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COMBATING PLANT LICE.

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*Connected with Second Judicial Department Branch Station.
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Plant lice are most peculiar insects. Popularly they are called "green flies" or "green aphides," and some species of them are known as "ants' cows." Science has found this name truly given, for ants know well how to excite the tiny lice, causing the sweet juice to flow upon which the wise little "milkers" delight to feast. If useful to the ants, however, the lice are injurious to man; and economic entomologists have devoted time and thought to the study of their lives, finding in the lice themselves peculiarities more wonderful than the ant's use of them.

The females of some species, instead of laying eggs fertilized by the males, produce offspring by a process of budding similar to the methods of reproduction existing in very low orders of plants like the bacteria, yeasts and molds. From the eggs which pass the winter only wingless females known as "stem mothers" are produced, and these give birth to living young; also all females, but some of them winged, some wingless. These in turn produce females only, and this process continues for several generations during spring and summer, the multiplication being often almost incredibly rapid. In the fall true sexual forms, both male and female, are produced, which pair, and the female lays a few eggs instead of producing many living young. The lice die, but the eggs endure the cold of winter and hatch in the spring into the

*This is a brief review of Bulletin No. 139 of this Station on Plant Lice: Descriptions, Enemies and Treatment, by V. H. Lowe. Any one specially interested in the detailed descriptions of the insects will be furnished, on application, with a copy of the complete Bulletin.
"stem mothers," which start the lice anew. Some species live only upon plants of one kind, the winged females spreading the species only to other plants of the same sort; while the winged females of other lice may live upon entirely different plants from those preferred by the "stem mothers," but they return in the fall, so that the eggs are laid upon the favorite food plant of the spring forms.

As already indicated, plant lice are not of one kind, as are all canker worms, gipsy moths or Hessian flies, but belong to different species, differing in life history, varying in form and living on different plants.

All, however, are true bugs, belonging to the economically important order of Hemiptera, which includes such destructive pests as the San Jose scale, chinch bug, squash bug and chicken louse.

The mouth parts of plant lice are not cutting or grinding instruments, but the outer parts are modified into sharp, tube-like beaks which enclose the thread-like inner parts with which the lice pierce the surface of the leaves and suck up the flowing sap. The mouth of each little plant louse is a complete drive-well outfit with a suction pump attachment. The wounds made by the lice and the effects produced by their feeding differ with the species of lice and with the plant attacked. In some cases galls are formed upon the twigs, roots or leaves; in others, the bark of the tender twigs is pitted and scarred; but most commonly the prominent sign of the presence of the lice is the curling up and withering of the leaves from which the lice have pumped the sap. Upon the leaves of currant bushes in the Station gardens during 1897, red bladder-like galls were formed, the amount of distortion seeming to depend considerably upon the variety of currant, as Fay and Cherry currants were more curled than London Red, though affected by the same lice in equal numbers. This distortion is shown at Plate IV, fig. 5. The honey dew secreted by the lice frequently coats the leaves, branches and fruit with a sticky liquid which soon becomes black and unsightly from a fungus which grows in it.
PLATE I—WORK OF PLANT LICE ON CURRANTS.
PLATE II.—ENEMIES OF PLANT LICE,
PLATE III.—Hyalopterus pruni, Plant Louse of Plum.
(Fig. 4 reversed by engraver.)
PLATE IV.—PLANT LICE OF CurrANT.
As these insects do not eat the leaves or buds, **Remedies.** internal poisons like London purple or Paris green do not affect them, but something which kills by contact must be used.

Perhaps the best and simplest of the remedies is *good* whale oil soap solution. This is made by dissolving 1 pound of a standard whale oil soap* in 7 gallons of hot water. A good soap of this character may be made at home by boiling together for two hours 1 pound of crystal potash lye, 3 gallons of water and 3 pints of fish oil. Do not add the oil until the lye is dissolved.

Other remedies are kerosene emulsion, kerosene-water mixture, tobacco decoction, concentrated extract of tobacco and pyrethrum, or “Persian insect powder.” Whichever of these remedies is used the application should be made early in the season when the lice are but few—when leaves are unfolding and buds are breaking—else the leaves will have curled up so that the lice cannot be reached by the solutions. Spray from below, as the lice choose the under sides of the leaves, and *spray thoroughly.* If the lice have not been noticed until late it will be best to cut off the worst affected leaves, especially on bushes and small trees where the curled leaves can be reached easily. One or two careful sprayings following this treatment should keep the lice in check. The work of the lice upon untreated currant bushes in the Station gardens is shown by Plate I. Other rows in the same plantation were sprayed three times—on May 15 with a “1 pound to 10 gallons” solution, which proved too weak to be effective, and again on May 30 and about June 6 with 1-to-7 solution—and were thus practically freed from the insects.

