THE PISTOL-CASE-BEARER.

V. H. LOWE.

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*Connected with Second Judicial Department Branch Station.
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BULLETIN No. 122.

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V. H. LOWE.

SUMMARY.

The pistol-case-bearer is one of the important injurious insects of the apple orchard. Last year it appeared in unusual numbers doing serious injury especially in the western part of the state.

This insect belongs to the same order as the moths and butterflies. It lives over winter in the half-grown larval condition, each larva or caterpillar being protected by a peculiar curved case which is firmly attached on end to the twig and which is just large enough to accommodate its occupant.

Early in the spring the case-bearers become active. They first attack the swelling buds and later the leaves, flower-buds and flowers as they appear. The fruit, also, is sometimes attacked.

The transformation to the pupa takes place within the case which each caterpillar carries, but which, as the time for pupation approaches, is attached firmly to the twig. This takes place during the latter part of May. The moths issue in from two to three weeks. The eggs are laid on the under surface of the leaves. The recently hatched caterpillars eat small holes into the interior of the leaves. Their cases, which are made
of excrement and silk, are also very soon constructed. During September they migrate to the smaller branches and twigs to remain until spring.

Experiments at this Station show that this insect can be controlled by thoroughly spraying the infested trees with Paris green, using one pound to 150 gallons of water, with the addition of enough freshly slaked lime to make the mixture milky. In the experiments the trees were sprayed three times, first, just before the buds began to swell, second, soon after the young leaves appeared, and third, just after the petals had fallen.
THE PISTOL-CASE-BEARER.

Coleophora malivorella, Riley.

HISTORY, NAME AND APPEARANCE.

Our attention was first called to this insect early last spring when a large apple orchard near the Station grounds was observed to be badly infested with it. Later in the season numerous complaints came to the Station, especially from fruit growers residing in the western part of New York, stating that this insect was doing serious damage in their apple orchards.

As the outbreak appeared to be of sufficient extent to cause serious loss to the fruit growing interests of the state and as the insect is quite likely to become a well established pest of the apple orchard, we have in addition to studying the life-history of the insect in the field as opportunity was afforded, conducted experiments with a view to determining upon a practical method of holding the insect in check. These observations and experiments are briefly reviewed in the following pages. Minute details of the life-history and structural characteristics of the insect are avoided herein as being of but little interest to the general reader.

Not a New Offender.

Although this insect appeared in such unusual numbers in some sections of the State last year that it was thought by some to be a new pest to the apple, it proves to be one of the insects which have been known for a number of years, but which have not caused sufficient damage, excepting in certain localities, to occasion more than a passing notice among fruit growers. The earliest account of this insect which we have seen shows that it was a serious pest in Erie County, Pennsylvania, in 1878. Since that time the species has been quite frequently mentioned by writers on economic entomology.
The Insect’s Name.

The scientific name for the insect, *Coleophora malivorella*, was proposed in 1878 by Dr. Riley, who published a technical description of the larva and the male and female moths in the Annual Report of the United States Department of Agriculture for that year. The popular name, Pistol-Case-Bearer, comes from the fact that the peculiar cases which the caterpillars construct for themselves slightly resemble a pistol in shape. Although we have not seen this name in print it seems to have been in general use throughout the season among fruit growers who are familiar with the insect.*

When and Where to Look for Them.

During the winter the case-bearers are not as readily detected, especially by those who are not familiar with them, as later in the season when the caterpillars have enlarged their cases, making them very easy of detection, especially when occurring in large numbers. It is important, however, that the trees be carefully examined during the winter or early spring, so that, if the case-bearers are present, the remedy may be applied before it is too late. They will be found in greatest abundance upon the young twigs and usually close to the buds or even upon them.

As will be shown later, each one of these little cases contains a living caterpillar which, when warm weather comes, moves about freely, carrying its clumsy looking case with apparent ease. Fig. 1 is from a photograph of two infested apple twigs, natural size, cut from the tree in December. The caterpillars themselves are not seen as they are hidden within their peculiar cases which, it will be observed, are fastened on end to the bark. Each case is made largely of silk which is spun and woven by its owner much as a caterpillar ordinarily spins and weaves its cocoon. The inner layer is comparatively smooth and closely woven while the outer is loose and less substantial. In color they closely resemble the bark.

*NOTE.—Since this bulletin was written we have received Bulletin 124 of the Cornell Univ. Agl. Exp. Station, in which Mr. Slingerland suggests the name.
A Closely Allied Species.

