

## A Leafhopper Infestation at the Bannockburn Golf Club

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During the early part of September the unusual abundance of small leafhoppers attacking the bluegrass upon the more elevated portions of the Bannockburn Golf Club, at Glen Echo, Maryland, near Washington, D. C., was observed by Mr. J. C. Bridwell, of the Bureau staff. In view of the number of recent inquiries provoked by this outbreak, and the probable extent of injury to be expected from the insects, it has seemed desirable to prepare the following brief statement for publication:

While a small portion of the damage at Bannockburn probably was wrought by other contributing factors, such as adverse soil conditions and inferior seed, yet the principal injury undoubtedly resulted from insect infestation. The largest single area of damage was located upon a new fairway where a sowing of bluegrass was made in April, 1922. A portion of this area was so severely injured as to require reseeding. There was practically no infestation upon the old greens or fairways, and it was interesting to note that wherever the grass had been kept closely mowed, the insects were present in such small numbers as to be inconsequential. They were much more numerous on the bluegrass than upon any other grasses or plants on the course. Considerable bent and crab grasses were present, and these were slightly injured. The first sowing of bluegrass upon the main portion of a new extension was made during the third week in September, 1921, upon "made land" of sandy loam containing two inches of earth from the woods and which was well manured during the fall. The leafhoppers, however, caused greater injury to the later-sown bluegrass, which grew in the clay soil, though the damage did not appear so severe where such soil had been manured the previous fall.

Leafhoppers are small, active, greenish or brownish, sap-sucking insects common in lawns, meadows, or pastures, and probably are most noticeable when distributed by pedestrians as the insects leap or fly away at such times for a short distance after which they settle down again in the herbage. These are members of one of the largest of the families of true bugs. Leafhoppers commonly are so abundant that it has been estimated by careful students that more than a million individuals can and often do live on a single acre of grass or herbage. These insects are rarely more than one-third of an inch in length, while the average length probably is not more than half as great. The body is very slender, usually widest just behind the head, and tapers back to the tips of the folded wings. The head, as viewed from above, seems to be more or less triangular, and, when viewed from below, appears to slope backward toward the base of the fore legs. The eyes are prominent and appear to occupy a large part of the sides of the head. The antennæ or feelers are very short and bristle-like. The legs are well developed, the hind pair especially being long and powerful, somewhat as in grasshoppers, and, like them, these little insects are powerful leapers. When in the later stages of growth they also make active use of their wings, and therefore are quite difficult to capture. They are usually quite inconspicuous and often are greatly protected by close colorational resemblance to the objects around them.

The injury wrought by them is caused by their extracting the sap of the plants by means of tiny sucking beaks thrust into the leaves or stems.

A large number of crops other than grasses habitually are infested by these pests. One well-known species attacks roses. Another may be found attacking grape-vines, and this often causes injury to the leaves marked by small brown spots which sometimes become so numerous as to cause the entire leaf to assume a burned appearance. A number of the species affect the common cultivated crops, while other species subsist upon the wild grasses and forage plants of the western ranges.

It is a matter of great difficulty to estimate the real extent of injury wrought annually by these insects, for the reason that their work is so insidious that it is exceedingly likely to pass unnoticed, unless, as in the present instance, they occur in such prodigious numbers as to excite general attention. Again, injury in reality caused by them, frequently is thought by observers to be due to various other agencies, such as plant diseases, frosts, wet or dry weather, or by ravages of other insects. The injured plants usually become more and more wilted or shriveled, and frequently there is a curling of the leaves; the plants at times take on abnormal shapes, and occasionally there may be a marked surface discoloration. The attack upon grasses and grains usually is in the form of punctures and slits on the leaves or stems, which soon become discolored or wilted blotches, and at times there is a slight whitening of the upper part of the stem and head of the plant. It has been ascertained that leafhoppers form an agency for the spread from plant to plant of certain plant diseases.

In common with many other families of insects, there is oftentimes considerable difference in the life history of the different species, but the greater number of those of economic interest go through the winter either in the egg stage, or in the adult stage beneath rubbish of various kinds or in crevices or wherever they may find suitable hibernating places. The following season, with some species the eggs hatch, or, with other species, the adults come out of their winter quarters, and soon are busy attacking the various plants upon which they habitually feed, and upon which they mate and deposit eggs. While the number of individuals which live through the winter is not usually great, yet those which do survive are so prolific as to produce numerous progeny in a very short time.

The species of leafhopper present in by far the greatest numbers at Bannockburn was that known to science as *Deltocephalus inimicus* Say (Fig. 1). Other species which occurred in scattering numbers on the course were *Kolla bifida* Say, *Oncometopia lateralis* Fabr., *Draeculacephala mollipes* Say, and *Chlorotettix* sp., as determined by W. L. McAtee, of the U. S. Biological Survey. *Deltocephalus inimicus* Say is one of the most injurious of the various species, and while it is known to occur only in America, its distribution is widespread, from Maine to Washington State, south to Tennessee, southwest to Kansas, and it also occurs in Canada. It has been known to feed upon bluegrass, various wild grasses, brome grass, orchard grass, wheat, timothy, alfalfa, clover, fescue, oats, millet, and barley. Its favorite food plant probably is bluegrass, as it occurs in largest numbers throughout the country where that is the common pasture grass. Timothy also seems to be another preferred food plant.

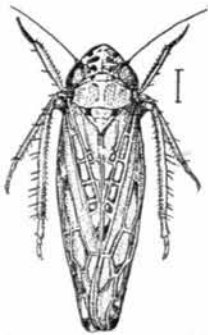


FIG. 1.—ADULT OF  
*DELTOCEPHALUS*  
*INIMICUS* SAY.

