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THE BUFFALO TREE-HOPPER.

(*Ceresa bubalus* Fab.)

GENERAL APPEARANCE AND NATURE OF INJURY.

The adult of this little grass-green insect is one of the best known of the common species frequenting vegetation, and often attracts the curious on account of its triangular shape, quick, active flight, and considerable vaulting powers. It receives its peculiar popular name from a supposed similarity in shape to the male buffalo or bison. The thorax, or pronotum, is greatly enlarged anteriorly, projecting laterally in two strong horns, and is distinctly triangular, as shown in the illustration (fig. 1, *a*). It is this peculiar shape rather than any knowledge of its habits that has given it its popular interest. During the last ten or twelve years, however, it has become important on other and strictly economic grounds. In the Mississippi Valley, especially from the Missouri northward, well up into Canada, it has been the cause of very great damage in orchards, particularly to young trees and nursery stock, not, however, confining itself to fruit trees, but attacking also all sorts of shade trees. The injury is due solely to the cutting up of the limbs by the female with her saw-like ovipositor (fig. 1, *f*, *g*) in the deposition of her eggs, in which particular the injury is not unlike that caused by the periodical cicada, and frequently is scarcely less in amount on account of the great numbers in which the insect occurs. On entering a badly infested orchard in the latter part of August, or in September, the buffalo tree-

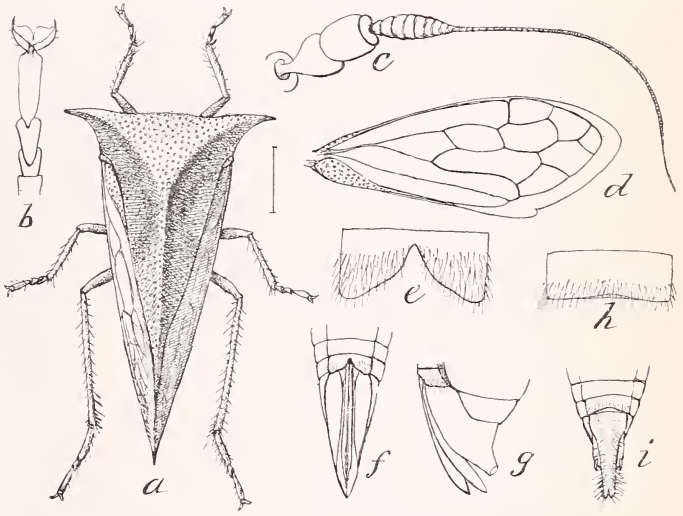

FIG. 1.—BUFFALO TREE-HOPPER: female (*a*), with enlargement of foot (*b*), antenna (*c*), wing (*d*), ovipositor (*f*, *g*), and terminal segment of male abdomen (*h*, *i*) (author's illustration).

hopper will indicate its presence by flying away with a distinct buzzing noise from the trees approached, and, as it is a very shy insect, there is some difficulty in coming close enough to see it at work and observe its methods. Once well engaged in oviposition, however, it becomes for the time being fearless, and may be closely watched, even under a hand lens.

Where abundant the smaller limbs of trees are often completely scarified over their upper and lateral surfaces, so that the trees become dwarfed or bark-bound, make a sickly growth, and are rendered more liable to the attacks of wood-boring insects. This latter source of injury was first prominently brought to our notice in a communication from Mr. J. A. Pettigrew, superintendent of Lincoln Park, Chicago, who described the attacks of a borer in the smaller branches of the cottonwood, *Populus monilifera*, which caused the limbs to break off and fall to the ground in great numbers. Examination of the twigs submitted by him showed at once that they had been oviposited in very abundantly by the buffalo tree-hopper a year or two before, and that the old scars from the egg-punctures of this insect had furnished favorable conditions for the attacks of a wood-boring beetle, *Oberea schaumii* Lec. This beetle had deposited its eggs in the diseased spots left by the Ceresa, and the larvæ of the beetle had burrowed up and down the twigs, weakening them and causing them to break off and fall as described. Healthy twigs would be distasteful or unsatisfactory to this insect, but the diseased condition, and particularly the dead spots left by the Ceresa, furnish the very conditions most favorable for this wood-borer, as similar injuries do for many other wood-boring insects.

HABITS AND LIFE HISTORY.

The habits and life-history of the buffalo tree-hopper are as follows: The adult insect chooses as a nidus for its eggs the twigs, preferably those of two or three years' growth, of various trees, particularly the apple, willow, cottonwood, maple, etc., confines itself in general to the upper surface of the twigs, and works more abundantly on the south side of the tree than on the north, although in this respect the prevailing winds and other conditions influence the insect. The eggs are deposited quite as readily in the new growth of old trees as in young trees, but the damage is much more noticeable in the latter case. The eggs are placed in small compound groups of from 6 to 12 eggs each, arranged in two nearly parallel or slightly curved slits extending in the direction of the twig about three-sixteenths of an inch in length, and separated by one-eighth inch or less of bark (fig. 2, *b*).

