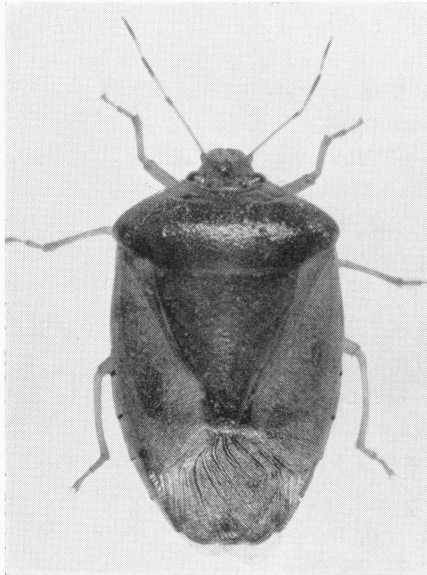


# Insect and Mite Pests of Peaches in Ohio

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OHIO AGRICULTURAL EXPERIMENT  
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# INSECT AND MITE PESTS OF THE PEACH IN OHIO

ROY W. RINGS

## I. INTRODUCTION

This bulletin has been prepared primarily for Ohio peach growers but may also be of value to entomologists in neighboring states since it contains certain information which has not previously been published. It is designed to supplement Service Bulletin SB-2 "Spraying Program and Pest Control for Commercial Fruit Crops" which is published in alternate years i. e. 1953, 1955, etc. In years when Bulletin SB-2 is not published a supplement is printed which contains only the revised spray schedules for the year of publication. These bulletins may be obtained from County Agents in any of the Ohio counties.

Because of the specific action of many of the newer insecticides, it is quite important that the peach grower be able to recognize insect pests or their damage so that the correct chemical may be used for control. Numerous cases have come to the author's attention where ineffective chemicals were being applied for control of a particular pest which of course resulted in a waste of materials and time. In most cases growers were confusing the injury caused by one insect species with that of another. In this bulletin an attempt is made to describe and illustrate the major peach insect and mite pests and their damage. When identification of the pest or its damage has been made, specific control measures as described in Bulletin SB-2 may then be undertaken.

## II. RELATIVE IMPORTANCE OF INSECT AND MITE PESTS

Each season, since 1928, a survey has been conducted at peach harvest in commercial orchards to determine the relative amount of injury caused by various insect and mite pests of peaches. Estimates based upon these annual surveys have indicated that insect and mite pests of peach partially or completely destroy from \$50,000 to \$300,000 in fruit each year.

The oriental fruit moth, which first invaded Ohio in the late 1920's, has undoubtedly caused more financial loss to peach growers than any other insect in the past 27 years. The annual amount of damage to the

Ohio peach crop by this destructive species during the period 1929 to 1947 has ranged from 5.0 percent in 1934 to 28.8 percent in 1947. In the latter year the amount of fruit injured had a retail value of \$250,300. The introduction and use of DDT for fruit moth control has so greatly reduced losses that this pest is no longer considered to be a significant factor in Ohio peach production. The insect is still present in small numbers in practically every commercial orchard in Ohio and, if not controlled, may cause severe losses.

The plum curculio is another fruit pest of major importance although its record of destructiveness cannot equal that of the fruit moth. This insect is a native species and is so widely distributed in Ohio that it occurs in almost all commercial and home orchards. Outbreaks of the plum curculio occur at irregular intervals, the status of the pest being largely determined by various ecological factors. A severe outbreak occurred in 1948 while in 1949 and 1950 the insect was unusually abundant. The new organic phosphate materials, EPN and parathion, which were introduced in 1951 have proven so effective against plum curculio that in recent years it is difficult to find injury in commercial orchards. Since 1951 this pest has damaged not more than 0.81 percent of the crop annually. In 1953 and 1954 the percent of fruit damaged in approximately fifty orchards was 0.20 and 0.21 respectively.

The reduction of fruit injury from oriental fruit moth and plum curculio with the newer insecticides brought attention to the fact that there was still considerable fruit damage which might be caused by other insect pests. Recent investigations have shown that an entire complex of insects is involved in this injury and that for the most part this complex consists of the tarnished plant bug and several species of stink bugs. Since these insects produce deformities in the fruit they have come to be known collectively as "cat-facing" insects. Cat-facing injury in 1954 in some orchards accounted for the destruction of from 18 to 36 percent of the total crop even though a complete insecticidal program was followed. In 1954 it was estimated that cat-facing insects destroyed approximately \$250,000 in the peach crop alone. Investigations are now in progress which have as their objective the development of effective control programs for these pests.

Two other pests of major importance are the peach tree borer and the lesser peach tree borer. These insects, as their name implies, attack the trunk, limbs and branches of peaches and other fruit trees. Injury by these borers may kill individual limbs or branches or even the entire tree.



The remainder of the species described in this bulletin are minor pests which under favorable circumstances may become major pests in certain orchards. Probably the most important factor influencing the abundance of species in this category is the use of certain pesticides which destroy natural enemies of the potential pest and thus bring about an increase in abundance. One outstanding example of this situation may be cited in the case of DDT. When this material had been used for oriental fruit moth control on peaches for several years, it was noted that both European red mite and the two-spotted spider mite increased to injurious proportions in many orchards. Presumably the DDT, which was ineffective against mites, destroyed the natural enemies of the mites and when this relationship was disturbed a significant increase in mites followed. There are numerous other instances of various insecticides which have changed the status of certain pests from minor to major importance.

### III. INSECTS ATTACKING THE FRUIT

**Plum curculio.**<sup>1</sup> This species is one of the most destructive insects which attack peaches. Injury is caused by both the larvae and the adults.

The adult plum curculio is a small, dark brown snout beetle about one-fourth inch in length and is shown in Figure 1. The beetles hibernate under debris in the orchard or in nearby fence rows or woodlands. They leave their hibernating places in the spring and fly to orchards during or shortly after the peach trees are in the full bloom stage. Adults of the hibernating brood may be found on peaches from about May 1 to the first of July.

The seasonal activity and relative abundance of spring brood adults for timing sprays may be determined by jarring trees vigorously over a muslin or canvas sheet as shown in Figure 2. Curculios which are disturbed by jarring operations have a characteristic habit of feigning death which is illustrated in Figure 1 (B). When the beetles assume this pose they are very difficult to recognize since they resemble small pieces of bark or dead fruit buds.

In addition to the plum curculio many other insects such as the tarnished plant bug, stink bugs and several other species of curculios may be obtained during jarring. Two additional species of the genus *Conotrachelus* have often been jarred from peaches along with the plum

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<sup>1</sup>*Conotrachelus nenuphar* (Herbst).

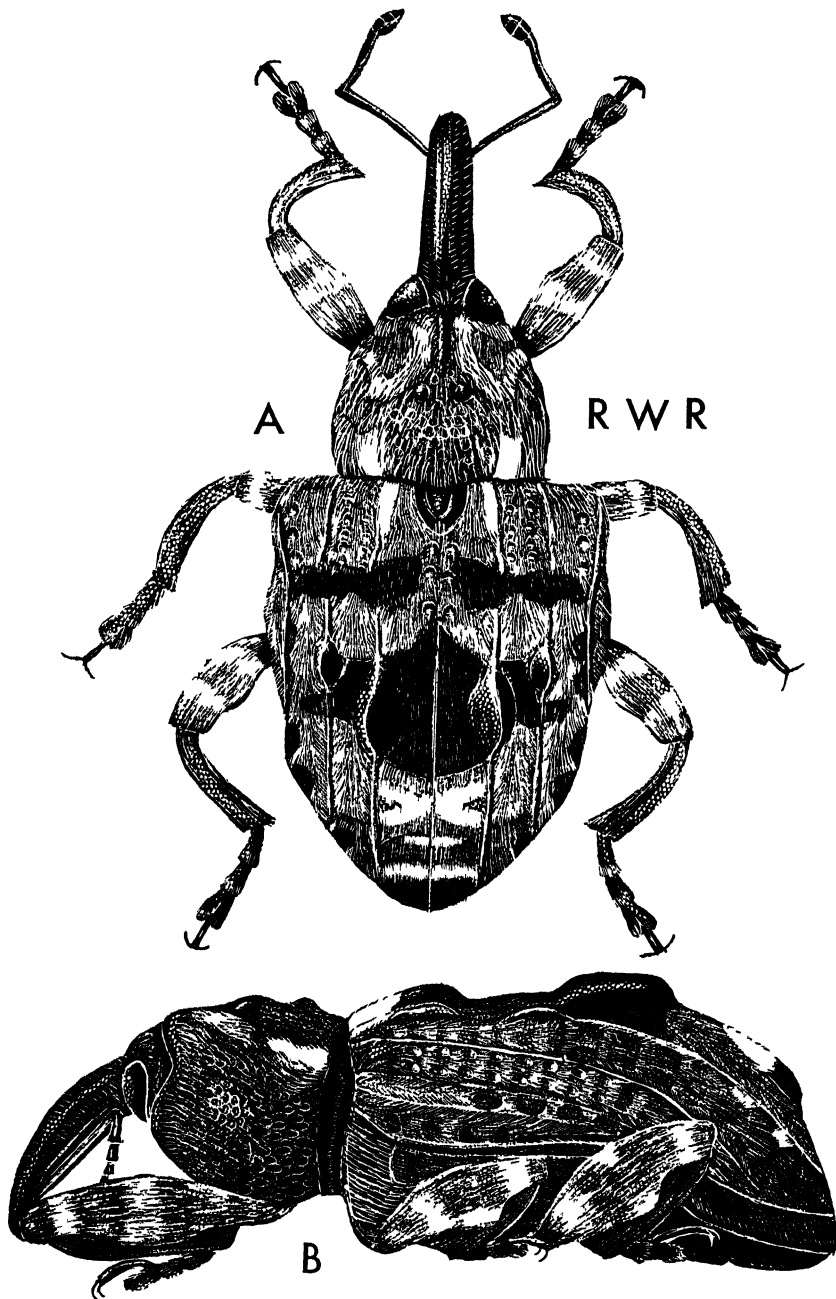


Fig. 1.—(A) Dorsal view of the plum curculio. (B) Lateral view of the plum curculio feigning death.

curculio and are easily confused with the latter species. The occurrence of these two species on peach is believed to be incidental since no adults have been reared from dropped fruits. The pecan-gall curculio<sup>2</sup> which is shown in Figure 3 is of the same color and proportions as the plum curculio but can be distinguished by the fact that it lacks the black, shiny protuberances on the back which are characteristic of the plum curculio.



Fig. 2.—Method of jarring to determine populations of plum curculio in orchard.

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<sup>2</sup>*Conotrachelus elegans* (Say).

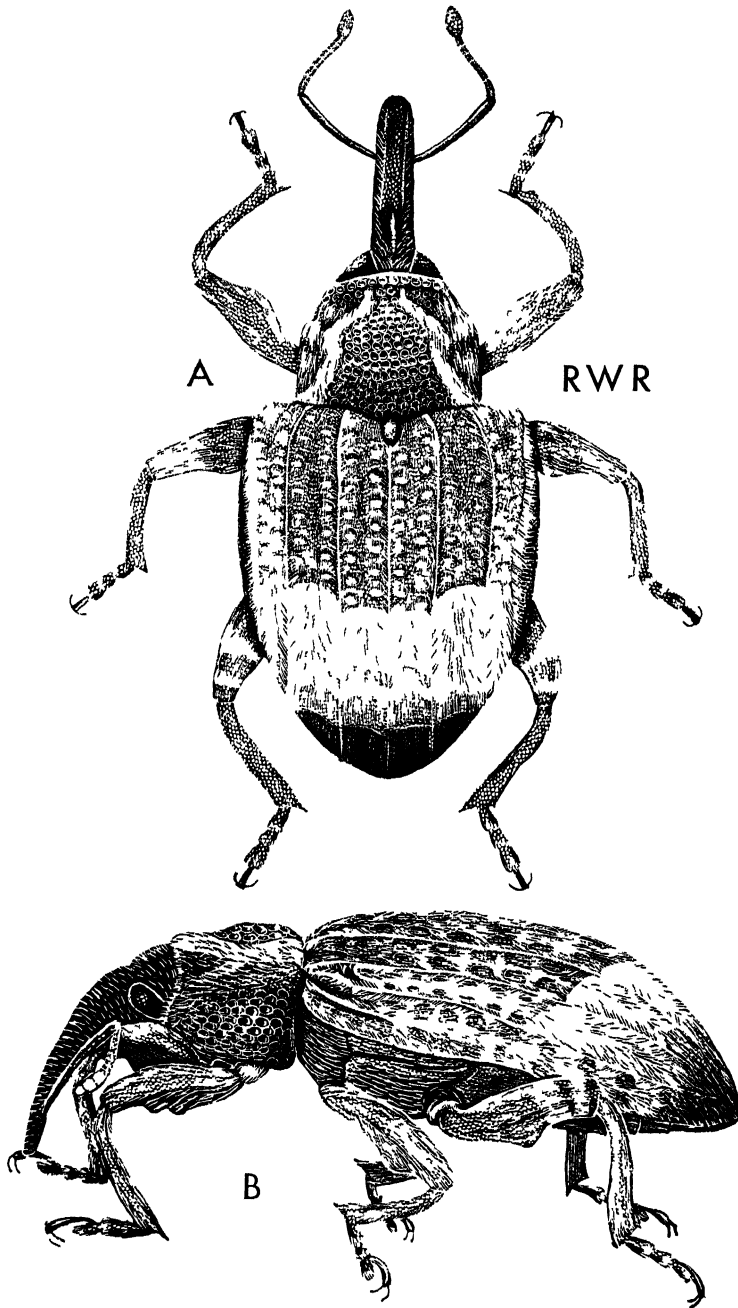


Fig. 3.—(A) Dorsal view of the pecan-gall curculio, *Conotrachelus elegans* (Say), a species which occurs on peach and is easily mistaken for the plum curculio. (B) Lateral view of the pecan-gall curculio.

