

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 membranous 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 develops 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.

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

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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.

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



The beet webworm is undoubtedly the most destructive pest of the leaf-eating group if not the greatest pest of the sugar beets. It undoubtedly ranks first and causes greater loss to the beet industry than any other pest.

### Early History

The exact history of the pest is not accurately known. It was first recorded from Utah in 1869, in 1873 it appeared in Michigan and in 1903 was reported from Colorado in Larimer County. From that time it has gradually spread to all areas where beets are grown.

Records show that it has been taken from New Mexico up to an altitude of 11,000 feet. Thus it has a wide range and can sustain life in several zones. This pest has not only been recorded from all beet-growing sections in the U. S. but also our island possessions and many European countries.

### Food Habits

While the main food plant is the sugar beet, the webworm is more or less of a general feeder and has been taken on all types of garden crops, weed, Russian thistle, alfalfa, fruit trees and what not.

The injury done by the worms feeding upon the young beet leaves often kill the beets outright; older beets also die when the crown has been destroyed. Where simple defoliation occurs growth is retarded and yield and sugar content is impaired. Every year more or less damage is done by this pest.

This insect has two and a partial third brood. It has been estimated by Mr. A. C. Maxson of the Great Western Sugar Co., that the first brood often defoliates and injures upwards of 31,000 acres of beets while the second brood defoliated more than 25,000, decreasing the tonnage by from 1/4 to one ton per acre, with a loss to the farmer of approximately \$300,000 annually.

The period of damage by this insect is prolonged, extending from early June to September. The first generation causes the greatest damage as the beets are rather small and cannot withstand the injury. At the time the second generation appears the beets have grown to sufficient size to withstand the worm attack, although they are very often completely defoliated. The third generation seldom causes serious damage. This pest passes through 4 stages, egg, larva, pupa and adult.

The winter is spent in the larval stage, in early spring pupation takes place in a silken tube in the ground. The adult emerges as a moth in May, feeds and soon begins oviposition.

The egg stage varies from five to seven days.

Larval stage lasts from 17 to 20 days, during which time it is continually feeding. The pupal stage is about 11 days. These periods of time are average, depending upon climatic conditions.

### Control

Control may be listed as natural and artificial. Under the former there are many natural enemies of these, birds play a very important part. The blackbird is its foremost enemy. Insects, both predaceous and parasitic,



are also important.

Under the latter may be placed cultural methods and poisons.

As the worm overwinters in the ground in the larval stage many of them are undoubtedly destroyed by dragging the beet fields. By this process the pest is exposed to winter conditions, birds and other enemies, and a partial control is effected. Deep plowing or harrowing after harvest will also prove quite effective. If this is not possible early spring soil preparation should be practiced.

Clean cultivation is also an important factor. As the worms are general feeders, all weeds especially Russian thistle and lambs quarter, should be kept down. Weeds should not be allowed to grow even around fence rows or on ditch banks as the moths will oviposit on them and when the worms have consumed these plants they will migrate to the beets where serious damage will follow.

Arsenical poisons are very effective in beet webworm control. Paris green has proven to be the most effective and satisfactory remedy as its action is quick and the beets are very resistant to its burning qualities. Arsenate of lead may be used in lieu of Paris green. Its action is slower and it must be applied in large amounts.

Dry pyrocidine was also used in some experiments on a small scale and this material was very effective but rather expensive. A small hand duster was used and the material applied at the rate of 30# per acre. The results obtained were very satisfactory, in fact better than controlling the worm by Paris green, as the feeding of the larvae stopped as soon as the dust was applied. It is believed that if a power duster is used that the amount used per application could be cut in half at least. I understand that by the use of airplane the amount per application has been cut to 13# per acre. Dry pyrocidine is very promising and more extensive experiments should be conducted.

Successful control depends largely upon applying the poison at the proper period, that is when the worms are but a few days old, it then requires less poison to kill them and they will not have an opportunity to do serious damage to the crop.

#### OTHER CATERPILLARS

While on the subject of leaf-eating caterpillars the alfalfa webworm should come next. This insect is a close relative to the sugar beet webworm, in fact it belongs to the same genus. The larvae of this pest are also general feeders. They will attack all types of garden crops, weeds, etc. Over 20 different weed species have been recorded as food plants. On cultivated plants, however, their attacks are generally confined to alfalfa on which the worms spin masses of whitish webs at the tips of the plants, enclosing the new tender leaves and blossoms which the worms eventually destroy. This web furnished ideal protection for the enclosed feeding worms.

The attacks of this pest on sugar beets is quite similar to that of the former insect. Occasionally leaves will be found practically covered with a web. These webs terminate in a long funnel-like process which extends to the ground.



This pest may be controlled by similar methods applied to the sugar beet webroom. With Paris green on small acreages the barrel type of sprayer may be used, but it is best to have a machine that will maintain sufficient pressure to apply the spray in a fine mist as coarse drops will collect on the waxy leaves of the beets and run off. The machine should also have an agitator to prevent the Paris green from settling to the bottom of the tank.

#### CUTWORMS

There are two cutworms that sometimes are important as sugar beet destroyers, the Army cutworm, Chosezagrotis auxiliaris Grote., and the pale western Porosagrotis orthogonis Morr. The latter is more prevalent and does greater damage when it occurs.

These worms like most all cutworms, develop in the fall and overwinter in the larval stage. About the latter part of April or first of May, when abundant, they are large enough to attract attention and may in heavy infestations cause considerable damage to young beets.

Other general leaf-feeding caterpillars at times attack sugar beets but these are of minor importance.

