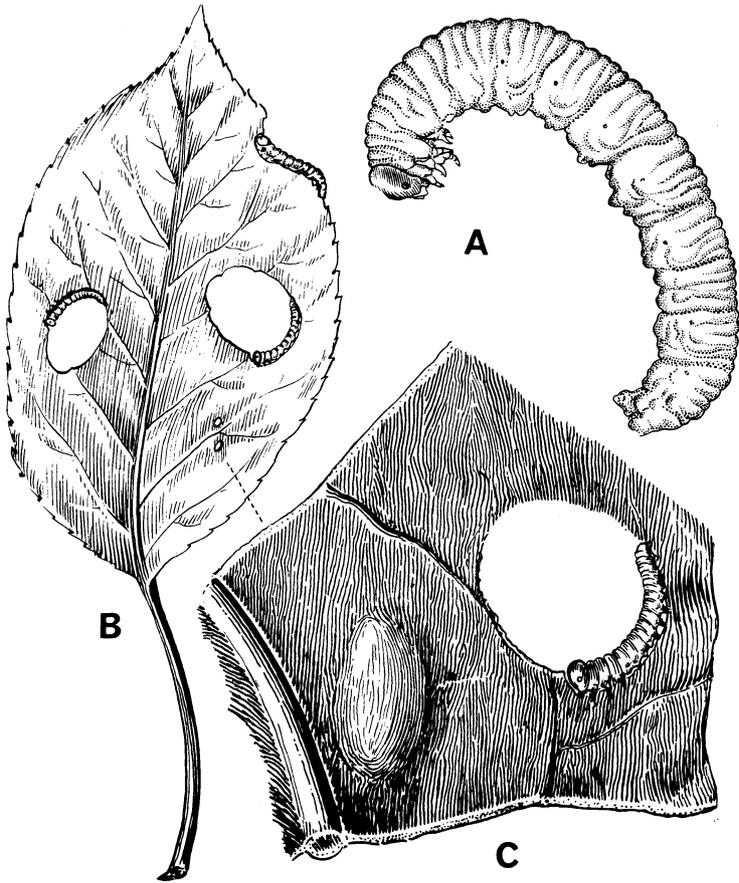


FIGURE 31.—California pear-slug: A, Full-grown larva (enlarged); B, injury to leaf; C, egg in tissue and young larva feeding (enlarged).

Flatheaded Borers

Two species of flatheaded borers—the flatheaded apple tree borer and the Pacific flatheaded borer—occur on apple and pear. They are very similar. The adult beetles are flattened and dark greenish blue or dark bronze with coppery spots. The larvae, or borers, are most often injurious to young trees, particularly those that are weakened from sunburn or other causes. They are waxy white, about an inch long when full grown, leg-

less, and with the forepart of the body broad and flat (fig. 33). The beetles emerge in the spring and lay eggs on the tree trunks, preferably in the sun. The young borers burrow into the bark and require a year or more for complete development. Both species are native American insects.

Trees should be kept in a resistant, healthy condition, as the young borers are unable to thrive in vigorous trees with strong-flowing sap. If the trunks of young trees are protected with whitewash, or if a board



F.I. 3381

FIGURE 32.—Larva of dock sawfly in apple.

or stave is placed so that it will shade the trunk, danger of injury will be reduced.

Other Borers

Small round holes, like shot holes, are sometimes found in the bark of apple and pear. They are made by small black scolytid beetles known as shot-hole borers. Usually only unhealthy trees are attacked. The borers rarely eat into the fruit itself. For further information about these insects, see page 35.

The bronze apple tree weevil attacks devitalized apple and prune trees, making several small holes in a patch in the bark. These are egg punctures, and the grubs hatching from the eggs feed beneath the bark, causing a sunken, discolored area about the size of a silver dollar. The adult beetles, which are small, bronzy or black, and have snouts, emerge the following spring.



F.I. 3532

FIGURE 33.—Larva of flatheaded apple tree borer (slightly enlarged).

The American plum borer is occasionally seen on pear in California, and it also attacks plum and other deciduous fruits. The mature larvae resemble those of the codling moth, but they live in the bark of trees that already have some other injury. The adult moths have a wingspread of about one-half inch and are gray with brown and black markings.

Rain Beetles

Type of Injury.—In the Hood River Valley of Oregon, the grubs of two species of rain beetles feed on the roots of apple and pear, sometimes causing severe injury. Affected trees make little growth and the foliage may become yellowed. These or allied species also sometimes attack apple and pear in southern Washington and in California. The grubs feed on the fibrous roots and also on the larger roots, where they eat patches of the bark or make long, winding bands. Sometimes the roots are girdled.

Life History.—The grubs are whitish with brown heads and vary from nearly one-half inch long when

first hatched to almost 2½ inches when full grown (fig. 34). Growth is slow and grubs may live 9 to 12 years. Pupation is deep in the soil. The pupae are about 1½ inches in length. The beetles (fig. 34) are about an inch long and reddish brown to black. They emerge in late fall during or after rains, mate, and the females then remain in the soil, depositing eggs from May to July of the following year. The oval eggs, which are about one-fifth inch long, hatch in about 60 days.

Ants

Orchards in the West are sometimes inhabited by ants, particu-

larly the large, pugnacious red ants (*Formica* spp.). They build nests in the ground, which are often covered with rather conspicuous heaps of dried stems and twigs of plants. These ants are attracted to the trees, primarily to feed on the honeydew excreted by aphids and other insects. At times the ants may chew the blossoms and cause direct injury.

Grasshoppers

Grasshoppers occasionally eat the leaves of young orchard trees to the extent that their growth is affected. They do not ordinarily cause much injury to mature trees.

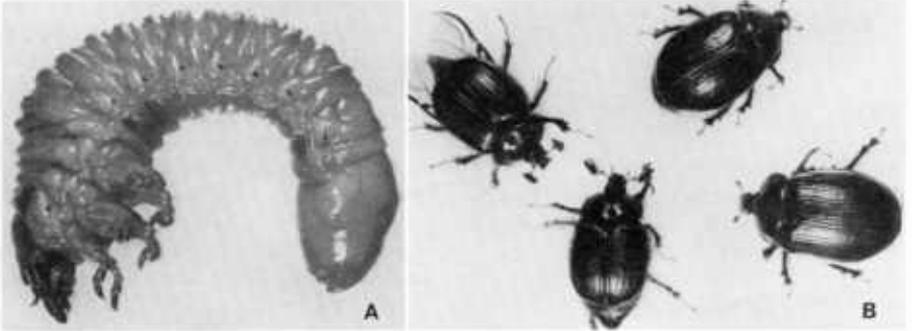


FIGURE 34.—Rain beetle: A, Full-grown larva (greatly enlarged); B, adults (enlarged). (Courtesy Oregon Agricultural Experiment Station.)

PEACH AND APRICOT INSECTS

Green Peach Aphid

Type of Injury.—Peach crops are sometimes seriously reduced by large numbers of green peach aphids feeding in the opening blossoms. These sucking insects remove the juices from the newly formed fruit causing it to drop. They also curl the leaves and prevent them from developing normally. It is important, therefore, that control measures be taken early, as little

or no injury occurs later on. The green peach aphid came from Europe and is common in all the peach-growing districts in the West.

Life History.—The glossy-black wintering eggs may be found on twigs, in the axil of buds, and in crevices of bark of peach trees. They hatch early in the spring, and the pinkish young commence feeding at once on the opening buds, pushing their way into the unfolding blossoms and between the devel-

oping leaves. The second and third generations are green, and the latter acquire wings and migrate to summer food plants, which include many of the common vegetables and ornamental plants, such as cabbage, cucumber, lettuce, potato, tomato, turnip, carnation, chrysanthemum, snapdragon, and violet. In the fall, winged forms return to peach and produce a wingless generation, which lays the overwintering eggs.

Black Peach Aphid

Type of Injury.—The black peach aphid is occasionally seen in the West. It was introduced from the Eastern States, where it is native. It feeds on the roots and leaves of peach and apricot, and is therefore potentially a pest of considerable importance, since root-feeding forms are often more difficult to control than those above ground.

Life History.—The black wingless forms live on the roots throughout the year, and in the spring some of them migrate to the new growth above ground, where they increase rapidly (fig. 35). As they become crowded, winged forms develop, which fly to other trees and establish new infestations. The aerial forms usually disappear by mid-summer.

Mealy Plum Aphid

The mealy plum aphid may be found on the underside of apricot leaves during the summer. For information on this aphid, see page 44.

Orchard Mites

Orchard mites, including the two-spotted spider mite, the brown mite, and the European red mite, injure peach, but are not often found on apricot. In the interior valleys of California, the Pacific spider mite



F.I. 508

FIGURE 35.—Black peach aphids on peach shoot.

may also be found on peach and apricot. It is similar to the two-spotted spider mite. For information on these mites, see page 9.