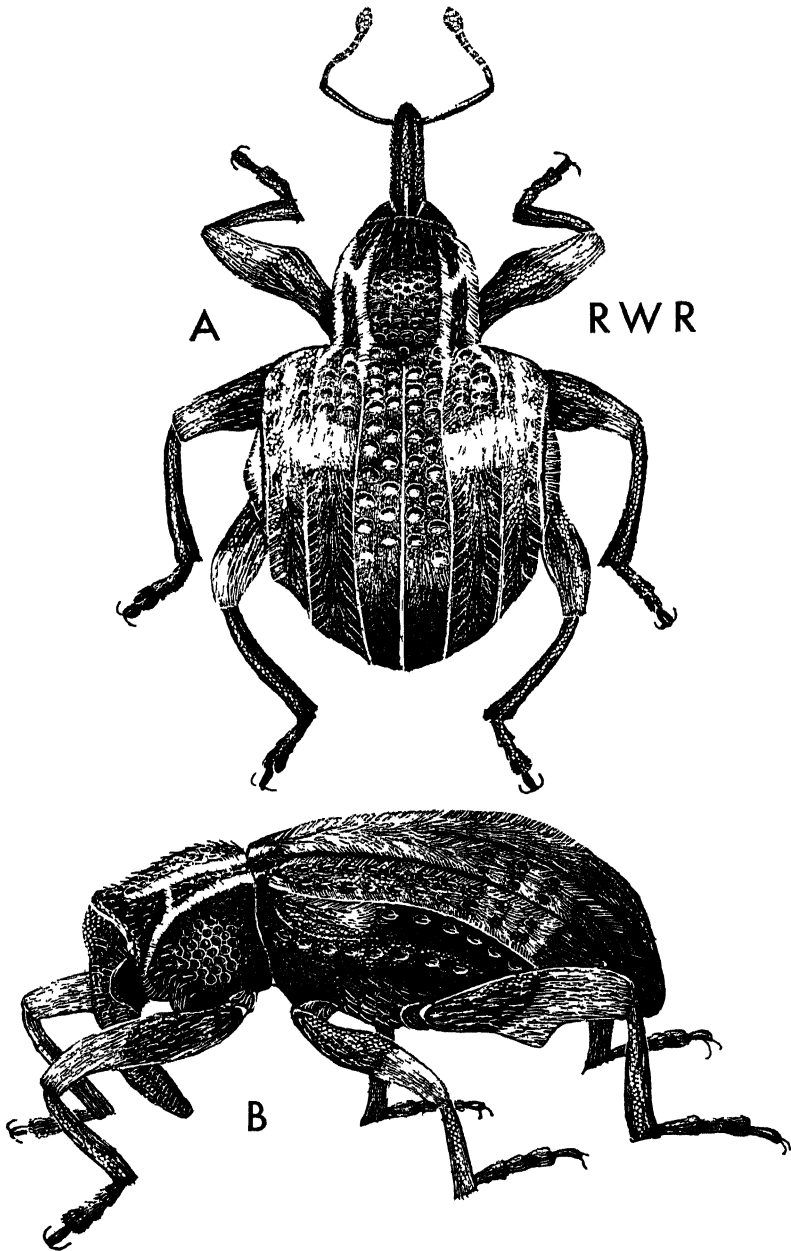


Fig. 4.—(A) Dorsal view of the cambium curculio, *Conotrachelus anaglypticus* (Say). (B) Lateral view of the cambium curculio. This species is frequently jarred from peach trees and may be confused with the plum curculio.

The cambium curculio bears a superficial resemblance to the plum curculio but is smaller and less elongate than the latter. It is more brightly colored and has two longitudinal rows of white pubescence on the sides of the pronotum.<sup>4</sup> This species is shown in Figure 4.

The adult plum curculios feed upon the foliage and other succulent parts of the tree for some time and do not begin to deposit their eggs until about the shuck-fall stage. In addition to the damage caused by females in depositing eggs, the adults also feed upon the fruit producing slight deformities or gummy spots on peaches. In many cases the beetles introduce spores of the brown rot fungus during feeding and thus indirectly cause the destruction of the fruit. Females may deposit up to 557 eggs although the average number of eggs is approximately 150 per female. The eggs are deposited just beneath the skin of the fruit and in a short time a tiny curculio larva emerges and burrows into the center of the fruit. In most cases, except in the early maturing varieties, the peaches drop when the larvae are nearly full grown, and therefore the larvae are not found in peaches at harvest. In early varieties, such as the Golden Jubilee, the fruit matures about the same time as the curculio larvae and consequently larvae may be found infesting the fruit at harvest. Figure 5 (C) illustrates typical damage to Golden Jubilee by curculio larvae.

The larvae are white or yellowish-white, legless grubs with a small brown head. It usually appears with the body in a curved position as shown in Figure 5 (A). They may be distinguished from larvae of the oriental fruit moth by the fact that the latter have three pairs of true legs and five pairs of fleshy prolegs on the abdominal segments as shown in Figure 6 (A). When full grown, larvae of the fruit moth assume a pinkish or reddish body color while mature curculio larvae which measure about one-third of an inch in length are yellowish white.

After the larvae have completed their development within the fruit they burrow through the skin, drop to the ground and enter the soil. The exit holes made by the larvae are very typical and may be used to diagnose the cause of injury. Exit holes made by the oriental fruit moth are slightly smaller and rounder than those of the curculio. Figure 5 (D) shows a characteristic curculio exit hole in a Golden Jubilee peach.

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<sup>3</sup>*Conotrachelus anaglypticus* (Say)

<sup>4</sup>In addition to the two species of *Conotrachelus* mentioned above *Conotrachelus cribricollis* (Say), *Conotrachelus posticatus* Boheman, and *Conotrachelus seniculus* Leconte have also been occasionally collected from peach.

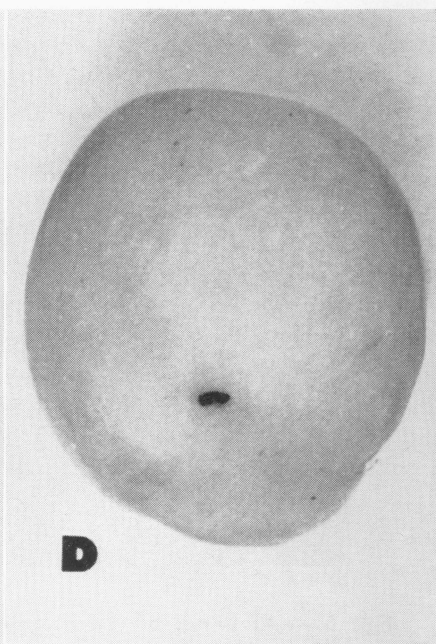
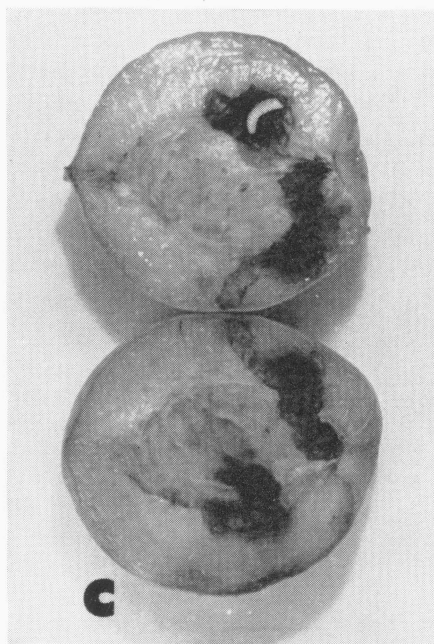
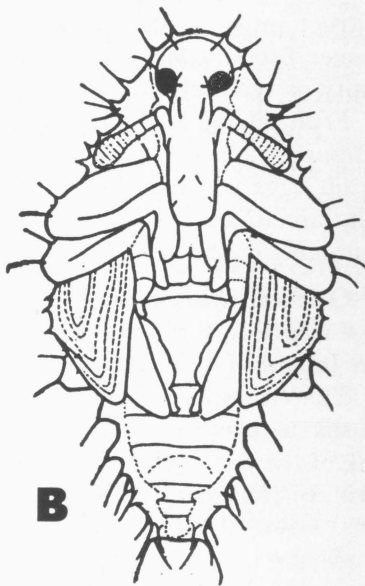
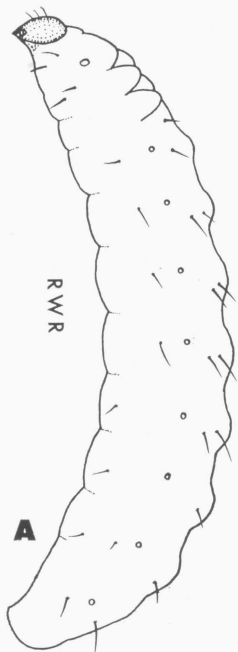


Fig. 5.—(A) Larva of the plum curculio. (B) Pupa of the plum curculio. (C) Larva of plum curculio and damage to peach. (D) Plum curculio exit hole in peach.

The larvae complete their development in the soil where they construct pupal cells and change first into pupae and then to adults. Summer brood adults emerge from about July 10 to August 5 in the vicinity of Wooster.

Fruit damage is rarely caused by the feeding of the summer brood beetles on peaches in Ohio but in Kentucky and farther south this brood deposits eggs which develop into second brood adults. Summer brood adults are found on peach trees for several days after emergence but presumably confine most of their feeding to the foliage.

**Oriental fruit moth.**<sup>5</sup> The oriental fruit moth as its name implies is not native to the United States but was introduced into this country from Japan.

The oriental fruit moth overwinters as a full-grown larva enclosed in a silken cocoon. The cocoons are located beneath the bark on the trunk of the trees or in peach mummies and other debris on the orchard floor. In the spring, the larva transforms into a pupa and later into a

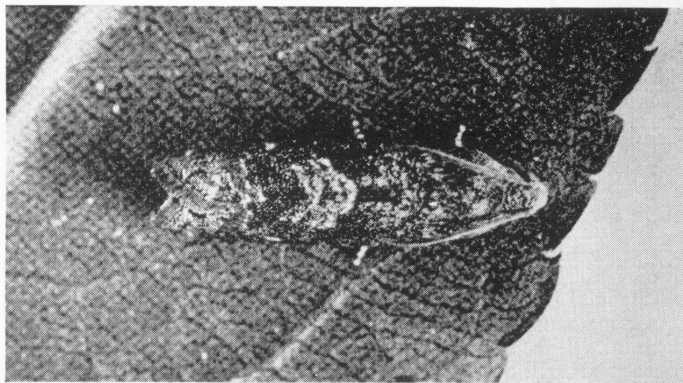
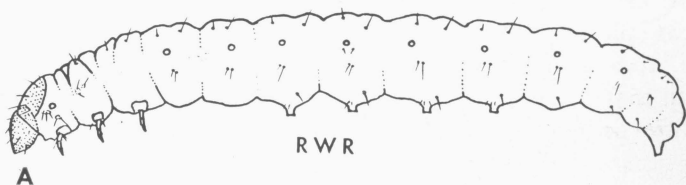


Fig. 6.—(A) Larva of the oriental fruit moth. (B) Adult fruit moth resting upon a peach leaf.

<sup>5</sup>*Grapholitha molesta* (Busck).



small, grayish moth (Figure 6 (B) ). Female moths lay their eggs on the terminal leaves of peach and other trees. The first generation larvae, upon hatching, burrow into the fruit or terminal growth and feed upon the succulent tissues. The first sign of fruit moth infestations in peach is indicated by wilting of the terminal growth (Figure 7 (A) ). In a few days these tips die and turn brown. In the southern portion of the state four to five generations of the insect occur, while in the northernmost areas only three generations are known.

Although the first and second brood larvae feed almost entirely in the terminals of peach trees, the first brood sometimes attack small fruits as illustrated in Figures 7 (B) and 7(C). Second brood larvae occasionally cause superficial fruit injury during late June and early July. During this period peaches exude considerable gum which prevents the entry of the larva. The resultant injury appears as a gummy blemish which is shown in Figures 7 (D) and 7(E).

The most severe damage is caused by the third brood larvae, which feed exclusively within the fruit. Sometimes the third brood larvae, when very small, enter the fruit at the stem end and no external signs of infestation are visible. These fruits when cut open quite frequently contain fat, pinkish "worms."