The cigar-case-bearer (*Coleophora fletcherella*) is sometimes confused, by the casual observer, with the species under discussion. The winter forms of the two species may at first appear somewhat alike, but a careful examination will show that the case of the cigar-case-bearer of average size is usually somewhat smaller and lighter in color than that of the other species; also that it is more nearly flat, comparatively smooth and curved in the shape of a half moon, while the case of the pistol-case-bearer, is more like a rough tube bent and shaped at the upper end so as to slightly resemble the handle of a miniature pistol. During the winter also, the cigar-case-bearer is found more abundantly in the angles made by the branching twigs while the pistol-case-bearer passes the winter in more open situations on the twigs and buds. The two species have many similar habits. Both are found most abundantly upon the apple. The mature insects in both species are delicate moths which resemble each other in general appearance.

LIFE HISTORY, DISTRIBUTION AND NATURAL ENEMIES.

The story of this interesting insect's life is, briefly, as follows: The peculiar cases, which, as previously stated, may be found during the winter attached to the twigs, contain the hibernating caterpillars which are to develop into the parent moths before the summer is over. They remain inactive until about the time that the buds begin to swell. The warm days seem to bring renewed life, and if a careful watch is kept the observer may be rewarded by seeing some of the caterpillars unfasten their cases from the twigs, thrust their heads and part of their bodies out of the opening, which is in the anterior or lower end of each case, and move toward the nearest buds carrying their cases with them.

*How the young case-bearers feed.*—Having reached the buds they begin at once to bore into them. In doing this they do not leave their cases, but thrust their bodies out as they gnaw into the interior of the buds. Thus an opening bud may have several of these cases attached to it which give no signs of activity until removed, when a small round hole will be observed which the little caterpillars have made in searching for food. The injury
thus done to the bud is very great, usually sufficient to destroy it. It often happens that nearly the whole inside of the bud will be eaten out.

As soon as the young leaves appear the case-bearers attack these, at first burrowing into them and feeding on the soft tissues between the two surfaces. Thus they are feeding at this time as leaf miners. Fig. 2 is from a drawing, representing a case-bearer feeding between the two surfaces of an apple leaf. The case-bearers do not feed long as leaf miners, however, but soon begin to eat off the entire upper surface, leaving only the frame work as shown in Fig. 3. The caterpillars grow rapidly during this time and are soon strong enough to eat holes clear through the leaves, avoiding only the midribs and larger veins.

How the caterpillars enlarge their cases.—As stated on a previous page, the caterpillars make their cases largely of woven silk. They are just large enough during the winter to accommodate the young caterpillars, and thus it is necessary to enlarge them as the occupants increase in size. This is done by extending the case at the anterior end in the form of a tube of silk into which is woven the pubescence from the leaf—frequently giving it a pinkish color or making it nearly pure white. Very soon, however, probably from the efforts of exposure to the weather, the entire case assumes a darker hue, resembling the bark in general color. By May 6 the new portions of the cases equalled the old in average length.

Habits of the caterpillars when attacking the flowers and full grown leaves.—As soon as the flower buds begin to swell, the case-bearers not infrequently attack these also, and the flowers themselves do not escape as many were found last season with the petals nearly eaten away by these intruders. When attacking the flower buds, the caterpillars bore into them in much the same manner as when attacking the leaf buds, as shown in Fig. 4, but when feeding in the full blown flower the petals may be entirely consumed and frequently a considerable portion of the pistil and stamens. Thus this insect not only injures the buds and leaves but indirectly destroys the fruit. Fig. 5 is from a photograph of two apple blossoms which have been injured by the pistol-case-bearer.
By the time the apple leaves are full grown the case-bearers have reached their full size. At this time their cases measure, on an average, a little more than one-fourth of an inch in length. The general shape of one of the full size cases is shown at Fig. 6. The full grown case-bearers feed readily on nearly all parts of the leaves usually leaving only the midribs untouched. Fig. 7 is from a photograph of a few mature apple leaves partially devoured by the case-bearers. The fruit may also be attacked by the caterpillars boring through the skin and feeding on the tissue just beneath. This causes the young apples to become more or less deformed, according to the extent of the injury.

The full grown caterpillars measure, on the average, a little more than one-fifth of an inch in length. The body is light-yellow, varying to deeper shades, with dark-brown markings on the thorax. The true legs are black. The head also is black with a more or less distinct yellow median line. Like other caterpillars the pistol-case-bearers undoubtedly molt, probably several times during their development, but this interesting operation was not observed by us.

