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Cicada Septendecim its Mouth Parts and Terminal Armor.

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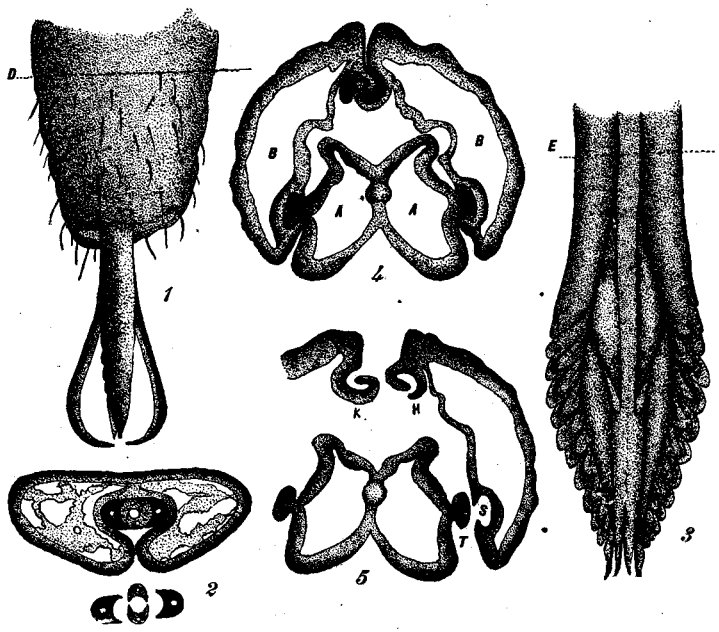
The long subterranean life, and regular periodic appearance of this insect, at intervals of exactly seventeen years, are characteristics in themselves so remarkable in insect life, as to render the appearance of the so-called seventeen year locust a matter of special interest, and a careful microscopical examination of the mechanism of some parts of its anatomy will reveal several features no less curious and interesting.

The fact that it has been generally known as a locust has connected it in the popular mind with the destructive insect of that name, and upon the advent of the harmless Cicada, its appearance in such immense multitudes, is sure to create in the minds of the farming people apprehensions for the safety of their crops, and fruit-trees, and some of the newspapers, whose editors and reporters are more desirous of creating a sensation than of spreading a correct knowledge of entomology, contribute not a little toward increasing the alarm by publishing hearsay, or purely fictitious, accounts of ravages done.

During the visit of the brood of 1894 some of the New York papers added a new sensation to the current reports, respecting its alleged depredations upon fruit and

forest trees, by publishing circumstantial accounts of persons "fatally poisoned by the bite and sting of the seventeen year locust."

Some eighteen years ago I became greatly interested in a study of the sting of the Honey Bee, the results of which were published in the Quarterly MICROSCOPICAL JOURNAL, and seeing these newspaper reports, I was naturally interested in making an examination of the



armor by means of which the Cicada accomplished such alleged fatal effects.

Cicada septendecim belongs to the natural order of insects called Hemiptera, which is not at all related to the destructive family of locusts, or grasshoppers, and its mouth parts are, in a general way, typical of the order to which it belongs, being drawn out into a long and extremely slender stylet or sucking tube, enclosed nearly to its point in the broad labium.

Figure 1 is a greatly enlarged view of the end of this labium or lip, with the projecting setæ which constitute the sucking tube, and this as may be seen consists of four pieces, the two outer ones being curved nearly to the form of hooks, while the two intermediate pieces are straight and terminate in extremely sharp points.

The two exterior pieces serve as hooks, or anchors which being inserted into the bark or leaf of a tree furnish a leverage for forcing in the two interior lancets, which together form a sucking tube through which the juices of plants, on which these insects are said to live may be drawn.

Figure 2 represents a transverse section through the abium, as at the dotted line d, in fig. 1, and shows in what curious manner the four setæ, which are grooved on the inner side, form a tube when held together by the lmuscular labium, which is wrapped closely around them. Sections of these four pieces as they appear when separated, are shown below in the same figure. Each of these has a minute tube through it, which would hardly seem to be of much use, considering the size of the insect, and its food requirements, for the main tube in the center is scarcely more than the one-thousandth of an inch in diameter, while the outer diameter of the whole four pieces constituting the stylet is exactly one-three-hundredth of an inch, or about the same as that of a rather fine human hair.

How much injury might possibly be done by these insects during their short lives, by sucking the juices of plants through such minute tubes is, notwithstanding their great numbers, a question, but I have never been able to discover one in the act of feeding, although I watched great numbers of them, on cherry, pear and other trees, and was equally unable to discover any injury to the fruit or foliage of such trees later in the sea-

son. In fact I think they take very little, if any, food after reaching the winged state.

