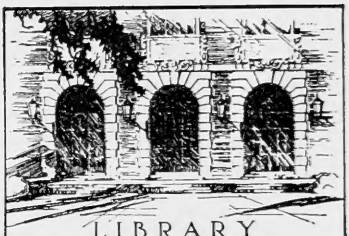

Control of Roundheaded Apple Tree Borer

S. C. CHANDLER
W. P. FLINT

Circular 40

ILLINOIS NATURAL HISTORY SURVEY

STATE OF ILLINOIS
Dwight H. Green, Governor

DEPARTMENT OF REGISTRATION AND EDUCATION
Frank G. Thompson, Director

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CONTROL of Roundheaded Apple Tree Borer

S. C. Chandler and W. P. Flint

THE grower who sets an apple orchard of several acres, and then fertilizes, sprays and cultivates it for 5 to 10 years, has made a large investment. If, during this period, roundheaded apple tree borers kill 25 per cent of the trees, a serious loss has resulted. Such losses occur rather frequently in central and northern Illinois. Any grower who has an apple orchard, large or small, in these sections of the state should be on the lookout for borers.

The roundheaded apple tree borer, *Saperda candida* Fabricius, figs. 1 and 2, tends to be more localized than some other major apple pests. It may be very serious in one orchard and not found at all in an adjacent one. Growers have observed that it is frequently confined to some one part of the orchard, especially if that part is near woods in which are growing service berry or shadbush, haw and other wild host plants related to apple. In such situations many trees are greatly weakened or are killed.

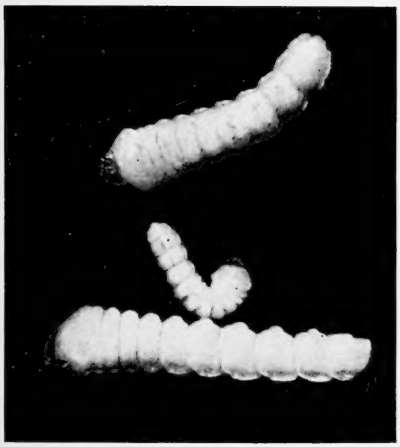

Fig. 1.—Larvae of the roundheaded apple tree borer. The damage is done by this borer in the larval stage. The larva is usually 1¼ inches or less in length and is white except for a dark brown head.

Fig. 2.—Adult beetle of the roundheaded apple tree borer. Its body, covered by a dense mat of flattened hairs, appears silvery white in color except for three longitudinal brown stripes on the back.

The young borers hatch from eggs laid near the base of the tree in slits cut in the bark by the female beetle. These borers enter chiefly at the base of the tree, near the ground line, as indicated in figs. 3, 4 and 5, tunneling up or down a few inches from the point of entrance. Presence of borers is indicated by whitish or brown frass at the point of entrance. The young borers work near the surface of the bark, but the older ones are found as much as one-half inch beneath the bark, in the heartwood and sapwood. Injury is produced by the cutting off of the flow of sap and the girdling or partial girdling of the tree.

The adult beetle, fig. 2, which lays the eggs from which the borer hatches, is about three-fourths inch long. Its body is entirely covered by a dense mat of flattened hairs; this hairy covering is silvery white, except for three longitudinal brown stripes on the back. These conspicuous beetles are active, mating and laying eggs during June and July in Illinois. The borers, usually 1¼ inches or less in length, fig. 1, are white, except for a dark brown head. In Illinois, they require 2 years to complete their development.

The borer is usually more troublesome in neglected orchards than in those regularly sprayed; the beetles, feeding to some extent on foliage and tender twigs, are poisoned by the insecticides. The roundheaded apple tree borer should not be confused with the flatheaded apple tree borer, which usually works higher on the trunk of the tree and which confines its attacks mostly to the south and west sides of the tree.

In the past, no very satisfactory control was evolved for the roundheaded apple tree borer. The grower had to rely on the old jackknife and wire method used to remove borers. This method is slow and laborious, not very efficient, and requires a certain amount of skill. We have attempted to work out a chemical treatment somewhat like that used for the borers in peach, and have developed one that is more rapid than the old system, less expensive and more effective.