Peach Silver Mite

A silvering of peach leaves is usually the result of prolonged feeding on them by the peach silver mite. This is an extremely small mite, but it may be seen with a hand lens. It is whitish and somewhat triangular and will be found on both surfaces of the leaves, usually near the veins or midrib. It winters around the lateral buds several inches below the terminals, invading the expanding buds and newly formed leaves in the spring. There are several broods a year.

Peach Twig Borer

Type of Injury.—Ripening peaches and apricots are sometimes wormy, and this worminess may be associated with a split pit. The brown worms in these fruits are peach twig borers, so named because early in the spring the young worms burrow into the tender terminal growth of the trees and cause the rapidly growing twigs to wilt (fig. 36). In this way they interfere with the development of new growth. Their presence in the fruit causes a direct loss. The peach twig borer also attacks prune trees, and the twig injury is especially serious on nursery trees or in young orchards. The species originated in Europe and has been in the United States for many years.

Life History.—The young peach



F. I. 3178

FIGURE 36.—Peach shoot injured by peach twig borer.

twig borers winter in very small silk-lined burrows, or hibernacula, in the bark. These are usually constructed in the folded bark found in the crotch of younger branches. Each burrow has a characteristic projecting tube or "chimney," composed of silk and tiny pieces of bark, which is difficult to see without a lens. The small worms leave these winter quarters as soon as twig growth has commenced and burrow into the new shoots, where they feed on the pith and inner bark and cause the shoot to wilt. Frequently a single worm injures several twigs in this manner.

By April or May the worms are mature, nearly one-half inch long, and reddish brown. They spin loose cocoons in rough places in the bark or in curled leaves, and the small, inconspicuous, grayish moths emerge in May or June. These lay minute eggs on the bark, and the tiny worms hatching from them attack the fruit as well as the new growth. They usually burrow into the fruit near the stem end and feed around the pit; or, if this is still soft, they enter it and feed on the kernel. This second brood of worms also produces a brood of moths, which lays eggs, and the young worms hatching from them build the silken burrows in which they overwinter.

Oriental Fruit Moth

An infestation of the oriental fruit moth (fig. 37) was found in California in 1942. Moths were first caught in baits in Idaho and Colorado in 1944 and in Oregon and Washington in 1945. In 1948 the first infestation was found in Washington. This pest was first discovered in the United States in 1916, having been accidentally brought from Japan in shipments of flowering cherry, peach, or other trees. It is now present in most of the



F.I. 4894

FIGURE 37.—Adult of oriental fruit moth (enlarged).



F.I. 4706

FIGURE 38.—Peach twigs injured by oriental fruit moth.

peach-growing districts of the United States.

Type of Injury.—The only injurious stage of the oriental fruit moth is the larva, or worm. The young worms burrow into the rapidly growing twigs near the tip and feed on the central core. (fig. 38). They also enter the fruit, particularly near the end of the season, either through the stem or the side, and feed on the flesh around the pit (fig. 39). The worms usually leave through holes in the side, from which considerable gum exudes. Injury to the twigs prevents the tree from growing normally, as it may send out several lateral twigs just below the injury. Injury to the fruit usually ruins it for consumption.

The oriental fruit moth at times causes serious losses to peach, which is its principal food. It also attacks the other deciduous fruits, but does not usually cause much injury to them. It has not been as injurious in the West as it is in the East.



F.I. 4335

FIGURE 39.—Larva of oriental fruit moth in peach.

Life History.—The oriental fruit moth winters in much the same manner as the codling moth—that is, as a full-grown worm in a cocoon

on the tree or in leaves or stems on the ground. The worms are pinkish with brownish heads. This color distinguishes them from the larvae of the peach twig borer, which are reddish brown. They look much like the larvae of the codling moth, but are smaller when full grown. They may be distinguished definitely by microscopic examination of the anal segments. The oriental fruit moth larva has a black anal comb on the dorsum of the last segment; this is lacking on the larva of the codling moth (fig. 40). The moths emerge in the spring shortly before the peach trees are in bloom. They fly for about a month. Eggs are usually laid singly on the upper surface of the leaves. There may be four to seven generations a year in the West.

Pandemis Moth

The larvae of the pandemis moth sometimes seriously injure ripening apricots in Washington. For a discussion of this insect, see page 41.

Fruit-Tree Leaf Roller

The fruit-tree leaf roller is sometimes an important pest of apricot in parts of the West. It feeds principally on the foliage but also attacks the fruit. It may feed on the

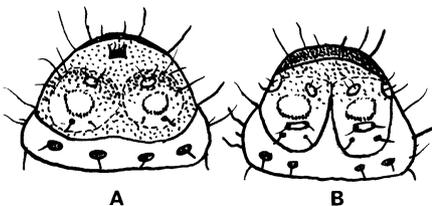


FIGURE 40.—Anal segments of larvae: A, Oriental fruit moth; B, codling moth. (After Garman.)

surface protected by a leaf that has been tied to the fruit or it may make deeper inroads, sometimes penetrating to the pit. Such fruits are rendered worthless. It has only one generation each year. For more information on the life history and habits of this pest, see page 19.

Orange Tortrix

Type of Injury.—Although primarily a pest of citrus, the orange tortrix also attacks deciduous fruits, particularly apricots, pears, and apples. The larva is essentially a leaf roller, feeding on and rolling the leaves, but also damaging the fruit. Feeding here is on the surface at the stem end, where two fruits touch, or where a leaf is in contact with the fruit.

Life History.—Hibernation is usually in the larval stage in nests constructed in dry leaves or in mummified fruits. Some of these insects overwinter in other stages, so that there is an overlapping of broods during the summer, and all stages may be found at the same time. There may be two to four generations. The adults are about one-fourth inch long, bell shaped when at rest, tan or rusty brown, and with a black chevron on the wings. Eggs are laid in overlapping masses of 10 to 40 on smooth bark. The greenish black-headed larva (fig. 41) is very active when disturbed, wriggling about and dropping on a silk thread. This pest occurs chiefly in California.

Climbing Cutworms

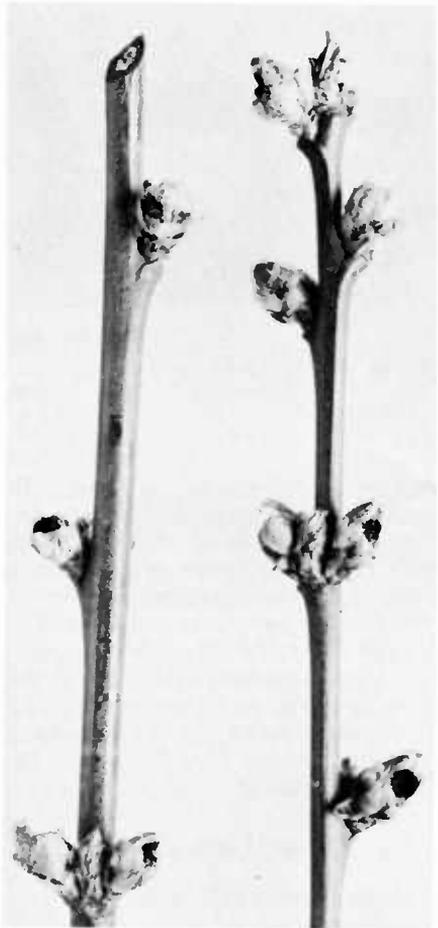
Type of Injury.—In the spring, orchardists sometimes find that the opening buds on their trees are being eaten and often entirely devoured, although no insects capable of causing the injury are visible (fig. 42). A careful search among the



FIGURE 41.—Larva of orange tortrix.
(Courtesy California Agricultural Experiment Station.)

leaves or trash at the base of the tree will probably disclose the culprits. They are climbing cutworms. These smooth, grayish-brown or blackish, greasy-looking worms are usually curled up. They range in length from $\frac{1}{4}$ to $1\frac{1}{2}$ inches when stretched out. They lie quietly just beneath the soil, under a leaf, or in a bunch of grass or alfalfa during the day and climb into trees at night to feed on the tender leaves and flower parts of expanding buds. Frequently their presence is made known by many buds and parts of buds that were dropped on the ground under the trees by the worms as they feed. At times dozens and even hundreds of these worms may be found in the daytime under each tree, and such numbers cause severe damage.

