THE PEAR PSYLLA AND ITS CONTROL.

SUMMARIZED BY
F. H. HALL
FROM BULLETIN BY
H. E. HODGKISS.

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Popular Edition*  
of  
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The Pear Psylla and Its Control.  
F. H. Hall.  

Probably the most troublesome insect attacking the pear is the psylla. These tiny creatures are similar in many ways to aphids and are sometimes called jumping plant lice. They are sucking insects, like plant lice, and like them, they multiply rapidly, producing several broods each season, so that, unless checked, they make up in numbers what they lack in size, and may injure the pear trees very severely. The larvae, or nymphs, of the first brood, in early spring cluster about the axils of the leaves or young fruits or work from the under side of the tender young leaves and suck out so much sap that growth is checked just when it should be greatest. The leaves become stunted and sometimes fall, and the fruit ceases to grow in size and may drop prematurely if the work of this first brood is continued by the later broods. In long-continued attacks the trees may become almost defoliated, and the new leaves, if they appear, are generally few in number and pale in color. With the injury caused by the draft on the sap of the tree, there is joined an external disfigurement of both leaves and wood due to the copious secretion of honey-dew by the psylla, which serves as food for the "sooty fungus." Growth of this fungus soon gives the wood a smutty, discolored appearance and darkens and stains the leaves. If the attacks of psylla are severe the trees go into winter in a weakened state and succumb much more readily to low temperatures than do uninjured trees. Renewed attacks, year after year, so lessen the vitality of the trees that they become profitless cumberers of the ground.  

Life history of pear psylla  
The mature psylla flies (Plate I, fig. 4) of the last fall brood pass the winter on the trees or in protected places about them; and appear not to become completely dormant until permanent low temperatures have been reached. During late November and early December, a rise in the daily mean temperature to only a few degrees  

* This is a brief review of Bulletin No. 387 of this Station on Susceptibility to Spraying Mixtures of Hibernating Pear Psylla Adults and Their Eggs, by H. E. Hodgkiss. Some information from Circular No. 20 of the Station is also included. Those interested in the detailed account of the investigations will be furnished, on application, with a copy of the above-mentioned bulletin.
above freezing, especially if the sun shines, will bring the flies from their hiding places under the rough bark or in crevices in it and send them to fruit spurs. With settled cold the flies remain dormant until warm days again occur in late March or early April. They then seek the bud spurs and may remain active continuously if the temperature remains above freezing, or may be chilled into quiescence if the mercury drops again. Soon, however, they mate, and egg-laying begins, the time for this varying with the weather. The dates of the beginning of oviposition for the four years 1910–1913, inclusive, were, in order, April 2, April 14, April 15 and March 21. While egg-laying does not have a very constant relationship to the condition of pear buds, some are always laid before the cluster buds break, and most of them before the tips of these buds have separated. This is an important fact to remember, for it is the index of the proper time to attack the insects—a most essential factor in control measures.

The eggs are orange-yellow in color and very small, so that single ones cannot be distinguished by the eye; but they are often deposited in such numbers that they appear as distinct orange spots or patches. The earliest eggs are laid on the wood, in crevices in the bark around the bases of the blossom buds or on the stems, or in some cases on watersprouts. Oviposition is more often on the under side than on the upper side of the stems and bud spurs. Later, when foliage is unfolded, eggs are laid on the leaves. Egg-laying lasts about two weeks, the time again varying with the weather; and the date of hatching is also dependent on the same factor. Under artificial conditions in the warm laboratory, the larvae may emerge in eight days, or outdoors, in cool weather, it takes ten days longer; while warm days hasten development. This frequently makes many early-laid and late-laid eggs hatch at the same time, as on April 19, 1910, May 2, 1911, May 4, 1912, and April 10, 1913, when the young larvae emerged in countless numbers.

The larvae are quite unlike the adult flies, as shown in Figs. 1 and 2 of Plate I, which represent the five stages of their development, the last being the well-known "hard-shells." These nymphs or larvae are rather sluggish, wingless creatures quite similar in all stages and always easily identifiable by their bright red eyes. Successive broods of these nymphs emerge about a month apart throughout the summer and continue the harmful work of the first brood.