Pupation.—During the middle of May many of the case-bearers were observed migrating from the leaves to the twigs. Toward the latter part of the month many of the caterpillars had pupated. Before pupating each caterpillar had fastened its case securely to the bark of the twig. A network of silk was woven over the anterior end of the case so that if the case was forcibly removed the occupant would not be exposed. Fig. 8 is from a photograph of some of the cases as they appeared at this time. Thus made secure the caterpillars managed to turn around in their cases so that their heads were in the opposite direction. The transformation from the caterpillar to the pupa then took place. The pupa is dark brown in color. Fig. 6 also represents two cases cut open longitudinally showing the caterpillar and pupa.

The pupa stage probably lasts from ten days to two weeks. We observed the moths issuing June 22 and until June 26. The moths escape by means of a slit-like opening at the posterior end of the case.

The adult insect is a beautiful steel gray moth which measures nearly one-half of an inch from tip to tip when the wings are spread. The front wings are flecked with white scales on the
basal half. Frequently these white scales are very numerous on
the wings of the female and almost lacking on the wings of the
male. Other striking characteristics are the rings of dark and
white scales on the antennæ and legs and the tufts at the bases of
the antennæ. The males are a little smaller on the average than
the females and of a somewhat darker color. The moths fly at
night and hence are not usually seen. Fig. 9 represents one of
the moths enlarged.

The eggs.—We did not observe the exact time of egg-laying,
but found eggs on the leaves late in June. These were on the
under surface of the leaves. They were placed singly, most of
them near the midribs and larger veins. Although they are very
small, the eggs are plainly visible to the unaided eye if one knows
what to look for. They are yellowish-green in color, nearly cir-
cular at the base, smaller, and with a slight depression at the
upper end. Parallel depressions and ridges extend along the full
length of the sides. Fig. 10, a and b represent an upper view and
a side view of an egg greatly enlarged. The eggs probably hatch
in about ten days or two weeks.

Habits of the young case-bearers.—We did not observe the exact
limits between which egg hatching might occur. Early in August,
however, the recently hatched case-bearers were found on the under
surface of the leaves. The cases were made of excrement and
silk presenting, when viewed under the microscope, the rough
appearance represented in Fig. 11. The caterpillars were feeding
on the soft tissues between the two surfaces of the leaves. When
one of them was forcibly removed, the small round hole made
through the skin of the leaf was plainly visible. September 5
the young case-bearers appeared when feeding on a leaf as shown
in Fig. 12. At this time they measured, on an average, about one-
eighth of an inch in length. From this time on they grew but
little and soon migrated to the twigs to remain during the winter,
attaching their cases to the bark as previously shown in Fig. 1.

Brief summary.—From the above we may briefly summarize
the life-history of this insect as follows:

The case-bearers, not yet half grown, when winter overtakes
them hibernate on the twigs of the infested trees in silken cases
curved at the upper ends, securely fastened to the bark in a nearly
upright position, and usually near but sometimes upon, the buds.
About the time that the leaf-buds begin to swell they become active again. They attack the growing buds, gnawing through the outer covering to feed on the tender tissues beneath. Later in the season they feed on the young leaves, boring into them and, for a short time, making mines similar to those made by true leaf miners. They may also eat away the entire soft part of the leaves, frequently making holes clear through them. In doing this the caterpillars do not leave their cases, but project their bodies apparently as far as they can without losing hold of these protective coverings. They also attack the opening flower buds, boring into them as when attacking the leaf buds; the full blown flower; the mature leaves, eating nearly the entire leaf with the exception of the midrib and larger veins; and the fruit, into which they mine to a short distance beneath the skin, causing the fruit to become slightly deformed.

When ready to pupate the caterpillars migrate to the twigs and attach their cases firmly to the bark. Pupation takes place about the middle of May. Before this transformation is made, however, the caterpillars turn around in their cases so that their heads are toward the upper or curved end.

The moths come forth early in June. The eggs are deposited on the under sides of the leaves. They hatch in about ten days or two weeks. The young caterpillars make small holes into the leaves to enable them to feed on the tender pulp. Their cases are made out of excrement and silk. During September they migrate to the smaller branches and twigs to remain until spring. Thus there is but one annual generation.

Food Plants.

The principal food plant of this insect is the apple. It is known, however, to attack the pear and it is said to attack the quince also.

Distribution.

The pistol-case-bearer is becoming well known throughout the apple growing sections of the state. It has also been reported from the south, from the central states and from Canada. It is an American species.

Distribution by means of nursery stock.—We have occasionally found this insect on nursery stock. It is undoubtedly in this way
that the insect is distributed from one part of the country to another.

Natural Enemies.