The larva of the oriental fruit moth (Figure 6 (A) ) is often confused with that of the plum curculio (Figure 5 (A) ); however, the two species differ in several respects. Larvae of the fruit moth are pinkish when mature and crawl rapidly over the surface of the fruit. On the other hand, curculio larvae are yellowish-white when full-grown, and are sluggish and grub-like in appearance.

Normally, injury to the terminal shoots of fruit trees is of little consequence but to the nurseryman it is a serious matter. The terminal shoots of young nursery stock are very susceptible to attack and in some cases every terminal may be damaged. The development of shoots from lateral buds, as a result of terminal injury, causes the tree to become bushy and its market value is considerably reduced.

**Tarnished plant bug.**<sup>6</sup> This species may cause several different types of injury to peaches although the most conspicuous injury is fruit deformation.

The adults are small, dark brown plant bugs with dark markings (Figure 8) about one-fourth inch in length. They hibernate beneath plants such as the common mullen and in other sheltered places. The insects become active very early in the spring and occur most abundantly on peaches during the bloom period. The adults which have

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<sup>6</sup>*Lygus lineolaris* (Palisot de Beauvois),

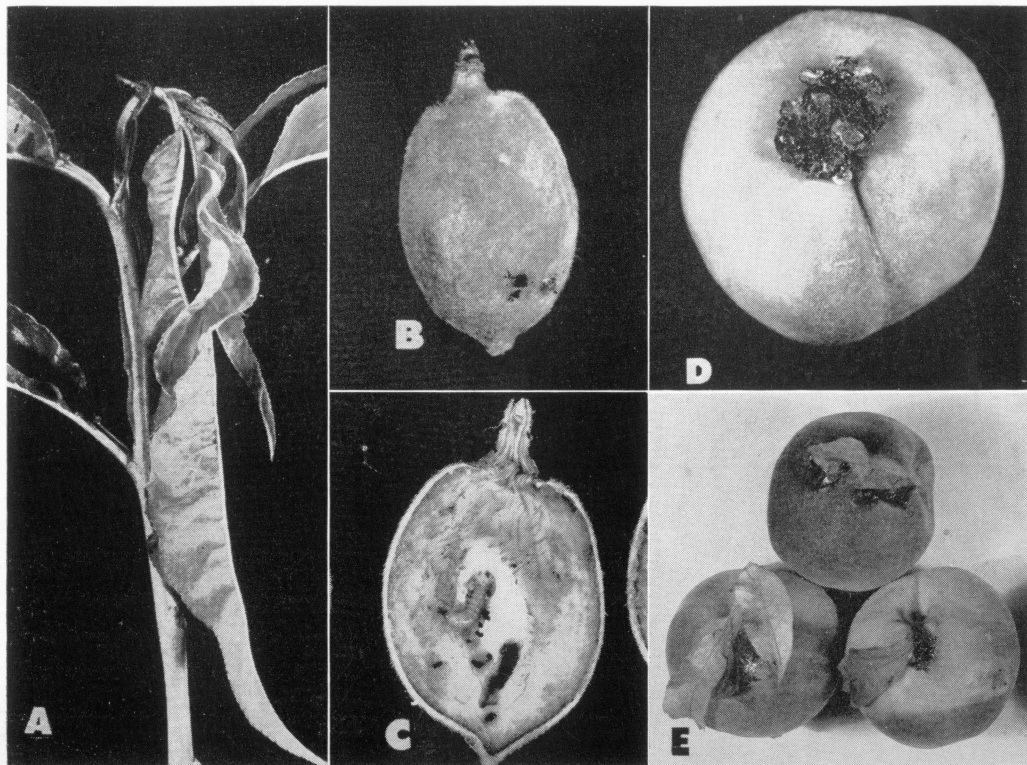


Fig. 7.—Oriental fruit moth injury. (A) Wilting of peach terminal caused by larval infestation. (B) Entrance hole of first brood fruit moth larva in peach. (C) Peach shown in (B) cut open to show larva within. (D) and (E) Second brood larval injury to peaches.

sucking mouth parts, feed upon peach blossoms and foliage. While feeding the bugs apparently inject a substance which inhibits plant growth. Most of the blossoms which are attacked drop as a result of the injury. The feeding also causes death or stunting of the growing terminals and when this occurs the new growth becomes distorted. When such injury is severe on young trees they develop an abnormal bushy appearance.

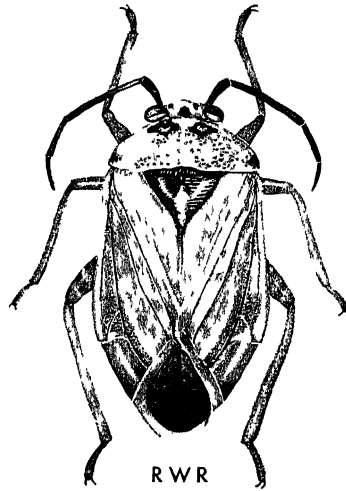


Fig. 8.—Adult tarnished plant bug.

A large percentage of the injured peaches drop to the ground prematurely. However, dropping does not occur in many cases when feeding has taken place after the fruit has reached a diameter of one-half inch. Such fruits are eventually disfigured by the uneven growth and are commonly referred to as “cat-faced” peaches (Figure 9). A similar type of injury is caused by several species of stink bugs.

When herbaceous plants appear in the spring the plant bugs usually leave orchards to deposit eggs upon legumes and various weeds.

**Stink bugs.** There are several species of stink bugs which produce various types of injury to peaches, the most easily recognized of which is the deformed or “cat-faced” injury. Species which have been found responsible for causing this type of feeding injury to peach in Ohio are the green stink bug<sup>7</sup> (Figure 10), the one-spot stink bug<sup>8</sup>, the brown

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<sup>7</sup>*Acrosternum hilare* (Say).

<sup>8</sup>*Euschistus variolarius* Palisot de Beauvois.

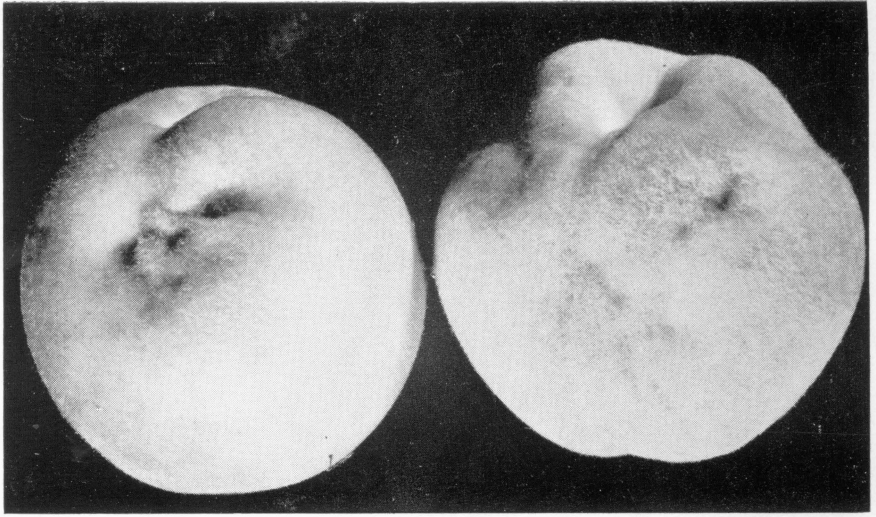


Fig. 9.—Peaches deformed by the feeding of the tarnished plant bug.

stink bug<sup>9</sup>, the northern brown stink bug<sup>10</sup> (Figure 11), the dusky stink bug<sup>11</sup> (Figure 12), and the clover stink bug<sup>12</sup>.

The one-spot stink bug and the brown stink bug closely resemble the northern brown stink bug in size and color while the clover stink bug is smaller and is greenish or brownish in color.

When these sucking bugs feed upon plant tissue they presumably introduce a salivary enzyme which breaks down the cellular tissue at the point where the beak is inserted. Although the healthy tissue surrounding the injured area grows at a normal rate, a scar is formed over the damaged area and normal development is inhibited at this point. When this occurs on peaches early in the season, the result is a “cat-faced”, dimpled or otherwise deformed fruit as shown in Figure 13 (A), (B), (C).

In addition to typical cat-facing there are three other types of injury which are not generally recognized. One of these occurs when the peaches are from  $\frac{3}{4}$  to 2 inches in diameter and is known as gum-mosis injury. This type of injury receives its name from the fact that gum exudes from peaches in droplets or strings at the point of stink bug feeding. During rains these gum droplets or strings are softened and

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<sup>9</sup>*Euschistus servus* Say.

<sup>10</sup>*Euschistus servus euschistoides* (Vollenhoven).

<sup>11</sup>*Euschistus tristigmus* Say.

<sup>12</sup>*Thyanta custator* Fabricius.

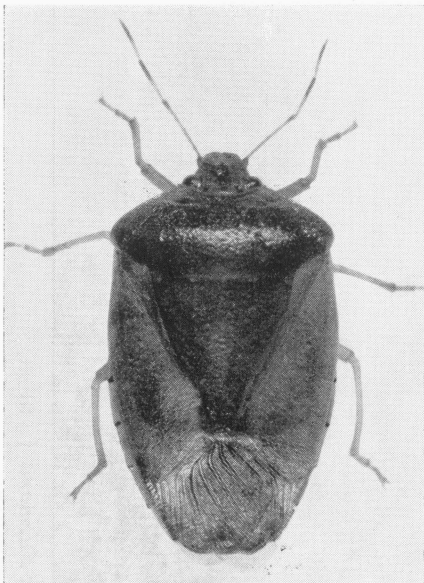


Figure 10

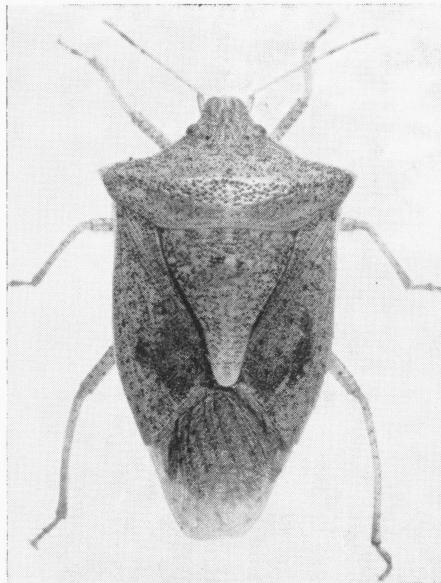


Figure 11

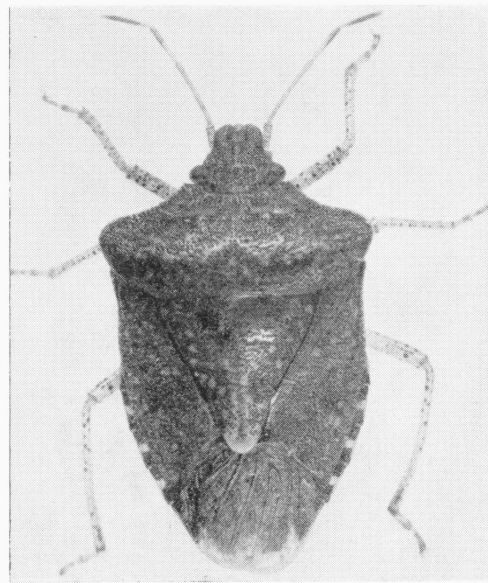


Figure 12

Fig. 10.—The green stink bug is a brilliant green insect slightly over one-half inch in length. Fig. 11.—The northern brown stink bug is slightly less than one-half inch long and is light brownish or grayish in color. Fig. 12.—The dusky stink bug is smaller than the two preceding species being only three-eighths inch long. In color it is a dark, dusky brown.

spread out over the surface of the fruit. Usually the gum is blackened by the growth of a sooty fungus which renders the fruit unmarketable (Figure 13 (D) ).

Another type of injury which occurs when the fruit is from 1½ to 2 inches in diameter is known as water-soaked injury. In this case the fruit has dark green, depressed areas which have a water soaked appearance.

The third type of injury occurs when the fruits are nearly ripe and is characterized by small depressed areas on the surface as a result of stink bugs removing juices from the ripening fruits. This type of injury is uncommon and is most often associated with the green stink bug.

Stink bugs hibernate as adults in debris and fence rows and begin to appear in the orchard at the full bloom stage. The overwintering adults are abundant for a period of about six weeks after bloom. The stink bugs do not ordinarily breed on peaches but usually develop on many species of weeds such as horseweed, tall ironweed, white cockle, and common mullen. They breed also in fields of red clover and alfalfa as does the tarnished plant bug.

In general stink bugs have one generation each year although a partial second generation may sometimes occur.

**Red-banded leafroller.**<sup>13</sup> This species has not been a serious pest in Ohio but the damage to the fruit is frequently seen at harvest time and is easily confused with that caused by the oriental fruit moth.

