

**BULLETIN 102.**

**CELERY INSECTS.**

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**ENTOMOLOGICAL DEPARTMENT.**

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Michigan is peculiarly a celery state. It no doubt has enough swamp lands, of the peculiar muck soil, so requisite to the best success in celery culture, to supply the whole country, and certainly will make use of them largely for this appetizing plant in the near future. Every year brings an increased acreage. When celery was first introduced and raised only in limited areas, no insect attacks were ever reported, and probably none occurred, as an introduced plant is seldom attacked for several years. As several species acquired a liking for it, occasional reports of injury would be received. The past two or three years, the species that attack celery have so greatly increased in numbers and severity that the calls demanded a more extended knowledge which would assist both professional and amateur celery growers to keep these little depredators in check by means of the best remedies that could be suggested. So far as can be ascertained, only two species have been reported in economic literature as celery insects.

But little celery is grown at the college, and what has been learned has been largely by frequent visits to the extensive fields at Kalamazoo, Tecumseh, and Jackson, and through correspondence with some of the most intelligent growers at these places. More might have been learned could the fields and myself have been in closer proximity, but the most destructive species are briefly described, illustrated, and remedies given. Many are spoken of that are not numerous at present but may be in the seasons following.

I wish to express my thanks to the members of the Board and the Directors of the station for their generosity and assistance in making this bulletin what it is, and to Mr. Russell of Tecumseh, and Mr. Wilson of Kalamazoo, and the many other celery growers at the various places visited, for their ever ready assistance in the field work. I am also very

grateful to Mr. VanDuzee, Prof. Fernald, Prof. Osborn, Prof. Williams, the department at Washington, D. C., Profs. Cook and Wheeler of this college, and others who have so kindly assisted me in determining the various material gathered.

#### LOCUSTS AND GRASSHOPPERS.\*

Owing to favorable seasons last year and this for grasshoppers and locusts, they have been very numerous and made their work felt on various plants—celery being one of the number. Those celery fields that have been surrounded mostly by high meadows, grain fields, forest or pasture lands, have suffered the most severely. It is on the drier, more sandy land that they are the most numerous early in the season, and then, as vegetation in these places becomes dry and partly dead, they avail themselves of the fresh and green fields of celery in the low lands. They will never be found on the low lands in numbers except in dry weather when they are driven from the uplands by a scarcity of food. The eggs are laid on sandy knolls or the mellower parts of the uplands, and here the young hatch and attain considerable of their growth before they travel any distance.

If the fields where the hoppers breed could be plowed and thoroughly rolled in the fall, and kept under cultivation the following season, the hoppers would probably be considerably reduced in numbers. The roller is especially important as it is found that rolling crushes so many of the frail egg cases.

#### THE MOST DESTRUCTIVE SPECIES.



Fig. 1. The red-legged locust, *Melanoplus femur-rubrum*—(after Riley.)

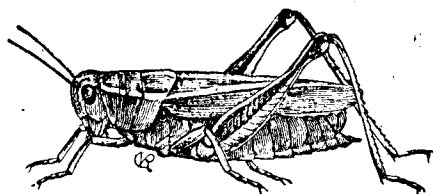


Fig. 2. The two-striped locust, *Melanoplus femoratus*—(after Riley.)

The species most frequently found and found in the greatest numbers was the common red-legged locust, *Melanoplus femur-rubrum* (Fig. 1). While no special study of the species on celery was made, it was evident that those common in meadow and pasture lands were proportionately common in celery fields. They stripped the celery of its leaves along the border as readily as that of any forage plant. Some of the species besides the red-legged locust that were common are the two-striped locust, *Melanoplus femoratus* (Fig. 2), and *Dissostertia carolina*. Of the common meadow grasshoppers, *Orchelimum vulgare*, *Xiphidium fasciatum* and *X. strictum*, and the katydid, *Scudderia furculata* (?) were plentiful.

