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THE COTTONWOOD BORER.[1]

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INTRODUCTION.

When the writer was stationed at Garden City, Kans., in 1913, some of the first inquiries he received were for methods of preventing injury by borers to shade trees—cottonwood (*Populus deltoides*) and willow (*Salix alba*). Neither entomological literature nor inquiries made of other entomologists regarding the cottonwood borer yielded accurate information upon which remedial measures might be based. Investigations were begun, therefore, to determine the life history and habits of the insect. Its large size and the obvious character of the injury it accomplishes have facilitated the securing of results, which are here given.

DESCRIPTION.

THE ADULT.

The cottonwood borer (*Plectrodera scalator* Fab.) is one of the largest beetles found in Kansas, the male measuring from 1.25 (3.2 centimeters) to 1.375 inches in length by 0.40 inch (1.1 centimeters) in greatest width, and the female about 1.5 inches long (3.5 centimeters) by 0.50 inch (1.2 centimeters) in width. The ground color in both sexes is shining black overlaid by stripes and patches of cream-colored scales. On each elytron the black shows through in two rows of irregularly rectangular patches, and there is a black patch on each side and one on the top of the prothorax. The antennæ are black, except the first two segments, which, with the legs, appear rusty or grayish from a scattering covering of the light scales. Much of the ventral surface is also covered with light scales, although not so thickly as the dorsal. In both sexes the prothorax

[1] The investigations of the cottonwood borer (*Plectrodera scalator*) were begun prior to the reassignment of shade-tree insect problems to the Branch of Forest Insect Investigation.—F. H. CHITTENDEN.

bears a strong, sharp spine on each side. In the female the antennæ reach the apex of the abdomen, while in the male they reach a fourth of an inch or more beyond, and the segments are thicker and longer. The male beetle is illustrated by Plate I.

THE EGG.

The egg is 0.12 to 0.15 inch (from 3 to 4 millimeters) long by about 0.10 inch (2.5 millimeters) thick and is elliptical in shape. The outer covering is pliable, but very tough, being almost leathery. It is yellowish or light brown in color.

THE LARVA.

The newly hatched larva is of the usual cerambycid form. In color it is white with black mouth parts and is much wrinkled transversely. It is about 0.20 in. (5 millimeters) long by 0.07 inch (2 millimeters) across the widest part, which is just behind the head. Little change occurs in color during the larval stages, but the length may increase eleven times and the width five or six times, making the mature larva nearly twice as long in proportion to its width as the newly hatched larva. (Fig. 1.)

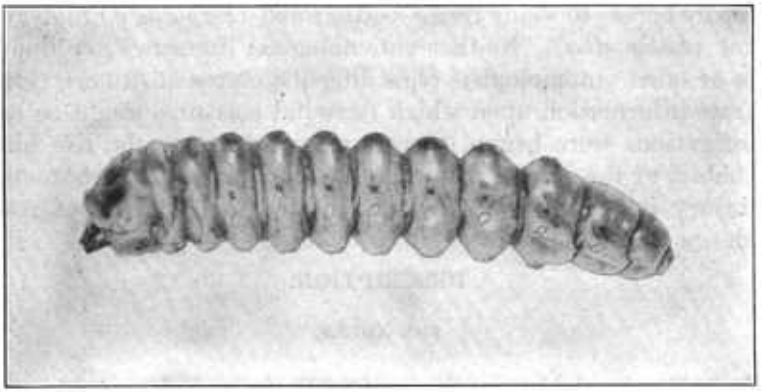

FIG. 1.—The cottonwood borer (*Plectrodera scalator*): Larva, lateral view. Enlarged. (Original.)

THE PUPA.

Of five pupæ the average length was 1.40 inches (3.5 centimeters) and the average width 0.80 inch (2 centimeters). When first formed the pupa is dull white, but the points soon become dark. The femur and tibia of each leg are folded against each other and placed transversely on the ventral surface of the body, with the tarsi extending backward beside the median line. The wingpads are folded ob-

liquely downward and backward, passing between the body and the first two pairs of legs, the tips extending under the posterior pair of legs. The antennæ curl outward and backward dorsally to the two anterior pairs of legs, then ventrally and inward nearly to the median line and forward along the tarsi, where they end with the apices or tips pointing nearly outward just below the legs. (Fig. 2.)

LIFE HISTORY AND HABITS.

OVIPOSITION.

The female deposits her eggs in the trunks of cottonwoods and willows at, or a little below, the surface of the ground. A preliminary examination is made, which, among very small trees, may include the bases of several. When satisfied with her selection, the female clings securely to the bark with her head toward the ground, and by means of her strong jaws loosens the surface soil. This she pushes away with her head by straightening her front legs and thrusting her body outward from the tree. In this manner the soil may be removed to the depth of half an inch. A hole is then made in the bark to receive an egg. In small trees, especially in cuttings set during the preceding spring, this hole may extend through the bark well into the wood. In any case the bark and wood are torn to shreds by the strong jaws of the insect, and some of these shreds usually remain attached to the small round cavity intended for the egg.

