Section D. Sugar Beet Insects - Chairman: C. R. Jones

APHIDS AFFECTING SUGAR BEETS

By Miriam A. Palmer

Aphids are peculiar in both life cycle forms and in their structural characters. It therefore seems necessary to make a few preliminary explanations.

The life cycle is peculiar in that the method of reproduction, the form of the adult, and often the choice of hosts, varies with the seasons. The winter is typically passed in the egg. From the egg, in the spring, is hatched the stem mother or fundatrix which form is wingless and starts the colonies of summer forms. The stem mother is agamic or parthenogenetic, i. e., reproducing without fertilization of eggs by sperm cells from a male. Her method of reproduction is also viviparous which means bringing forth young alive instead of laying eggs. Her progeny are called summer viviparous females, either winged or wingless, and are also parthenogenetic like the stem mother. There are numerous generations of this form thruout the summer, as it takes only about ten days for development to maturity. In the fall appear the sexuales, or true females, typically wingless, and males, either winged or wingless. Reproduction is now sexual and oviparous. The females, after fertilization by the males, lay the eggs and soon afterwards both males and females die. The eggs lie dormant till spring when they hatch, producing the stem mothers.

The choice of hosts varies in different species. Some kinds of aphids will feed on only one species of plant and remain thereon thruout all seasons of the year. Other species have winter hosts, also called primary hosts, and summer or secondary hosts. The eggs are laid on the winter host and this is always some perennial plant, usually woody. The placing of the eggs on this plant necessitates the presence of also the sexuales and since the females and often also the males are wingless, fall migrants must fly to the winter host to give birth to the females and possibly also the males. The stem mother hatching from the eggs, does not acquire wings and therefore not only developes on the winter host, but deposits the first summer generation there. Her descendants either in the first generation or gradually thru two or three generations, eventually come to consist of all winged individuals which fly away to the summer or secondary hosts. The summer hosts are usually herbaceous plants and one kind of aphid may accept quite a variety of plants. If the summer host is able to live thru the winter in protected locations out doors, or in warm climates, or in greenhouses, summer forms may remain on this host and reproduce there thruout the year, either with or without producing fall migrants to fly to the winter host.

Aphids belong to the sucking insects. They feed not by biting off pieces of the plant and chewing them up like grasshoppers, but by piercing the surface of the plant and sucking up the sap. The mouth parts are of the nature of a beak which contains slender bristles which penetrate the tissues of the plant and form a tube thru which the sap is drawn into the alimentary canal.

The family of aphids is distinguished from other insects by wing venation and number and shape of antennal joints. The antennal joints are never more than six in number. Aphids generally possess also certain peculiar structures, namely cauda and cornicles. The cauda is a tail-like projection at the

tip of the abdomen. It varies in size and shape in different species. The cornicles are openings varying in shape from a mere pore to long tube-like structures, situated one on each side of the posterior part of the abdomen. These structures were formerly supposed to secrete the honey dew which is the sticky substance found on the leaves about and below aphid colonies, and is eagerly sought by ants. The honey dew, however, comes not from the cornicles but from the tip of the abdomen and is excreted from the alimentary canal. That this is what the ants are taking and that they are not milking the cornicles or feeding from them can be easily observed by watching with a hand lens the activities of ants in a colony of aphids.

There are three species of aphids which attack sugar beets, viz., the sugar beet root-louse (Pemphigus balsamiferae Williams or Pemphigus betae Doane); the black beet-seed louse (Aphis rumicis Linn.) and the green peach aphid (Myzus persicae Sulz).

The sugar-beet louse attacks the roots of the beet, using the beet as a summer host. The winter host is the narrow-leaved cottonwood (Populus augustifolia) also possibly the balsam poplar (Populus balsamifera). The eggs are laid on the bark and from these hatch the stem mothers in the spring. The feeding of the stem mother and her progeny on the upper side of the leaf next the midrib close to the petiole causes a depression to form in the leaf which developes into a pocket-like gall which projects on the underside and encloses the colony of aphids. The gall opens on the top surface of the leaf along the midrib, but the edges of the opening remain closely pressed together till the first of the progeny become mature. The outlet of the gall then opens, allowing the escape of the winged lice, the spring migrants, of which there are eventually a hundred or more from a single gall. These winged females are black on head and thorax and dusky green on the abdomen. They fly to beets and related plants, crawl into the ground, and there deposit living young on the roots of the plants. Many generations of wingless lice are produced thruout the rest of the summer. These aphids are pale yellow, two millimeters long and covered with white threadlike waxy secretion. About the end of August winged aphids again appear, similar in color to the spring migrants from the galls. These are the fall migrants. They leave the beets, flying back to the narrow-leaved cottonwoods, where they deposit their young on the bark. These young develop into the sexuales. The females are yellow in color and much smaller and more slender than the viviparous forms. The males are darker yellow and still smaller than the females, barely visible to the naked eye. After copulation with the males, the females lay each a single egg, nearly as large as their bodies and then crawl away to die. The eggs remain on the bark unhatched until spring when the leaf buds start to open.

Injury to the beets consists in yellowing, shrinking and stunting the plants in proportion to the number of aphids present.

Control mostly recommended is irrigation at the time the spring migrants are arriving from the cottonwoods. This time will vary according to latitude and lateness of season; in the vicinity of Denver it is usually from June 11 to 20. Wet soil discourages aphids while dry soil encourages them. Rotation of crops does little good since the hibernating aphids in the soil are usually of little importance in the next years infestation. Cutting out of narrow-leaved cottonwoods in the vicinity of beet fields should be quite helpful.