Early Tests With PDB in Oil

Following the success of PDB (paradichlorobenzene) in *Dendrol* (a miscible oil) for the lesser peach borer,* we applied this mixture in October, 1935, to affected areas of apple trees in an abandoned nursery near Godfrey. Using PDB in *Dendrol* at

*Described by S. C. Chandler in *The Peach Tree Borers of Illinois*. Illinois Natural History Survey Circular 31. Feb., 1939.

the rate of 2 pounds of PDB to 1 gallon of the miscible oil, we made up two dilutions: one in which we added enough water to make a total of 2 gallons and the other in which we added enough water to make 4 gallons. One dilution now contained 2 ounces and the other 1 ounce of PDB to each pint of liquid.

Enough of the soil was removed from the base of the tree to enable the operator to locate the injured areas indicating the presence of the borers, the spots were painted with the diluted material and the soil was scraped back; the trees were not mounded. The results of this test are given in table 1.

Table 1.—Results of tests for control of roundheaded apple tree borer: PDB in *Dendrol* and water painted on affected areas of trees, Godfrey, October, 1935.

Material Used	Total Borers	Dead Borers	Per Cent Dead	Injury to Trees
PDB in *Dendrol* and water				
2 ounces to 1 pint	21	13	61.9	None
1 ounce to 1 pint	11	3	27.3	None
Check, no treatment	13	1	7.7	None

Tests With Ethylene Dichloride

Because ethylene dichloride emulsion had proved to be very effective in killing peach borer larvae, we tested it for roundheaded apple tree borer control, using it in the abandoned nursery

Table 2.—Results of tests for control of roundheaded apple tree borer: ethylene dichloride emulsion, Godfrey, 1938, 1939.

Time of Treatment	Strength, Ethylene Dichloride	Number of Trees	Total Borers	Dead Borers	Per Cent Dead	Number of Trees Injured and Extent of Injury
Spring, 1938	50%	7	6	6	100.0	3 dead, 4 badly injured
Spring, 1938	25%	10	7	7	100.0	All badly injured
Spring, 1938	Check	5	5	0	0.0	None injured
Fall, 1938	15%	9	9	9	100.0	7 severely injured, 1 slightly injured, 1 uninjured
Fall, 1938	10%	9	7	7	100.0	4 severely injured, 2 slightly injured, 3 uninjured
Fall, 1938	Check	5	2	0	0.0	None injured
Fall, 1938	5%	10	0	—	—	1 slightly injured, 9 uninjured
Fall, 1938	2½%	10	0	—	—	None injured
Fall, 1939	5%	10	8	2	25.0	None injured
Fall, 1939	Check	5	4	0	0.0	None injured

near Godfrey in 1938 and 1939, starting with strengths thought necessary to kill the larvae and continuing down through lower dilutions as injury to the tree developed. Table 2 summarizes the data obtained.

From these tests we concluded that although ethylene dichloride is very effective in killing borers in apple when used at strengths of 10 to 50 per cent, any strength sufficient to give a good kill of borers will injure the apple trees.

Later Tests

During the years 1939, 1940 and 1941, we tested three treatments in three orchards, as follows:

Treatment 1: 20 per cent strength of carbon bisulfide, in a fish oil soap emulsion, one-half pint applied per tree, tree mounded.

Treatment 2: PDB in *Dendrol*, one-half pint applied, fig. 5, per tree (2 pounds PDB in 1 gallon *Dendrol*, made up to 2 gallons with water), tree mounded, fig. 6.

Treatment 3: Carbon bisulfide (unemulsified), injected into insect burrows from oil can, fig. 3, tree not mounded but trowel full of earth placed over each treated spot.

Treatment 4: Check, no treatment.

Fig. 3.—Oil-can method of injecting carbon bisulfide into burrow of the roundheaded apple tree borer. The location of the burrow near the base of the tree is indicated by whitish or brown frass.

The data from these tests are summarized in table 3.

In table 3 the data on circumference show that the dosages in treatments 1 and 2 were effective on trees averaging 6 to 22 inches in circumference. No correlation was found between

Table 3.—Results of tests for control of roundheaded apple tree borer: PDB in *Dendrol*, and carbon bisulfide.