#### REMEDIES.

A very good preventive, in one instance at least, that came under my observation while in one of the fields, was to leave a strip of land about

\* The term *locust* is applied in its more restricted sense to the brown hoppers with short horn-like antennae, or feelers, and *grasshopper*, to the green hoppers with long thread-like antennae, and will be so used in this bulletin.

four rods wide without plant growth. The instance cited was a strip used in the spring for a plant bed. It was along the end of a field next to a pasture field. The plants had all been taken up and transplanted in other parts of the field and the strip left idle until used for a late crop of celery. The locusts were plentiful along the border, but only a few wandered in far enough to reach the celery, while the other borders were suffering from locust invasions. The disuse of so large a strip of land makes this method of prevention rather expensive unless the surrounding land is of little value. The surrounding of the fields with ditches partly filled with water, although reported as effectual, is also quite an expensive outlay.

At my suggestion, Mr. Slater of Tipton tried sweetened bran with Paris green added, as suggested on page 4 in bulletin 98. He reports that he had no trouble in getting the hoppers to eat it, but was unable to tell whether it killed them or not. From some experiments conducted by myself there seems to be no doubt but that they are killed and quite quickly. The locusts were placed in three lots of which one was fed on molasses and bran with enough Paris green added to give it a green tinge, another the same with strychnine instead and the third without poison. Inside of twenty-four hours those fed on the Paris green were all dead. At the same time only one of those given strychnine was dead, and all were lively and active in the unpoisoned case. It is quite probable that Paris green used in this way will prove very helpful in keeping the number of locusts diminished, but care must be taken that it is not used where fowls or stock can get at it.

What at present seems to be the most effectual means of thinning the numbers is a modification of the "hopper dozer" spoken of and illustrated in bulletin 98. This modification was devised and used by Mr. C. H. Hardy of Tipton and, from his trial of various remedies through the season, he feels that this method is superior to all others. He bought large flocks of turkeys and chickens hoping they would keep the locusts in check, but they trampled the plants and ate the plume of the older ones and did not diminish the number of locusts as much in a day as two men would in a few hours with his hopper collector. The accompanying cut shows

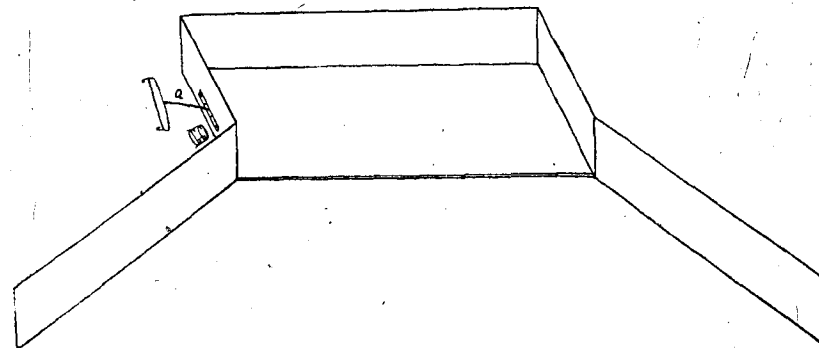


Fig. 3.—Modification of the "hopper dozer" as used by Mr. Hardy. a, Whiffletree attachment—(original).

the outline plan. The pan is made of sheet iron and is about 12 or 15 feet long by 4 to 6 wide. Then with a high fender on three sides and projecting wings from these and a whiffletree attachment at one end as at a, the mechanism is complete. The horse draws the pan to where it is to be set

on the grass at the border of the celery, then two men go into the celery and drive the locusts toward the pan. The two wings aid in crowding them into the center, and soon a large number of the hoppers are on the tar which has been previously coated over the inside of the pan. The collector is then driven up another space and the same operation repeated. Mr. Hardy used an old sugar pan with one side cut off and wings added. It is easier to collect the hoppers before their wings are fully developed, or in the cooler part of the day when they do not fly so readily. The regular hopper dozer is not practical in the celery fields as it must be raised so high to run over the plants without injuring them that the hoppers mostly go under the pan.

#### THE TRUE BUGS—ORDER HEMIPTERA.

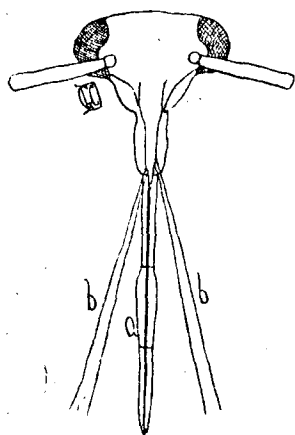


Fig. 4.—Head of the tarnished plant bug, showing the jointed beak, or rostrum, a, and the four needle-like mouth parts, b, used in piercing plants—(original).

is thought by many that these bugs injure the plants by secreting a poison when the sap is drawn. It is quite probable this may be so for the purpose of increasing the flow of sap. We all know of the mosquito poisoning for a similar purpose the puncture it makes.