The insect overwinters as a pupa in leaves and debris on the ground. The moths emerge at blossom time and soon deposit small, oval masses of yellowish eggs on the trunk and scaffold limbs. These eggs hatch into slender, yellowish larvae or caterpillars which make their way to the foliage upon which they feed. The larvae feed on the undersurface of the leaf next to the midrib and eventually spin whitish silken webs over the leaf surface. When the larvae become full grown they are approximately ⅝ inch in length and in color range from a pale, dull yellowish-green to a bright green. First brood larvae usually pupate in leaves which they have rolled up by webbing. Brightly colored moths emerge from the pupal chamber around July 1. The moths are from ¼ to ⅔ inch in length and have a basal color of reddish-brown with silver, orange and gray markings. When the wings are folded a broad transverse band of reddish-brown is quite evident and it is this band which has suggested its common name.

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<sup>13</sup>*Argyrotaenia velutinana* (Walker).

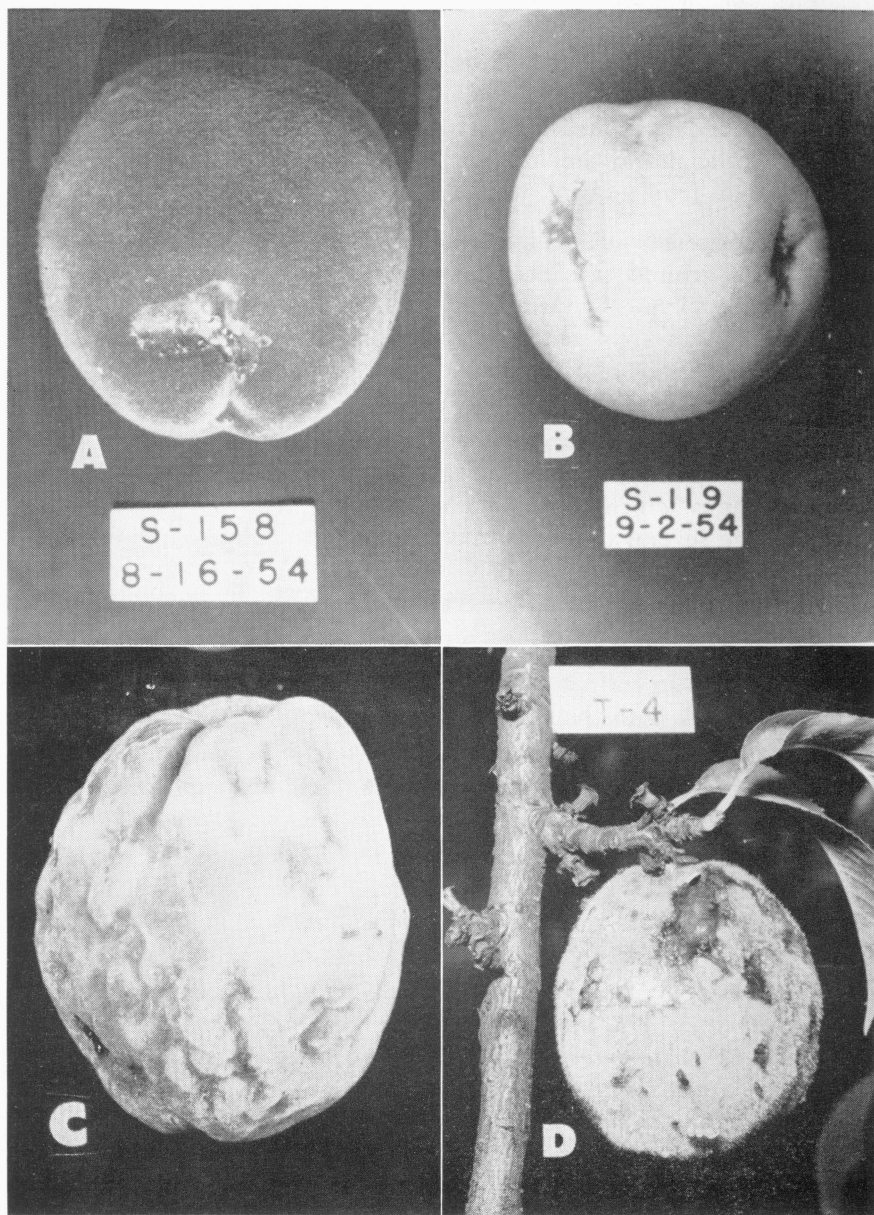


Fig. 13.—(A) Peach cat-faced by northern brown stink bug. (B) Peach cat-faced by dusky stink bug. (C) Peach cat-faced by green stink bug. (D) Peach showing gummosis injury caused by green stink bug.



The first brood moths deposit eggs on the foliage and the second generation larvae become full grown from late July to the end of September. On peaches during this period the larvae sometimes spin a web between the fruit and foliage and feed upon the ripening fruit. In some cases the larvae attack the fruit at the stem end but their feeding is very superficial and they do not burrow into the flesh like the larvae of the oriental fruit moth.

**Grasshoppers.**<sup>14</sup> Ripening peaches, particularly those on limbs close to the ground, are occasionally attacked by various species of grasshoppers. Typical injury to the fruit is easily recognized by fairly large areas which are eaten from the surface of the fruit. The "teeth-marks" of the grasshopper's chewing mouth parts are usually distinct in the damaged areas.

These grasshoppers hibernate as eggs in clusters beneath the surface of the ground. During May the eggs hatch into small, wingless, grasshopper nymphs which feed upon many different types of vegetation. After molting several times the insects mature from about the middle of August to the first of September. The grasshopper species attacking peaches have but one annual generation.

**Japanese beetle.**<sup>15</sup> This introduced species has become established and is abundant in certain areas in Ohio. In these locations the beetles sometimes attack both the foliage and fruit of peach.

The injury caused by Japanese beetle on foliage is quite conspicuous since the insects devour the leaf surface between the veins and leave only a lacy, skeletonized network of the leaf structure.

Fruit injury is generally difficult to recognize unless the beetles are actively feeding. In some cases the insects congregate in large numbers on individual peaches and completely consume the skin and flesh of the fruit leaving only the stone.

The beetle is approximately one-half inch in length and is very highly colored. The outer wings, which form a protective covering over the back of the insect, are coppery brown while the other portions of the body are metallic green. There are two tufts of whitish hairs on the end of the upper surface of the abdomen just behind the wing covers and also five tufts along each side of the abdomen.

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<sup>14</sup>*Melanoplus femur-rubrum* (De Geer) and various other species of *Melanoplus*.

<sup>15</sup>*Popillia japonica* Newman.



This insect passes the winter as a grub-like larva in the soil at a depth of about 6 to 14 inches. In the spring the larva makes its way upward and feeds upon the roots of grasses and various other herbaceous plants. In late May the larva transforms to a pupa and the adult appears during the latter part of June.

There is but one generation of this insect each year. The adults, which emerge in June, deposit eggs in the soil and the adults developing from these eggs do not make their appearance until the following season.

**Rose chafer.**<sup>16</sup> The adults of this species attack the foliage and in some cases the fruit of peach trees. Injury is seldom seen in commercial orchards which are sprayed regularly. Occasionally the feeding of this beetle produces deformed fruit similar to that known as cat-facing as shown in Figure 14 (A).

The rose chafer overwinters as a grub-like larva in the soil. In the spring the full-grown larvae work their way towards the surface of the ground and feed upon the roots of grasses, weeds and other plants. During May the larvae pupate and adults emerge from the pupae around the latter part of May or the first of June. The adult beetles (Figure 14 (B) ) are yellowish-brown and are approximately one-half inch in length. When feeding beetles are disturbed they elevate their long hind legs as if attempting to ward off the intruder. The beetles have gregarious habits similar to those of the Japanese beetle and tend to gather in masses on the fruit. The adults may feed upon the foliage and fruit for about a month after they appear.

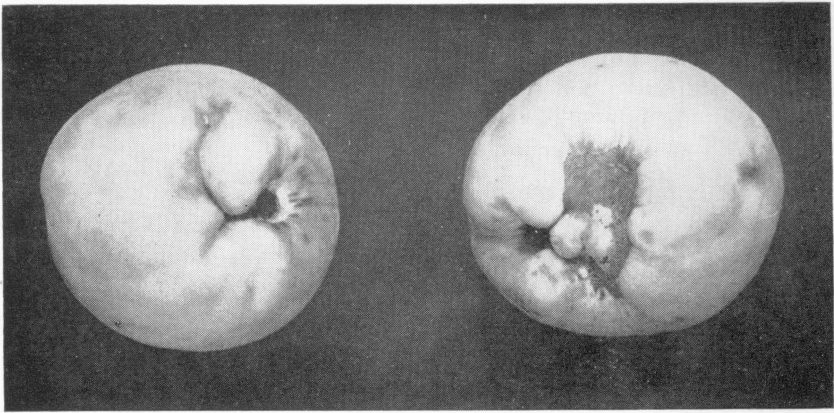
**Cotton leafworm.**<sup>17</sup> The adults of this species sometimes attack ripening or dropped peaches and suck the juice from small cracks or from small punctures that they make in the fruit. This species is not native to Ohio but under certain conditions the adult moths fly northward in large numbers as far as Lake Erie from breeding areas in the south.

The adult moths may be recognized by the fact that they are by far the largest moths found on peaches and are nearly an inch in length when the wings are folded. The adults are tan in color and some have a slight purplish tinge. There is a small, dark, oval spot near the middle of the front wing. A close examination of the dark spot shows that it has a smaller and lighter oval spot superimposed on the inner side of the dark spot. The hind wings are lighter tan without markings.

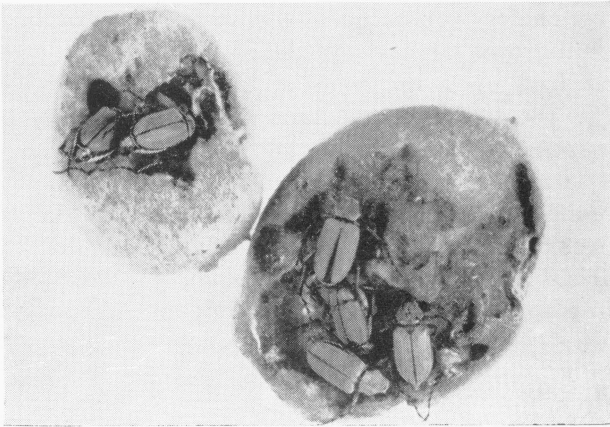
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<sup>16</sup>*Macrodactylus subspinosus* Fabricius.

<sup>17</sup>*Alabama argillacea* (Hubner).



A



B

Fig. 14.—(A) Peaches cat-faced by the feeding of the rose chafer. (B) Rose chafers feeding on peaches.

#### IV. INSECTS ATTACKING THE FOLIAGE

**European red mite.**<sup>18</sup> This mite has been troublesome only in orchards where certain insecticides, such as BHC and DDT, have disturbed the balance between mites and their natural enemies. Some strains of red mite have developed a resistance to the organic phosphate insecticides, EPN and parathion, on peaches as well as other fruit crops such as apples and plums.

<sup>18</sup>*Metatetranychus ulmi* (Koch).

Red mites cause injury by rasping the surface of the leaves and withdrawing the liquid contents of the leaf cells. Repeated feeding by large mite populations results in a bronzed or grayish leaf color which is evident from some distance (Figure 15). When this occurs the quality and size of the fruit is seriously impaired.

Mite populations reach their peak abundance during July and August and in some cases cause workers harvesting peaches considerable discomfort by crawling over the exposed portions of their skin. When mites are abundant on peaches the hands of pickers are soon covered with small reddish spots which result from crushing the mites.

Red mites overwinter as deep red eggs which in shape resemble onion bulbs. A small six-legged immature mite hatches from the egg and the fourth pair of legs are acquired after the first molt or shedding of the skin. There are then two additional immature stages, the protonymph and the deutonymph, each of which possesses eight legs. An adult female is shown in Figure 16. There are a considerable number of generations each year and these vary with the season and the climate. Nine generations have been reported from Virginia (3) and from five to eight in Ohio (7).

**Two-spotted spider mite.**<sup>10</sup> This species is sometimes confused with the European red mite but there are several important diagnostic characteristics which separate both the visible injury caused and the mites themselves. Although the two-spotted mite has feeding habits similar to the red mite, the former species has a tendency to congregate on the lower side of the leaves near the mid-vein. Thus leaves which are heavily infested usually have a profuse scattering of whitish specks, which are concentrated in irregular bands near the mid-vein and are quite visible from the upper surface. These mites also produce a considerable amount of webbing which is seldom found on leaves infested by the red mite.

The two-spotted mite overwinters as an adult female which has an orange to brick-red color. In the spring these females produce eggs which are deposited for the most part on the leafy vegetation near the ground. The eggs are spherical and of a whitish-yellow color. The developmental stages are quite similar to those described for the European red mite. The adult males and females (Figure 17 (A) and (B) ) differ considerably in size and in shape. Although definite data are not available on the number of generations which occur on peach, it is believed that they may have from 5 to 8 generations each year in Ohio.

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<sup>10</sup>*Tetranychus bimaculatus* Harvey.