At least three species of parasitic insects prey upon the pistol-case-bearer. We bred this number from specimens kept in the laboratory. The number of parasitized case-bearers was sufficient to indicate that these little parasites may be an important check to the increase in numbers of this pest.

Remedial Measures.

As shown by the above account, the pistol-case-bearer belongs to that class of insects which in their larval state devour the tissue of the food plant instead of sucking the juices, as is the case with certain other insects, such as plant lice, scale lice, etc. It is therefore reasonable to expect that this insect can be controlled by spraying with an arsenical poison, provided the poison is applied at the right time. As we have already seen, the caterpillars do not feed openly on the leaves until quite late in the season, but feed for the most part on the interior of the buds and young leaves. The poison, then, should be applied before the winter buds begin to swell, so that the first meal of the young case-bearers as they begin to burrow into the buds may be a poisoned one. Another application made when the leaves are half grown, at which time the case-bearers begin eating holes clear through the leaves, should prove effectual.

With this in mind the following experiments were made. Full grown Baldwin apple trees were used in the experiments. All of them were badly infested with the pistol-case-bearer.

Experiment No. 1.—On April 20, May 1, and May 6, 12 trees were sprayed with Paris green used at the strength of one pound to 150 gallons of water. At the time of the first application the leaf buds had just begun to swell. But very few of the case-bearers were active. At the time of the second application the young leaves were well started while at the time of the third application, the young case-bearers were beginning to eat holes through the leaves.

From the first the effect of the treatment was plainly apparent. At the time of the last treatment the treated trees were comparatively free from the insect, although others in the same orchard,
which had not been sprayed, plainly showed the effect of the injurious work of this pest.

Experiment No. 2.—On May 6, 15 trees in the same orchard were sprayed with kerosene emulsion, at a strength of one part of the emulsion to ten parts of water. The application was very thorough, the emulsion being applied until the trees were dripping wet. Although these trees were badly infested with both the pistol-case-bearer and the cigar-case-bearer, the emulsion seemed to have no effect upon either insect. Possibly a stronger emulsion would have penetrated the cases, but under the circumstances, it would undoubtedly have been endangering the trees to use a stronger emulsion, as the foliage was very tender and the flower buds were nearly ready to burst.

Experiment No. 3 consisted in trapping the moths with trap lanterns. These were kept all summer in the orchard of Mr. J. B. Collamer, of North Parma, to whom we are indebted for aid in this work. On the night of July 2d, a large number of the moths were captured and a few on succeeding nights. Examinations in the laboratory showed that but few of the females contained eggs, which would indicate that the eggs are usually laid previous to this time, hence the trap lantern was of little value as a means of combating this insect.

Conclusions.—From the above experiments, we may conclude that the pistol-case-bearer can be controlled by the thorough application of Paris green at a strength of one pound to 150 gallons of water. The first application should be made just before the leaf buds begin to swell, the second about ten days later, and the third about a week or ten days from that time.

Kerosene emulsion, at summer strength, has no effect on either the pistol-case-bearer or the cigar-case-bearer. The use of the trap lantern does not seem to be a satisfactory method of combating this insect.

Additional notes.—When buying Paris green be sure that it is pure. A simple test for pure Paris green can be made with strong ammonia. Place a little of the Paris green in a test-tube and add enough ammonia to cover it well. Stir thoroughly with a glass stirring rod or other convenient instrument. If pure, all of the Paris green will dissolve readily, the solution turning at once to a deep blue color. If any sediment appears in the bottom of the
test-tube, the Paris green may be considered adulterated. This is not necessarily an infallible test but may usually be considered of practical value. Another very good test is to place a little of the Paris green between two pieces of window glass and rub the pieces of glass together. If the Paris green is adulterated with lime or barium sulphate, which are quite frequently used for this purpose, the Paris green will appear to turn white in places. This appearance is caused by the small chunks of lime or barium sulphate which, when broken open, appear light colored.

As it is usually desirable to spray the orchard with Bordeaux mixture at the same time that the Paris green is applied for the pistol-case-bearer, the two may be combined as neither interferes with the beneficial action of the other. Add the Paris green to the diluted Bordeaux mixture in the same proportion as if it were being mixed with water. No additional lime need be added as the lime in the Bordeaux mixture will be sufficient.

_Do not spray while the trees are in bloom._—There is nothing to be gained by so doing, and a good deal of injury may be done. The Bordeaux mixture and Paris green will be just as effectual if applied as indicated above, and then no injury will be done to the bees and other friendly insects which visit the blossoms and upon which largely rests the important responsibility of carrying the pollen from one flower to another.