#### LEAF HOPPERS.

All through the season, leaf hoppers were common on the celery. Early in the season they were especially abundant, usually flying ahead of one like a swarm of flies, as he passed through the field. When the plants are small, these leaf hoppers do a great deal of injury by sucking the sap from the plant through the thousands of little punctures that they make with their pointed, beak-like mouth parts (see 4a, plate I). While the plants, for the first few weeks after transplanting, are having their hardest struggle for existence, the little leaf hopper's work is the most destructive. This season many fields of celery were retarded in growth at this period. This is a part of the season when the celery grower can the least afford to allow any interruption in the growth of his plants.

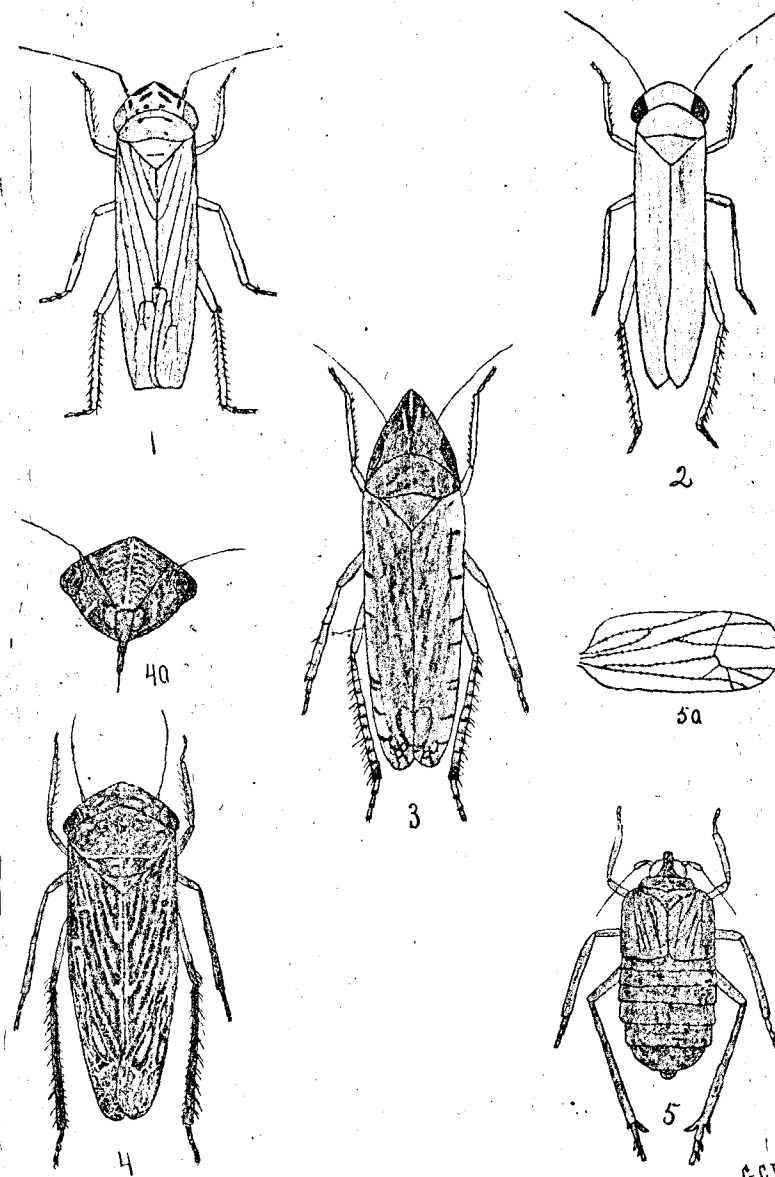


PLATE I.—Fig. 1, *Cicadula 4-lineata*; 2, *Empoasca mali*; 3, *Platymetopius acutus*; 4, *Athysanus instabilis* n. sp.; a, front view of the head showing clypeus, lora, cheeks and front; 5, *Megamelus piceus* n. sp.; a, complete wing of macropterous form. All drawn ten times the natural size.