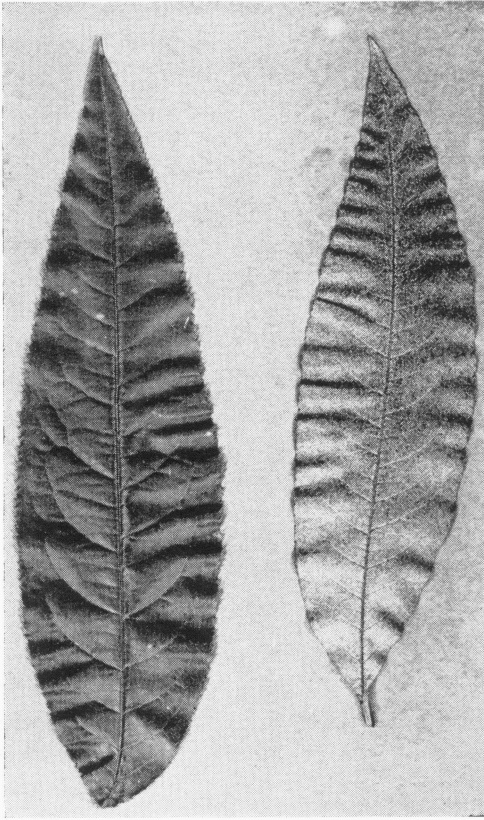


Fig. 15.—European red mite injury to peach foliage. Left, unfested leaf. Right, heavily infested leaf.

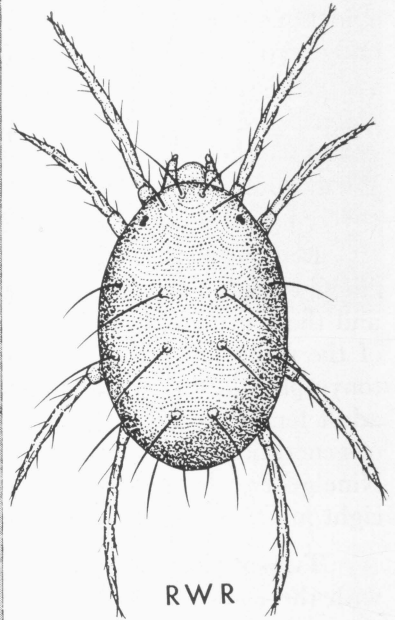


Fig. 16.—Adult female of the European red mite.

**Clover mite.**<sup>20</sup> The clover or brown mite is found occasionally on peach and may under certain conditions cause economic damage. It can be readily distinguished from the European red mite and the two-spotted mite by the extremely long front legs as shown in Figure 18.

The clover mite normally overwinters in Ohio in the egg stage but in mild winters many adults and nymphs also survive. These hibernating mites quite frequently enter houses in large numbers in early May or in late fall and although they do no actual damage their presence is very annoying.

<sup>20</sup>*Bryobia praetiosa* Koch.

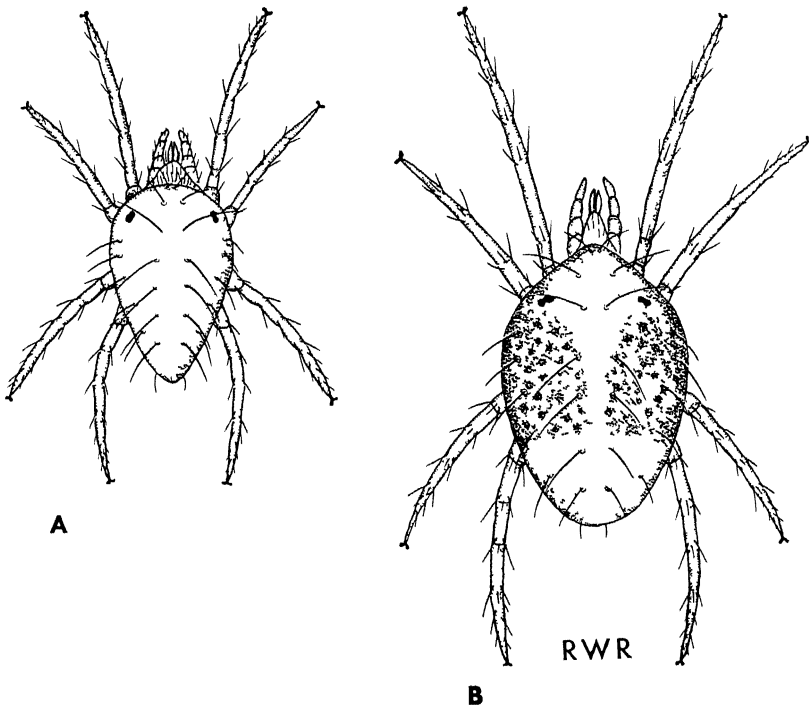


Fig. 17.—Two-spotted spider mite. (A) Male. (B) Female.

The overwintering eggs are deep red and sometimes have a yellowish tinge. These eggs hatch about the time when the peach buds are beginning to open. The young mites feed upon the blossoms and the developing leaf buds. Later generations of mites feed upon the foliage and if abundant, they cause it to turn yellowish or grayish-green. Some defoliation occurs on infested trees during periods of prolonged drouth.

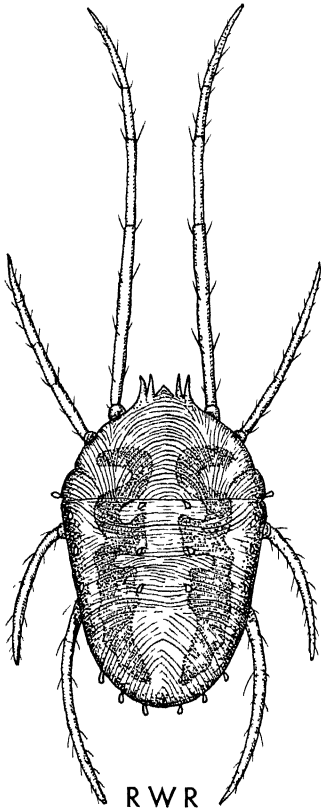
There are a number of generations throughout the growing season.

**Peach silver mite.**<sup>21</sup> This mite has caused injury in some orchards but has not been of sufficient economic importance to include in the general spraying program. It is included here to differentiate the species from other mites which occur on peach.

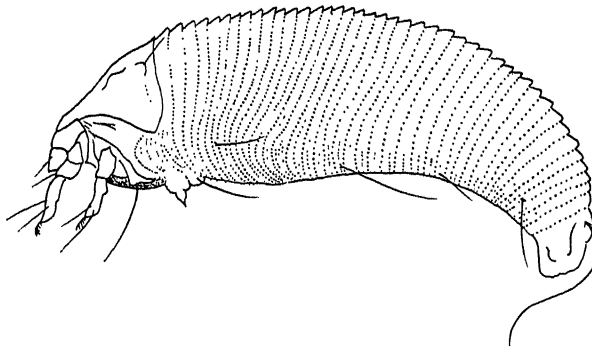
The silver mite sometimes attacks nursery stock including young peach trees and their feeding causes the lower leaves to become curled and spotted. Mature peach trees also serve as hosts and the feeding of large populations of the mite eventually result in what is commonly known as "silver leaf" injury.

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<sup>21</sup>*Vasates cornutus* (Banks)



**Fig. 18.—Adult female of the clover mite. This species is reddish-brown with a tinge of green. The first pair of legs is greatly elongated and it is by this characteristic that these mites may be distinguished from the European red mite and the two-spotted spider mite. The male is slightly smaller than the female and the abdomen is more pointed.**



**Fig. 19.—Peach silver mite. The elongate body, short legs and extremely small size separate this species from other mites attacking peaches. In length it is less than 1/100 inch long.**

The mites themselves are extremely small and are invisible to the naked eye. The unusual appearance of these mites is illustrated in Figure 19.

**Green peach aphid.**<sup>22</sup> The curling of peach leaves in the spring may be caused by either peach leaf curl or by the green peach aphid. Leaves attacked by aphids usually retain normal color but may be distorted and contain either whitish aphid skins or small green aphids. The aphids feed upon the lower surfaces of the leaves and apparently inject a toxic material which causes the leaf to curl. Ordinarily the injury caused is slight even in unsprayed orchards.

This insect passes the winter as a small, elongate shining black egg on the underside of twigs of peach trees. In the spring a very small yellowish-green aphid nymph emerges from the egg and makes its way to the newly formed leaves. The aphids mature on the foliage and produce several generations on peach, after which the aphids fly to other plants and continue breeding throughout the summer. In the fall the females return to peach and other fruit trees to deposit the overwintering eggs.

**Peach leaf miner.**<sup>23</sup> This species is apparently widely distributed in Ohio but is of economic significance in only one locality. The appearance of typical leaf miner infestation in peach leaves is shown in Figure 20.

The leaf miner spends the winter as a pupa in the leaf debris in and around the orchard. A tiny, hump-backed fly emerges from the pupa during the latter part of April or in May. After mating the female flies deposit their eggs singly within the tissue on the underside of the leaf. The small maggot-like larvae which hatch from these eggs feed between the two leaf surfaces and form a serpentine mine which may be two to three inches in length. When the larvae mature they pupate at the end of the mine and the pupae are visible through the leaf when the latter is held up to the light.

In northern Ohio there are three complete generations annually and sometimes a partial fourth.

**Leafhoppers.**<sup>24</sup> Leafhoppers are of considerable economic importance on peaches not only because of the actual injury caused but also because they are capable of transmitting peach yellows and other virus diseases.

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<sup>22</sup>*Myzus persicae* (Sulzer).

<sup>23</sup>*Phytomyza persicae* Frick.

<sup>24</sup>*Erythroneura plena* Burmeister, *Empoasca fabae* (Harris) and other species.

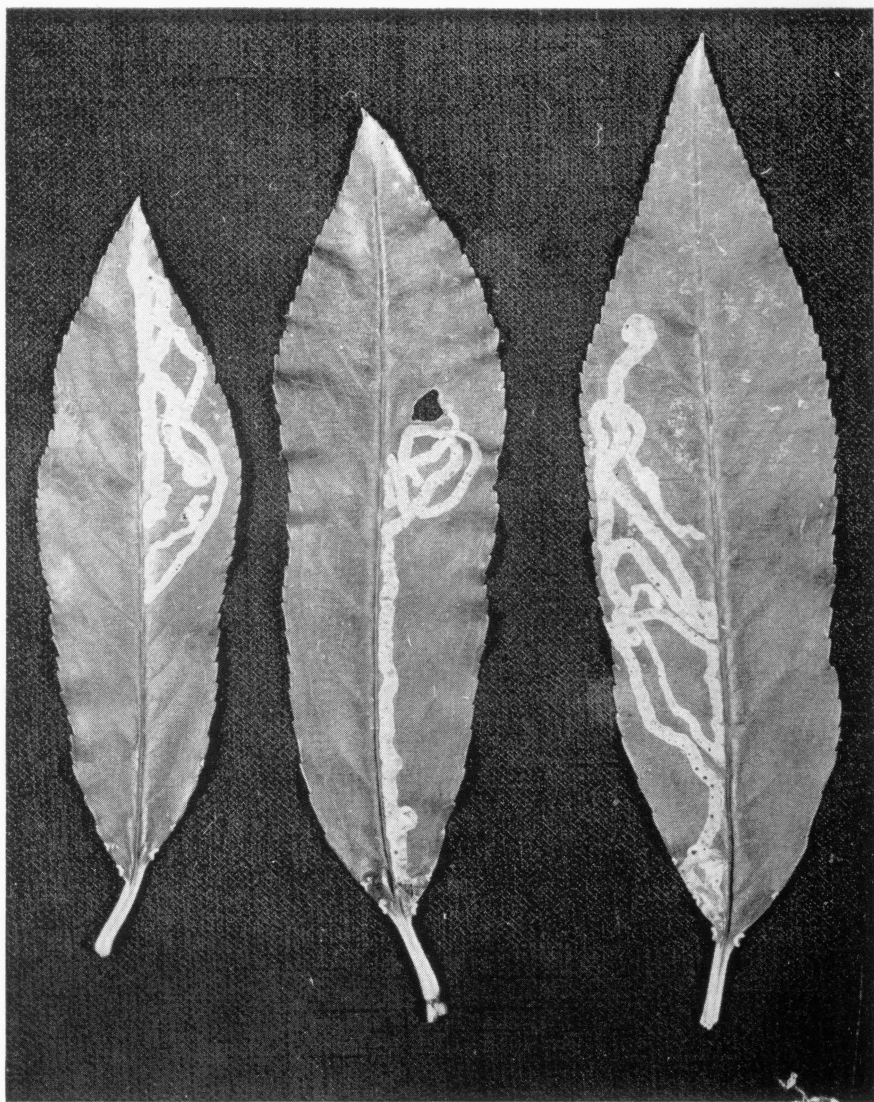


Fig. 20.—Larval mines of the peach leaf miner in peach leaves.

Leafhopper injury on peach foliage appears to be most pronounced during and for several weeks after the harvesting of Elberta peaches. The damage somewhat resembles that caused by two-spotted mite except that the whitish specks on the leaves are larger and more scattered. When the branches of heavily infested trees are disturbed



swarms of leafhoppers fly for a short distance and then return to the foliage. In some cases small, whitish or greenish nymphs which are very active, running forward, backward or sideward, may be seen on the undersurface of the leaf.