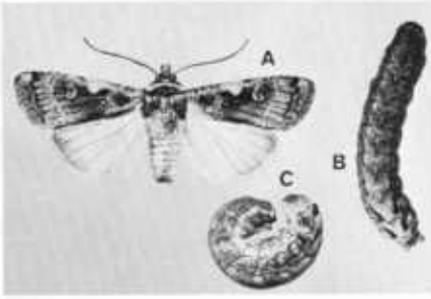
Life History.—Several species of cutworms, including the spotted cutworm (fig. 43), are responsible for most of the damage of this type done to fruit trees. Their habits are similar. Most of them spend the winter as small partly grown worms, coming out of hibernation



F. I. 7929

FIGURE 42.—Peach buds showing holes made by climbing cutworms.

in the spring voraciously hungry. For a time the tender buds of fruit trees offer a very attractive food supply, and most of the damage is caused over a relatively short period. Later the worms feed on alfalfa and other ground plants. When full grown they construct cells in the soil, where they pupate, and the orange-brown pupae are often turned up when the soil is plowed or spaded. The moths emerge at various times during the summer



TC-3668

FIGURE 43.—Spotted cutworm: A, Moth; B, larva extended; C, larva curled. (Enlarged.)

and are among the fairly large, dull-grayish or brownish moths seen flying about lights at night. There may be one or more generations a year, but later generations are of little consequence, as vegetation is plentiful by the time they appear. Eggs are deposited in the fall on the trees or cover crops in patches of a hundred or more. After hatching, the small worms feed for a time before hibernating.

Other Caterpillars

Several other caterpillars may occasionally feed on apricots. These include the green fruitworms (see p. 22), the cankerworms (see p. 22), and the caterpillars of the tussock moth (see p. 21).

San Jose Scale

The San Jose scale is not so injurious to peach as to pear and apple, and it seldom injures apricot. For a description of this scale insect, see page 3.

Black Scale

Type of Injury.—The black scale (fig. 44) is a common pest of apricot in California and it also lives on



FIGURE 44.—Immature black scales on twig (enlarged). (Courtesy California Agricultural Experiment Station.)

olive, citrus, and many other plants. It may cause serious damage by removing sap from the tree and by producing honeydew, which disfigures the fruit and in which a black fungus grows.

Life History.—The female scales winter in a partly grown condition and reach maturity in April and May. The full-grown scales, which will be found on the twigs and branches, are hemispherical, one-eighth to one-fourth inch in diameter, usually black, and with ridges on the dorsum forming a letter H. Eggs are laid under the mature female, and one insect may produce several thousand of them. The eggs are round and pearly white. The crawlers emerge in June, move to the leaves, and develop slowly during the summer. In the fall they move back to the twigs before the leaves drop and develop into the partially grown wintering scales. There is only one brood a year in the apricot-growing districts.

Other Scales and Mealybugs

The European fruit lecanium attacks peach and apricot as well as other deciduous fruits. In California it is often associated with the black scale, but differs from it in being shiny brown and without the H mark. For a description of this scale, see page 43.

In California several other scales may be found on apricot, but none are of great importance. These include the frosted scale, the brown soft scale, the olive scale (see p. 5), the oystershell scale (see p. 5), the Howard scale, and the Putnam scale.

The grape mealybug sometimes infests apricot, particularly in the coastal areas of California. Damage is caused chiefly by the honeydew, which drips onto the fruit and in which a black fungus grows. For a description of this pest, see page 7.

Peach Tree Borer

Type of Injury.—The peach tree borer and the western variety of the same species are serious pests of peach and apricot, as well as of prune, plum, and occasionally cherry. The injury occurs chiefly in the crown and roots of the trees, where the borers tunnel beneath the surface, feeding on the inner or growing layer of bark. Young trees may be completely girdled and killed. Older trees are frequently so weakened that they become subject to other insect pests or to diseases. The presence of borers in the trees is often first indicated by a quantity of gum at the base of the trunk, mixed with dirt and frass. Poor condition of the trees may also indicate the presence of the borers. Trees should be examined periodically for borers, especially if they are not making good growth or do not appear to be thrifty.

Life History.—The adult is a steel-blue moth with a wing expanse of more than an inch. The wings of the male moth are clear, except for the margins, but the forewings of the female are opaque. The female of the eastern form has an orange band about the abdomen, whereas the entire abdomen of the western form is steely blue. The male moth of the eastern form has several narrow yellow bands on the abdomen and yellow markings on the wings; these do not appear on males of the western variety. Otherwise the two forms are similar in appearance and habits.

In California the moths first appear in May and continue to emerge until September. In other parts of the West they do not appear until June or July. They fly about actively during the warm part of the day. Each female lays several hundred oval, cinnamon-brown eggs, singly or in groups on the tree trunks. The eggs hatch in about 10 days, and the young borers crawl down the trunks and enter the damp bark just beneath the surface of the soil. At once they begin feeding on the inner bark and continue doing so until late in the fall, remaining in the burrows during the winter. In the spring, feeding is resumed, and the borers become full grown in May and June, when they are about 1 inch long, yellowish white or cream colored, with brown heads (fig. 45). They construct cocoons of silk and frass at the surface of the soil, either in their tunnels or close to the trunk, within which they change to pupae and several weeks later to moths. There is only one generation annually.

Shot-Hole Borers

Two kinds of shot-hole borers occur in the West. They attack the wood of all the deciduous fruit trees



F.I. 3077

FIGURE 45.—Full-grown peach tree borers and injury to peach trunk (enlarged).



F.I. 4628

FIGURE 46.—Trunk of young tree injured by shot-hole borers.

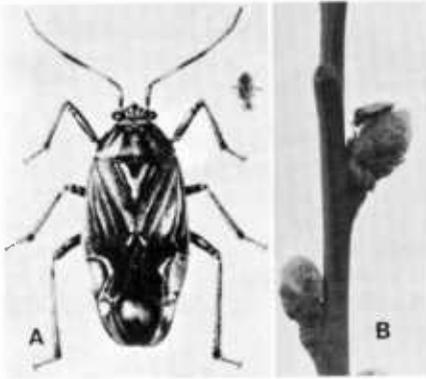
(fig. 46), preferring wood that is unhealthy or dying due to mechanical or winter injury, improper watering, insects, or fungus diseases. They will also attack the larger wood that has been pruned from trees, at least until it has dried out thoroughly. They seem to be particularly attracted to the souring sap, but under some conditions they will attack healthy wood. The beetles, which are about one-tenth inch long, bore into the sapwood and make tunnels through it, in which they lay their eggs. The souring sap favors the growth of a fungus, and the young grubs feed on this as well as on the wood. There are two or more broods a year.

In the fall the grubs of the last summer brood transform to beetles, which remain in the tunnels until spring, when they emerge and construct fresh tunnels. If the tunnels are numerous, the growth of

the trees may be affected seriously. The beetle sometimes attacks the heartwood also. On healthy trees the attack often takes place just below a bud, which is weakened and killed, even though the beetle may be repelled by a flow of sap before it has been able to deposit eggs. To prevent attacks of this beetle, the trees should be kept in a healthy, vigorous condition. If they are unhealthy, the cause should be determined and corrected if possible.

Lygus Bugs

Type of Injury.—Lygus bugs (fig. 47) appear in the trees early in the spring and puncture the swelling fruit and leaf buds, sucking the sap from them. Their presence is often first indicated by the brownish drops of sap exuding from these punctures. This loss of sap causes



F.I. 9150 AND F.I. 5153

FIGURE 47.—Lygus bug: A, Adult (enlarged); B, adult on peach bud.

the buds to dry, and in the case of fruit buds the blossoms may never open, or, if they do, they may be deformed. When the bugs are sufficiently numerous, the injury is severe and the entire crop may be lost. The degree of injury depends not only on the number of bugs but on the weather. Continued settled warm weather in March or early in April, before alfalfa and other ground crops have developed, causes the bugs to feed in the trees; cold, rainy, or windy weather at this time prevents extensive feeding. Pears and Delicious apples, as well as peaches, are susceptible to this injury. The bugs also sometimes feed on the young and maturing fruit and cause dry or corky, sunken spots. Lygus bugs occur throughout the West and are apparently native insects.

Life History.—The adult lygus bugs are nearly one-fourth inch long, grayish or greenish, and with variable markings. They come out of hibernation during the first warm, sunny days of early spring and feed for a time on fruit-tree buds and the leguminous cover crops. They are active, flying readily or moving around to the opposite side of a twig or bud when

approached, and are not easily seen. Eggs are laid in the tender shoots or in the flower heads of several plants. The nymphs resemble the adults, except they are smaller and have no wings. They feed chiefly on cover crops and weeds. Growth is attained in less than a month. They go through a series of molts as they increase in size. There are three or four broods during the season, and the bugs are often very numerous in the fall. Many die with the onset of cold weather, and the mortality among those hibernating is apparently high.

Other Sucking Bugs

Several other species of sucking bugs feed on peaches, causing them to develop irregularly and to become distorted. These include the consperse stink bugs (see p. 18) and the leaf-footed bugs. The latter are about three-fourths inch long, narrow, and brown, with some yellow markings. Their long hindlegs have flattened enlargements on them simulating leaves, which tend to make these bugs less conspicuous. Feeding may occur at almost any time during the growing season.

