

OKLAHOMA

AGRICULTURAL EXPERIMENT STATION.

Bulletin No. 26--June, 1897.

Some Injurious Orchard Insects

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Some Injurious Orchard Insects.

This bulletin has been prepared in order that it might answer some of the needs of the fruit growers of Oklahoma. No attempt has been made to include all the insects that are injurious to orchard fruits and trees but some of those that are troublesome and others that are likely to become so are described.

This department is always glad to receive inquiries in regard to insects and would be glad to prescribe an easy and efficient remedy for all the injurious sorts. This is, in many cases, an impossibility with our present means of combatting insects. The most practicable means will be recommended in each case but this is not always an easy and inexpensive one.

It is expected that fruit growers of Oklahoma who receive this bulletin will preserve it for future reference. An account of the insects herein considered will not be likely to appear from this station in the near future.

SPRAYING APPARATUS.

It has been proven many times that the spraying apparatus for distributing poisons or kerosene emulsion is at once the most efficient and economical means of destroying many insects. This apparatus may be called expensive, but the intelligent use of the apparatus will frequently make the difference between a full crop and a complete failure. A good apparatus ought to last a man a life time; provided it is not accidentally broken. The work is so rapid that two or more growers may possibly own an apparatus in partnership and each get sufficient use of it. The fruit growers of Oklahoma can scarce expect complete success without the use of a spraying apparatus.

Spraying outfits range in price from \$1, suitable for spraying a single window plant, to \$125 which buys an outfit that

uses steam power for force. A knapsack sprayer costs from \$4.50 to \$20. This is intended to be carried on the back of the user and when full, weighs nearly fifty pounds. The bucket spray pumps cost rather less, but are not suitable for extensive use.

Probably the most satisfactory spraying pump for Oklahoma orchardists to purchase is one that can be fastened to a barrel. This style can be had for about \$12, without the barrel. An old vinegar barrel well washed out will answer every purpose. The barrel with the pump attached can be placed in a wagon or on a sled and drawn with a horse.

There are some essential points that should not be overlooked in selecting a spraying pump. In the first place the nozzle should distribute the mixture in as fine a mist as possible. Second, there should be some arrangement in the tank or barrel that will keep the mixture well agitated, for, unless this is done, the ingredients of the mixture that are heavier than water will settle to the bottom. Third, there should be an ample but not too large air chamber on the pump which will cause the spraying to continue after the handle of the pump ceases to be operated.

The mixtures that are used for both insects and fungi are so simple that every fruit grower should know how to make and use them.

BORDEAUX MIXTURE.

1. Dissolve six pounds of copper sulphate in six gallons of water in an earthen vessel.

2. Slake four pounds of fresh lime in six gallons of water.

Pour 2 slowly into 1 and add twenty gallons of water. Mix thoroughly and strain through coarse gunny-sacking into a barrel. Reject the undissolved material and add eighteen gallons of water and the mixture is ready for use. The mixture will keep in this condition as long as desired.

Orchards should be sprayed with this after the leaf buds but before the flower buds open, to prevent fungous diseases. Add four ounces of Paris green to the fifty gallons of mixture, prepared as above described, and spray the orchard just after the flowers have fallen to further prevent fungous diseases and coddling moth, leaf-crumpler, bag-worm and others. Make a third application about ten days after the second.

KEROSENE EMULSION.

1. Soap, 1½ lb.
2. Coal oil, 2 gals.
3. Rain water, 1 gal.

Heat 3 to the boiling point and then dissolve in it 1 and when cool add 2 and agitate vigorously until a creamy mass is formed; dilute with nine parts of water and apply for all kinds of sucking insects.

This bulletin is in no sense an advertising medium but as a matter of information the addresses of a few firms who deal in spraying apparatus are given:

The Bean-Chamberlain Manufacturing Co., Hudson, Mich.

The Deming Co., Salem, Ohio.

The Field Force-pump Co., Lockport, N. Y.

Morrill & Morley, Benton Harbor, Mich.

F. E. Myers & Bros., Ashland, Ohio; branch office, Crane & Co., Kansas City, Mo.

Spraying is not all that is necessary to keep an orchard practically free from insects. It is very easy to keep a breeding place in or near the orchard from which hosts of the enemy may come forth. Therefore every dead or decaying tree or limb should be speedily removed and only the thrifty allowed to remain.

THE APPLE LEAF-CRUMPLER, *Phycis indiginella* Zeller.

This insect is one of the most common in the orchards of Oklahoma. It is not only abundant in the orchards, but large numbers will be found on trees that are growing on town lots. Its work is not confined to the apple, but it infests plum and cherry as well.

During the winter the larvæ will be found in a crooked and twisted horn-like case, lined with silk and obscured by dry leaves on the outside, the whole being attached to the tree by a silken thread in such a manner that the bunch closely resembles dry leaves in normal position.

As soon as the young leaves start in the spring these larvæ, which are about half grown, will come out and begin feeding on the foliage, often eating out the terminal bud. They feed until May, in the latitude of Oklahoma, when they pupate within the horn-like cases above mentioned, and in a short time

thereafter they appear as moths, which lay eggs on the trees. These eggs soon hatch and the larvæ begin feeding and forming new cases in which to pass the following winter, and thus its life history is completed.

Remedies.—Trees that have been sprayed with poison for codling moth are not usually injured by this insect, as it eats the poison and dies. If the trees are not sprayed, the cases may be pulled off in winter.