Treatment No.	Location, County	Date of Treatment	Number of Trees	Total Borers	Dead Borers	Per Cent Dead	Average Tree Circumference, Inches
1	Washington.	Oct. 18, 1939	10	20	16	80.0	16.5
	Schuyler....	Oct. 19, 1939	10	21	16	76.2	6.0
	Washington.	Sept. 21, 1940	10	19	17	89.5	....
	Washington.	Oct. 7, 1940	5	16	10	62.5	....
	Washington.	Sept. 26, 1941	10	28	26	92.9	21.9
	Summary,	*Treatment 1..*	*45*	*104*	*85*	*81.7*	
2	Washington.	Oct. 18, 1939	10	36	33	91.7	21.6
	Schuyler....	Oct. 19, 1939	10	36	34	94.4	8.5
	Washington.	Sept. 21, 1940	10	17	15	88.2	....
	Washington.	Oct. 7, 1940	5	29	21	72.4	....
	Washington.	Sept. 26, 1941	10	41	40	97.6	21.2
	Summary,	*Treatment 2..*	*45*	*159*	*143*	*89.9*	
3	Schuyler....	Oct. 19, 1939	10	25	9	36.0	6.5
	Madison....	Oct. 3, 1939	10	8	8	100.0	10.0
	Washington.	Oct. 18, 1939	10	20	9	45.0	21.9
	Washington.	Sept. 21, 1940	10	17	9	52.9	....
	Washington.	Oct. 7, 1940	5	7	3	42.9	....
	Washington.	Sept. 26, 1941	10	21	14	66.7	19.8
	Summary,	*Treatment 3..*	*55*	*98*	*52*	*53.1*	
4	Madison....	Oct. 3, 1939	5	4	0.0	0.0	
	Schuyler....	Oct. 19, 1939	10	23	0.0	0.0	
	Washington.	Oct. 18, 1939	5	14	0.0	0.0	
	Washington.	Sept. 21, Oct. 7, 1940	5	21	0.0	0.0	
	Washington.	Sept 26, 1941	10	27	0.0	0.0	
	Summary,	*Treatment 4..*	*35*	*89*	*0.0*	*0.0*	

failure to kill and size of tree. Evidently one-half pint of the materials used was sufficient for all trees in this range of size.

The results obtained from each treatment were fairly uniform for the 3 years and for the different localities. Probably the reason for not obtaining a complete kill in treatments 1 and 2 was frequently due to the height to which the larvae had tunneled above the ground line, as shown in fig. 4.

Three possible explanations help to account for failure to obtain a better kill in treatment 3: some borer holes were missed

in the oil can injection; much less material was used than in treatments 1 and 2, and so the amount of gas generated was insufficient to kill the borers; lack of mound resulted in too rapid an escape of the gas.

In addition to securing data on kill of larvae, we made examinations for immediate injury to trees and kept the orchards

Fig. 4.—The knife blade indicates the height, about 6 inches above the base of the tree, at which a borer larva was found in tunnel. Larvae move up or down the trunk from the point of entrance near the base of tree.

under observation for any permanent injury affecting growth. In all these treatments, we found a browned area on some of the trees. Contrary to expectations, this browning was more serious and appeared on a larger percentage of the trees in the two carbon bisulfide treatments than in the treatment with PDB in oil. The percentage of trees showing any degree of browning in the 3 years of tests was as follows:

Treatment 1, Carbon bisulfide emulsion.....31 per cent
Treatment 2, PDB in *Dendrol* and water.....11 per cent
Treatment 3, Carbon bisulfide injection.....24 per cent

Later examinations showed that even trees with a considerable degree of browning were not permanently injured.

Recommended Treatments

Inasmuch as the injury in the trees treated with PDB in *Dendrol* and water was less both in percentage of trees injured and in area affected in each tree, and the kill of borers was highest, we feel safe in recommending this treatment. **Do not use PDB in crystal form** as in that form **it will cause serious injury to apple trees.**

It may be seen in table 3 that the percentage of kill with PDB in *Dendrol* and water was nearly 90 for a 3-year average.

To prepare this recommended material, stir 2 pounds of PDB crystals in 1 gallon of *Dendrol* until the crystals are dissolved. Heating the oil a little, not over 100 degrees F., will hasten this process. Increase the dilution to 2 gallons by the addition of water. This means the addition of somewhat less than a gallon, because the PDB occupies some space. The material is then ready for use.