#### Control

If any of the leaf-eating caterpillars are known to be in beet fields in the early spring they may be controlled by use of Paris green. If their presence is not noted until the damage is done and the vegetation is destroyed, one will have to revert to the use of a poisoned bran mash similar to that used in grasshopper control; 100# should be sufficient to poison 12 acres of land.

#### THE BLISTER BEETLE EPICAUTA MACULATA

These beetles are formerly known as the "Old Fashioned Potato Beetle". This was to distinguish them from the "Colorado potato beetle". The common name is now obsolete.

Blister beetles belong to the order Coleoptera, are slender, elongated and cylindrical in shape, the head being broader than the thorax. This gives them the appearance of having a neck. The elytra are soft and not of the texture of other members of this order. There is an oily substance in their bodies known as Cantharidine which will blister the tender skin of persons if the beetles are crushed on it, hence the name Blister Beetle. A commercial produce "Cantharides" or "Spanish fly", which is used extensively in veterinary practice, is made by grinding the beetles into a very fine powder.

Blister beetles are gregarious in habit. They feed in droves and at various times the bands may be found in a certain part of a field; the next day returning to the same spot not a single beetle will be found. Thus they migrate from one part of the field to another or even to a different field altogether.

The larvae of this insect, as far as is known, feed upon the eggs of grasshoppers. Thus we have an insect that is noxious in one stage and beneficial in another.



There are about 200 species of blister beetles known to occur in America north of Mexico.

### Life History

The life history of only a few of the American blister beetles has been worked out. The best one known is that of the striped blister beetle (Epicauta vittata, Fabr.) and is briefly as follows. The insect winters as a full grown larva, in an earthen cell in the soil, and is known as a pseudopupa. It is about 2/5 of an inch in length, tough-skinned, yellowish in color, with much reduced legs and mouth parts. According to Crosby and Leonard it may remain in this condition several years, but usually molts the first season, acquiring functional legs and moves about for a while before it pupates. The true pupal stage lasts about 2 weeks and the adults emerge in June and July. The beetles are very restless creatures and tend, in a very short while, to mass together in great swarms, and migrate from place to place.

The female lays her eggs in clusters, about 1/2 inch below the surface, in rather compact soil. Riley has recorded as high as 1222 eggs laid in 16 masses from a single individual, which varied from 19 to 125 eggs per mass. The eggs are long, cylindrical, yellowish objects. The period of incubation is from 10 days to 3 weeks. Upon hatching the young are very active, and very strong-jawed and are known as a triungulia. They burrow through the soil until they reach an egg pod of some grasshopper, where they feed and develop. The larvae molt four times in 4 to 5 weeks, and pass through a remarkable series of changes known as hypermetamorphosis, during which time its legs and mouthparts become progressively smaller and smaller until it reaches the pseudopupa stage described above. In this stage it winters. There is apparently but one generation each season. The larvae of several species of blister beetles are known to feed upon grasshopper eggs and are thus beneficial in the immature stages. The food of the majority has not yet been determined. As the adults are general feeders they will feed upon all types of vegetation.

Plants known to be attacked by blister beetles are; potato, tomato, eggplant, beans, carrots, peas, pumpkin, onions, spinach, beets, radish, cabbage, corn, clematis, aster, zennia, and all types of weeds and sugar beets.

### Control

As the beetles are very restless and rather resistant to arsenicals at ordinary strengths, early recommended controls were dusting or spraying with exceedingly strong applications of arsenicals, or sodium fluosilicate, or to dust heavily with slaked lime in order to disturb the beetles and cause them to move on. They have actually been driven from fields by waving brush over infested plants or by beating the plants with gunny sacks. The latter are only temporary methods and in a very short time the beetles disturbed in other quarters will reinfest previously infested areas.

As this pest follows outbreaks of grasshoppers it is only in late years that it has become an important pest, not having appeared extensively in Colorado for the past 20 years or more. When it did occur in '36, after the previous heavy grasshopper outbreak, considerable experimental work was necessary to find a product that would kill the insect by contact. This was necessary, due to its migratory habit. Several compounds were used, such as sodium fluosilicate, Garden Guard, Kalite, Rotenone, Cubor, sulfur, dry pryocide, etc.



The latter applied at the rate of 1 to 9 gave a kill of 93% of the beetles with one application, and is therefore to be recommended for this pest in any outbreak.

#### SUMMARY

1. Arsenicals do little good as they have to be applied in such concentrated form.
2. Commercial dusts such as Kalite cause the beetles to leave the plants in about 24 hours.
3. Cubor apparently has the same affect as Kalite.
4. Lime alone is effective in causing the beetles to migrate.
5. Pyroicide mixture actually kills the beetles in less than 24 hours and is therefore the most effective dust used, but it is rather expensive.

#### THE ALKALI BEETLE

In the beet-growing districts of Colorado the beetle is known as the alkali beetle because it breeds most freely on weedy low, damp ground, where alkali is brought to the surface by seepage.

It feeds upon the beet in both the larval and adult stages. Its damage generally is confined to places in the field near its breeding ground as mentioned above.

The adults are quite active and will often migrate in swarms to various parts of the field. In severe infestations they skeletonize the beet leaves, leaving only the larger veins. The plants thus attacked will soon shrivel and turn brown.

#### Control

When occasion warrants the beets may be sprayed with Paris green, 4# to 100 gallons of water, but as the outbreaks are generally spotted in the fields, a knapsack sprayer is best to apply the poison. It is recommended, however, to note the low alkali places near the beet fields and apply the poison to the weeds, thus killing the larvae and adults before they migrate to the beet fields proper.

#### FLEA-BEETLES

There are many flea-beetles that feed upon beet leaves and these may be controlled by an application of arsenate of lead or dry pyroicide.