Western Spotted Cucumber Beetle

The western spotted cucumber beetle is about one-fourth inch long and bright green. It has 11 black spots and a black head. These beetles feed on various truck crops, flowers, and ornamentals and also eat irregular holes in green and ripening apricots and peaches. The yellow eggs are laid at the base of host plants, usually truck or forage crops, and the larvae feed on the roots of these plants. Pupation is in the soil. Thus the only injury to fruit comes from the adults. This insect occurs chiefly in California and Oregon.

Thrips

In California several species of thrips are found on apricot, but they are not important pests. They are usually called flower thrips because they are noticed most often in the blossoms. They scar the young fruit by feeding under the husks. An invasion of thrips into the trees often results from the harvesting or disking of nearby field crops or cover crops, and the thrips are forced to find new feeding grounds.

European Earwig

Type of Injury.—The European earwig has spread into most of the western fruit-growing districts. It is most often seen in the adult stage (fig. 48). The insects hide under leaves and trash during the day and feed mostly at night. They often climb into fruit trees, particularly apricot and peach, and feed on the foliage and ripening fruit. Injury to the latter is in the form of irregular pits, usually shallow but sometimes deep.

Life History.—The adults are slender, shining brown insects,



F.I. 4905

FIGURE 48.—Adults of European earwig.

two-thirds inch long, with a pair of conspicuous forceps on the posterior end. They winter in the soil, where the females deposit eggs. The young earwigs, or nymphs, emerge in April or May and develop in the open. They are gregarious. Often they are found hiding in considerable numbers under boards or loose bark or in crevices on tree trunks. When disturbed they move about rapidly looking for new hiding places.

Stone Fly

Stone flies or salmon flies occasionally injure the buds of peach, apricot, and plum trees in the spring (fig. 49), particularly in the Northwest, where these trees are growing near the Columbia River or some other large stream. The young of these insects live in the streams. The adult flies emerge early in the spring, when thousands of cast skins may be found among the rocks along the streambanks. The flies feed on the fruit buds mostly during warm, sunny weather, destroying many of the buds and injuring others so that they produce deformed fruit.



F.I. 4825

FIGURE 49.—Stone fly feeding on peach buds.

CHERRY INSECTS

San Jose Scale

The San Jose scale is not often very injurious to sour cherries, but it does a great deal of damage to

sweet cherries. As these trees usually grow large, the tops are difficult to spray thoroughly, and dead leaves are commonly seen clinging to the upper branches of large sweet

cherry trees during the winter. This is an almost sure indication that these branches are infested with the scale. For information on the life history and habits of this pest, see page 3.

Cherry Fruit Flies

The cherry fruit fly and the black cherry fruit fly (fig. 50) attack cultivated cherries. The latter is chiefly injurious in Montana, although it occurs elsewhere in the West. The former species is most often found in Washington and Oregon and in some parts of Idaho. Both species also live in the bitter cherry (*Prunus emarginata*). In California they infest the fruit of this wild cherry in the mountains, but are not found in commercial orchards.



F.I. 9964A AND F.I. 9964B

FIGURE 50.—Wings of cherry fruit fly (A) and black cherry fruit fly (B) (enlarged).

Type of Injury.—Injury is especially severe in years when the cherry crop matures late, since a late season apparently delays the fruit more than it delays the flies and gives them the opportunity to infest the main crop of cherries. In normal years the maggots live chiefly in seedlings and late varieties. The young maggots begin to feed about the cherry pit, and the flesh of an infested cherry may be separated from the pit very easily; this separation cannot be done with an uninfested cherry. Feeding may occur before there are any outward signs of infestation and often before the maggots are large enough to be seen easily. Later on the cherry begins to shrivel on one

side, the flesh is more or less decayed, and small holes appear in the skin. At this stage the white, nearly full-grown maggot may readily be found in the fruit. Usually there is only one, but sometimes two or more. The maggots are more easily seen in the dark-meated varieties of cherries, such as the Lambert and the Late Duke, and give the impression that white cherries are not seriously infested. However, careful examination shows that the white cherries are often infested just as much as the black ones. The infestation in unsprayed trees at times amounts to 75–90 percent of the crop.

Life History.—The maggots overwinter in the soil in small, hard brown cases, or puparia. These are produced by the shrinking and drying of the outer skin of the maggot. The flies (fig. 51) emerge from the ground during June or July and fly about in the sun for some days, feeding on any moisture or honeydew on the trees. After a few days the females lay eggs in the cherries, piercing the skin of the fruit with their ovipositors and depositing the eggs in the flesh. The very small white maggots hatch in a week or less and immediately begin to feed



F.I. 9965

FIGURE 51.—Cherry fruit flies.

about the pit. Feeding continues for about 2 weeks. When fully grown the maggots, which are about one-fourth inch long, drop to the ground and form their puparia a few inches beneath the surface. They remain there until the following spring.

Orchard Mites

On cherry trees the McDaniel spider mite and the yellow spider mite are usually more injurious than other mite species. They hibernate beneath the fallen leaves or in other trash and migrate into the trees in the spring as soon as the new leaves appear. They are not often seen before June, and do their most serious injury after the fruit has been picked. Cherry trees are frequently neglected at this time and allowed to become dry. This condition aggravates the injury caused by the mites and may very materially reduce the succeeding year's crop by weakening the fruit buds. If cherry trees appear dry and dusty during the late summer, mites may be suspected on the trees. Closer examination will reveal the webbing, in which the small greenish or yellowish mites are running about. For more complete descriptions of these and other red spiders, see page 9.

Plum Rust Mite

The plum rust mite, or cherry rust mite, causes browning or bronzing and sometimes curling of the leaves. It feeds mostly on the upper surface, where it is not easily seen even with a hand lens. It is much smaller than spider mites. The plum rust mites overwinter under the bud scales, mostly in the adult stage. They are whitish and somewhat triangular. They occur on cherry, plum, and prune trees.

Black Cherry Aphid

Type of Injury.—The black cherry aphid is large, shiny, and black. It occurs on the young foliage of cherry trees and often interferes with the terminal growth. It is found much more often on sweet than on sour cherry trees and is particularly injurious to young trees and to nursery stock. The leaves of infested trees are severely curled (fig. 52) and covered with a sticky honeydew. This aphid is a European species that has become prevalent in the United States.

Life History.—The winter eggs, which are tucked in among the buds, hatch about the time the buds burst. The young develop rapidly on the new growth, curling the leaves and feeding within the protection thus afforded. There are several generations a year. Winged adults develop in the middle of the summer and migrate to watercress, pepper-



FIGURE 52.—Cherry foliage injured by black cherry aphid.

grass, and other plants of the mustard family. A later generation returns to the cherry in the fall and produces wingless individuals that lay the overwintering eggs.

Leafhoppers

Type of Injury.—The Western X-disease virus is transmitted in cherry by the geminate leafhopper and by several other species. These insects live normally in alfalfa, but they also feed on fruit trees, and thus may carry the virus from diseased to healthy trees. The disease is not of great importance, but if individual trees become seriously affected, they should be removed.

Life History.—These leafhoppers overwinter as eggs, which have been inserted into leaves of cherry or into the leaves and stems of alfalfa or other field crops. The eggs hatch in the spring, and there may be two or more generations a year. For more information on leafhoppers, see page 16.

Pear-Slug

The pear-slug, sometimes called the cherry slug, frequently skeletonizes the leaves of cherry trees. If it is not controlled, the trees may be almost completely defoliated, as the skeletonized leaves die and drop off. This condition seriously affects the development of fruit buds for the following year's crop. The life history of this pest is given on page 24.

Cherry Fruitworm

Type of Injury.—The cherry fruitworm is the larva of a small moth found in many parts of the United States. It is a native insect that originally lived on wild cherry. The larvae bore into the green cherries and feed about the pit. Injured cherries are often misshapen.

Life History.—The cherry fruit-

worms winter as full-grown larvae in the stubs of pruned branches or in cells cut into the corky bark. The small gray moths appear in May or early June and deposit eggs singly on the cherries, usually in the suture or at the stem end. The eggs are opalescent, circular, flattened, and smaller than the eggs of the codling moth. They hatch in about 10 days, and the larvae immediately bore into the fruit. The pinkish larvae are three-eighths inch long and mature in about 3 weeks. There is only one brood a year.

Destructive Pruneworm

The destructive pruneworm is sometimes a pest of cherries, particularly in Oregon. For further information, see page 48.

Pandemis Moth

Type of Injury.—The pandemis moth has been present in the West for many years, but only occasionally does it become a pest. It is similar in appearance and habits to the fruit-tree leaf roller (see p. 32). The caterpillars feed on apple, apricot, cherry, plum, and prune, but apparently not on peach. The small larvae feed on tender foliage at the tip of branches or along the midrib of leaves and develop slowly. Later they feed on the fruit. On cherries they are most often found feeding about the stem end, and some of them may burrow into the fruit. On apricots a single larva may feed on all fruits in a cluster, making large holes in the sides. Feeding on plums and apples is similar. In California they sometimes feed on the buds during the winter.