G. C. Davis

## SPECIES THAT WERE MOST NUMEROUS.

1. *Cicadula 4-lineata* Forbes (Fig. 1 of plate I) was the most common species everywhere. At the college and where the muck had considerable clay in it, they could be taken by the hundred at almost any time in the season. The species is greenish brown, with yellow scutellum, and head spotted as shown in the figure.

2. *Empoasca mali* Le B. (Fig. 2 of plate I). This is a pretty little yellow species with transparent greenish wing covers and green legs. It was very common through the season after July. At Kalamazoo many were found down in near the heart on blanching celery. It is probable that they help spot the white stalks. They breed on the plants.

3. *Platymetopius acutus* Say (Fig. 3 of plate I) was common the latter part of the season. The young were found on the plants early this fall. The species probably does little harm as it prefers to be high up on the leaves instead of on the stems. To the naked eye it is a dark brown and can be easily told by the acute projection of the head.

4. *Athysanus instabilis*\* n. sp., Van Duzee (Fig. 4 and 4a of plate I).

Form of *Deltocephalus inimicus* Say. Black, dotted and marked with fulvous as follows: hind edge of the vertex, a dot, sometimes wanting, touching this either side of the middle, another near each eye, two marks on the disc, a line before each of these, an angular mark at apex including a short longitudinal dash, a dot on the temples, six or eight arcs and the central line on the front, the latter expanded on the clypeal suture, two dots on the base of the clypeus, another on each lora, a spot on the cheeks and their slender outer edge, the irrorations of the pronotum and a few large spots on its anterior edge, six spots on the scutellum—four marginal and two discal—and its median line, knees, a transverse band on the femora and the slender hind edge of the abdominal segments. Posterior legs pale, more or less clouded with fuscous, with the inner face of the flattened tibia black. Elytra pale, slightly clouded at apex, the areoles broadly margined with fuscous, nervures whitish. Last ventral segment of the female long, feebly arquated either side of the middle, with the lateral angles prominent. Valve of the male short, plates triangular subacute. Length 4-4½ m. m.

Quite common at the college through August and September. Mr. Van Duzee has the specimens of the same species from Colorado also.

5. *Megamelus piceus* n. sp., Van Duzee (Fig. 5 and 5a plate I).

Piceous-black; base of the vertex, keels and narrow hind edge of the pronotum, disc of the mesonotum, or at least its carinae, disc of the tergum, especially towards its base and apex, and the edge of the dorsal keel; the genital segments and sometimes the base of the venter, brownish yellow. Face pale shaded to brown above, clypeus deep black. Antennae, rostrum, tylus, and legs pale, soiled yellow, the latter lineate with brown. Elytra reaching to the second abdominal segment in the branchypterous form, with the apex truncated, piceous-brown, or even black, with the apical edge white more or less broadly interrupted with black at the middle; nervures strong, granulated. In the macropterous form the elytra extend considerably beyond the tip of the abdomen about as in *Liburina pellucida*; they are smoky with pale granulated nervures, the exterior and interior of which are forked at about three-fourths their length. Pygafers of the male cylindrical, on their ventral aspect cut out for about one-half their length and carrying on the broad base of this incisure a broad and short projection extended into a short conical divergent tooth at each angle, beyond this are the incurved spine-like stylets included between the long slender ventral projections of the plates. Length, 2½ to 3 m. m.

New York and Michigan. Described from many examples of both sexes taken in western New York on grass in low swampy meadows in August and September, and one female taken on celery at Kalamazoo, Mich., August 26, 1893, by Mr. G. C. Davis.

In this species the vertex is shorter and broader, the pronotum shorter and the meso-

\* This and the following species were found to be new to science and Mr. E. P. Van Duzee, a specialist on Jassids, to whom they were sent, has kindly consented to describe them. His same descriptions will also appear in the Canadian Entomologist.

notum longer with more divergent carinae than in *M. notulus*. The yellowish markings above vary much in extent, some specimens being almost entirely of a dull piceous-black while some are pitchy brown with the pale markings much extended. The characters of the head, the pale face and the black vertex and clypeus seem quite constant as does also the color of the tylus, rostrum, legs and elytra.