Greatly enlarged; the  
small vertical line in-  
dicates the exact  
length of the insect.  
(After Osborn.)

The eggs of the winter brood of this species are deposited on the leaf or stem, where they cause tiny blister-like swellings. The eggs hatch the following spring. During the growth of the nymphs five distinct stages have been noted. This brood reaches maturity in early summer, and the adults therefrom deposit eggs which hatch within about 10 to 12 days, and form another brood. The greater number of these mature within a few weeks, although scattering nymphs are likely to occur at intervals during the autumn months. Eggs deposited by the adults during the autumn survive the winter and renew the cycle the following year.

Another species of leafhopper also present in considerable numbers at Bannockburn was *Euscelis (Athysanus) exitiosus* Uhl. (Fig. 2). These insects are known to be distributed over practically the entire United States, a portion of Mexico, and the West Indies. They are, however, usually found in greatest numbers in the South. When the wide distribution and possibilities for multiplication are taken into account, it, too, may well be considered an important species of leafhopper. The insects are known to feed upon grasses, oats, and fall rye, but the wheat plant appears to be one of the preferred host plants, and at various times in the past considerable damage to that crop has been reported. With this species there is rather clearly discernable a definite line between eaten and uneaten portions of an infested field. Instead of spreading out indiscriminately over a field or half-eating patches here and there, they feed upon and do marked injury to the plants over small well-defined areas, as they progress across the field. They are very shy and fly away to considerable distances upon the least disturbance. They are readily attracted to lights.

The adults of this species are found until late autumn or even on warm days during winter, and it is probable that they remain active under favorable conditions during the greater part of the winter.

In the control of leafhoppers upon golf courses, probably one of the most effective measures would be the burning of the dead grass in late autumn or early spring, where practicable to do so, as such procedure is undoubtedly one of the most effective means of destroying the eggs of the insect. It is realized, however, that the treatment is not always feasible, for the reason that some grasses will not withstand burning except when the ground is frozen or is sufficiently wet to prevent the heat from penetrating below the surface. Then too, where courses have been recently seeded to grass, there is always a possibility that the young plants may be injured by such treatment. The cleaning up and burning of weeds and refuse upon waste land contiguous to golf courses will tend to destroy many of the hibernating leafhoppers and the elimination of common weeds will tend to reduce the numbers of these insects. It was noteworthy at Bannockburn that no systematic effort had been made to clean up the weeds and under-

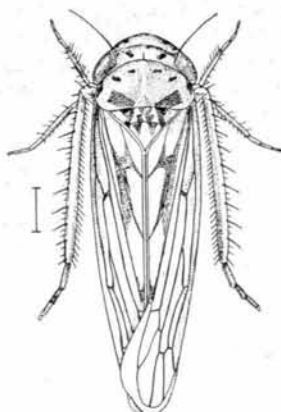


FIG. 2.—ADULT OF EUS-  
ITIOSUS

CELIS (ATHYSANUS) EX-  
Greatly enlarged; the small  
vertical line indicates the exact  
length of the insect.  
(After Osborn.)

brush in the woodlands which were adjacent on three sides of the most heavily infested areas.

Another control measure of considerable value is the practice of frequent close cutting of the grass and removal of the math. This is of greatest value where it occurs at a time when the insect is present either in the egg stage or in an immature stage so small that it can not migrate widely or readily. Mowing in this way not only removes such eggs as may be included in the leaves or stems, but also exposes the young leafhoppers to a shortage of food and to the direct rays of the sun.

The capture of leafhoppers by means of hopperdozers or tar pans also has been found of considerable practical value in some cases. Such apparatus commonly consists of a long shallow sheet-iron pan, coated with coal tar and mounted on small wheels. When this is drawn over the grasses, the insects, rising at its approach, fall upon the surface of the tar in the pan and are killed. It has been found by repeated experiments that in infested pasture lands the insects could be captured by this method at a rate of approximately one-half to one million per acre—a very appreciable reduction in the number which occurred in the treated areas. It has been estimated that two treatments of this character would capture about three-fourths of the leafhoppers present. This treatment is applied to best advantage during the latter part of the afternoon on sunny days, when the insects are most active and jump about with greatest facility. The expense involved is not great, as it amounted, under pre-war economic conditions, to about seven cents per acre.

Upon areas where the growth of the grass will permit of penetration through it to the insect, it seems possible, in view of the recent development of spraying apparatus, that broadcast sprays of insecticides such as a kerosene mixture or emulsion would likewise secure very effective results.

Additional information concerning various species of leafhoppers, life-histories and control, may be obtained from U. S. Bureau of Entomology Bulletin No. 108, entitled, "Leafhoppers Affecting Cereal, Grass and Forage Crops," by Herbert Osborn, issued in 1912. This is obtainable by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 20 cents per copy. Acknowledgment is gladly rendered to that publication for a considerable portion of the matter included in this article.

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**Pebble blisters on greens.**—On one northern Michigan course with sandy gravelly soil there was trouble each spring from the little irregularities caused by the frost over winter having lifted pebbles to or near to the surface of the greens. This trouble was obviated by probing the greens with a tool made of stiff wire smaller in diameter than a lead pencil, set into an awl handle. The pebbles within two or three inches of the surface were thus found and were removed by a similar tool with a short flattened hook upon the end. This work was done early in the spring growing season, and the wounds in the green were filled by raking in sandy loam with the back of an ordinary iron garden rake and rolling. The trouble has not returned during the five years since the pebbles were removed.—*Dr. Maynard M. Metcalf, The Orchard Laboratory, Oberlin, Ohio*