Life History.—There are two broods of this insect a year. It winters as a small larva hiding in trash or in a web constructed on the tree trunk at the ground surface. The larvae crawl up the trees in the

spring, as soon as the leaves are out, and feed on the foliage. They mature in May, spinning loose cocoons in the leaves. The moths appear in late May and in June. The light-green eggs are deposited in flat clusters of 90 to 150 on the smooth upper surface of the leaves (fig. 53), and they hatch in about 2 weeks. The larva may be distinguished from cherry fruit fly maggots because it is greenish and has a definite head and legs. The second brood matures late in July or August. Moths from this brood are flying in August and September, and the young larvae coming from their eggs feed until cold weather and then hibernate.



F.I. 9717

FIGURE 53.—Egg masses of pandemis moth.

Syneta Leaf Beetle

Type of Injury.—The syneta leaf beetle, a common pest of cherry, ranges from northern California to British Columbia. It is most injurious in western Oregon and Washington. It is a native insect that frequents cultivated orchards, where it feeds on apple, pear, plum, prune, small fruits, and some nut trees as well as cherry. The beetles eat the skin and flesh of the immature fruit (fig. 54). This injury causes scars and deformities on the mature fruit. The beetles also feed on the stems, causing some of the fruit to drop, and on the buds, blossoms, and leaves.

Life History.—The beetles emerge from the ground just before the trees begin to bloom. They are about one-fourth inch long and light gray or yellowish (fig. 55). They begin feeding in the trees at once and may be found in the orchards for about 2 months. They remain between the buds or among the foliage, but fly out in warm



F.I. 4867

FIGURE 54.—Immature cherries injured by syneta leaf beetle.



FIGURE 55.—Male and female of syneta leaf beetle.

weather if the trees are shaken or sprayed. Eggs are simply dropped to the ground, where they are very difficult to find because they are so small. The eggs hatch in 2 or 3 weeks, usually just after a rain or in damp weather, as the young grubs find it difficult to survive in dry soil. The grubs burrow into the ground, where they feed on the fine fibrous roots of the trees and in this way do a certain amount of damage. Feeding continues throughout the summer and fall. The grubs remain in the soil during the winter, forming small cells early in the spring. Within these cells they change to pupae and then to beetles.

Pear Thrips

The pear thrips is sometimes injurious to cherries. Its habits are much the same as on prune trees (see p. 46).

PRUNE AND PLUM INSECTS

European Fruit Lecanium

Type of Injury.—The European fruit lecanium is found throughout the West wherever deciduous fruit is grown. Injury from this scale results in reduced tree vigor. More direct injury is caused by the quantities of honeydew secreted by the scales. This drips down over the fruit and foliage, and a black fun-

Shot-Hole Borers

Cherry trees are sometimes attacked by one of the shot-hole borers. They make small round holes in the trunks or small limbs. At times these insects attack healthy trees, boring into the twigs just beneath the buds and killing the buds. For more information on these insects and their habits, see page 35.

Rain Beetles

In Wasco County, Oreg., a species of rain beetles attacks the roots of cherry. Its appearance and habits are similar to those injuring apple and pear (see p. 27). Allied species are occasionally found on cherry roots in other parts of the Pacific States.

Other Root-Feeding Grubs

The grubs of the ten-lined June beetle and of the California prionus will occasionally be found feeding on the roots of cherry. The former are 1 to 2 inches long and the latter may reach a length of 3 inches. They are somewhat similar in appearance to the grubs of the rain beetles. However, the adults are different. The June beetle is a little more than an inch long and brown with whitish stripes, and the prionus is 1½ to 2 inches long and uniformly dark brown.

gus grows in it, greatly depreciating the appearance of the fruit.

Life History.—This is a large, hemispherical, more or less wrinkled, brown scale insect, one-eighth to one-fourth inch in diameter. It lives on the twigs and limbs of deciduous fruit trees and also on many shade trees (fig. 56). It winters as a nearly mature insect, laying eggs beneath the shell in the

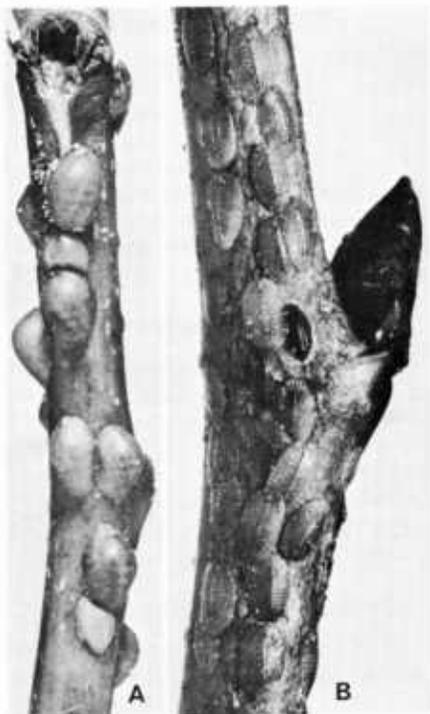


FIGURE 56.—European fruit lecanium: *A*, Adult; *B*, immature stage. (Courtesy California Agricultural Experiment Station.)

spring. The eggs hatch from May to July, and the young settle on the twigs and leaves. In the fall before the leaves drop, those that have survived on them migrate back to the twigs. There is only one generation a year.

San Jose Scale

The San Jose scale is an important pest of prune and plum. For further information, see page 3.

Other Scale Insects

In California several other scale insects infest prune and plum. These include the black scale (see p. 34), the brown soft scale, which has similar habits, the olive scale

(see p. 5), and the Italian pear scale (see p. 5).

Aphids

Type of Injury.—Four or five species of aphids occur on prunes and plums in the West. Habits and injury are similar for all of these species. Their feeding causes splitting of fruit, curling of leaves, and stunting of growth. The discharge of honeydew also injures the tree and fruit.

One of the commonest species is the hop aphid, which is a serious pest of hops but spends a part of the year on prune trees. Planting hops near prune orchards should therefore be avoided if possible. This green aphid often covers the undersurface of the leaves of prune trees early in the season. The mealy plum aphid is bluish green, with a whitish, powdery covering (fig. 57). It frequently becomes exceedingly abundant on the undersurface of leaves. The thistle aphid, the leaf-curling plum aphid, and the green peach aphid also occur on prune and plum trees and occasionally become abundant. These aphids are green or reddish, and they curl the leaves considerably. All these species originated in Europe.

Life History.—The life histories of these aphids are similar. Wintering eggs are laid on the trees and hatch early in the spring before the buds have swelled appreciably. The young feed within the opening buds and on the leaves. After several generations have developed on the prune trees, winged forms develop and fly to the summer host plants, and later generations return to the trees in the fall. During the summer the hop aphid is found on hops, the mealy plum aphid on reed grasses and cattails, the thistle aphid on thistles, chrysanthemums,



F.I. 3056

FIGURE 57.—Mealy plum aphids on plum foliage.

and other plants, and the other species on a large variety of wild and cultivated plants.

Orchard Mites

Prune and plum trees are often seriously affected by red spiders. The foliage is bronzed and defoliation may occur in nonirrigated orchards, frequently accompanied by dropping of some of the fruit. Injury by the mites may prevent the fruit buds from forming or at least may weaken them, causing a small crop or small fruit the following year. This injury is often much more serious than is apparent. The species most commonly found on these trees are the brown mite, the European red mite, the McDaniel spider mite, the two-spotted spider mite, and the Pacific spider mite.

For further information on these mites, see pages 9, 29, and 40.

Plum Rust Mite

Injury by this mite to prune and plum is similar to that on cherry (see p. 40).

Leafhoppers

Leafhoppers often become numerous on prune trees. Some of these may be the same species found on apple (see p. 17). In the Yakima Valley and perhaps elsewhere another species, *Typhlocyba prunicola* Edwards, occurs on prune.

Peach Twig Borer

Prune trees are attacked by the peach twig borer in much the same manner as are peach trees. The brown worms bore into the tender new growth, causing leaves to wilt, and later they feed in the fruit. The life history of this pest is given on page 30.

Peach Tree Borer

The peach tree borer is chiefly injurious to peach in California, but in other parts of the West it may do more harm to prune trees than to peach trees. For a discussion of this insect, see page 35.

Other Borers

The California prionus (see p. 43) attacks prune and plum in California. The American plum borer may be found attacking these trees in both California and Oregon. The latter is the larva of a small, obscurely colored moth, which emerges in May and June. The larvae, or borers, make winding burrows in the sapwood, causing dead areas to appear in the bark. When

full grown they are about an inch long. There are two broods. The larvae of the second brood mature in November. This pest usually attacks only trees in poor condition.