Of the others species *Phelpsianus irroratus* Say and *Agallia sanguineolenta* were quite often taken; *Tettigonia noveboracensis*, *Thamnotettix clitellaria*, *Deltocephalus melsheimeri* Fitch and *D. inimicus* Say, occasionally taken. No extensive collecting was done in getting this material. To secure specimens of those most common on celery rather than a complete list was the object.

## REMEDY.

Owing to the fact that leaf hoppers do not feed by chewing the plant, but live on sap taken from the inside of the stem or leaf, most of our insecticides are of little avail. This being the condition and the hoppers so injurious to the young plants, another method was devised that has

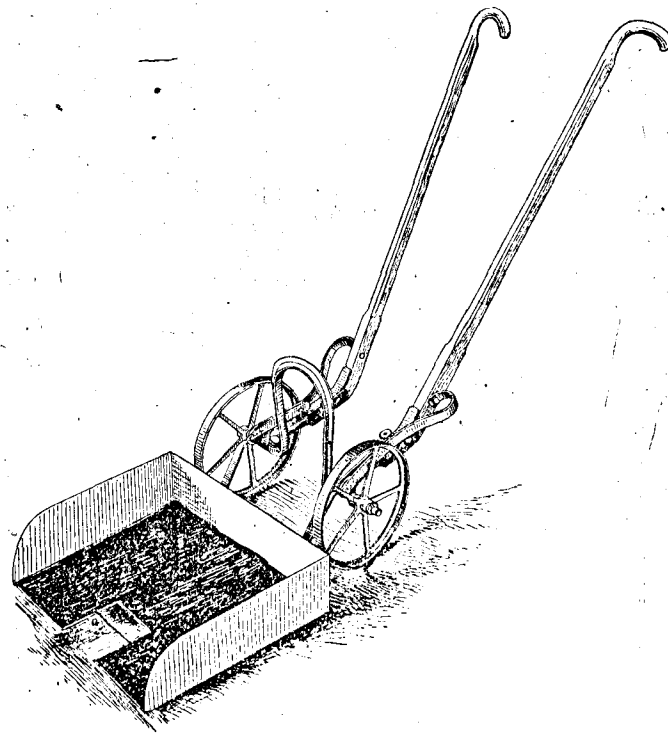


FIG. 5.—The hopperette used in collecting leaf hoppers, flea beetles and many of the celery bugs. a, string—(original).

succeeded even better than my first anticipation had predicted. It is by means of a small tarred pan attached to a hand wheel hoe as in Fig. 5. The pan is made of sheet iron. The bottom is 16x20 inches with a not

six inches deep by four wide cut in the center of the front edge. On the two sides and back is an upright sheet about four inches high to prevent the leaf hoppers jumping over. The edges of the front side and notch are rolled up merely sufficiently to prevent the tar on the bottom from running off; one-eighth of an inch is ample. The hopperette, as we will designate this collecting pan, is attached to the wheel hoe by two strips of strap iron fastened under the pan as a support and at the other end bolted to the frame of the hoe or fastened in any way that will make it solid. The shaping of these braces and the lowering of the pan depends entirely upon the make of carriage used. The one used in my own experiments was a two wheeled hoe sold by D. M. Ferry & Co. under the title "Planet Jr." With this machine the pan was lowered five inches below the axle, which brought it very close to the ground and still kept it level. When placed entirely in front the pan can be raised or lowered considerably to conform to the uneven surfaces on the ground. The notch cut in the bottom is a great aid as it permits the plant to be nearly surrounded before it is disturbed and all insects are caught that jump to the sides as well as back. Another feature that added considerably to the efficiency of the hopperette was a strong twine string stretched across the notch about four inches in from the edge, as at *a*. This not only protects the plants from the sharp edges, but causes the hoppers to leap at the right time. If the holes punched for the string cut it, eyelets may be used or a wire about the same size may be used.