In depositing the eggs the bark is cut by the ovipositor in such a way that the narrow bark intervening between the two incisions is

cut entirely loose. This has a very important bearing on the subsequent condition of the wounds made by the insect in oviposition. The object is doubtless to cause a deadening of the wood between the two rows of eggs, to prevent their being crushed and choked out by the subsequent rapid growth of the twig, and it is due to this peculiarity that the injury later assumes so serious a nature. A single incision made by the insect to contain its eggs would heal over and cause little after-damage, but with the combination of two incisions and the killing of the intervening bark, causing it to adhere to the wood, a large scar is produced, which, with each subsequent year's growth, enlarges and ultimately assumes an oval form, the dead bark of the center breaking out. After a few years, limbs which have been thickly worked on by the insect become very scabby and rough, are easily broken off by the wind, and are very liable to attack by wood-boring insects (fig. 2, *e*).

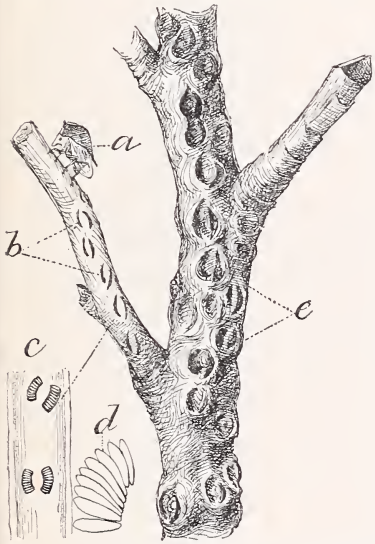

FIG. 4.—*Ceresa bubalus.*: twig of apple showing: *a*, female at work; *b*, recent egg-punctures; *c*, bark reversed with eggs in position, slightly enlarged; *d*, single row of eggs still more enlarged; *e*, wounds of two or three years' standing on older limbs (author's illustration).

The adults first appear about the middle of July, and become most numerous during August and September. They begin oviposition about the middle of August, or even earlier, and continue this work until they are killed by the frosts of early winter, sometimes working as late as the end of October. The number of eggs deposited by a single female exceeds 100, and possibly 200. The eggs remain unchanged, or dormant, in the twigs until the following spring, hatching in May or early in June. The egg is about one-sixteenth of an inch long, slightly curved, tapering towards the outer end and more rounded at the inner one. It is without markings, of a dirty, whitish color, and cylindrical, except as more or less angulated by the pressure of the wood and the adjacent eggs.

The eggs of the buffalo tree-hopper are subject to the attacks of at least two minute egg parasites, which often do much to keep the insect in check.

In general characteristics the larvæ and nymphs resemble the adults, but are wingless and covered along the center dorsally with numerous forked or barbed projections.

FOOD PLANTS.

The larvæ and pupæ, as well as the adults, feed on all sorts of succulent vegetation, such as weeds and garden vegetables, and are apparently not particularly fond of the apple, much preferring the more succulent annual plants. Mr. J. G. Jack reports that he found the adults feeding on the young and tender shoots of the apple, near the ground, by which I suppose he means the watershoots, for certainly, after very careful and repeated observations in an orchard which was so infested as to be nearly ruined, I failed to find any indication of the feeding of larvæ or adults on apple. The injury, at any rate, in this direction, to fruit and shade trees is practically not worth considering.

REMEDIES AND PREVENTIVES.

The destruction of the insects themselves is difficult and in general impracticable, because the larvæ and adults feed on all sorts of vegetation and are very widely distributed. The adults, also, are too active and quick of flight to be successfully reached by caustic washes; and spraying to destroy the early stages is ordinarily out of the question, because it would necessitate extending the treatment to all surrounding vegetation, and, as the adults are strong flyers, even this would give no absolute security.

The limiting of the amount of foreign vegetation about and in orchards and nurseries is an excellent precaution, and little damage may be anticipated where the ground between the trees is kept clean and constantly cultivated. The larvæ and pupæ under these conditions will be starved out. The orchard in which the writer first studied this insect, and which was so thoroughly infested as to be seriously injured, was one which had been neglected for a number of years and was full of weeds and succulent undergrowth, furnishing conditions under which an unusual multiplication of the Ceresa had taken place during a number of years. Surrounding and better kept orchards showed little, if any, damage.

Vigorous pruning in the fall or winter should be given trees which have been cut up to any extent, and this with clean culture should reduce the insect to small numbers. It is possible that some good could be accomplished by planting trap plants between the rows of trees, such as beans or other similar summer crops, which could be sprayed with the stronger mixtures of the kerosene and soap emulsion when the larvæ became numerous, or about the first of July, but the more promising method is the cultural one already described.

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Approved:
James Wilson,
Secretary.

Washington, D. C., May 10, 1897.