

LIFE HISTORY AND CONTROL OF THE BEET ROOT LOUSE
(Pemphigus betae Doan)

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Before discussing the sugar beet root louse it will be well to give a brief on the habits of plant lice relative to the methods of feeding and host plants.

Plant lice in general have piercing mouth parts and penetrate the plant tissue with piercing stylets and then suck the plant fluids through a tube-like structure formed by the upper and lower lip. The feeding is similar to a mosquito sucking the blood from some higher animal.

Most plant lice have one or a series of plants upon which they feed, but many of them have two distinct host plants (this varies with different species), some have a winter host plant known as the primary host, upon which the louse deposits its eggs which remain during the winter, and the secondary or alternate host upon which it lives during the summer.

The method of reproduction also varies from that of general insect life. The eggs hatch into stem-mothers which gives rise to several generations of offspring by giving birth to living young. These mature rapidly and the process is repeated through several generations, all producing females and the reproduction is accomplished without copulation with the male. Such a type of reproduction is known to science as a "parthenogenic reproduction." It requires only about 10 days for a generation, consequently there are many generations each season. The cabbage plant louse produces about 33 generations in one season.

There are in Colorado three distinct species of plant lice that attack beets; the sugar beet root-lice (P. betae); or P. balsamifera William, (probably the one in Colorado), the green peach-aphis (Myzus persicae Sulz.) and the black beet-seed louse (Aphis rumicis Linn.). Only the root-lice will be discussed here.

Life History

The life history of the sugar beet root-lice is rather complicated. The food plants are the roots of beet and many other plants, and the leaves of the narrow leaf cottonwood. The louse feeds upon the beet roots in the summer and migrates, in winged form, to the cottonwood trees in the fall during September and October depending upon weather and soil condition. The winged fall migrants are all females and these, after reaching the winter

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host plant, produce a generation of the true sexes. These are all wingless and the females are about twice the size of the males. Only a few of these individuals are produced by each fall migrant and they are mostly females. In about 4 days these forms mature sexually, copulate, and the female deposits a single egg in a crevice of the bark on the tree and then dies. The males are also short lived.

Eggs

The eggs, which are very small, yellowish in color, remain without change on the tree until spring when they become dark in color and start hatching about the last of April or first of May.

Stem Mothers

The young lice that hatch from the eggs in the early spring crawl out on the twigs and cluster upon the expanding buds. As soon as the leaves unfold they begin feeding on the upper side of the leaves near the base of the leaf and generally at the angle of the midrib and the first vein. The feeding causes the leaf to proliferate first forming a depression, which gradually deepens and forms a gall which finally closes from above by leaf growth forming a narrow slit along the midrib. The gall soon encloses the young stem mother. About June 1 the stem mothers begin giving birth to young aphids. The average is about 75 but as high as 172 progeny has been recorded. All these young lice are winged and are females. They are termed spring migrants.

Winged Spring Migrants

The progeny of the stem-mothers, which are all females, develop wings by the latter part of June and by July 20, 90 percent have left the galls and flown to some other summer host plant where they produce young which eventually make their way to the food plant roots. Pigweed (Chenopodium album) and many grasses are favorite early summer food plants as well as small beet plants. The fact that beet-root louse seldom becomes plentiful in beet fields until the middle of July has led to the belief that the majority of beet fields become infested from the cottonwood gall migrants.

There is another source of infestation of this louse as considerable numbers of them overwinter in soil where beets have been grown and are ready the next season to attack the young beets as soon as they start to grow.

The lice produced on the beets or related plants are pale yellowish and the tip of the abdomen is covered with a white thread-like waxy secretion and resembles in no way the wingless forms on the cottonwoods.

Control

The control of this pest is generally cultural practices. Irrigation of crops at the time the spring migrants are arriving from the cottonwoods is probably the most effective. This would vary with the locality and season but in this part of Colorado it would be somewhere between June 10 and 20. Wet soil is detrimental to the beet-root louse while dry soil is inducive to their development.

Early irrigation, to many, is a debatable question and where there is a shortage of water may be out of the question. We would therefore have to make this recommendation with reservation as this might waste early water and cause a shortage at the critical growing period later on. Some people are of the opinion that early watering is detrimental to beets. However, the results of the work done by the Great Western Sugar Company at Longmont, Colorado, show that early application of water (about the 20th. to the 22nd. of June) increased not only the yield in tonnage but also in the percentage of sugar produced. This was particularly true in the dry season which favored the development of the root- louse.

As a comparison of early and late watering on the effects of beet growth and sugar content let me cite from Mr. Maxson's work at Longmont Great Western Experimental farm.

Beets irrigated June 22 yielded 15 ton per acre with 16.05 percent of sugar; those irrigated July 5 to 10 yielded 14 tons per acre with 15.84 percent sugar with a gross return of the early irrigation of approximately \$5.00 per acre over the late watering.

Preparation of the seed bed is another factor important in the control of those lice that overwinter in the soil. The fields should have fall cultivation so as to pulverize the clods, giving a surface mulch that would seal the aphids in the ground and eventually kill them. Dry, cracked, cloddy ground is inducive to longevity of the beet root- louse.

As this pest is a general feeder crop rotation is of little value in its control. To sum up then, the best method of control is to bring about the most favorable conditions for beet growth, this would include soil fertility, cultivation, and irrigation.

Experiments and observations have proven that the losses caused by heavy infestation of the beet root- louse varies from one to three tons of beets per acre, with a corresponding loss in sugar content and a decrease in the purity of the beet juices.

Natural Enemies

As in all things, nature takes a hand in controlling this pest and this biological control is accomplished through insect enemies of different kinds, such as parasites and predators.

The most efficient predaceous enemy is the Lady beetles. These feed upon plant lice in both the young and adult stages. Many small, wasp-like insects will parasitize the plant lice. These insects deposit a single egg in the body of the plant louse. The egg hatches into a tiny grub-like animal which feeds upon the juices of the plant louse and when full grown it changes from the footless grub to the adult insect and emerges as a parasite through a small hole in the aphid. In a short time it is ready to continue the good work of killing, by parasitizing other plant lice.

There are several flies that are also aphid enemies. One of these feeds underground and is always associated with the beet root-lice. It is Chloropisca glabra. The larvae are pale yellowish in color and very slender; the adult is black with yellow longitudinal stripes. Syrphus or hover fly larvae feed almost entirely on plant lice and a certain midge (Aphidoletes marina) is very beneficial in plant lice control. Chrysopa larvae Pentatomids; Capsids and many other insects, are also enemies of plant lice.