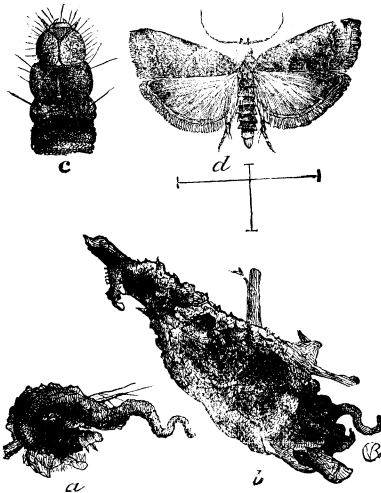


FIG. 1.—The apple leaf crumpler, *Phycis indiginella* Zeller. *a*, tube showing head of larva; *b*, mass of tubes and leaves; *c*, head of larva; *d*, moth. (After Riley.)

Some of the leading entomologists claim that it is best to burn the cases as soon as gathered, while others claim that the parasite which is always found with the leaf crumpler should be saved from destruction, and advise that the gathered cases be carried to some place at least forty rods from any fruit tree and left in an open receptacle whence the parasite may escape to carry on its work of destruction, while the larva will not be able to again reach its food plant and must therefore die.

It is the custom to go through the orchard on the station grounds some time during the winter and collect all the larvæ that may have otherwise escaped destruction. In spite of this vigilance there are always some to be found. The following is the result of a count that was made the past winter on trees which were planted in 1892 at the age of two years and which have made an average growth:

Number of trees counted	66
Largest number of cases on any one tree	141
Smallest number of cases on any one tree (two trees)	0
Average number of cases per tree	24

The per cent. of these cases which contained living larvæ was further ascertained, as follows:

Number of cases opened	280
Number containing larvæ	220
Number containing no larvæ	60
Per cent. containing larvæ	79
Per cent. containing no larvæ	21

The per cent. of empty cases is higher than might be expected, and the reason that may be offered is that the larvæ that built the empty cases may have been destroyed either by birds or parasites. It is maintained by some that birds will keep the insect in check, but in practice this is not found to be the case.

It took one man four hours to collect the 1,584 cases.

THE CODLING MOTH, *Carpocapsa pomonella* Linn.

This is one of the most troublesome insects with which the apple grower has to contend. There are two broods each season. The first brood comes from eggs that are deposited by a

moth in the blossom end of young apples just after the blossoms fall. In a few days the larvæ hatch from these eggs and begin eating their way toward the core of the young apple. It feeds in the apple for about four weeks, when it leaves the apple and finds a suitable place on the bark of the tree, where it transforms to the pupa and finally to the perfect stage, and thus, within the period of about eight weeks, its cycle of life is completed. The summer brood of moths lays eggs on the apples and the larvæ from these feed on the apples until fall, when they remain in the

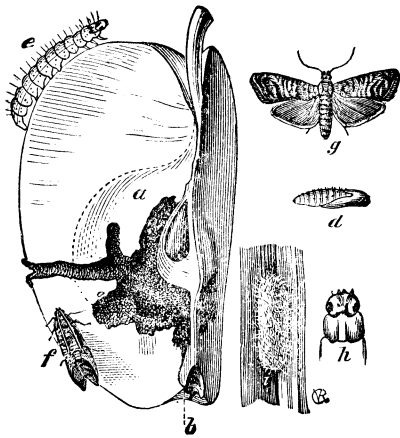


FIG. 2.—The codling moth, *Carpocapsa pomonella* Linn. *a*, work of larva inside the fruit; *b*, place where larva entered; *d*, pupa; *e*, larva; *f*, moth at rest; *g*, moth with wings spread; *h*, head of larva, magnified; *i*, cocoon. (After Riley.)

apple or crawl out and spin a slight cocoon in which they pass the winter and appear the following spring as moths,

about the time that apple trees are in bloom, to lay eggs for the first brood of the season.

Remedies.—Great benefit has been derived from the use of arsenical poisons against this insect. Spraying the orchard is the only successful means of subduing it. The operation is so simple with the proper facilities that no apple grower can afford to neglect it. Sufficient direction for the application of the poison will be found under the description of "Bordeaux mixture." If Paris green is to be used separately it should be applied in the proportion of one pound of Paris green to 200 gallons of water.



THE APPLE TREE TENT CATERPILLAR,

Clisocampa americana Harris.

The presence of this insect is always known by the mass of web that it spins in which to live. In the latitude of Oklahoma the larvæ hatch in April from eggs that have been laid by the moth the previous season. They feed for a short time on the gummy secretion that is left on the egg shells, but soon begin to feed on the young, tender foliage and at the same time to spin a web on some near by branch or twig. As the age and size of the larvæ increase the web is likewise increased until it becomes very conspicuous on account of its great size and the devouring of the neighboring foliage by the larvæ. The larvæ of a colony remain in the web at night and until about the middle

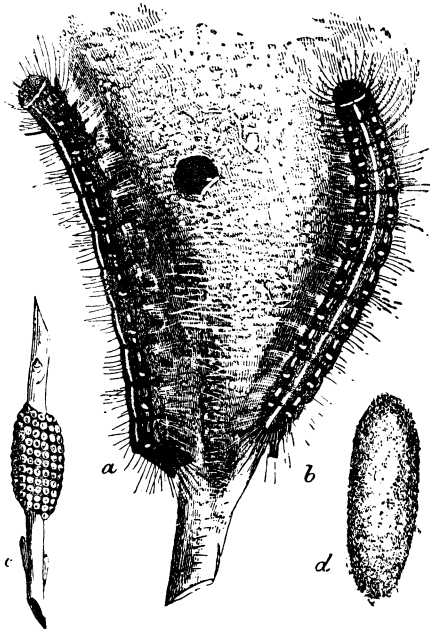


FIG. 3.—The apple tree tent caterpillar, *Clisocampa americana* Harris. *a* and *b*, larvæ on the outside of tent near entrance; *c*, egg mass of an allied species; *d*, cocoon; the female above all.

of the forenoon of the next day, when they come out and feed for a short time and return to the web and then feed again in the afternoon and return to the web.