Apply one-half pint of the emulsion per tree, pouring it around the base of the infested tree, touching the bark as shown in fig. 5. Mound with four or five spades full of soil as indicated in fig. 6. The mound of earth will tend to confine the gas given off by the PDB and aid in killing the borers.

We consider carbon bisulfide emulsion as the next choice. Emulsify the carbon bisulfide cold, pumping together 50 per cent of carbon bisulfide and 25 per cent of fish oil soap dissolved in 25 per cent of water. Before using, dilute this 50 per cent stock to 20 per cent by mixing 4 parts of the stock in 6 parts of water. Apply one-half pint of the diluted emulsion per tree, as described for PDB in *Dendrol*.

We have made no extensive investigation concerning the best time of year for applying the mixture of PDB and *Dendrol*,

Fig. 5.—Method of applying one-half pint emulsion of PDB, *Dendrol* and water to borer entrance at base of tree.

but our experience shows that late September or early October is favorable for Illinois.

Experiments have shown that a soil temperature of 55 degrees F., at 1 inch below the surface, is about the lowest at

Fig. 6.—Tree mounded after application to base of tree of one-half pint of PDB in *Dendrol* and water.

which PDB in *Dendrol* and water is effective against peach borers. We do not recommend treating for the roundheaded apple tree borer when the soil temperature is lower than this. Although we have had little experience with any but fall treatments for the apple tree borer, we see no reason why spring treatments should not be effective if the soil temperature at the time is above 55 degrees F.

Other Publications of Interest to Fruit Growers

Some Causes of Cat-Facing in Peaches. By B. A. Porter, S. C. Chandler and R. F. Sazama. Ill. Nat. Hist. Surv. Bul. 17(6):261-75. 10 figs. March, 1928.

Peach Yellows in Illinois. By L. R. Tehon and G. L. Stout. Ill. Nat. Hist. Circ. 21. 23 pp., 9 figs. Nov., 1929.

Epidemic Diseases of Fruit Trees in Illinois, 1922-1928. By L. R. Tehon and Gilbert L. Stout. Ill. Nat. Hist. Surv. Bul. 18(3):415-502. 31 figs. Aug., 1930.

Practical Sanitation for Apple Orchards. By M. D. Farrar, S. C. Chandler, H. W. Anderson and W. V. Kelley. Ill. Ag. Exp. Sta. and Ext. Serv. Circ. 443. 23 pp., 9 figs. Jan., 1936.

The Peach Tree Borers of Illinois. By S. C. Chandler. Ill. Nat. Hist. Surv. Circ. 31. 36 pp., 22 figs. Feb., 1939.

Controlling Peach Insects in Illinois. By S. C. Chandler and W. P. Flint. Ill. Nat. Hist. Surv. Circ. 33. 40 pp., 32 figs. Aug., 1939.

Bramble Fruits: Raspberries, Blackberries and Dewberries. By A. S. Colby, H. W. Anderson and W. P. Flint. Ill. Ag. Exp. Sta. and Ext. Serv. Circ. 508. 72 pp., 34 figs. June, 1940.

Directions for Spraying Fruits in Illinois, 1942. By W. P. Flint and H. W. Anderson. Ill. Ag. Exp. Sta. and Ext. Serv. Circ. 492. 32 pp., illus. Jan., 1942.

Available Numbers in the Biological Notes Series Illinois Natural History Survey

10.—Progress in the Control of Elm Diseases in Nurseries. By J. C. Carter. 19 pp., 5 figs. (Mimeographed.) June, 1939.

11.—Lake Management Reports 3. Lincoln Lakes Near Lincoln, Illinois. By David H. Thompson and George W. Bennett. 24 pp., 8 figs., 2 maps. Aug., 1939.

12.—The Waterfowl Research Program in Illinois. By Arthur S. Hawkins, Frank C. Bellrose, Jr., and Harry G. Anderson. 16 pp. (Mimeographed.) Oct., 1939.

13.—Quail and Pheasant Studies in an Orchard County. By Frank C. Bellrose, Jr. 11 pp. (Mimeographed.) May, 1940.

14.—Lake Management Reports 4. A Second Year of Fisheries Investigations at Fork Lake, 1939. By George W. Bennett, David H. Thompson and Sam A. Parr. 24 pp., 10 figs., 4 pls. Aug., 1940.