The green peach aphid appears on the leaves of the beet, especially on the undersides. The aphids are hardly two millimeters long and pale green in color; winged ones also with black patch on back of abdomen, as seen with a hand lens. The primary or winter hosts are the peach and plum trees and the eggs are laid on the bark of these trees. The little stem mothers hatch just before the buds open and may be nearly mature by the time the blossoms appear. At first they are dark green but when fullgrown the color is apple-green to deep pink, matching the color of the blossoms. Length of stem mothers is two millimeters. The lice feed on the leaves causing them to curl and twist very badly. The progeny of the stem mothers contain some winged forms which leave the peach for the summer hosts, which are various herbaceous plants besides beets. This migration from peach and plum begins about March 23 and ends about June 15 in the vicinity of Ft. Collins. These winged spring migrants start colonies on the beet leaves, each female producing six to eight living young a day. As only about ten days is required for development to maturity numerous generations can be produced thruout the summer. Fall migrants start to appear in September continuing even into November and fly back to the peach and plum to deposit there the young egg-laying females. The males develop on the beet, acquire wings and fly to the winter host to fertilize the females.

Control would be either (1) killing the stem mothers on peach or plum by spraying with lime-sulfur just before the buds open or by Black Leaf 40 just after buds open, but before leaf curling; or (2) killing the summer forms on the beet by spraying with Black Leaf 40.

The black beet-seed aphid appears as a black or green-black aphid massed in compact colonies on and under the leaves and in case of seed producing beets also on blossoms and seeds. The aphids are slightly over two millimeters in length and colonies usually contain quite a number of winged individuals.

The winter host is Euonymus or Strawberry Bush. Here the eggs are laid in the fall and the young stem mothers hatch in the spring about the time the buds open. The little newly hatched dark green or black lice are barely visible to the naked eye. They settle and feed on the opening leaves and when full-grown, about May 7, are over two millimeters in length, green-black in color and start producing the first summer generation. Winged forms, the spring migrants, develop and fly away to the summer hosts which include besides the sugar beet various truck crops and herbaceous flowering plants. On the leaves of the beet great colonies are formed, possibly causing the leaves to be puckered or curled more or less. In September or October fall migrants will appear and fly back to the winter host to deposit the little egg-laying females. These latter when full-grown, are smaller and more slender than the summer viviparous forms and of an olive-green or olive-brown color. The males develop on the summer host, acquire wings and fly to the winter host, arriving when the females are approaching maturity. They copulate with the females, fertilizing the eggs, and then die. The eggs are then laid on the twigs where they await the spring for hatching.

The viviparous generations, however, may continue thru the winter at the bases of protected plants which may live thru. From such places infestation may spread by means of winged individuals.

Control is the same as given above for the green peach aphid.

Biological control is accomplished by a number of insects of different kinds, both predaceous and parasitic. Lady beetles and their larvae are prob-

ably the most important enemies. Certain diptera, flies, are enemies of aphids, since their young, called larvae, or maggots, feed on aphids. One of these which is found only underground and is partial to the beet root-aphid, is Chloropisca glabra* The larvae are pale yellowish, smooth and slender maggots, often found among the aphid colonies on the beet roots. The adult is a tiny black and yellow striped fly.

Found with aphids above ground are various kinds of syrphus fly larvae which can easily be observed to pick up aphids and suck out the juices, throwing away the empty skins. The adults feed on nectar in flowers and can often be seen hovering about flowers for which reason they are also called hover flies. The flies are often marked with black and yellow bands.

A certain kind of midge fly (Aphidoletes meridionalis Felt) lays its eggs in colonies of aphids. The young are tiny maggots, pinkish in color. They seem to lie idly about among the aphids, but if observed closely with a hand lens for a sufficient length of time, they can be found sucking juice from the membraneous connections between the joints of the legs. The aphids thus weakened soon die and their bodies turn brown.

Capsid bugs of different kinds feed on aphids in both larval and adult forms. They have sucking mouth parts or beaks with which they stab the aphids and feed on the body fluids.

Certain Hymenoptera, or tiny wasp-like insects, lay a single egg just under the surface of the body of the aphid. This egg developes into a grub which feeds on the juices of the aphid until full-fed. It then kills the host, pierces the underside of the aphid's body fastening it to the leaf and pupates inside the remaining shell which is all that is left of the aphid. This shell turns either whitish or black, varying with the kind of parasite. Later the adult parasite emerges thru a round hole which it has cut in the aphid shell. These dead parasitized aphids show up very clearly in an aphid colony.

When large numbers of any of these kinds of predators or parasites are found it is not necessary to apply methods of artificial control.

LIFE HISTORY AND CONTROL OF THE MAJOR LEAF EATING INSECT PESTS OF THE SUGAR BEET, EXCLUDING GRASSHOPPERS

By

Chas. R. Jones
Station Entomologist

The damage caused to any crop by leaf-eating insects is supposed to be paramount. This is undoubtedly because the feeding being exposed to view and to the casual observer and grower it attracts attention, hence is more generally known. There are several insect pests that attack the leaves of sugar beets and each will be treated separately and arranged in accordance to economic importance.

---

* Parker, 1918 - Jour. Econ. Ent., Vol. 11:p 368-380