They feed in this manner for only a few months, when they become full grown and leave the tree and find a suitable place for pupation, where they spin a cocoon and soon appear in the moth stage and lay eggs in masses on the twigs. The eggs remain without hatching until the following season.

The moth is dull brown in color, measuring about an inch and a half across when the wings are expanded. The moth conceals itself by day and is often seen around artificial light at night.

Remedies.—Where the trees have been sprayed for codling moth the larvæ of this will generally be poisoned. The eggs may be destroyed in winter by hand or the web may be taken out and destroyed at a time when the larvæ are in it.

The remedies are so easily employed that this enemy should be speedily conquered.

THE BAG-WORM, *Thyridopteryx ephemeraeformis* Haw.

This insect is most frequently found when the tree is not in leaf, for then the bags that are built are more readily seen.

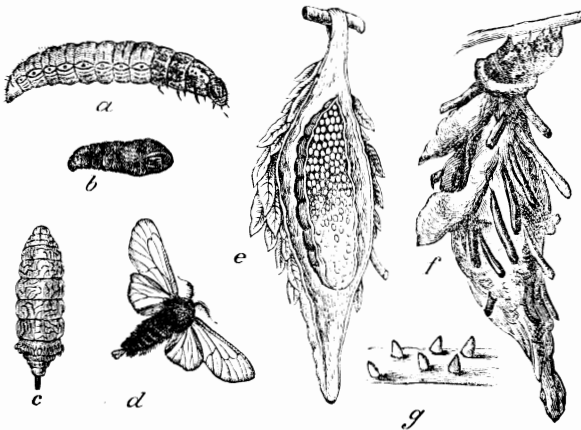


FIG. 4.—The bag worm, *Thyridopteryx ephemeraeformis* Haw. *a*, larva; *b*, male pupa; *c*, female moth; *d*, male moth; *e*, bag and pupa cut open to show eggs; *f*, full grown larva with bag; *g*, young larvæ with conical, upright coverings; all natural size. (After Riley.)

The bags or sacs are suspended from twigs of trees of various sorts and are often found on the dry stems of weeds. The bags are about two inches long, thickest in the middle and taper toward each end. If some of these are cut open at any time during the winter, a part of them (those of

the female) will be found to contain a considerable number of yellowish eggs. After the foliage has started in spring these eggs hatch and the young come forth and each individual begins to build for itself a sac, which he increases as the size of the body demands, and begins to feed on the leaves of the apple tree or any other of several species of trees, depending on the location of the sac from which the larva came. The larva always carries the sac on the extremity of its body. When it is full grown it drops to the ground by a silken thread and wanders about for some time until it finds what it considers another suitable tree or other support, which it ascends, and fastening the sac to a twig, withdraws into the sac and transforms to the pupa and soon to the moth stage. The female is wingless and never leaves the sac, but lays her eggs within the sac as we find them in winter. The insect is capable of doing a great deal of damage if not interrupted.

Remedies.—Trees that have been treated with arsenical poisons for codling moth will not be likely to be injured by this insect. The bags may be gathered from the trees in winter and disposed of same as for leaf-crumpler.

THE FLAT-HEADED APPLE TREE BORER,
Chrysobothris femorata Fabr.

This beetle is very different in its life history, family relations, and appearance from the round-headed apple tree borer, although the popular names of the two are much alike.

The eggs are laid late in April or in May on the trunk of the tree, or sometimes on the larger branches. As soon as the egg hatches, the larva makes its way into the inner bark and sap wood and excavates shallow chambers from one-half to two-thirds of an inch broad in some places and narrower in others, and in doing this frequently girdles the tree. Later in the season it works into the more solid wood either upward or downward, and returns to near the sur-

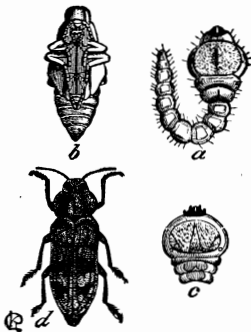


FIG. 5 — The flat headed apple tree borer, *Chrysobothris femorata* Fabr. a, larva; b pupa; c, head of larva enlarged; d, mature beetle. (After Riley.)

face, where it transforms the next spring to a pupa and finally to a perfect insect, when it comes forth to lay eggs for the continuation of the species, the cycle of life being completed in one year. The beetle is about one-half inch long and one-half

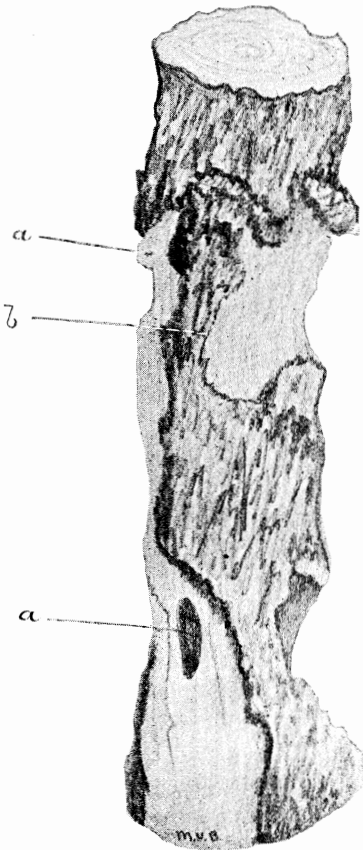


FIG. 6.—Work of flat headed apple tree borer. Stem completely girdled except a narrow vein shown at *b*: *a*, hole where borer entered stem; natural size. (M. V. Bogue, Del.)