Of course, spraying is practically the only possible method for controlling the pear psylla—spraying with a contact insecticide, since the insects feed from beneath the surface and cannot, therefore, be poisoned. But the older sprays and methods proposed have not proven thoroughly satisfactory, as these were usually attempts to control the psyllas after the larvae were present in large numbers on opened buds and developing leaves. The difficulty of
reaching all the tiny creatures at this time with a spray that would be effective and at the same time safe to the tree made it almost impossible to destroy all of the early broods and made repeated treatments necessary—a time-requiring and expensive plan. As far back as 1896, however, Dr. J. B. Smith of the New Jersey Station recommended spring spraying with whale-oil soap just as the buds begin to swell; and in 1899 Prof. Slingerland of Cornell also urged treatment at this time and suggested kerosene emulsion or kerosene and water as applications. In his tests these and other materials for destroying the eggs did not prove successful and, consequently, few attempts have hitherto been made to fight the insect in this stage, as the eggs have been thought quite resistant to any contact insecticide at a strength safe to use on foliage.

The advent of lime-sulphur suggested new possibilities, and tests were accordingly planned by this Station to determine the feasibility of getting rid of the insects in the winter or early-spring stages and to escape, thereby, the difficult task of summer control.

Successful treatments. These tests have now been continued for four years, and have proved very conclusively that the psylla can be readily controlled by either of two methods, each involving but one treatment, or, at worst, by using both applications. For complete success, however, the treatments must be carefully made, and, particularly for the destruction of eggs and young larvae in the spring, at just the right time.

The treatments recommended—fall or early spring spraying with nicotine preparations, miscible oils or soapy solutions to kill the hibernating adult flies, and treatment with lime-sulphur just as the cluster buds are beginning to spread, to destroy eggs and emerging nymphs, can be made uniformly successful in isolated orchards, or in communities where all growers unite in the effort. Where adjacent orchards are neglected, however, it may be necessary to make supplementary sprayings to control invaders from such unsprayed plantations.

Fall spraying for adults. During 1911, experiments were conducted by the Station in the pear orchards of the Middlewood Farms, Varick, N. Y., to test the value of fall spraying to reduce the numbers of overwintering adult psyllas or "flies." The orchard contained 800 Bartlett trees and had suffered severely from psylla injury during the summer. Spraying began on December 6 and continued at intervals, as weather permitted, for ten days, during which period thousands of the insects were clustered on the untreated trees. The insecticides used were tobacco extract, fish-oil soap, and lime-sulphur used separately, and each of the others in combination with the tobacco extract.

The tobacco preparations and the soap solutions proved very effective, but lime-sulphur at the strength for dormant spraying was
not destructive to the "flies" unless combined with the tobacco extract.

On warm days which followed the sprayings few "flies" were detected, and it was estimated that less than five per cent. of them escaped. In the spring so few of the psyllas emerged that no further sprayings were necessary.

Similar experiments in many other pear orchards have been made in the years subsequent to 1911, and wherever weather and other conditions allowed the work to be done thoroughly large percentages of the "flies" have been destroyed by these late fall applications and the insects so reduced in numbers that no further treatments have been needed to control them. Where conditions have been unfavorable for thorough work, or where the psyllas in adjoining orchards were uncontrolled, spring treatments have been found necessary in addition to the fall spraying. The three spray mixtures used—tobacco extract, fish-oil soap and lime-sulphur with tobacco—have been about equally efficient, and perfectly safe to use on the trees. Some orchardists prefer the soap, as it is somewhat less expensive.

The fundamental experiments in spring spraying to control the hibernating adults were made in the Collamer orchards at Hilton late in March, 1910. The psyllas were then very numerous in the large orchard of Bartlett, Kieffer and Seckel pears, and 1,530 trees were sprayed either with kerosene emulsion or fish-oil soap. The kerosene emulsion was not effective, possibly because improperly prepared so that the percentages of oil varied on different trees. The fish-oil soap as originally applied, and where used as a supplement to the kerosene emulsion, greatly reduced the severity of the infestation. The following spring another test of this kind was made in the orchard of Mr. L. B. Wright at Hilton, in which about 800 trees were treated with miscible oil or fish-oil soap. The trees in this orchard had been freed from their rough bark, giving less protection to the insects and greater effectiveness to the sprays used. Both applications were successful, the fish-oil soap being rather more satisfactory.