15.—Preliminary Report on Availability and Use of Waterfowl Food Plants in the Illinois River Valley. By Frank C. Bellrose, Jr., and Harry G. Anderson. 14 pp. (Mimeographed.) Dec., 1940.

16.—A Contribution Toward a Bibliography on North American Fur Animals. By Lee E. Yeager. 209 pp. (Mimeographed.) Dec., 1941.

Any of the publications listed above may be ordered from the Illinois Natural History Survey, Natural Resources Building, Urbana, Illinois.

Recent Publications

A.—ILLINOIS NATURAL HISTORY SURVEY BULLETIN.

Volume 21, Article 3.—Studies of Nearctic Aquatic Insects. By H. H. Ross and T. H. Frison. September, 1937. 52 pp., frontis. + 86 figs., bibliog. 50 cents.

Volume 21, Article 4.—Descriptions of Nearctic Caddis Flies (Trichoptera), with special reference to the Illinois species. By Herbert H. Ross. March, 1938. 84 pp., frontis. + 123 figs., foreword, index. $1.00.

Volume 21, Article 5.—Preliminary Studies on Parasites of Upland Game Birds and Fur-Bearing Mammals in Illinois. By W. Henry Leigh. August, 1940. 10 pp., frontis. + 2 maps.

Volume 21, Article 6.—Preliminary Investigation of Oak Diseases in Illinois. By J. Cedric Carter. June, 1941. 36 pp., frontis. + 51 figs., bibliog. (Bound with Article 7.)

Volume 21, Article 7.—A Needle Blight of Austrian Pine. By Robert L. Hulbary. June, 1941. 6 pp., frontis. + 3 figs., bibliog. (Bound with Article 6.)

Volume 21, Article 8.—Duck Food Plants of the Illinois River Valley. By Frank C. Bellrose, Jr. August, 1941. 44 pp., frontis. + 35 figs., bibliog., appendix.

Volume 22, Article 1.—The Plant Bugs, or Miridae, of Illinois. By Harry H. Knight. September, 1941. 234 pp., frontis. + 181 figs., bibliog., index.

B.—ILLINOIS NATURAL HISTORY SURVEY CIRCULAR.

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33.—Controlling Peach Insects in Illinois. By S. C. Chandler and W. P. Flint. August, 1939. 40 pp., frontis. + 32 figs.
Contents: Part I. Insects attacking bark and trunk of the peach tree; Part II. Insects attacking twigs, foliage and fruit of the peach tree.

34.—Rout the Weeds! Why, When and How. By L. R. Tehon. January, 1940. (Second printing.) 47 pp., color frontis. + 13 figs.
Contents: The importance of weeds; Weeds as economic factors; Weeds as harborers of insects; Weeds as harborers of plant diseases; Relation of weeds to public health; Control methods; Thirteen noxious and pernicious weeds of Illinois.

35.—Diseases of Small Grain Crops in Illinois. By G. H. Boewe. September, 1939. 130 pp., frontis. + 47 figs.
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38.—Windbreaks for Illinois Farmsteads. By J. E. Davis. February, 1942. (Second printing.) 24 pp., frontis. + 19 figs.
Contents: Introduction; Planning the windbreak; Planting the windbreak; Care of the windbreak; What the windbreak trees are like; Windbreaks and wildlife.

39.—How to Collect and Preserve Insects. By H. H. Ross. June, 1941. 48 pp., frontis. + 53 figs.
Contents: Where to collect; What to use; Special collecting equipment; Sending insects for identification; How to handle unmounted specimens; How to mount and preserve specimens; How to label the specimens; Housing the collection permanently; Identifying the specimens; Useful books; How to ship a collection; Where to buy supplies.

C.—ILLINOIS NATURAL HISTORY SURVEY MANUAL.

1.—Fieldbook of Illinois Wild Flowers. By the staff. March, 1936. 406 pp., color frontis. + 349 figs., index. $1.50.
Contents: Introduction; Key to families; Description of species (650).

2.—Fieldbook of Illinois Land Snails. By Frank Collins Baker. August, 1939. 166 pp., color frontis. + 170 figs., 8 pls. $1.00.
Contents: Land snails, what they are and where they live; Land snails native to Illinois; Land snails introduced from foreign countries; Land snails of uncertain presence in Illinois; Bibliography; Check list of Illinois species; Index.

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