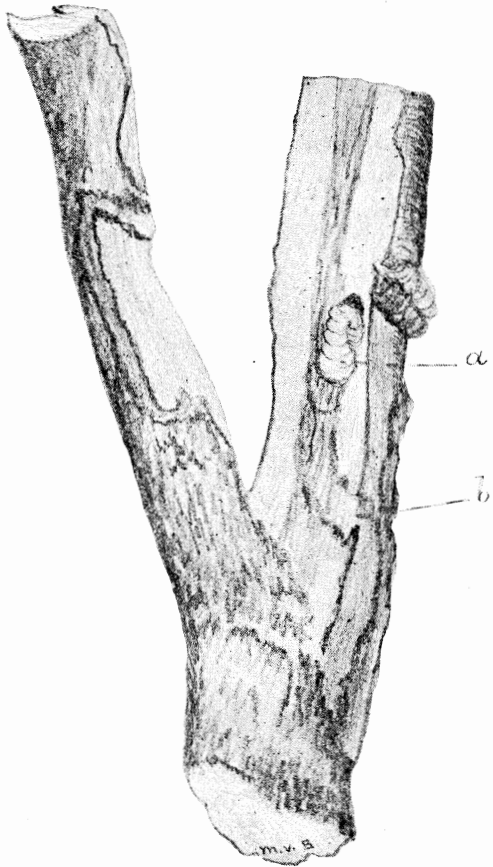


FIG. 7.—Stem split open showing larva in burrow at *a* and place of entrance at *b*; natural size. (M. V. Bogue, Del.)

to two-thirds as broad. The color is nearly black and, to the naked eye, looks slightly dusted with gray and is conspicuously

pitted. It is about the color of the old weather-beaten bark of the apple. Below, it is dark, shining, copper color.

This insect is capable of doing great injury to nursery stock, but the work of the larvæ is so conspicuous that no one need make the mistake of planting trees that have been injured by it. It perhaps does more injury to the appletrees of this Territory than any other insect. It is a native of this country and is now distributed from the New England states to Mexico. Dr. Riley, in his Seventeenth Report on the Insects of Missouri, states that he has reared it from the oak, mountain ash, box-elder, peach, and pear, and has found the larvæ in the basswood, beech and cherry. The present writer can add one more species in which the larvæ have been found—the Carolina poplar. Of the trees above cited, only the box-elder, oak, and poplar are native here, so that most of the insects will have to be supported on cultivated trees. It must be urged that no pile of wood be allowed to remain in or near the orchard, as not only this insect, but many others, may find suitable breeding places in such accumulations.

Remedies.—The remedies recommended for the round-headed apple tree borer should be employed for this insect as well. It is possible that in some cases hand-picking may be profitably employed. The female lays her eggs, in the latter part of April or in May, on the sunny side of the trees or limbs in the warmest part of the day. If diligent search is made at this time many of the beetles may be found and destroyed. It would be profitable to examine the trees carefully and frequently during June and July and if the borers are present they may be detected by a few, fine sawdust-like chips on the bark below the holes which have been pushed out by the young larvæ. If any such are found they may be cut out and destroyed with a knife.

THE ROUND-HEADED APPLE TREE BORER, *Saperda candida* Fabr.

This insect, like many others, is known to the fruit grower by the kind of work it does. Unlike most of the insects with which we have to deal, it requires three years for its complete development. The eggs are laid by the beetle in a little slit made for the purpose in the bark at the base of the tree. The egg soon hatches and the young larva, gnawing its way into

the inner bark and sap wood, remains there until toward winter, then burrowing down into the wood below the surface of

the soil, rests there until spring, when it ascends and passes the second season as it did the first. It again goes down in the trunk and reascends the next spring to carry on its work for the third and last season. During this last season it cuts

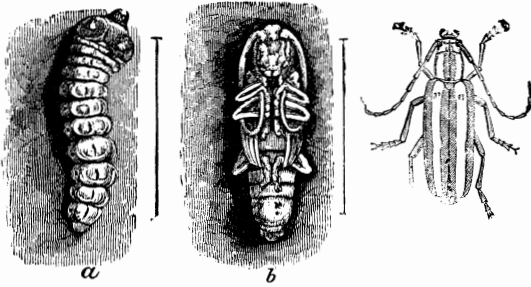


FIG. 8.—The round headed apple tree borer, *Saperda candida* Fabr. *a*, larva; *b*, pupa; *c*, mature insect. Hair line at the side indicates the natural length.

cylindrical channels in every direction until at last it starts upward and outward and reaches a place near the bark, where it lines a cavity with dust that it has made and there transforms to the pupa, and, at last, in the third spring of its existence, it comes forth a perfect beetle and lays eggs and the cycle of life is begun anew.

The beetle is brown in color, save a whitish stripe on each wing cover.