FIG. 2.—The cottonwood borer: Pupa, ventral view. Enlarged. (Original.)

After completing the egg cavity the female turns round and backs into the excavation, locating the cavity with the tip of her abdomen. She then secures a firm hold on the bark and remains in this position for several minutes, during which time much muscular activity is evident at the tip of the abdomen. The egg is finally extruded and pushed firmly into the cavity intended for it. A quantity of a dark gelatinous substance is deposited around and over the egg, and the adhering wood fibers are patted into place with the tip of the abdomen. The wound is then covered and the depression usually

filled with earth by means of the abdomen, which is carried outward from the tree and drawn back against it with the tip scraping the loose soil. All evidence of injury to the tree is often obliterated by the first succeeding shower. In the instances under observation oviposition required about one hour.

After the egg has been covered the female crawls aimlessly about the tree trunk. Her wanderings usually end among the branches, where copulation may occur, some of the tender leaves may be eaten, or the female may take wing from the tip of a branch.

The place of oviposition was discovered in July, 1913, when the wind blew down cottonwood and willow cuttings in the Forest Service nursery at Garden City, Kans. The forest supervisor, Mr. B. R. H. D'Allemand, brought in damaged cuttings to learn the cause of the injury at the surface of the ground. Field observations revealed eggs in the wounds on the sides of the cuttings, and these eggs were identified as those of the cottonwood borer. Later they were discovered in trees of all ages, and adults were observed in the act of oviposition. The cuttings and younger trees were preferred for egg laying.

In 1913 the injury to cuttings was reported on July 29. At that time the edges of many of the wounds had healed and many of the eggs had hatched and the young had worked well into the tree. About two weeks are required for hatching; the eggs, therefore, must have been deposited about July 10. On July 9, 1914, eggs were found that had been deposited after July 4, as the work was fresh and the last preceding rain occurred on the latter date. Oviposition probably extends into September, as adults were numerous on August 22, 1914, and one was found on August 28, 1913. Mr. C. H. Popenoe collected both sexes at Dodge City, Kans., September 23, 1913. They were abundant, and several were found in copula.

One female after depositing 2 eggs was found on dissection to contain 13 others of different sizes, a total of 15; another female deposited 1 egg and contained 15, a total of 16; a third deposited 1 egg and contained 16, a total of 17; and a fourth contained 23 after depositing 1, a total of 24. During July of 1914 the average period of incubation for 14 eggs was 13 days.

DEVELOPMENT OF LARVA.

On hatching, the young larva works out of the egg cavity and begins to bore in the tender bark just outside of the wood. The tunnel which it forms is usually filled behind it with excrement and fine pieces of wood. As cold weather approaches it passes into the wood, remaining either above or below the ground level. During

THE COTTONWOOD BORER (PLECTRODERA SCALATOR): MALE BEETLE. MORE THAN TWICE NATURAL SIZE. (ORIGINAL.)

November, 1913, and January and February, 1914, the larvæ that hatched in 1913 varied in length from 0.70 inch (1.75 cm.) to 1.0 inch (2.5 cm.). By September, 1914, they had grown to 1.20 inches (3.25 cm.) and 2.0 inches (5 cm.). By the spring of 1915 nearly all were more than 1.60 inches (4 cm.) long, some reaching 2.20 inches (5.5 cm.).

During the second winter the larvæ occupy large tunnels that reach from the inside of the bark near the ground level to the bark several inches below. Both ends of the tunnel are plugged with excelsiorlike fibers of wood, the larva resting on the lower plug. In the spring, before transforming to the pupa, the larva cuts through the bark at the upper end of the tunnel, and plugs the openings with wood fibers.

TIME AND PLACE OF PUPATION.

In 1914 pupæ were secured on June 23. Of the larvæ reared from the 1913 material, one was found as a pupa when examined on July 3, 1915. Another was found as a dead pupa a few days later.

The pupa rests back downward on the fiber plug at the lower end of the tunnel which was occupied by the larva during the second winter.

EMERGENCE OF ADULT.

One adult, which was reared from a larva hatched in 1913, emerged on July 13, 1915. In 1914 adults emerged from 12 screened trees from July 8 to August 4. However, as noted, eggs were secured that had been deposited about July 4, which indicates that emergence occurred during the last of June, and one report was received on June 16 that adults had been seen several days before. The period of emergence thus computed is about 50 days.

NATURAL ENEMIES.

Several young larvæ were found dead, overgrown with a fungus. No instances of parasitism were observed during the investigations.

METHODS OF CONTROL.