The branch and twig borer attacks prune and sometimes apricot and pear in California and Oregon. It bores into the twigs and smaller branches, often at the axil of a bud or where two branches fork. The beetle is about one-half inch long, slender, brown, and with a round head. The early stages do not live in fruit trees.

The shot-hole borers attack unhealthy deciduous fruit trees, making round holes in the trunks (see p. 35). The flatheaded apple tree borer may also at times be found in the trunks of such trees (see p. 26).

Pear Thrips

Type of Injury.—The pear thrips probably causes more injury to prune in the West than to other fruits. This pest was apparently introduced from Europe. There are three types of injury. The most serious is caused by the adult thrips, which emerge from the ground in the spring. They feed in the developing buds, cause deformed leaves and blossoms (fig. 58), and thus reduce the crop. Later the adults lay eggs in the stems of the fruit and foliage. Both the young and the adults feed by rasping the surface and then sucking out the plant juices.

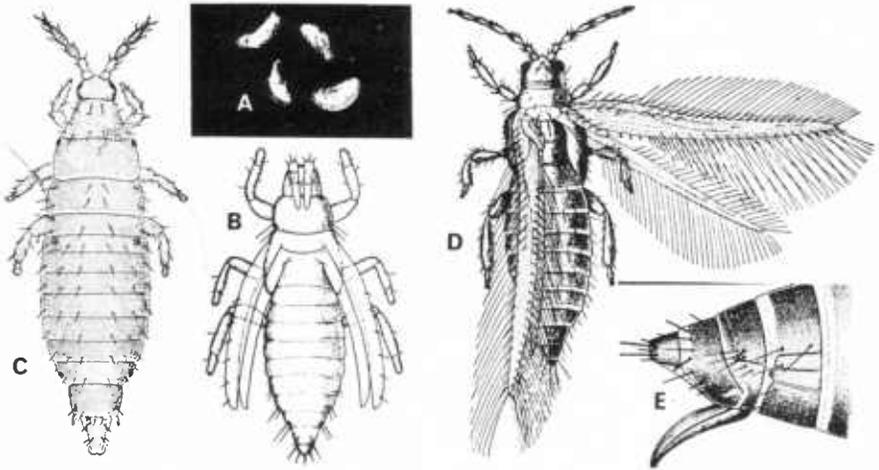
Life History.—There is only one generation of the pear thrips annually. The adults are small, less than one-twentieth inch long, slim, and dark brown. They emerge when the fruit buds are swelling and beginning to show green. After feeding for about 3 weeks, they begin egg laying, which lasts another 3 weeks. The very small, whitish,



F.I. 1778

FIGURE 58.—Prune twigs showing deformed leaves and poor set of fruit caused by pear thrips.

kidney-shaped eggs hatch in less than 2 weeks. The young are white and similar to the adults in shape (fig. 59). They develop for about 3 weeks, then drop to the ground, burrow into the soil, and construct small cells a few inches to 3 feet from the surface. Here they remain dormant, changing late in the fall to adults, which emerge the following spring. The pear thrips is thus active on the trees for only about 2 months in the spring and is dormant in the ground the rest of the year.



F.I. 1244

FIGURE 59.—Pear thrips :A, Eggs; B, larva; C, pupa; D, adult; E, posterior end of female showing ovipositor.

Eye-Spotted Bud Moth

The eye-spotted bud moth is a cool-climate insect, occurring in British Columbia, Montana, northern Idaho, western Washington and Oregon, and in some parts of California. It is also a pest in the Eastern States and in Europe, which was its original home.

Type of Injury.—This insect damages prunes and plums, but is also found on all the orchard fruits as well as on some other plants. It causes most injury to the expanding buds, which are devoured by the partly grown, hungry caterpillars that have hibernated on the trees. Crops are reduced by its bud-feeding habit, and injury to the terminal shoots causes a bushy growth (fig. 60). Later the insects eat the foliage, and a new generation feeds on the fruit, often attaching a leaf to it and feeding in the shelter thus formed.

Life History.—The partly grown dark-brown larvae of this bud moth

winter in small silken nests, or hibernacula, attached to the twigs, often in a crevice or crotch. These nests are made of pieces of leaves or bark held together with silk and are difficult to find on the trees. The larvae leave them in April, or whenever the buds begin to swell appreciably, and burrow into the expanding buds and into the terminal shoots, feeding from the inside. Nests of silk are formed in the opening leaves. As the foliage surrounding them dries, the larvae go outside to eat leaves or blossoms, retiring to the nests when not feeding. These webbed nests are often the first indication of the presence of the insects. The larvae become full grown in June or early July, when they are olive brown with black heads.

They transform to pupae in the nests of webbed leaves, and the moths appear about 3 weeks later. These are somewhat smaller than codling moths, ashy gray, and with a cream-white band across both



F.I. 5168

FIGURE 60.—Bushy terminal growth of prune caused by larvae of eye-spotted bud moth.



F.I. 5810

FIGURE 61.—Eye-spotted bud moth.

wings (fig. 61). The flattened eggs, similar to those of the codling moth, are deposited on the leaves and hatch in a week or so. The young larvae feed on the leaves, protecting themselves with silk, and often eat small holes in the fruit.

In the fall these larvae build the hibernacula in which they spend the winter. There is only one generation a year.

Lesser Appleworm

The lesser appleworm occasionally injures prunes in eastern Oregon and southern Idaho. It also occurs in British Columbia, and is known as a serious pest of apple in sections of the Eastern United States and Canada. The egg, larva, and adult moth are somewhat similar in appearance to the corresponding stages of the codling moth, except that they are smaller (see p. 1). The habits of the insect are also similar.

Destructive Pruneworm

The destructive pruneworm has become a rather serious pest of prune and cherry trees in southern Idaho and in parts of Oregon. Its habits are somewhat like those of the eye-spotted bud moth. The partly grown brown worms winter in small hibernacula woven of silk and placed in the smaller crotches or in crevices in the bark. These worms emerge in the spring before the flower buds are open and bore into the buds, feeding entirely on the inside and destroying many blossoms. They become full grown in 2 to 4 weeks, when they drop to the ground and spin loose cocoons. The moths emerge from these cocoons in June and lay eggs singly on the lower surface of the leaves. The worms hatching from these eggs burrow into the green prunes or cherries and cause considerable injury by feeding on the fruit. This second brood of worms becomes full grown late in July or early in August and produces a second brood of moths. Worms com-

ing from eggs laid by these moths feed for a time in the maturing prunes or on the foliage and then leave them and spin the silken nests in which they hibernate. There are thus two complete generations a season.

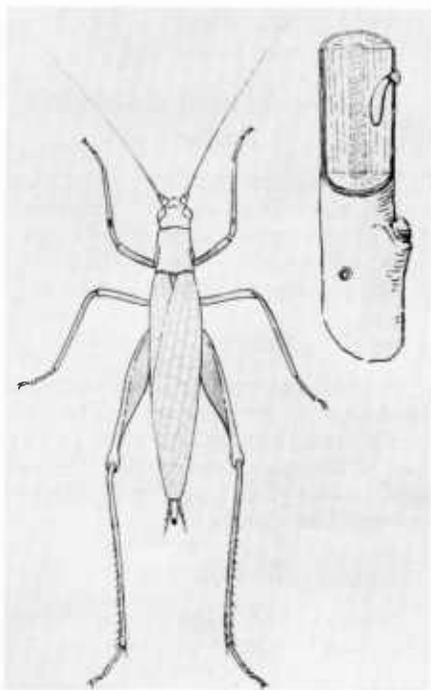
Snowy Tree Cricket

Type of Injury.—The snowy tree cricket occurs throughout the Northwest, but has been of economic importance chiefly in southern Idaho, where it sometimes does considerable harm to prunes by eating holes in the ripening fruit. Much of the injured fruit drops prematurely and the remainder is unfit for market. Early in the season the young feed on the foliage, but this injury is of little consequence.

Life History.—The adult crickets are slightly more than one-half inch long and light green or yellowish. The females (fig. 62) have narrow, transparent wings, and the males have somewhat broader wings. There is but one generation a year, and the adults may be found in the orchards from July until frost occurs.

Leaf-Cutting Bees

Sometimes large round holes may be found in the leaves of prune and plum trees. These are usually caused by the small brown, metallic green, or blue leaf-cutting bees. The nests of these bees are built in holes in the ground, in hollow stems of plants, or holes bored in wood. The nests may usually be found not far from the injured trees. The bees cut circular or oblong disks from the leaves and use them to line the nests in which eggs are laid and where the young develop. Injury



F. I. 5873

FIGURE 62.—Female of snowy tree cricket (enlarged) and section of twig showing egg.

to trees is usually not serious. Since the bees are also beneficial as pollinating insects, no measures should be taken against them unless the injury is extreme.