Remedies.—Many remedies have been tried for this insect, but an altogether satisfactory one is yet to

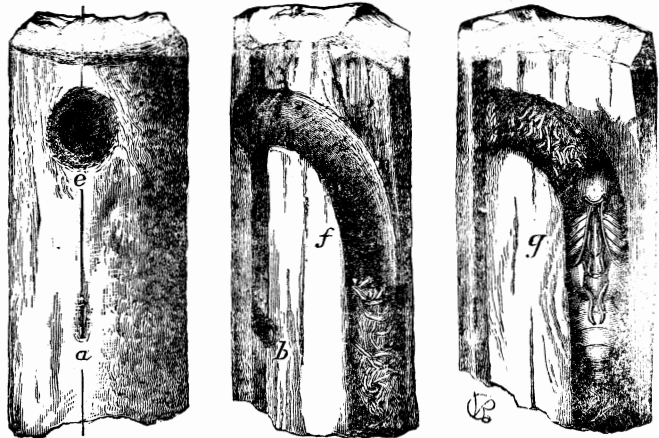


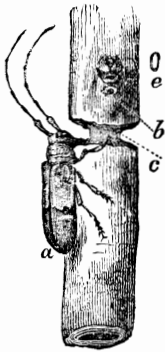
FIG. 9.—Work of round headed apple tree borer, *Saperda candida* Fabr. *a*, puncture in which egg is laid; *b*, same cut open; *c*, hole from which beetle has emerged; *f*, same cut open; *g*, pupa in its cell.

be discovered. In the latitude of Oklahoma the eggs are probably laid late in April or in May, and, as they are more or less exposed,

this seems the best time to attack the enemy. Alkalies have destructive effects on the eggs as a rule so that, if a strong soap solution can be made to reach them, they probably will be destroyed. A solution of this kind may be made by mixing one quart of soft soap or one pound of hard soap with two gallons of boiling water. Its effectiveness will be increased by adding a pint of crude carbolic acid, about two ounces of Paris green and four ounces of lime. This mixture should be applied late in April to every part of the trunk of the tree, from two inches below the surface of the ground up into the fork formed by the branches. This may not entirely prevent injuries; therefore, it would be well to thoroughly examine the trees in September and, if any borers are found, cut them out with a knife before they descend to pass the winter.

THE TWIG-GIRDLER, *Oncideres cingulatus* Say.

The work of this insect would seem to indicate a higher development of instinct than is present in most of its kindred.



The female lays her eggs on a twig about one-half inch in diameter and then gnaws the bark from around the twig below where the egg is laid, and the twig thus girdled dies and soon falls to the ground, where the larva feeds in it, goes through its transformations, and comes forth a perfect beetle to lay more eggs which continue the species. The beetle is a little over one-half inch long, of a brownish gray color, with reddish yellow dots, and with a broad gray band across the middle of the wing-covers. The antennæ are longer than the body. It lives extensively on the hickory, but

FIG 10.—The twig girdler, *Oncideres cingulatus* Say. a, beetle at work; b, egg puncture; c, girdling done by beetle; e, egg.

frequently attacks the apple.

Remedies.—The only remedy that can be suggested is to pick up and burn the fallen twigs in September and October.

THE APPLE TREE PRUNER, *Elaphidion villosum* Fabr.

The female of this insect places an egg in the axil of a leaf. When the larva hatches it bores into the center of the twig

and downward, living on the soft, inner portion of the twig until it becomes strong enough to attack the hard wood, by which



FIG. 11.—The apple tree pruner, *Elaphidion villosum* Fabr. Mature insect.

time it has reached the branch from which the twig came, and proceeding a short distance downward the larva begins gnawing away the wood from the center to the circumference until the branch is so weakened that it falls to the ground where either in spring or fall it completes its transformation

and comes out a perfect beetle to lay eggs for another generation. The beetle is dull-blackish in color with a few grayish spots.

Remedy.—Collect and burn all fallen branches.

THE APPLE TWIG BORER, *Amphicerus bicaudatus* Say.

The damage done by this insect—unlike that done by the other borers mentioned in this bulletin—is done, not in the larval

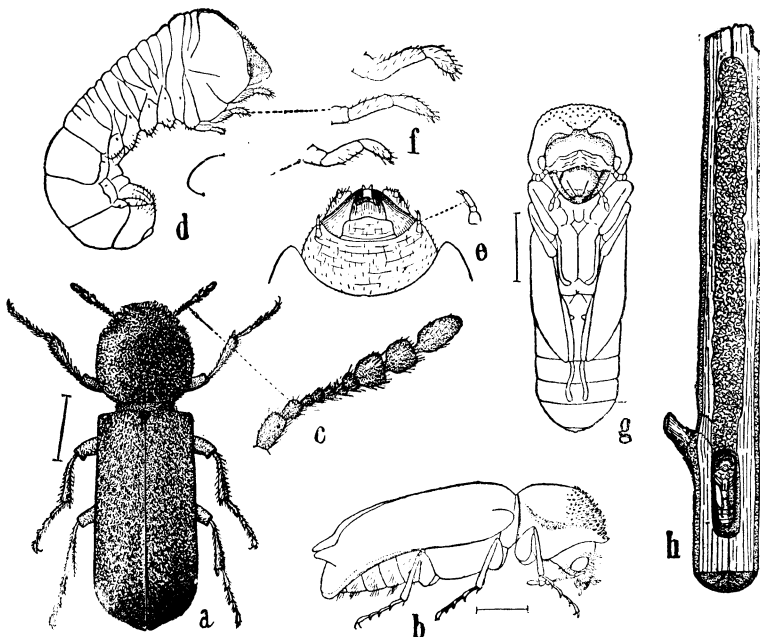


FIG. 12.—The apple twig borer, *Amphicerus bicaudatus*, Say. *a*, beetle as seen from above; *b*, same in outline as seen from the side, showing projections on wing covers; *d*, larva; *g*, pupa; *c*, antenna; *e*, head of larva; *f*, feet of larva; *h*, pupa in burrow; all but *h* much enlarged.

stage of the insect, but in the perfect stage, by the beetle itself. It works on the apple, pear, and cherry. It attacks the twig just above a bud and bores a cylindrical hole for several inches in the center of the twig causing it to wither and die. The early stages of this insect are not well known.

Remedy.—The injured twigs should be cut out and burned.

THE FRUIT BARK BEETLE OR SHOT-HOLE BORER,

Scolytus rugulosus Ratz.