Some of the species overwinter as adults in Ohio while others winter farther southward and fly north during the summer. The eggs are inserted in the larger veins or midribs of the leaves, in the leaf stems and in other similar plant tissue. The first nymphs appear when the leaves are nearly full grown and these nymphs feed, as do the adults, by sucking the sap from the succulent portions of the leaves.

## V. INSECTS ATTACKING THE TWIGS AND SMALLER BRANCHES

**Peach twig borer.**<sup>25</sup> This species may occasionally cause some injury in unsprayed orchards but has not, to the author's knowledge, caused damage of economic importance in Ohio. Its twig-feeding habits are similar to those of the oriental fruit moth and it may be confused with the latter for that reason.

Typical injury is evidenced by the dying and browning of peach terminals accompanied by the exudation of gum where the larvae have burrowed in the twigs.

The twig borer overwinters as a partially grown larva in a silken cocoon on the trunk or limbs of peach trees. The larvae emerge from these cocoons about the time the leaves appear and burrow into the tender terminal growth. They may be distinguished from oriental fruit moth larvae by the fact that they are dark brownish in color while the larva of the fruit moth is whitish or pinkish.

Relatively little is known about the life history of this species in Ohio but it probably has from one to two generations each year.

**San Jose scale.**<sup>26</sup> This scale insect was at one time the most destructive fruit pest in Ohio. In the early part of the twentieth century entire orchards were killed as a result of the activities of this insect. Rather infrequent, but severe, infestations are still reported from time to time in Ohio.

The scale insects feed upon the bark of peach trees but in other fruits such as apple and pear the fruit is also attacked. When trees become heavily infested the entire surface of the bark is covered by a grayish layer of overlapping scale insects.

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<sup>25</sup>*Anarsia lineatella* Zeller.

<sup>26</sup>*Aspidiotus perniciosus* Comstock.

The San Jose scale overwinters as an immature scale on the bark of twigs and limbs and begins to feed when the sap begins to flow. The scales mature rapidly and, after mating, produce living young or "crawlers" which spread to other parts of the tree. The crawling forms may be spread from one part of the orchard to another by winds and sometimes by birds or other animals. After the crawlers become established they produce a waxy secretion which hardens and forms a protective scale over the insect. The pest is recognizable from the size and shape of the scale covering although considerable magnification is necessary to recognize these characteristics. The mature female scale is about 1/12 inch in diameter, nearly round in shape with a raised nipple in the center. The immature male scales are elongate-oval in shape approximately 1/25 inch long with a raised dot near the large end of the scale.

There are two to three generations per year in Ohio.

**Terrapin scale.**<sup>27</sup> The terrapin scale is not widely distributed in Ohio but in orchards where it has become established it has caused severe injury.

Infestations of this scale are usually discovered in the spring at pruning time. The small oval scales are concentrated on the lower sides of twigs and branches and when numerous cause the death of these parts. When scales are numerous they secrete a considerable amount of honeydew and sometimes nearby foliage and fruit is almost covered with this material. A sooty black fungus develops in the honeydew and renders the fruit unmarketable (Figure 21).

The insect passes the winter as a fertilized, female scale. These scales are about 1/10 inch in length, light brown in color with darker markings at the sides as shown in Figure 22. The females mature in early June and soon begin to produce living young or "crawlers" which spread to the foliage where they feed upon the undersurface of the leaves along the lateral veins. When the females are partially grown they move back to the twigs and become immobile. The male scales mature on the leaves and fly to the twigs where they die a short time after the females are fertilized.

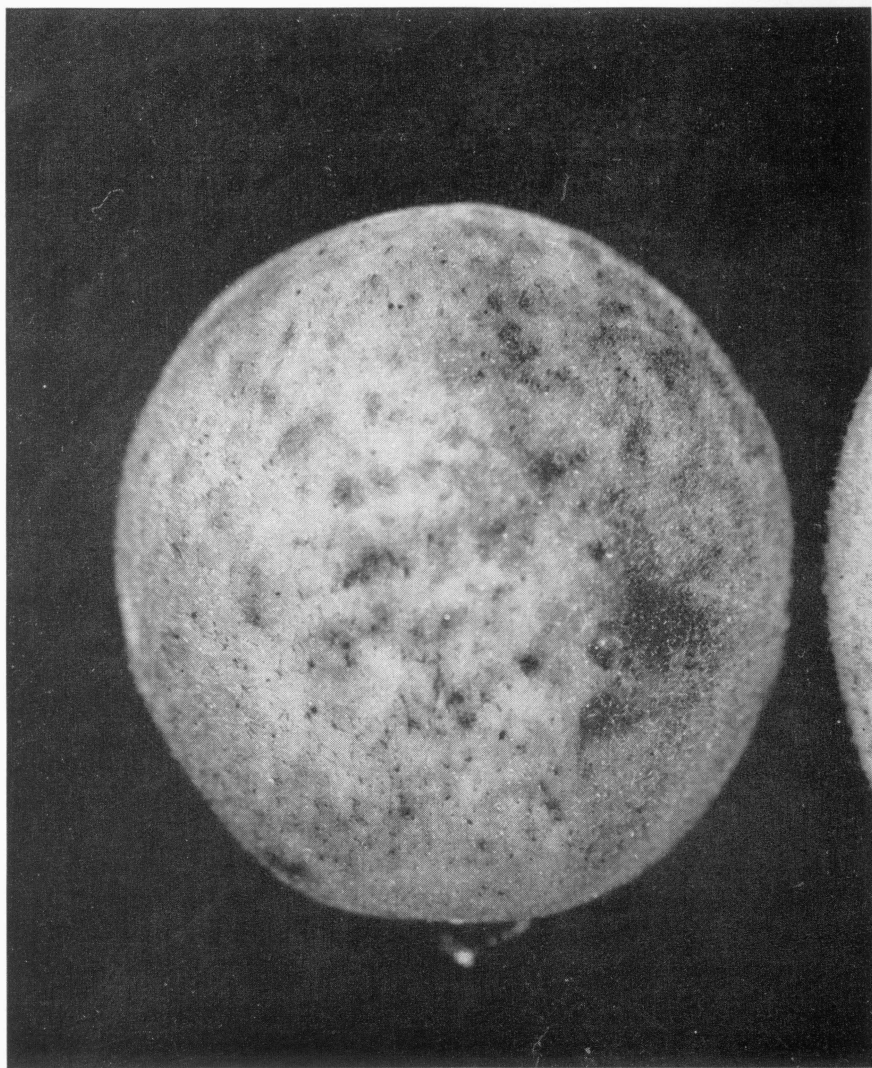
**European fruit lecanium.**<sup>28</sup> This scale insect was introduced from Europe during the latter part of the nineteenth century. The pest spread rapidly and caused considerable damage to plums, and to a

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<sup>27</sup>*Lecanium nigrofasciatum* Pergande.

<sup>28</sup>*Lecanium corni* Bouché.

lesser extent to apples in the eastern United States. It has appeared sporadically in peach orchards in northeastern Ohio, evidently as a result of applying DDT sprays for the control of the oriental fruit moth.



**Fig. 21.**—Peach covered with the honeydew secretion from terrapin scale. The secretion has been darkened by the growth of a sooty fungus.

Infestations are most frequently noticed during pruning operations when branches and twigs killed by the scales are removed. The dead limbs may be completely encrusted on the underside with old female scale coverings as shown in Figure 23.

Copious amounts of honeydew are secreted by these scales and the fruit is discolored in much the same manner as that described under terrapin scale.

This insect overwinters as a partially grown nymph on the bark of the branches. These nymphs are nearly microscopic in size and are oval in shape. Figure 24 illustrates the general appearance of the overwintering form. Growth is quite rapid in the spring and the females

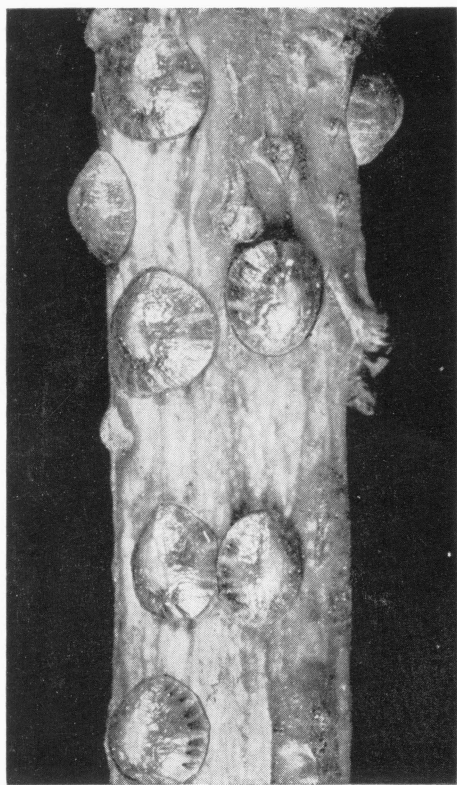


Fig. 22.—Peach twig infested with terrapin scale.

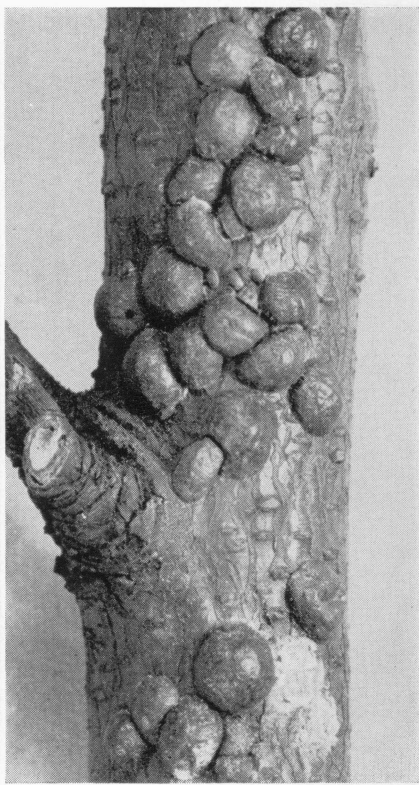


Fig. 23.—Infestation of the European fruit lecanium on peach branch.

begin to deposit their eggs in early May. A tremendous number of eggs are produced by the female over a period of several weeks. The eggs soon hatch and the crawlers move from the branches to the underside of the leaves where they feed until early fall. Just before the leaves fall the scale nymphs crawl back to the woody parts of the tree and overwinter on the underside of the smaller branches.

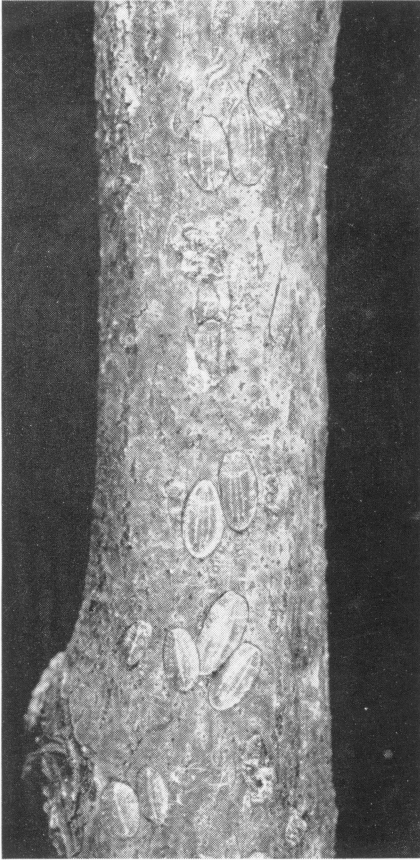


Fig. 24.—Overwintering nymphs of the European fruit lecanium.

are full grown and emerge from the soil. The nymphs appear in large numbers during early evening in late May and June and climb up tree trunks and weed stems. During the night the adults emerge from the

**Periodical cicada.**<sup>29</sup> A rather unusual and sometimes severe injury is caused by the periodical cicada. In some localities this species is known as the seventeen year locusts. The cicada does not produce its characteristic injury by feeding but damages the twigs in the process of depositing its eggs. The egg punctures weaken the branches to such an extent that they wilt and are easily broken by strong winds (Figure 25). Young trees which are severely attacked become distorted in shape and the growth of desirable scaffold limbs is retarded. The females insert their eggs beneath the bark into the sapwood of various trees. From 12 to 28 eggs may be deposited in a row in individual twigs while some females produce as many as 600 eggs.

The eggs hatch in approximately six weeks and the newly emerged nymphs drop to the ground and enter the soil. These nymphs, which feed upon tree rootlets for nearly seventeen years, are seldom seen until after they

<sup>29</sup>*Magicalicada septemdecim* (Linneus).



**Fig. 25.—Young apple tree with branches broken as a result of periodical cicada injury.**

nymphal skins and are capable of flying by the following day. The adults are shown in Figure 26 and can be distinguished from the annual cicada by the fact that the wings have an orange tinge and a black "W" may be seen on the lower margin of the front wing.

The cicadas fly about during the day feeding upon the sap of trees which causes only minor injury. The males begin their shrill singing in 3 to 4 days after emergence. Most of the adults emerge over a relatively short period but the insects may live from 30 to 40 days.