The desirability of developing control measures will be understood from a perusal of the following figures. On September 15, 1913, the bases of 10 trees that varied in diameter from 4 to 8 inches were examined for eggs and larvæ. The number of eggs, small larvæ, and large larvæ, and of the tunnels that penetrated too deeply into the wood for their extent to be ascertained, are shown in Table I.

TABLE I.—*Record of damage by the cottonwood borer (Plectrodera scalator) to 10 trees at Garden City, Kans., 1913.*

	Tree No.—										Total.
	1	2	3	4	5	6	7	8	9	10	
Eggs	2	0	0	0	0	0	0	0	0	0	2
Small larvæ	9	5	4	6	10	7	14	8	6	9	78
Large larvæ	0	1	2	1	0	0	0	0	0	0	4
Tunnels	2	2	1	2	0	0	2	8	2	1	20

The total of the eggs and small larvæ was 80, an average of 8 to a tree. Such a number of young larvæ, nearly all of which were working in the bark, would seriously check the growth of the tree, as well as render the tree liable to damage by heavy winds.

PREVENTIVE.

Since the eggs are placed only on the trunks of the trees at the surface of the ground, infestation is easily prevented by a screen cone about a foot high, wrapped about the base of the tree and with its lower edge sunk in the ground. This cone should fit the tree trunk closely at its top to exclude the beetles and be set out at the base an inch or two to prevent the eggs from being deposited through it. It can be made by cutting common window screen, usually galvanized netting, one-fourth to one-half inch mesh, into strips about 1 foot wide and of the proper length. Each strip is then slit from a third to half way across from one edge at distances of from 3 to 4 inches, as shown in the diagram (fig. 3). The screen is then wrapped around the tree, the lap fastened at its lower end with a nail, pin fashion, and

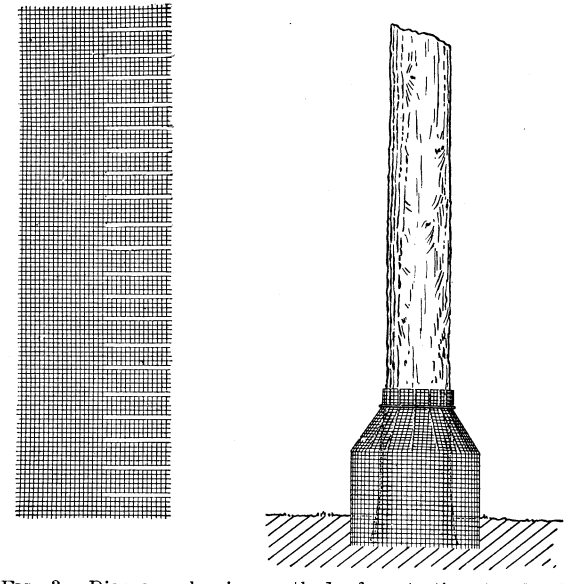

FIG. 3.—Diagram showing method of protecting trunk of cottonwood against attack by the cottonwood borer. At left, section of screen; at right, cottonwood trunk showing screen in position. Reduced. (Original.)

the lower edge sunk into the ground about an inch. The top parts of the screen should be pinned to one another with small brads so as to fit closely about the tree; or they may be held in place by a piece of binding twine wrapped around them. The same screen cone will protect a tree for several years if made large at first; but the screens should be examined during June of each year, being loosened where too tight and repaired where torn.

REMEDIES.

When the 10 trees were examined in September, 1914, all eggs and young larvæ were removed. (Table I.) Where possible the large larvæ were also removed, and the number of eggs and larvæ secured from each tree is noted in the table. The tunnels from which, owing to their depth, the larvæ could not be removed were treated with a small quantity of carbon bisulphid injected from an oil can. From the 10 trees treated in this manner only five adults emerged during 1914, whereas from two untreated trees that were screened eight adults, or an average of four beetles to a tree, emerged. However, the treatment with carbon bisulphid is of little benefit, as the larger larvæ in tunnels from which they can not be removed have done, at this stage, nearly all the injury of which they are capable. The greatest benefit arising from the careful examination of the tree trunks lies in the removal of the immature borers that are working in the bark. This work is inexpensive and is entirely practicable for shade trees.

SUMMARY.

The injury by the cottonwood borer results from the adults ovipositing in cuttings and very young trees, the young larvæ cutting the bark and preventing the sap flow, and the larger larvæ tunneling the wood, thus weakening the trees against wind.

The eggs are deposited in the younger trees principally during July and August. The larvæ work in the trees until the second summer after the eggs hatch, when the adults emerge from about the middle of June until the 1st of August.

Oviposition in shade trees may be prevented by screening the bases of the trees. The young larvæ can be removed before they injure the trees severely if the remedial work is done during the first two weeks of September, but removal of the large larvæ from deep tunnels often injures the trees more than would the larvæ if allowed to remain and complete their development.

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