The writer has not seen this beetle in the Territory, but if it is not here now it will be before the orchards are much older. It works on plum and cherry and perhaps other trees. Its presence may generally be known by an unhealthy appearance of the trees infested. On close examination, if this insect is present, there will be found on the underside of the limbs, and sometimes on the trunk of the tree, holes about the size of small shot. The holes were probably made by the mature beetles that were escaping from the tree. The female lays her eggs in a channel made between the bark and sap wood. There they hatch and the young larvæ begin making channels in every direction, sapping the life of the tree.

Remedy.—Since the insect, during the stage in which it works destruction, is out of the reach of insecticides about the only thing that remains to be done is to cut out and burn the affected tree or branch as soon as the presence of the insect is discovered.

PLATE I.—The Fruit Bark Beetle or Shot-hole Borer, *Scolytus rugulosus* Ratz.

FIG. 1—Larva; enlarged twenty diameters.

FIG. 2—Pupa, side view; enlarged twenty diameters.

FIG. 3—Beetle; enlarged twenty diameters.

FIG. 4—Pupa, view from above; enlarged twenty diameters.

FIG. 5—Parasite of larva; enlarged 20 diameters. (*Chirofachys colon* Linn.)

FIG. 6—Branch of peach, showing holes in bark made by beetle; natural size.

FIG. 7—Branch of plum, with bark removed, showing breeding chamber and tunnels made by larvæ; natural size.

FIG. 8—Larger branch, showing holes made by beetle; natural size.

FIG. 9—Larger branch, with bark removed, showing breeding chambers made by beetle and channels made by larvæ; natural size.

PLATE I.

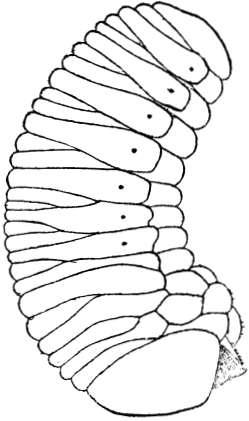


Fig. 1.



Fig. 2.

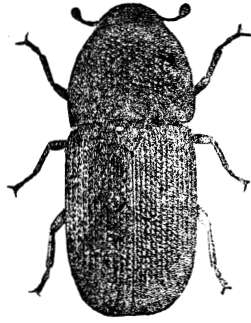


Fig. 3.

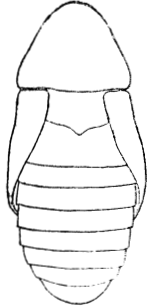


Fig. 4.

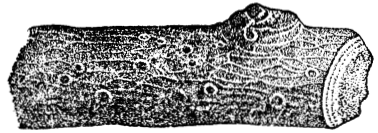


Fig. 6.

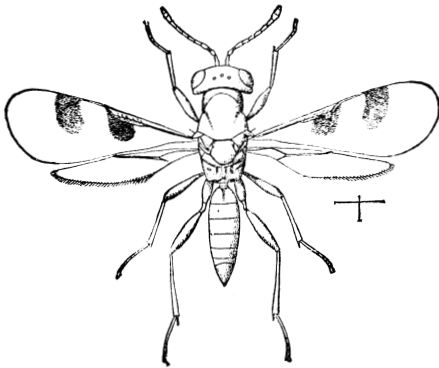


Fig. 5.

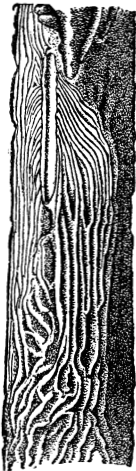


Fig. 7.

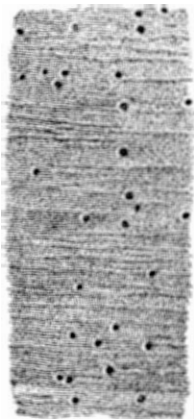


Fig. 8.

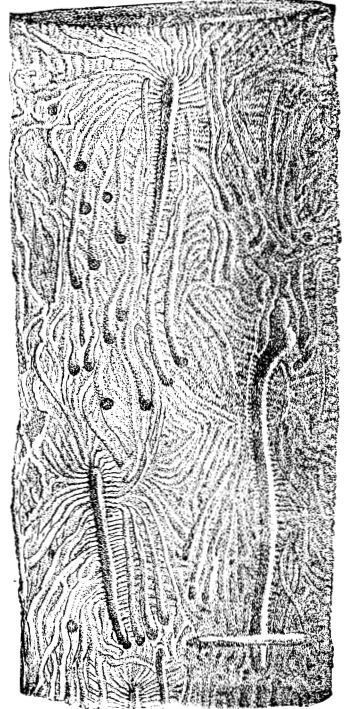
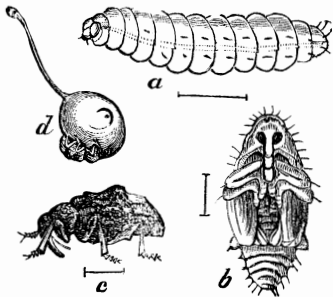


Fig. 9.

NOTE—For explanation of Plate I see page 16.

THE PLUM CURCULIO, *Conotrachelus nenuphar* Herbst.

The plum is being planted quite extensively in Oklahoma, and in all probability the curculio will be present to do its usual amount of injury when the trees come to bearing. The beetle appears in spring, about the time the plum trees are in



bloom, and for a time feeds on young tender foliage, but when the young fruit is well set it leaves the foliage and attacks the fruit. The female lays eggs in crescent-shaped cuts in the skin of the fruit. In a short time the larvæ hatch from these eggs and begin feeding on the pulp of the young fruit, which eventually falls to the ground, carrying the larvæ with it. The larvæ then leave the decaying fruit and enter the ground to the

FIG. 13.—The plum curculio, *Conotrachelus nenuphar* Herbst. *a*, larva; *b*, pupa; *c*, mature insect; beetle at work on plum, showing a crescent-shaped mark

depth of a few inches, where they transform to the pupa and finally to the perfect stage of the insect. There is but one brood each year.