The ovipositor is an instrument used by the female for making incisions in the twigs of trees in which to deposit her eggs. It is about three-tenths of an inch in length and is attached to the hinder extremity of the under side of the abdomen, and protected by lying in a longitudinal groove into which it fits like a surgical instrument in its case. It consists of three parts; two blades, furnished with saws at their extremity, where they are considerably enlarged and a central piece, called by some a sheath, but which is nearly enclosed by the two exterior saw-blades. The extremity of all three is shown in figure 3, which represents them as seen from the under, (outer) side, each saw blade carries on its inner side a tube, (oviduct), which opens on the inner side near the extremity of the saw (o,o, figure 3) by a kind of flap through which the eggs are extruded. These saws are a microscopical study, for while figure 3 fairly represents the appearance on the under side, in which view the saw-teeth are seen to consist inwardly of a row of hooks pointing in a direction opposite the extremity, and laterally of rounded teeth with extremely sharp edges directed backward, or toward the end of the saw. If examined from the opposite side, the teeth resemble those of a file, arranged obliquely and spirally from a line along the center outward over the sides. When one of the ovipositors is detached, and a lateral view is taken, the same spiral arrangement of teeth is seen, with a set of sharp hooks on the outer side pointing in an opposite direction to the knife-edged teeth seen in figure 3.

In cutting a channel for her eggs the insect closes her legs around the twig and forcing the ovipositor saws beneath the bark and into the soft sap wood, works them backwards and forwards, cutting loose but not removing

the wood fiber. In doing this the broad end of the central piece which lies between the saws causes them to spread as they are extended, so that two grooves are cut at once, lying in a v shaped direction from the entrance, and leaving a ridge of solid wood between the two. After finishing the cut, which is about three-tenths of an inch in length, she withdraws the ovipositor, and again forcing it in at the first entrance proceeds to deposit her eggs, which are placed very symmetrically in a direction oblique to the middle partition, a little cavity being cut for each egg, into which it exactly fits. The eggs are about fifteen in number in each groove, and about fifteen minutes is occupied in the whole operation.

When one set of grooves has been stocked with eggs, she moves forward about half an inch, and begins another and so continues until her whole stock of eggs is disposed of.

I have before me a branch containing twenty-one consecutive cuts, evidently made by the same insect, and holding probably, more than 600 eggs.

The extremely curious mechanism by means of which these processes are accomplished will be easily understood by inspecting figure 4, which is a transverse section of the three parts constituting the ovipositor, cut at the dotted line *e*.

The central piece, *a*,*a*, would seem to be a pair of tubes somewhat triangular in shape, and firmly cemented together in the middle. These cannot be separated, and the tubes have no outlet at the extremity, where the central piece ends in two, extremely hard, sharp and solid points, as seen in the figure, which no doubt serve an important purpose in cutting the channels for the eggs.

On each side are seen sections of the two ovipositors *b*, *b*, which are bounded on their exterior sides by a hard chitinous frame, extending for a short space up the in-

terior where it then thins out into a semi-transparent, muscular or contractile tissue, to its connection with the opposite side of the ovipositor, thus forming a tube through which the eggs are extruded.

Along each side of the middle piece extends a "T" shaped rail, better shown in figure 5, r; this figure being the same as 4 with the parts separated.

While the insect is engaged in the act of sawing, the ovipositors slide backward and forward on these T shaped rails, being held in place and guided by the central piece or so-called sheath, which as shown in section is trussed in such a manner, that it might serve as a model of rigidity combined with lightness and strength.

But the most unique feature of this beautiful piece of mechanism is shown in the pair of hooks seen in the upper part of figure 4, or more distinctly in figure 5, *h*, *k*, where they are separated. (This drawing is the same as part of figure 4 but in separating the parts on the slide they were turned over and thus reversed).

In viewing these sections there is seen an outer branch *h*, figure 5, resembling a thumb which closes over the opposing hook thus enabling it to maintain a firm hold.

These hooks, as seen in section, are of course folds along the whole length of the ovipositors which enable the insect to hold these two margins together, or at will to separate them, as it must necessarily do in cutting the two diverging grooves.

The figures here given were traced under the camera lucida, and shaded from their appearance under the microscope.

Should any amateur microscopist desire to test his skill at section-cutting, I would recommend him to try the mouth parts of a dry Cicada, and make a section that will leave all the parts in their natural position.

From what I observed during the visit of the 1894 brood

I suspect that there is a difference of habit in broods that appear in different years, or in different places.

Harris states that the female, after depositing her eggs, goes back on the branch and saws it partly off, so that the leaves die and the end of the branch breaks off and soon drops to the ground, and I have in former years seen the same thing myself, but during this visit, although the woods near this place were swarming with them, and hardly a branch of any kind of deciduous tree could be found that was not filled with eggs, no dead leaves were to be seen except upon the beech the outer branches of which were so small that the numerous cuts nearly girdled them. There were certainly no cuts made across the branches below the eggs.

Another curious circumstance connected with the appearance of these insects of which I have not seen mention made, is the most remarkable unanimity with which they came forth from their underground residences.

Is it possible that such an innumerable multitude, scattered over several square miles in extent, as in this vicinity, and living under varying conditions of food, temperature, moisture, &c., for seventeen years, should reach the mature state and undergo their last metamorphosis on almost exactly the same day, or do they have some system of underground telegraphy, or psychologic mind-reading by which there is a general understanding that all shall leave their subterranean abodes at once. Certain it is that in this neighborhood, on the 21th day of May, nobody had noticed their appearance, but on the 25th everybody knew they were here and the woods resounded with the music of their drums.

Remember the meeting of the American Microscopical Society at Pittsburg.