Along the same lines as these two tests cooperative work was carried on with twenty-five pear-growers, in which miscible oils, homemade oil emulsions and soapy sprays were used alone or in combination with tobacco extract. Of these mixtures the soap solutions alone and the tobacco extract with soap were both efficient and safe, but the emulsions were less satisfactory.

Psylla eggs have generally been found quite resistant to sprays at any strength safe to use on trees at the stage of growth when the eggs are present. Many different materials and combinations had been used in early tests, but they proved either harmless to the eggs or harmful to the trees.
Plate I.—The Pear Psylla:
1, Nymphs, stages 1–3; 2, nymphs, stages 4–5; 3, eggs; 4, winter adult.
(All figures much enlarged.)
In lime-sulphur solution, however, a spray seems to have been found both efficient and safe.

In 1910 and 1911 five careful tests were made by the Station in pear orchards near Lockport and Medina, using either the homemade or concentrated lime-sulphur sprays. Both forms of the mixture proved destructive to the eggs or so weakened or repelled the minute nymphs that did hatch that few of them reached the young leaves. Other insecticides used had little or no effect on eggs or young larvae and could not be counted on to control the pest. The results of these tests are summarized in Table I.

**Table I.—Effect of Various Insecticides on Psylla Eggs.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dilution of spray</th>
<th>Bud spurs counted</th>
<th>Eggs Counted</th>
<th>Eggs killed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Concentrate 1–8)</td>
<td>90</td>
<td>39</td>
<td>2,082</td>
</tr>
<tr>
<td>Lime-sulphur</td>
<td>(Concentrate 1–6)</td>
<td>75</td>
<td>18</td>
<td>339</td>
</tr>
<tr>
<td>Lime-sulphur</td>
<td>(Formula 15–20–50)</td>
<td>102</td>
<td>1,806</td>
<td>564</td>
</tr>
<tr>
<td>Fish-oil soap</td>
<td>(1–5)</td>
<td>100</td>
<td>232</td>
<td>20</td>
</tr>
<tr>
<td>Kerosene emulsion</td>
<td>(1–8)</td>
<td>100</td>
<td>900</td>
<td>52</td>
</tr>
<tr>
<td>Miscible oil</td>
<td>(1–15)</td>
<td>100</td>
<td>800</td>
<td>45</td>
</tr>
<tr>
<td>Black leaf extract</td>
<td>(1–30)</td>
<td>100</td>
<td>824</td>
<td>64</td>
</tr>
<tr>
<td>Black leaf 40</td>
<td>(1–40)</td>
<td>100</td>
<td>920</td>
<td>48</td>
</tr>
<tr>
<td>Checks</td>
<td>Unsprayed</td>
<td>100</td>
<td>810</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2,522</td>
<td>175</td>
</tr>
</tbody>
</table>

*The small percentage of eggs destroyed in this test was presumably due to the lower amount of sulphur in solution in the wash.

Cooperative tests in twenty-five other orchards were made in 1911, using lime-sulphur only as this had proved most effective in the preliminary tests. In all cases where care was used to make the treatments thorough and to apply the solution at the right time, practically all of the eggs were destroyed. The owners who were careful were highly pleased with the results of their work and have come to depend almost entirely on this method for controlling the psylla.

To secure these good results it is essential to watch closely the development of the pear buds and spray just when the cluster buds are opening at the tips.

**Conclusions.** To a comparatively simple one—to make a thorough “clean-up” of the adult “flies” just before they enter or just before they emerge from winter hibernation,
or to destroy the eggs and young larvae of the first brood while they are still on the branches, stems and fruit spurs or on the unopened cluster buds.

The first treatment is usually the best one to adopt as it so reduces the number of hibernating flies that few eggs are laid the next spring. Then, if lime-sulphur is to be used in the spring for scale, as is the common practice in many large orchards, its application can be postponed a little and the few psylla eggs that are laid be destroyed.