Syneta Leaf Beetle

The syneta leaf beetle ordinarily does not injure prunes as severely as it damages pears and cherries (pp. 25 and 42). Most of the prunes grown in the area where this beetle occurs are sold in the dried form, and the smaller injuries are of less consequence than those on fruit that is to be marketed green or fresh. Large russeted areas on the prunes detract from the appearance of the

dried product (fig. 63) and make the fresh fruit unmarketable.

Western Spotted Cucumber Beetle

The western spotted cucumber beetle sometimes injures prunes in the same manner that it does apricots and peaches. For information about this beetle, see page 37.

Caterpillars

Several caterpillars may at times be found on prune trees. They include tent caterpillars (see p. 20), fall webworms (see p. 20), tussock moths (see p. 21), and red-humped caterpillars (see p. 21).

Stink Bugs

Several stink bugs may be found on prune (see p. 18).



F.I. 4880

FIGURE 63.—Dried prunes: Above, russeted by syneta leaf beetle; below, uninjured.

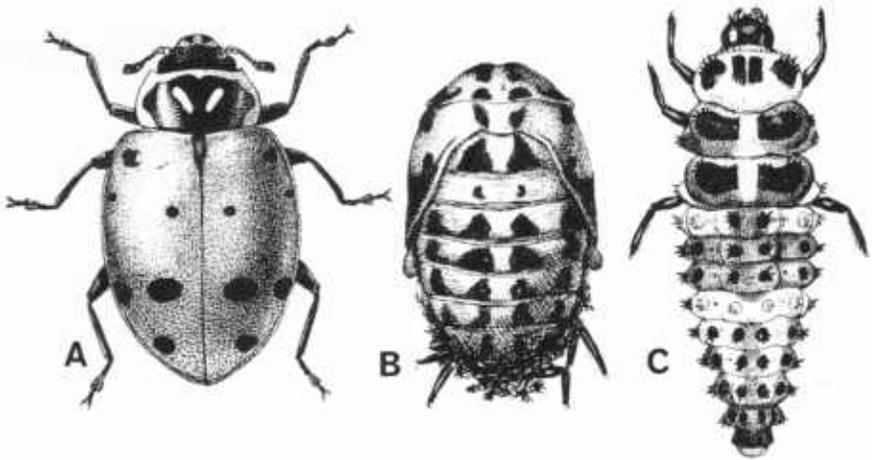
BENEFICIAL INSECTS

Not all insects found in an orchard are harmful. Many are of no importance because they are not sufficiently numerous or do not injure the trees or the cover crop. Many others are beneficial because they feed on some of the insects that are harmful to the crops. The most conspicuous beneficial insects and the ones most often found in an orchard are those that prey on aphids.

Lady beetles are nearly always abundant in orchards, and their young feed on the aphids in cover crops or on trees. There are many species. One of the commonest is the convergent lady beetle (fig. 64), which is red with black head and black spots on the back. Some species are plain red, others are black with two or more red spots. There are also small black lady beetles (fig. 65) that feed chiefly on orchard mites and scale insects. Most of these species lay yellow or orange

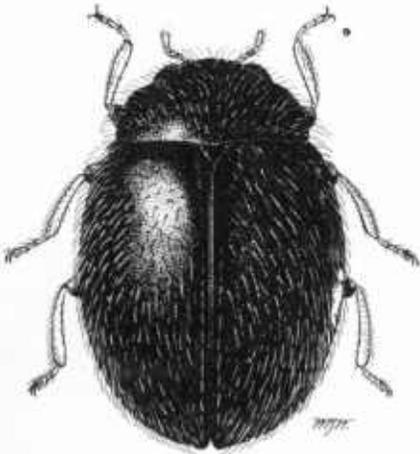
cigar-shaped eggs, which stand on end in clusters. The larvae are usually black or gray, with various red or orange markings. Some of them are covered with a white waxy secretion, giving them the appearance of mealybugs. Although most of the lady beetles are conspicuous, they are not molested by birds, possibly because of a disagreeable taste.

The larvae of syrphid flies are very common enemies of aphids and are most often found in colonies of the woolly apple aphid. Frequently they destroy the colonies entirely. These larvae or maggots (fig. 66) are nearly one-half inch long when full grown, yellowish or grayish, and often with a stripe down the back. The posterior end of the body is widest, and the narrow head is restlessly moved about as the maggot searches for food. No legs are evident. The adult syrphid flies are usually black, striped with yellow, and may be mistaken for wasps or



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FIGURE 64.—Convergent lady beetle: A, Adult; B, pupa; C, larva. (Enlarged.)



F.I. 9825

FIGURE 65.—Small black lady beetle (enlarged).

bees. They fly rapidly and often poise in midair before darting down to a colony of aphids to deposit their grayish elongated eggs. The eggs are laid singly among the aphids.

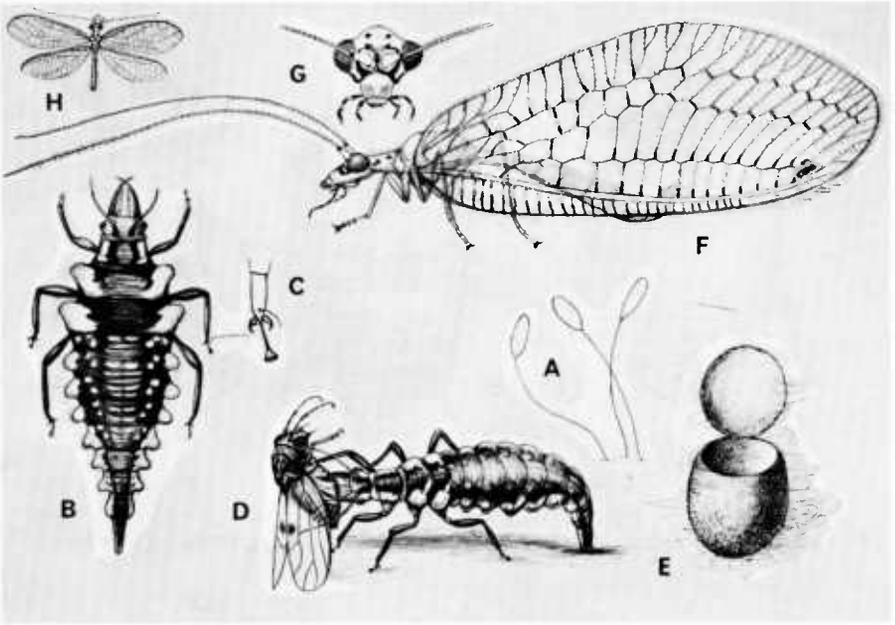
The young of lacewing flies (fig.



F.I. 9826

FIGURE 66.—Larva of syrphid fly (enlarged).

67) are effective enemies of aphids and also feed on other insects such as newly hatched codling moth larvae and the young of leafhoppers. The lacewing fly larvae, known as aphid lions, are flat, elongated, tapering at both ends, and with long legs and conspicuous sickle-shaped



F.I. 7886B

FIGURE 67.—Lacewing fly: A, Eggs; B, larva; C, foot; D, larva feeding on psylla; E, empty pupa; F, adult; G, head of adult; H, adult. (All enlarged except H.)

jaws. When mature they are about three-eighths inch long, grayish or yellowish, and with red or brown markings. They spin spherical white cocoons, from which the adults escape by cutting circular lids. The adults are light green with delicate transparent wings and golden eyes. They emit a very disagreeable odor when crushed, and this doubtless protects them from birds and other enemies in the same manner as lady beetles are protected. The eggs are deposited in clusters, each egg on a long stalk (fig. 67). This characteristic is believed to prevent the eggs from being eaten by the young or by other insects.

There are also many predaceous bugs and beetles that prey on various insects, as well as small predaceous mites and thrips that feed on orchard mites. In addition to these, there are hosts of small inconspicuous parasitic insects, most-

ly related to the bees and wasps, that take their toll of the pests. One of these, *Aphelinus mali* (Halderman), a parasite of the woolly apple aphid, has been introduced into the Pacific Northwest.

It is difficult to estimate the benefit from predaceous and parasitic insects. The beneficial species prevent many potentially harmful insects from becoming numerous, and therefore should be promoted in every way. Frequently, also, outbreaks of serious pests are checked more completely by beneficial insects than is possible with artificial control measures. Unfortunately the beneficial forms often are not effective until after the harmful species have done much damage, and the fruit grower cannot afford to wait but must control the pests himself. The sprays applied to trees, particularly the contact sprays, destroy many of the beneficial in-

sects. Some of these insects, such as the syrphid flies and the lady beetles, withstand insecticides fairly well, but the smaller ones are often seriously reduced in numbers. However, some of them may increase late in the season after spraying has been discontinued.