Remedies.—Spray the trees with the Bordeaux mixtures, to which has been added Paris green, as recommended for the codling moth of apple. All the fallen fruit should be destroyed.

PEACH TREE BORER, *Sannina exitiosa* Say.

The presence of this insect is known by the gummy exudation, mixed with larval excrement and soil, from the stem of the peach tree near the ground. The larva develops between the sap wood and bark where it bores and often

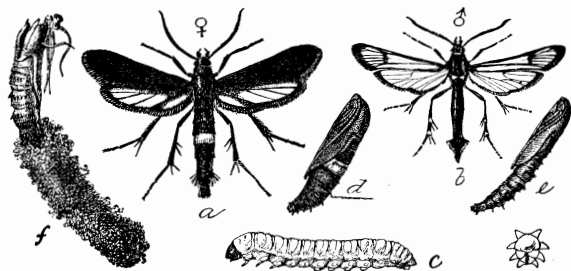


FIG. 14.—Peach tree borer, *Sannina exitiosa* Say. *a*, female moth; *b*, male moth; *c*, larva; *d*, female pupa; *e*, male pupa; *f*, pupa case extruded from cocoon; all natural size. (After Marlatt.) U. S. Department of Agriculture, Division of Entomology, Circular 17, Second Series.

completely girdles the tree, causing its death. In Oklahoma the moth probably comes forth as early as in May, and possibly in April. The eggs are placed on the stem of the tree, usually near the ground. As soon as the young larva is hatched it enters the bark usually at some crack. It feeds during the summer and fall and early the next season changes to a pupa and soon emerges as a perfect moth. The moth is dark blue in color and much resembles some common wasps.

Remedies.—After a larva has entered the tree it is out of the reach of poisons, so that remedies for the most part must be in the form of prevention, rather than cure. Any sort of protection that will prevent the moth from laying her eggs on the tree will be thoroughly successful. This protection may be given by sheathing the base of the tree with fine wire netting, cloth, paper, straw, or even cornstalks, if they are put on in such a manner that the moth can not get at the base of the trunk. It should extend two or three inches below the surface of the soil (the soil being removed for the purpose and returned again after the sheathing is in place) and about eighteen inches above the surface of the soil. The same may be accomplished by banking soil around the base of the tree or by coating the tree with some form of plaster. Success has been secured in some cases by whitewashing the trunks of the trees with three ounces of Paris green or London purple mixed with each pailful of whitewash. Another remedy that is frequently employed is to cut out and destroy the larvæ with a knife.

THE BUMBLE FLOWER BEETLE, *Euphoria inda* Linn.

This is one of the earliest insects of spring. It flies close to the ground and on wing sounds much like a bumble bee, for which it is often mistaken while in flight. There are two broods each season. The first brood visits flowers and does not seem to do any harm except to make provision for the second brood, which appears in August, just when the peaches and other choice fruits are ripening, and upon which it feeds extensively. Some fruit growers in the Territory have already suffered considerable loss from it. It



FIG. 15.—The bumble flower beetle, *Euphoria inda* Linn. Mature beetle.

is yellowish-brown, with wing-covers sprinkled all over with small, irregular black spots, and is about one-half inch in length. Its complete life history is not well known.

Remedy.—About the only remedy that can be suggested is to catch and kill the insect wherever found.

SPOTTED VINE-CHAFER, *Pelidnota punctata* Linn.

This is a large beetle about one inch long and half as broad and rather thick. The wing-covers are tan yellow or reddish

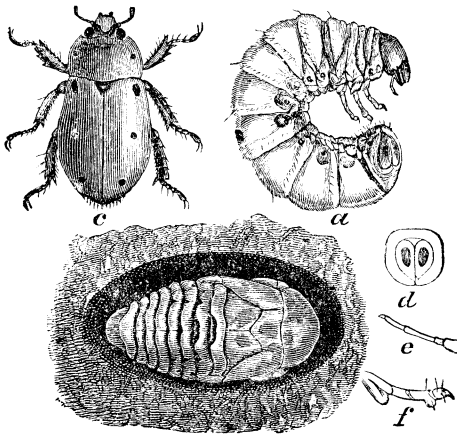


FIG. 16.—The spotted vine chafer, *Pelidnota punctata* Linn. *a*, larva; *b*, pupa; *c*, mature beetle.

brown, and each has a black spot at each end and one in the middle of the margin, and there is also a black spot on each side of the thorax. The under side of the body is deep bronze-green. The legs of some individuals are the color of the wing-covers and of some others the color of the under side of the body. The larva feeds on decaying roots and stumps. It is not usu-

ally a troublesome insect, but some complaint has been heard of its eating the foliage of the grape.

Remedies.—On account of its large size, hand picking can be recommended. The collector described in the discussion of the rose-chafer might be used to advantage if the beetles are present in large numbers.

THE ROSE-CHAFER, *Macrodactylus subspinosus* Linn.

This beetle is rather slender, measuring three-eighths inch in length. A thick clothing of fine yellow hairs on the body gives it a grayish-yellow appearance. The legs are long, slender, and pale red in color; the tufts of spines on their outer portion being black. Most of the fruit growers of the Territory are familiar with this beetle and those who are not can recognize it from this brief and untechnical description. Its habit of

feeding on the flowers of the rose gave to the beetle its common name but the number of its food-plants has been extended until it is now nearly omniverous. The flowers and leaves of the grape are relished by it but the leaves of the apple, pear, plum, cherry and leaves of many other plants are greedily eaten as well as young fruits.