**Spraying winter flies.**

Especial pains should be taken to destroy the pest in this stage, as effective work greatly reduces the number of eggs deposited on the trees and simplifies subsequent spraying operations. The best means of killing the "flies" is spraying during a period of warm weather, preferably in November or December, or during March or early April. A rise in temperature induces the insects to emerge from their hiding quarters and creep to the portions of the trees exposed to the warm rays of the sun and protected from a cold wind. While the insects are able to crawl they are very sluggish in their movements and do not fly. This habit makes them very vulnerable to treatment and the grower should take full advantage of it by so spraying that none of the insects be allowed to escape. To kill the flies it is essential to wet thoroughly all portions of the trees, and especial pains should be taken to force the liquid under loose bark and into all cracks and crevices in the bark. The experiments by this Station have also shown the wisdom of spraying one tree thoroughly before proceeding to another. In balmy weather the flies, like squirrels, may dodge quickly to the opposite side of the tree. By spraying the entire tree they are unable to avoid wetting by the spraying mixture. Treatment late in the fall or early winter is especially recommended as the influence of steadily decreasing temperatures at this season on the movements of the flies makes them especially vulnerable to spraying. In planning for this work select days when there is no danger of the spraying mixture freezing on the trees. The most satisfactory spray from the standpoints of safety to fruit and leaf buds and effectiveness against the insect is three-fourths of a pint of tobacco extract to one hundred gallons of water to which are added from three to five pounds of dissolved soap. (Formula 1.) It is also advisable to remove the loose and rough bark to discourage the flies from wintering on the trees and to render them more exposed to spraying mixtures. This operation may be done at a convenient time but the bark is more easily detached following a wet period. To avoid infection with disease care should be taken not to cut into live tissues.
The eggs about to hatch and the newly-
emerged nymphs succumb to an application of
the lime-sulphur mixture. In this
lies a hint to the fruit-grower for
an effective use of this spray against
the psylla as well as the scale. The
eggs of the psylla are laid principally
during April and commence to hatch
early in May or when the blossom
cluster-buds are beginning to separate
at the tips. (Fig. 2.) Most growers
spray much earlier than this for the
San Jose scale, but by postponing
the treatment of pear orchards until
the blossom clusters are well advanced
one may deal another effective blow
against the psylla and with the same
treatment successfully combat the
scale. The lime-sulphur solution,
testing 32°-34° B., should be diluted
in the proportion of one gallon to
eight or nine gallons of water. (Formula 4.) The spray should be
used in liberal quantities and pains should be exercised to wet
all portions of the tree, especially the fruit spurs and the
under sides of the young wood, where most of the eggs are laid.

A third opportunity to
strike hard at the psylla
is when all of the eggs
have hatched and the young
nymphs are largely assem-
bled in the axils of the young leaves and
fruits. This occurs normally during the
latter part of the blossoming period and
the young insects can be reached by spraying
just as the blossoms drop. The most satis-
factory spray is tobacco extract, using three-
fourths of a pint to one hundred gallons
of water to which are added from three to
five pounds of dissolved soap. (Formula 1.)

The grower should endeavor
to combat the pest by the
preceding measures and thus
avoid, if possible, the neces-
sity of later spraying. If the trees are badly infested during the
summer time it is a very difficult task to bring the pest under
control as there is an intermingling of all stages of the insect, and some of them are resistant to any spraying mixtures which can safely be used on foliage. Moreover the leaves, especially if the growth is heavy, seriously interfere with thorough treatment, and there is also danger that foliage injured by the psylla may be further damaged by the applications of the sprays.

Frequent and thorough spraying with the tobacco extract (Formula 1), on the first discovery of injurious numbers of the insects is the most satisfactory means of affording protection to the trees.

**SPRAYING MIXTURES AND FORMULAS.**

**Formula 1. Tobacco Extract.**
- Tobacco extract (40 per cent. nicotine) ........................................... ½ pt.
- Water .......................................................... 100 gals.
- Soap ........................................................... 3 to 5 lbs.

**Formula 2. Fish-oil Soap.**
- Fish-oil soap .......................................................... 20 lbs.
- Water .......................................................... 100 gals.

These are recommended for fall or spring spraying to destroy the "flies."

**Formula 3. Miscible Oil.**
- Miscible oil .......................................................... 7-8 gals.
- Water .......................................................... 100 gals.

This is a rather dangerous spray and should be used only in the spring as buds are swelling and never after buds begin to show green at the tips.

**Formula 4. Lime-Sulphur Mixture.**
- Lime-sulphur solution (32°-34° B.) ........................................... 1 gal.
- Water ........................................................... 8 to 9 gals.

To be applied just as the blossom cluster-buds separate at the tips to destroy psylla eggs about to hatch and newly-emerged nymphs.