**Natural enemies.** Plant lice were very abundant during the season of 1897 owing to specially favorable conditions; but usually they are not very troublesome because other insects destroy them.

*The Station has had good success with Caustic Potash Whale Oil Soap No. 3 (James Good, 514–518 Hurst St., Philadelphia), and with Anchor Brand whale oil soap (Leggett & Bro., 301 Pearl St., New York). These cost $3.25 to 4 cents a pound, wholesale.
These are of two classes: predaceous insects which eat the lice or suck their juices; and parasitic insects which lay their eggs within the bodies of the lice so that their young find there both homes and food.

Several of these friends of the fruit grower are shown in Plate II. Their appearance and character should be learned by all who have to deal with plant lice, so that the little helpers may be protected and encouraged—not dreaded and killed as some of them now are.

Among the most important of these are the larvæ of the syrphus flies. The egg of one species of this fly, enlarged 4 times, is shown at Fig. 11, attached to the base of an apple leaf bud, upon whose tip the lice are collected. At the left is shown the larva, natural size. These little larvæ, and those of another species, work their way in among the clustered lice, whose bodies they quickly seize, drain of their juices and cast to one side; so that the little destroyers are sometimes wholly concealed by the brown shriveled bodies of the dead lice and the white dust which covers them. When full grown these larvæ form little cases, larger at one end, which are usually attached to the under surfaces of the leaves, and from which the mature insect, a two-winged fly, emerges in a few days. It is thought a moderate statement to say that 40 per cent of the plum lice in the Station orchard last season were destroyed by larvæ of syrphus flies.

The lady bird beetles are also very destructive to plant lice, the one most commonly found last year, especially on the plum trees, being the 15-spotted species shown as larva, natural size and enlarged, at Fig. 7; as pupa at Fig. 8, and as a mature beetle at Fig. 10. Both larvæ and mature insects eat the plant lice, and do no damage. The pupæ, although they may attach themselves to the plums, as shown at Fig. 9, do not break the skin but simply cling to it by a gummy secretion. Five distinct species were found at work in quite large numbers last year.

Another fierce enemy of the plant lice is the aphis lion shown, greatly enlarged, at Fig. 12. The actions of this little insect do not belie its name or appearance; for it is most ferocious in its attacks upon the lice, grasps them with
its long jaws, speedily sucks their life juices and casts away the empty skins. This savage little larva comes from an egg attached to the top of a stiff stalk of silk nearly a half an inch in length, which is fixed upright upon the surface of the leaf. When the larva has attained its growth and sattiated itself with lice it rolls up into a white, silk-covered ball, from which emerges, not a savage beetle or stinging hornet as might be expected, but a delicate lace-winged fly.

A parasitic enemy of our soft-bodied little foes is shown in the upper figures of Plate II. This minute little ichneumon fly (Fig. 2; Fig. 3, enlarged) is allied to the wasps and its ovipositor is more to be dreaded by the lice than is the wasp’s sting by man. The fly hovers over a louse-infested leaf, selects a victim, usually one about half grown, and deposits an egg upon its abdomen. This soon hatches, the little larva eats its way into the distended body of the doomed louse, at first avoiding any vital organ, and there subsists until full grown, when it cuts out a little hinged door, as shown at Fig. 6, and emerges. The parasitized lice become inactive, swell up and become hard, brittle and pearly white, as shown on the underside of a leaf at Fig. 1.

Species of lice. All species of lice were abundant during 1897, but one species did most of the damage upon plum trees, and two species upon currants. The louse, Hyalopterus pruni, which was unusually abundant on the plum, is shown in the figures of Plate III, Fig. 1 being the larva; Fig. 2 the pupa, or half grown winged female; Fig. 3, the winged female which gives birth to living young; Fig. 5, the wingless female of this character, and Fig. 7, the true female or egg-layer. Fig. 9 represents the winter eggs near the buds, Fig. 10, the lice collected on the under side of a leaf, and the other figures show details of structure which mark specific differences.

The currant lice, Myzus ribis and Rhopalosiphum ribis, and their work are shown in Plate IV, Figs. 1 and 2 being of the mature male, and Fig. 3 of the larva of the former species; and Fig. 4, the winged female of the latter. In this figure he anterior wings are not typical.