LIST OF ORCHARD INSECTS

Common name	Scientific name
American plum borer	<i>Euzophera semifuneralis</i> (Walker)
Apple-and-thorn skeletonizer	<i>Anthophila pariana</i> (Clerck)
Apple aphid	<i>Aphis pomi</i> DeGeer
Apple fruit miner	<i>Marmara pomonella</i> Busck
Apple grain aphid	<i>Rhopalosiphum fitchii</i> (Sanderson)
Apple lacebug ¹	<i>Corythucha salicata</i> Gibson
Apple leafhopper	<i>Empoasca maligna</i> (Walsh)
Apple leaf miner ¹	<i>Lithocolletis crataegella</i> Clemens
Apple leaf trumpet miner	<i>Tischeria malifoliella</i> Clemens
Apple rust mite	<i>Aculus schlechtendali</i> (Nalepa)
Bailey's apple rust mite ¹	<i>Calepitrimerus baileyi</i> Koch
Bean aphid	<i>Aphis fabae</i> Scopoli
Bean thrips	<i>Caliothrips fasciatus</i> (Pergande)
Black cherry aphid	<i>Myzus cerasi</i> (F.)
Black cherry fruit fly	<i>Rhagoletis fausta</i> (Osten Sacken)
Black peach aphid	<i>Brachycaudus persicaeicola</i> (Boisduval)
Black scale	<i>Saissetia oleae</i> (Bernard)
Boxelder bug	<i>Leptocoris trivittatus</i> (Say)
Branch and twig borer ¹	<i>Polycaon confertus</i> LeConte
Bronze apple tree weevil	<i>Magdalis aenescens</i> LeConte
Brown mite ¹	<i>Bryobia rubrioculus</i> (Scheuten)
Brown soft scale	<i>Coccus hesperidum</i> L.
Buffalo treehopper	<i>Stictocephala bubalus</i> (F.)
Calico scale	<i>Lecanium cerasorum</i> Cockerell
California pear-slug	<i>Pristiphora abbreviata</i> (Hartig)
California prionus	<i>Prionus californicus</i> Motschulsky
Cankerworms ¹	Geometridae
Cherry fruit fly	<i>Rhagoletis cingulata</i> (Loew)
Cherry fruitworm	<i>Grapholitha packardi</i> Zeller
Climbing cutworms ¹	Noctuidae
Codling moth	<i>Carpocapsa pomonella</i> (L.)
Conspire stink bug ¹	<i>Euschistus conspersus</i> Uhler
Convergent lady beetle	<i>Hippodamia convergens</i> Guérin-Ménéville
Cottony maple scale	<i>Pulvinaria innumerabilis</i> (Rathvon)
Dark-colored treehopper ¹	<i>Ceresa basalis</i> Walker
Destructive pruneworm ¹	<i>Mineola scitulella</i> Hulst
Dock sawfly	<i>Ametastegia glabrata</i> (Fallén)
European earwig	<i>Forficula auricularia</i> L.
European fruit lecanium	<i>Lecanium corni</i> Bouché
European red mite	<i>Panonychus ulmi</i> (Koch)
Eye-spotted bud moth	<i>Spilonota ocellana</i> (Denis & Schiffermüller)
Fall cankerworm	<i>Alsophila pometaria</i> (Harris)
Fall webworm	<i>Hyphantria cunea</i> (Drury)
Flatheaded apple tree borer	<i>Chrysobothris femorata</i> (Olivier)
Flower thrips	<i>Frankliniella tritici</i> (Fitch)
Frosted scale ¹	<i>Lecanium pruinosum</i> Coquillett
Fruit-tree leaf roller	<i>Archips argyrosipilus</i> (Walker)
Geminate leafhopper ¹	<i>Colladonus geminatus</i> (Van Duzee)
Grape mealybug	<i>Pseudococcus maritimus</i> (Ehrhorn)
Green clover treehopper ¹	<i>Stictocephala inermis</i> (F.)
Green fruitworms ¹	Noctuidae
Green peach aphid	<i>Myzus persicae</i> (Sulzer)
Hop aphid	<i>Phorodon humuli</i> (Schränk)
Howard scale	<i>Abgrallaspis howardi</i> (Cockerell)
Italian pear scale	<i>Epitaspis picicola</i> (Del Guercio)
Lacewing fly ¹	Chrysopidae

See footnotes at end of table.

LIST OF ORCHARD INSECTS—Continued

Common name	Scientific name
Leaf-curling plum aphid ¹	<i>Anuraphis heliochrysi</i> (Kaltenbach)
Leaf-cutting bees ¹	<i>Megachile</i> spp., <i>Osmia pella</i> Sandhouse
Leaf-footed bug.....	<i>Leptoglossus phyllopus</i> (L.)
Lesser appleworm.....	<i>Grapholitha prunivora</i> (Walsh)
Lygus bugs ¹	<i>Lygus hesperus</i> Knight, <i>L. elisus</i> Van Duzee
McDaniel spider mite ¹	<i>Tetranychus mcdanieli</i> McGregor
Mealy plum aphid.....	<i>Hyalopterus pruni</i> (Geoffroy)
Measuring worms ¹	Geometridae
Melon aphid.....	<i>Aphis gossypii</i> Glover
Oblique-banded leaf roller.....	<i>Choristoneura rosaceana</i> (Harris)
Olive scale.....	<i>Parlatoria oleae</i> (Colvée)
Orange tortrix.....	<i>Argyrotaenia citrana</i> (Fernald)
Orchard mites ¹	Tetranychidae
Oriental fruit moth.....	<i>Grapholitha molesta</i> (Busck)
Oystershell scale.....	<i>Lepidosaphes ulmi</i> (L.)
Pacific flatheaded borer.....	<i>Chrysobothris mali</i> Horn
Pacific spider mite.....	<i>Tetranychus pacificus</i> McGregor
Pandemis moth ¹	<i>Pandemis albaniana</i> Walker
Peach silver mite.....	<i>Aculus cornutus</i> (Banks)
Peach tree borers.....	<i>Sanninoidea exitiosa</i> (Say), <i>S. exitiosa graefi</i> (Hy. Edwards)
Peach twig borer.....	<i>Anarsia lineatella</i> Zeller
Pear leaf blister mite.....	<i>Eriophyes pyri</i> (Pagenstecher)
Pear psylla.....	<i>Psylla pyricola</i> Foerster
Pear rust mite.....	<i>Epitrimerus pyri</i> (Nalepa)
Pear-slug.....	<i>Caliroa cerasi</i> (L.)
Pear thrips.....	<i>Taeniothrips inconsequens</i> (Uzel)
Plum rust mite.....	<i>Aculus fockeui</i> (Nalepa & Trouessart)
Putnam scale.....	<i>Aspidiotus ancylus</i> (Putnam)
Rain beetles ¹	<i>Pleocomma minor</i> Linsley, <i>P. crinita</i> Linsley, <i>P. oregonensis</i> Leach
Red-humped caterpillar.....	<i>Schizura concinna</i> (J. E. Smith)
Red spiders ¹	Tetranychidae
Rose leafhopper.....	<i>Edwardsiana rosae</i> (L.)
Rosy apple aphid.....	<i>Dysaphis plantaginea</i> (Passerini)
Rusty tussock moth.....	<i>Orgyia antiqua</i> (L.)
Salmon fly ¹	Plecoptera
San Jose scale.....	<i>Aspidiotus perniciosus</i> Comstock
Shot-hole borers.....	<i>Scolytus rugulosus</i> (Ratzeburg), <i>Anisandrus pyri</i> (Peck)
Snowy tree cricket.....	<i>Oecanthus fultoni</i> T. J. Walker
Spotted cutworms.....	<i>Amathes c-nigrum</i> (L.), <i>Abagrotis barnesi</i> (Benjamin), <i>Euxoa</i> spp.
Spring cankerworm.....	<i>Paleacrita vernata</i> (Peck)
Stone fly ¹	<i>Taeniopteryx pacifica</i> Banks
Syneta leaf beetle ¹	<i>Syneta albida</i> LeConte
Syrphid fly ¹	Syrphidae
Ten-lined June beetle.....	<i>Polyphylla decemlineata</i> (Say)
Tent caterpillars ¹	<i>Malacosoma</i> spp.
Tentiform leaf miner ¹	<i>Lithocolletis</i> sp.
Thistle aphid.....	<i>Brachycaudus cardui</i> (L.)
Tussock moth ¹	Lymantriidae
Two-spotted spider mite.....	<i>Tetranychus urticae</i> (Koch)
Western spotted cucumber beetle.....	<i>Diabrotica undecimpunctata undecimpunctata</i> Mannerheim
Western tussock moth.....	<i>Hemerocampa vetusta</i> (Boisduval)
Woolly apple aphid.....	<i>Eriosoma lanigerum</i> (Hausmann)
Woolly pear aphid.....	<i>Eriosoma pyricola</i> Baker & Davidson
Yellow-necked caterpillar.....	<i>Datana ministra</i> (Drury)
Yellow spider mite.....	<i>Eotetranychus carpini borealis</i> (Ewing)

¹Name does not appear in list of Common Names of Insects approved by the Entomological Society of America.

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