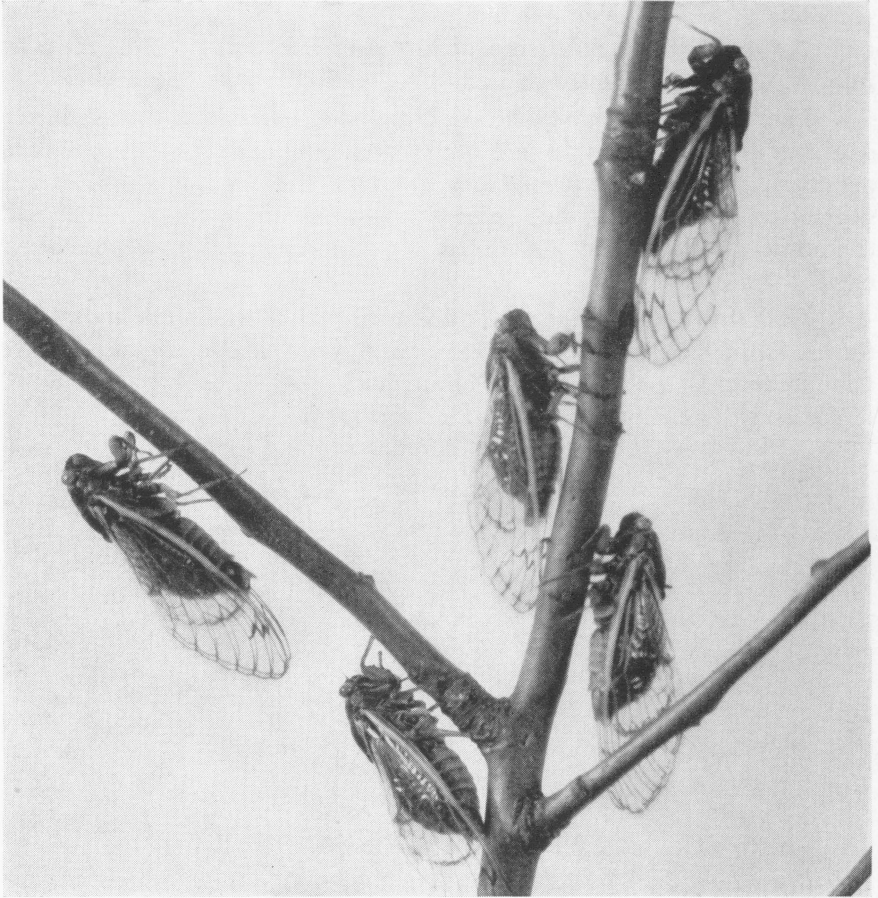


Fig. 26.—Adults of the periodical cicada.

There are four distinct broods of the periodical cicada in Ohio some of which overlap others in their geographical distribution. The adults of these broods appear in different years and the date of appearance and the distribution of these broods are announced in advance by the Ohio Agricultural Extension Service.

**Treehoppers.** The buffalo treehopper<sup>30</sup> and several related species deposit their eggs within the woody tissues of small branches of various fruit trees, including peach.

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<sup>30</sup>*Ceresa bubalus* (Fabricius).

The typical injury is shown in Figure 27 and consists of rows of curved slits in the bark of smaller branches and twigs. The bark on infested trees is roughened and has a scaly or cracked appearance.

The treehoppers, which attack fruit trees, overwinter as eggs in the sites mentioned above. In late spring, these eggs hatch into very small, greenish nymphs which drop from the tree and feed upon succulent vegetation near the ground. The nymphs mature in late summer and the adults fly to various kinds of trees including peach to deposit their eggs.

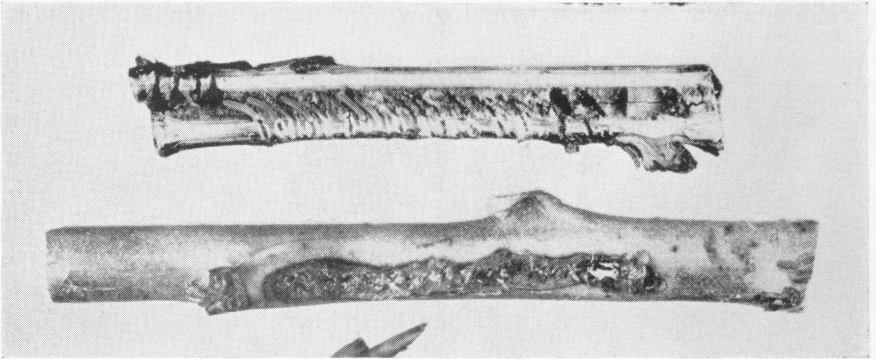
The adult treehoppers are odd-shaped insects which are about one-fourth an inch in length. When viewed from above the adults are triangular in shape and have a blunt, horn-like projection at the front of the body on each side. They are light green in color.



Fig. 27.—Treehopper injury to peach.



**Tree crickets.**<sup>31</sup> Injury by various species of tree crickets may sometimes be confused with that caused by the periodical cicada. The injury which is shown in Figure 28 may be distinguished from that of the periodical cicada by the fact that egg punctures made by the tree cricket are clean cut and round while those of the periodical cicada are splintered and slit-like. The injury by cicada usually occurs during May, June or early July while that of the tree crickets is not normally found until late summer.



**Fig. 28.**—Injury to peach by tree crickets showing method of egg insertion.

Tree crickets pass the winter as eggs in the woody portions of smaller branches of brambles or fruit trees. The young pale green nymphs emerge in the spring and feed on the foliage of various plants. Development is rather slow and the nymphs do not mature until late summer. The adults are delicate in appearance, pale greenish in color and resemble somewhat the common field cricket although more slender. In the fall the females prepare small round holes in the twigs of various plants and deposit their eggs. Although the eggs are laid singly they are deposited close together in a line along one side of the twig. The number of eggs deposited in each twig may vary from a few to as many as 75.

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<sup>31</sup>*Oecanthus niveus* (De Geer), *Oecanthus nigricornis* Walker and other species.

## VI. INSECTS ATTACKING THE TRUNK AND LIMBS

**The peach tree borer.**<sup>32</sup> This insect is one of the most destructive pests of peach and heavy infestations considerably reduce yield and many times cause the death of the tree.

The peach tree borer usually attacks peach trees at the ground level although entrances may be occasionally found several inches above the ground. After the larva has burrowed beneath the bark, it nearly always burrows vertically downward for several inches as shown in Figure 29. Even though most of the damage is caused below the soil surface, peach tree borer infestation is evident by the masses of gum and frass occurring at the base of the tree.



**Fig. 29.—Young peach tree infested with larva of the peach tree borer.**

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<sup>32</sup>*Sanninoidea exitiosa* (Say).

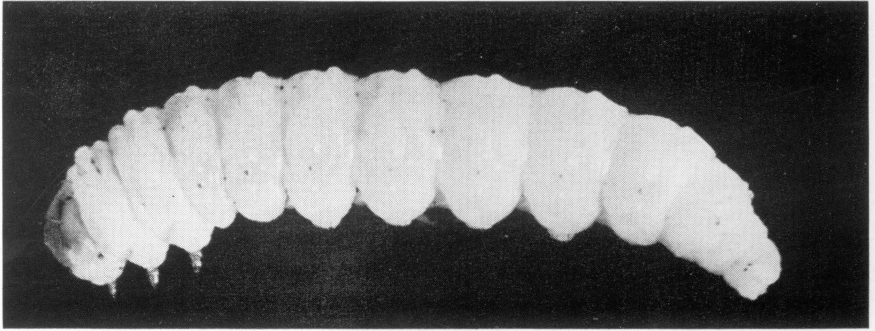


Fig. 30.—Larva of the peach tree borer.

The peach tree borer hibernates as a partially grown larva in the burrows at the base of the tree. These brown-headed, whitish larvae (Figure 30) become active in the spring and growth continues up until the first of July. When full grown, the larvae measure from 1 to  $1\frac{1}{4}$  inches in length. Prior to pupation the larvae construct a silk-lined cocoon which is covered externally by brown particles of bark fiber (Figure 31). Pupation in northern Ohio begins during mid-June and continues through August. Although a few moths emerge during the latter part of June, emergence in numbers does not occur until the middle of July. The peak of emergence occurs about the middle of August and then their numbers decline until late September. The adults of the peach tree borer are clear-winged moths and the female (Figure 32 (B) ) is easily recognizable by the broad band of orange on the abdomen. The male (Figure 32 (A) ) is covered with bright steel-blue scales and has narrow stripes of yellowish scales on the head, thorax and abdomen.

Since mating and oviposition take place very shortly after emergence, the egg-laying period corresponds roughly to the emergence period. Females lay several hundred eggs upon the bark, upon weeds or debris near the trunk or upon the surface of the ground.

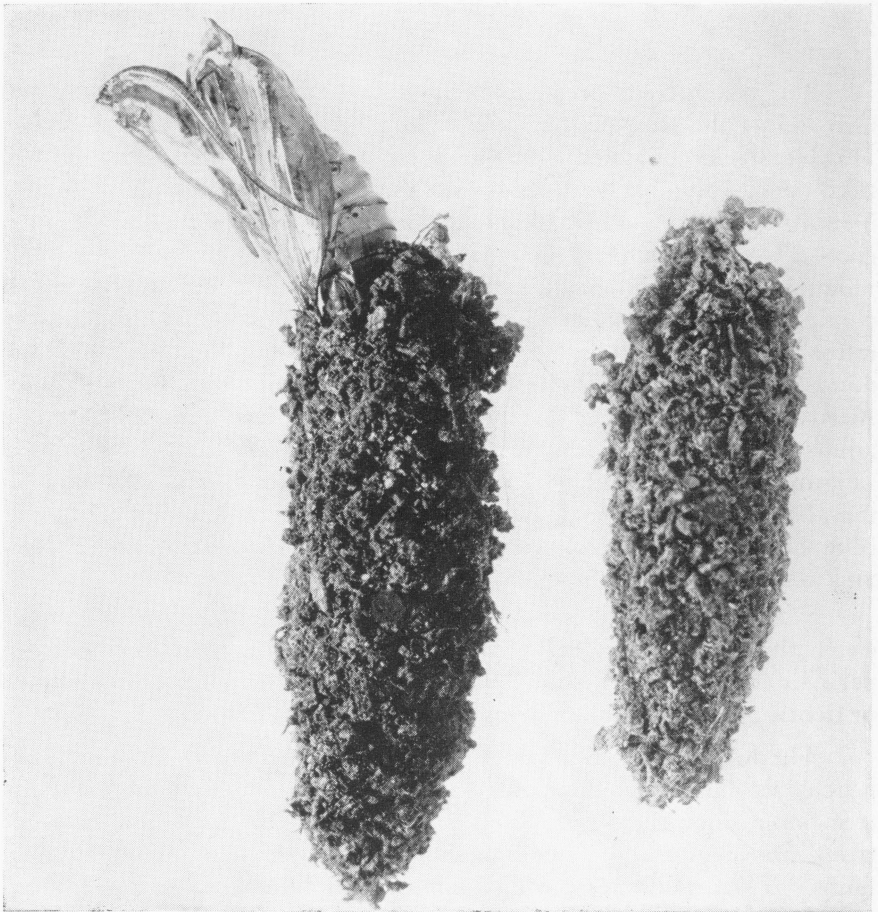
**The lesser peach tree borer.**<sup>33</sup> The injury caused by the lesser peach tree borer may be distinguished from that caused by the peach tree borer since the lesser borer nearly always infests the parts of the trunk above ground, the crotches or roughened areas on the scaffold limbs. The attacks are confined almost entirely to diseased and injured areas on the tree. Trees with wide angled crotches and smooth,

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<sup>33</sup>*Syanthedon pictipes* (Grote and Robinson).

uninjured bark are very seldom attacked. As in the case of the peach tree borer, injuries caused by the lesser peach tree borer are characterized by the exuding of gum which contains a brown sawdust-like material.