#### COST OF HOPPERETTE.

The first cost for collecting leaf hoppers in this way is very slight and it takes comparatively little time in collecting, as a man can pass over a considerable area in a day. The pan made of sheet iron cost \$1.25. There is no patent on this or the collector spoken of under locusts and they may be made by any tinner. The coal tar used in coating the pan is very cheap. Enough of the tar should be kept in the pan to occasionally run over the bottom and recoat it, and by this means cover over refuse material and insects that have accumulated. Those who may wish to purchase a "Planet Jr." for use in the celery fields and for leaf hoppers too will find it listed in D. M. Ferry & Co's catalogue at \$4.00. With an outlay of not over \$6.00, and a few hours work, many times that amount will be saved in the celery crop where the little leaf hoppers are at all thick. One may not realize how many there are of them till he stirs the plants and watches the number hop away. In my first trial of the hopperette, the hoppers were not as common as a week or two earlier, but on a row five rods long at least two hundred were caught.

#### THE TARNISHED PLANT BUG (*Lygus pratensis* Linn.).

##### ORDER HEMIPTERA.

##### FAMILY CAPSIDÆ.

A brown bug that is the cause of the rusty, dead spots and streaks on celery known among growers as one form of "sun scald," but different from the disease known as leaf spot, which will be treated of later.

Although not found in such great numbers as some other pests, the tarnished plant bug is one of the worst with which the celery grower has yet had to contend. It goes directly to the tender stalks of the plant that are blanching and by means of its beak draws the sap from the stem, and

leaves a large brown wilted spot which greatly mars the attractive appearance on the market and lowers the price accordingly. I do not remember of talking with a celery grower this season, who knew the real cause of these brown spots on celery. The most general belief was that it was caused by "sun scald," or perhaps bruised in blanching. This is not at all surprising as the bug is so shy and retiring, when one is near, that it is only by quiet and careful watching that it is seen feeding. Then, too, it

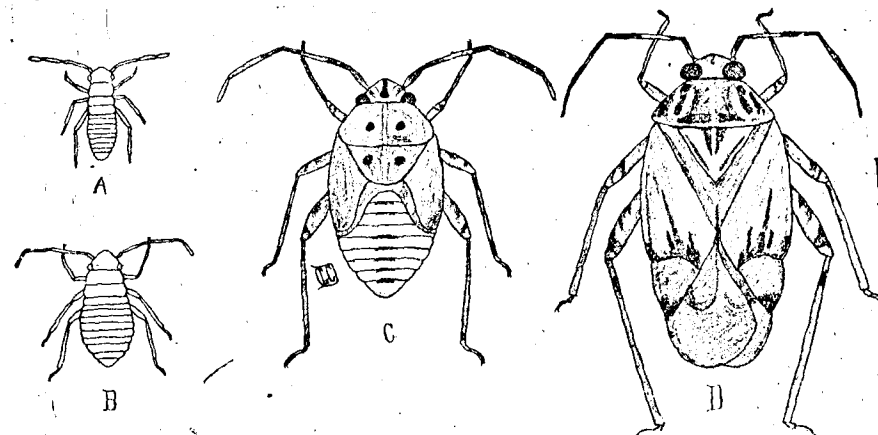


FIG. 6.—The tarnished plant bug, showing the various stages of growth. A, very young bug; B, second stage; C, the fourth stage; D, the matured, winged form. The line at the right shows the natural size—(original).

is almost always well in toward the center of the plant and is protected largely from view. Very often when disturbed, or even on the approach of possible danger, the mature form will take wing and fly away, and the younger ones not having wings will drop to the ground and seek protection there.

#### LITERATURE.

The tarnished plant bug is a native of nearly all parts of our country. For this reason, coupled with its general destructiveness, it has been made the subject of many articles. Nearly all are brief notices of injury done. The only really extensive or exhaustive article on the species is by Prof. Forbes in the 13th Illinois Entomological Report, 1883, pp. 115-135 (Ill.). All of the more important literature is referred to here. The work treats of the bug as a strawberry insect, causing the berries to shrivel by sucking the juice from them. Pyrethrum is the remedy recommended. In the following year, report 14, pp. 79-80, additions to the previous report are given in which Prof. Forbes describes the egg of the bug and records an experiment with pyrethrum not working as well as expected.

Several other authors have before and since written short accounts of it as a strawberry bug.

The earliest important article was by Dr. Harris in "Insects Injurious to Vegetation," pp. 199-203. Under the name of *Phytocoris lineolaris*, he treats of it as injurious to flowering plants and potato vines, and recommends simple but as inefficient remedies.