The rose-chafer appears in Oklahoma in May and begins feeding voraciously and continues for from four to six weeks.

During this time each female lays from one to two dozen eggs, singly, in the soil. Soon the eggs hatch and the larvæ begin feeding on the young grass rootlets if such are in reach. If not, then the rootlets of other plants that are within reach. In autumn the larvæ have reached maturity, when they are yellow-

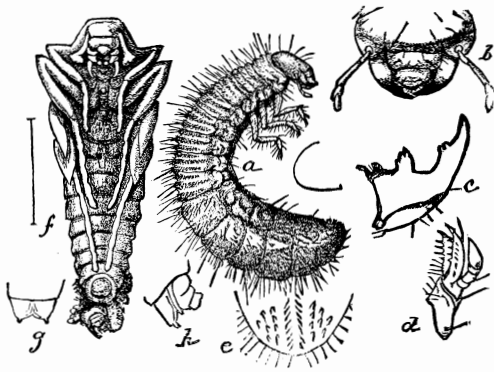


FIG. 17.— The rose chafer, *Macrodactylus sub-spinosus* Linn. a, larva; f, pupa; b, c, e, g, h, structural details.

ish in color with a brownish head. They descend to below the frost line; come near the surface in early spring, pupate, and soon emerge as perfect beetles to begin again the cycle of life. The insect prefers a light sandy sod soil for a breeding ground, so that if the grape growers guard their vineyards against this condition it will be a good preventive measure.

Remedies.—It is by no means an easy task to overcome this enemy. It frequently appears in vast swarms and devours foliage rapidly, so that any remedy in order to be entirely successful must act quickly and surely. The ordinary arsenical poisons do not take effect until two or three days after the poison has been eaten, and the beetle is feeding heavily meanwhile. The contact insecticides, as usually applied, do not reach all individuals present at the time the application is made and leave no impediment to subsequent hordes that may appear; therefore, some other means must be employed. It will be observed that the beetle drops from the plant very readily. Perhaps the

most efficient remedy, all things considered, is to make a funnel-shaped collector with a receptacle at the bottom containing kerosene. By holding this collector under and slightly jarring a portion of the foliage large numbers may be taken. The collector can easily be made by using a round or angular frame of wood or wire. The sides should be of cloth and as smooth as possible, so that the beetles will readily roll to the bottom and into the receptacle containing the oil.

One grape grower in the season of 1896 found the rose-chaffer coming into his vineyard from a piece of sod ground and he hand-picked them twice a day for several days, thus holding them in check so that very little injury was done. When this insect is doing damage action must be prompt and effective. "Delays are dangerous."

THE GRAPE VINE LEAF-ROLLER, *Desmia maculalis* Westwood.

The work of this insect is known by its beginning on a small portion of the leaf of the grape, rolling the upper surfaces together and fastening them with silk. It feeds on the

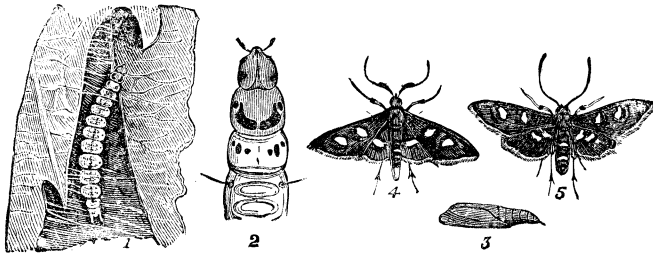


FIG. 18.--The grape vine leaf roller, *Desmia maculalis* Westwood. 1, larva, natural size; 2, front part of body, enlarged; 3, pupa, natural size; 4, male moth, natural size; 5, female moth, natural size.

inside of the roll and is thus out of the reach of ordinary insecticides. The full grown larva is about three fourths of an inch

long. It changes to the pupa stage within the folded leaf, from which the moth emerges. The moth is about one inch broad when the wings are expanded. The wings are nearly black, with a few white spots and a faint white margin. There are two broods each season. The larvæ of the first brood appear in May or June in Oklahoma and the last one in August. The last brood passes the winter in the rolled leaves. The attack of this insect was quite severe on a small vineyard about eight miles south of Stillwater in August, 1896.

Remedies.—The insect has a parasite that doubtless does a good deal toward keeping it in check. This may be preserved and the enemy destroyed by collecting the rolled leaves before the moths escape from them and enclosing them in any kind of a receptacle that may be covered with a piece of loosely woven cloth that will allow the small parasites to escape, but will hold the moths. With a little care and observation this can be done very successfully. However, as has been mentioned, some recommend that no attention be given the parasite, but burn the leaves as soon as collected, which will destroy both parasites and moths.

ACKNOWLEDGEMENTS.

The cuts illustrating this bulletin should be credited to the following sources:

Fig. 1; Nebraska Agricultural Experiment Station.

Figs. 2, 10, 11, 13, 15, 16, 18, Saunder's "Insects Injurious to Fruits."

Figs. 3, 5, 8, 9, 12, 17, Smith's "Economic Entomology."

Figs. 6, 7, made for this bulletin, M. V. Bogue, Del.

Fig. 14, U. S. Department of Agriculture, Division of Entomology. Circular No. 17, Second Series.

Plate 1, with contained figures, Seventeenth Report of the State Entomologist of the Noxious and Beneficial Insects of the State of Illinois. Sixth Report of S. A. Forbes.

Fig. 4, Kentucky Agricultural Experiment Station.