In orchards where both peach canker and lesser borer are found, a serious problem may develop. Because of the fact that peach canker may infect areas injured as a result of lesser borer infestation and because the lesser borer tends to infest cankered areas, each of these two pests thus contributes to the increase and spread of the other. Since



**Fig. 31.**—Peach tree borer cocoons with empty pupal case protruding from one on left.

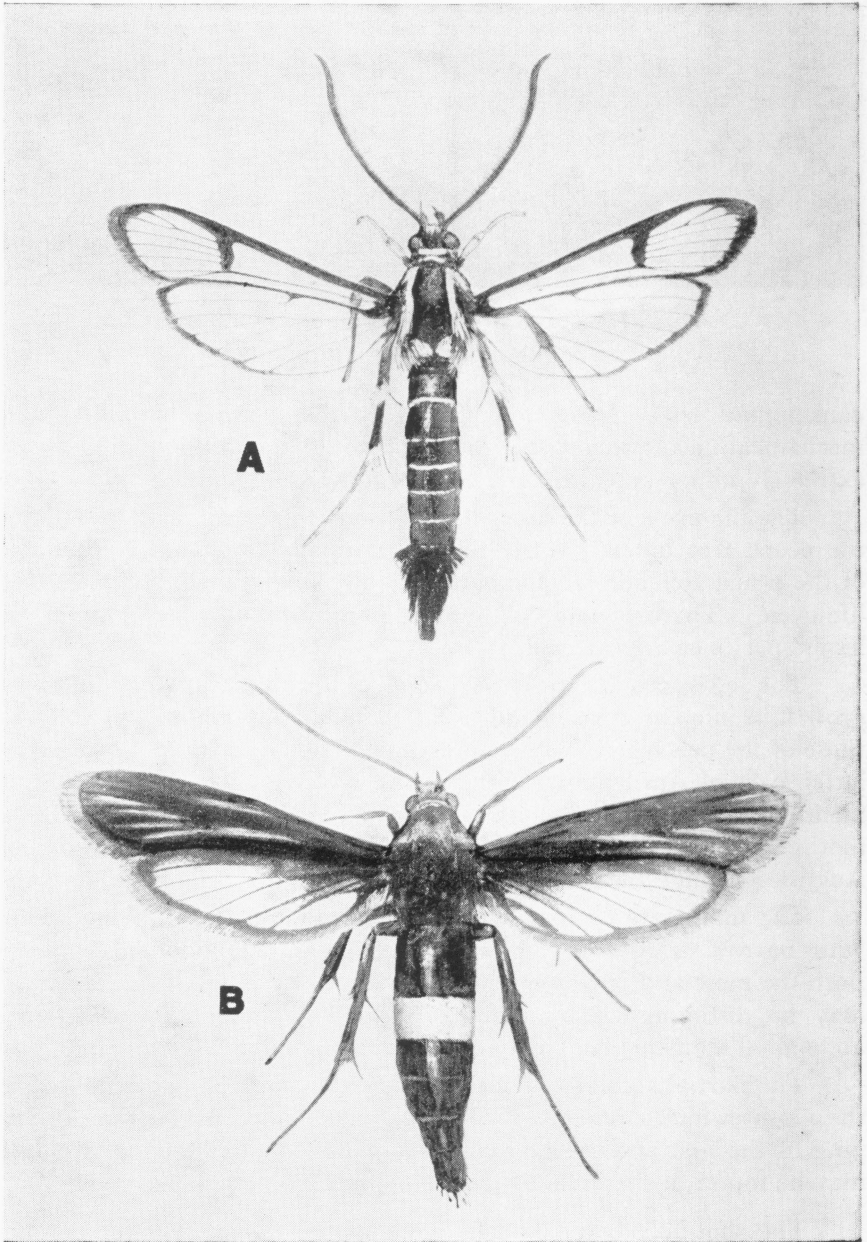


Fig. 32.—Peach tree borer moths. (A) Male. (B) Female.

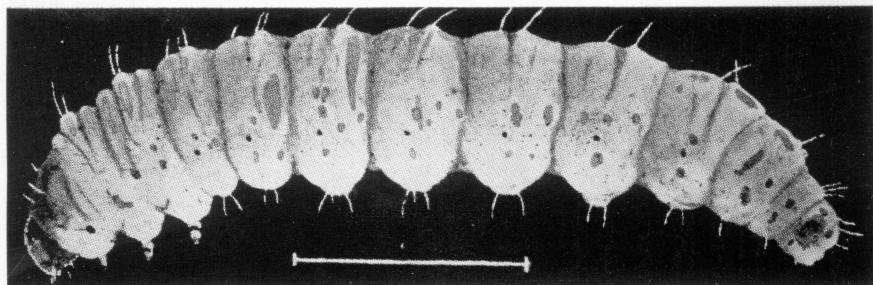


Fig. 33.—Larva of the lesser peach tree borer.

canker and lesser borer may invade areas injured by weather or mechanical means, any precautions taken to avoid such injuries are extremely important in maintaining productive orchards.

The life cycle of the lesser borer is somewhat different from that of the peach tree borer. While there is normally one annual generation of the peach tree borer, some borers require two years to complete their life cycle. There is one full and a partial second generation of the lesser species each year.

The lesser peach tree borer hibernates in different stages of larval growth in infested areas of the trees. The larvae (Figure 33) resemble those of the peach tree borer and become active in early spring. By the latter part of April many of the larvae have completed their development and constructed cocoons. In northern Ohio the first spring brood moths appear about the middle of May. Emergence extends into August, although the greatest number of moths are present in late June.

The moths are clear-winged and covered with metallic blue scales with narrow transverse yellow bands upon the abdominal segments. Both the male and female resemble the male of the peach tree borer but may be distinguished by the fact that only the second and fourth abdominal segments bear the yellow bands (Figure 34).

The partial second generation develops from the eggs deposited by the moths which emerge early in the season. Because of the overlapping of the first and second generation, eggs, larvae, pupae and adults may be found in the orchard from late June to early September.

**The shot-hole borer.**<sup>34</sup> The work of the shot-hole borer is much different from that of the borers discussed previously. Small spots of gummy exudate on the twigs, smaller branches and sometimes on the

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<sup>34</sup>*Scolytus rugulosus* (Ratzeburg).



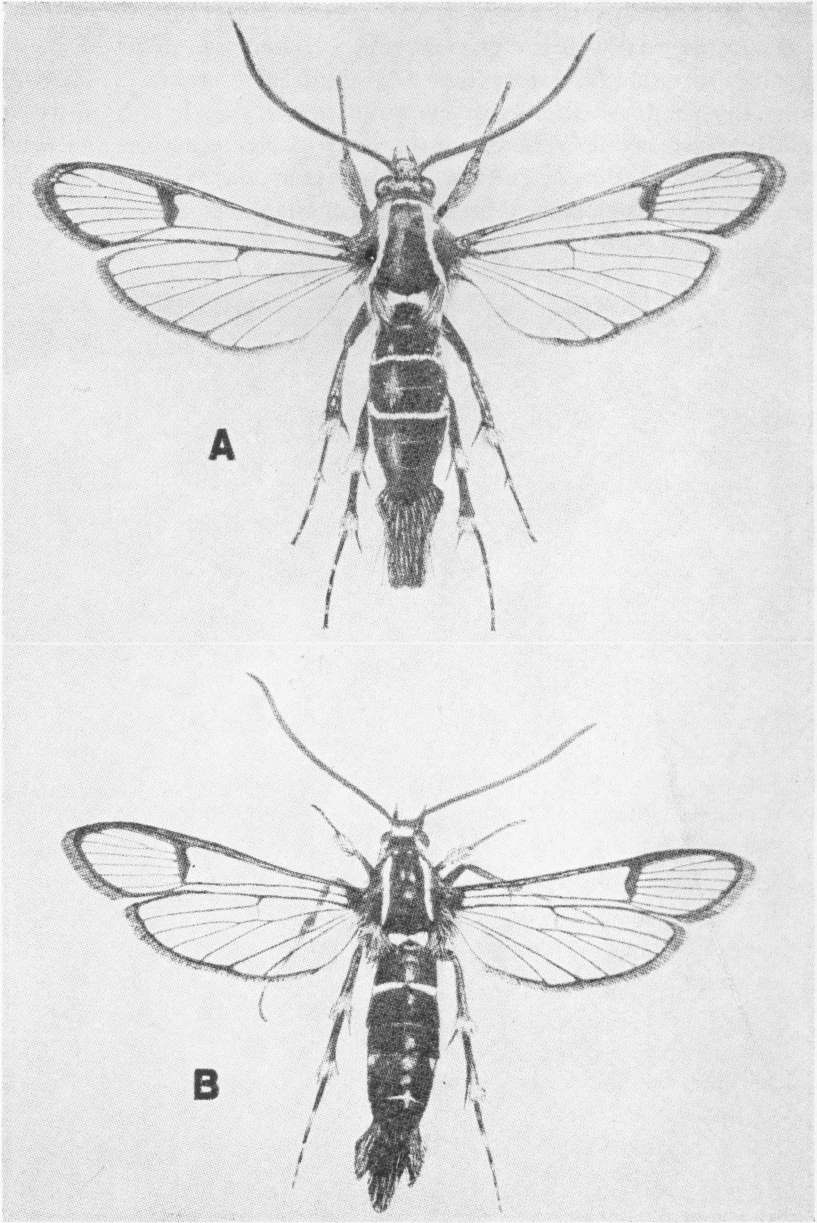


Fig. 34.—The lesser peach tree borer. (A) Male. (B) Female.

trunk, are signs of shot-hole borer injury (Figure 35). No frass is present in the gum. If the gum is removed, there will be found beneath it a small circular hole, less than 1/16 inch in diameter. This small hole is the result of attack by the adult of the shot-hole borer, a very small, blackish beetle. Beetles are not usually found in these holes because the exudation of gum forces them from the burrows before they have been able to construct their breeding chambers.

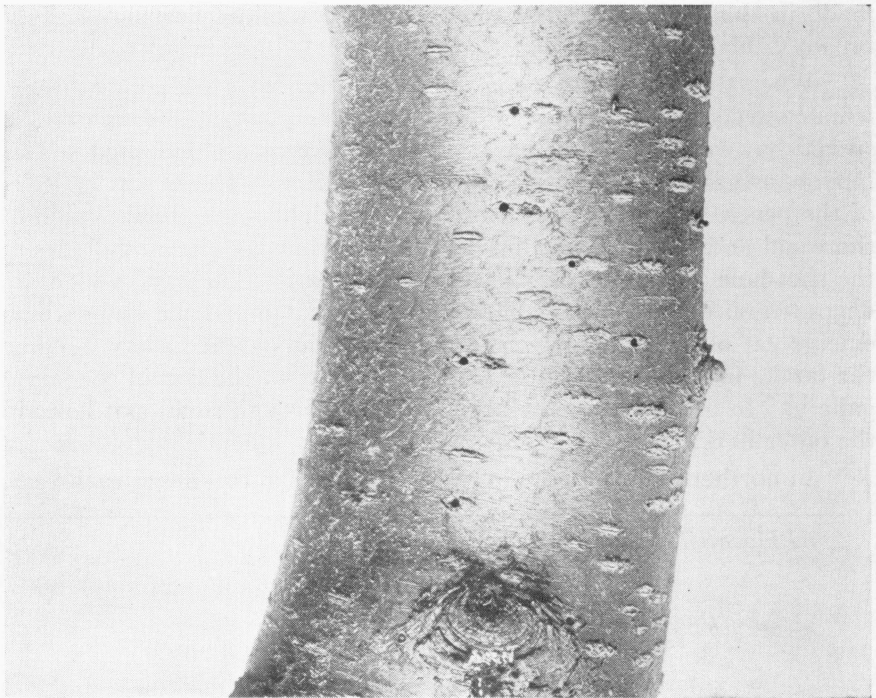


**Fig. 35.—Peach limb showing gum exuding from injuries resulting from shot-hole borer attack.**



Trees which are low in vigor or which have been injured are most susceptible to shot-hole borer attack. However, the shot-hole borer may burrow into the bark or twigs of healthy trees in the fall and from these injuries copious quantities of gum may exude the following spring. Repeated attacks on healthy trees may reduce the level of vigor to such an extent that they may become suitable for sustaining larval development. The larvae mine the sapwood in all directions and, if numerous, will kill a tree in a very short time. Trees or limbs which have been killed either partially or fully by shot-hole borers are riddled with small circular holes which are made by the adults as they emerge from their larval galleries beneath the bark (Figure 36).

The shot-hole borer hibernates as a small, pinkish-white, legless grub in the inner bark of the tree. These grubs transform to pupae and later into small beetles. The adult insect is a very small, blackish beetle about 1/10 inch or less in length.



**Fig. 36.—Emergence holes made by adult shot-hole borers in peach limb.**

Spring brood emergence begins during the latter half of May and continues until the middle of June. Maximum numbers of beetles are present during the first half of June. Eggs are laid a few days after the appearance of the females and hatch in 3 or 4 days. The larvae mature in from 30 to 36 days after hatching and pupate in the larval burrows. Beetles of the summer brood begin to appear about the middle of July and are present in the orchard until late August or early September. The progeny of the summer brood hibernate as larvae in the bark and develop into the spring brood of adults the following May and June.

**Peach bark beetle.**<sup>35</sup> This species is very similar in habits to the shot-hole borer although it is not quite as destructive nor as widely distributed. Infestation of peach limbs and trunks by this species is characterized by small beads of gum exuding from injured areas. When the outer bark of injured areas is removed the borer galleries which radiate in all directions are quite noticeable.

The peach bark beetle hibernates as an adult in pupal cells in dead or dying limbs or in specially constructed overwintering cells which are made in the bark of healthy trees. The adults are very small, light brown to blackish beetles which are less than 1/10 inch in length.

When the beetles emerge in the spring they mate and soon after the female selects trees or limbs which are low in vigor and prepares a special burrow beneath the bark in which the eggs are deposited. This burrow or gallery is known as the parent gallery. The parent galleries of the peach bark beetle are constructed at right angles to the grain of the wood and have a slight fork at the end while the parent galleries of the shot-hole borer run parallel with the grain. The eggs, which are deposited on the sides of the parent galleries, hatch and the grubs which emerge eat out galleries which radiate from the parent gallery. When the larvae or grubs are full grown they pupate at the end of the larval gallery. In a short time the adults emerge through small exit holes in the outer bark.

In northern Ohio there are two generations of this insect each year.

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<sup>35</sup>*Phloeotribus liminaris* (Harris).

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