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THE CRANBERRY ROOTWORM AS AN APPLE PEST

S. W. HARMAN

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ABSTRACT

THE cranberry root-worm (*Rhabdopterus picipes* Oliv.) is considered with reference to its status as an apple pest. The beetles in some localities have caused serious damage to the apple crop, rendering it unmarketable except as it may be utilized by the canner or evaporator. Thoro, properly-timed applications of lead arsenate sprays afforded effective protection.

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S. W. HARMAN, *Associate in Research (Entomology)*

INTRODUCTION

THE cranberry rootworm (*Rhabdopterus picipes* Oliv.) is widely distributed over the United States. It is primarily a pest of the cranberry, feeding largely on the roots of the plant. The adult or beetle attacks the fruit and foliage of the cranberry, and it is in this stage that the insect feeds on the apple. The species has attracted attention in western New York, more especially in Wayne County, for a number of years past. Nearly every season there are reports of damage of varying extent to apple plantings in this area. During 1928 one grower stated that 70 per cent of his Ben Davis crop had been mutilated by the pest. Fruit injured by the beetles is unfit for the general market and can only be utilized for canning or evaporated stock.

LIFE HISTORY

Larva.—The larval stage (Fig. 1, B) of the cranberry rootworm is whitish in color with a brown head and pale yellowish brown thoracic shield. It is usually found lying in a curved position in the soil, and when full grown measures about $^{5}/_{16}$ inch in length. The larvae appear to feed on the roots of grasses and other vegetation growing beneath the trees. The eggs hatch in midsummer and the larva attains its full growth by the following June. In the fall the grub burrows deeper into the ground where it forms an earthen cell in which to pass the winter months.

Pupa.—Pupae (Fig. 1, C) were first observed early in June, the insect remaining in this stage for about two weeks. The pupa measures slightly shorter than the full-grown larva, is white in color, and very fragile and easily damaged by handling.

Beetle.—The adult stage or beetle (Fig. 1, D) is shiny, greenish-bronze in color with reddish yellow legs. It measures slightly less than ¼ inch in length. The beetles may be found in the orchard in greatest numbers during late June and July.

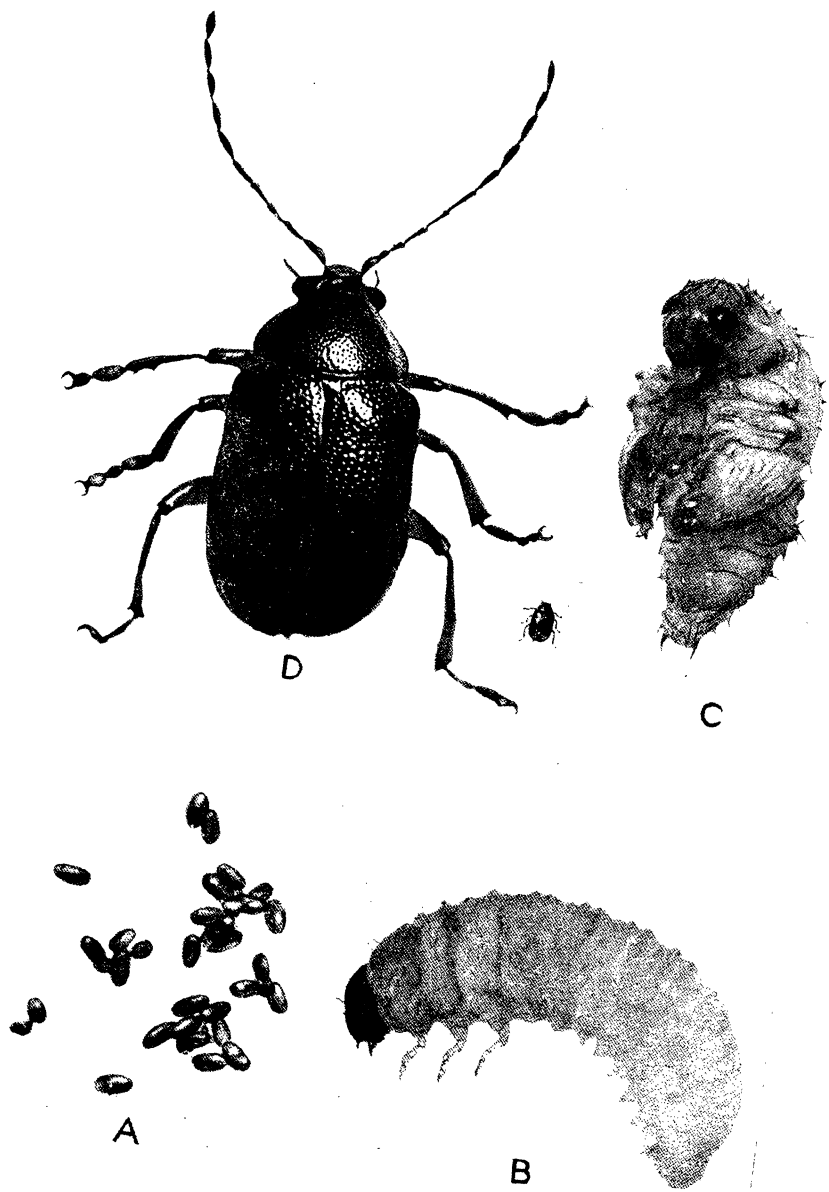

FIG. 1.—STAGES IN THE DEVELOPMENT OF THE CRANBERRY ROOTWORM. A, eggs (× 8); B, larva (× 9); C, pupa (× 9); D, beetle natural size and enlarged (× 9).

Egg.—The eggs (Fig. 1, A) are deposited in masses during July just beneath the surface of the soil. They are yellowish in color, capsule shaped, and average $^1/_{40}$ inch long by $^1/_{80}$ inch wide (0.67 mm × 0.33 mm). The incubation period averages about 8 days, but may vary considerably.

HOST PLANTS

Scammell[1] reported comparatively few plants that served as hosts for the cranberry rootworm. In western New York the beetle proved to be a general feeder and was observed attacking the foliage and, in many cases, the fruits of the following plants: Apple, blackberry, basswood, cherry (sweet, sour, wild black cherry, and pin cherry), cranberry, dock, dogwood, elm, grape (wild and cultivated) maple-leaved arrow-wood, myrtle, pear, plum, red raspberry, rose, strawberry, swamp blueberry, and woodbine. Of six varieties of apples, namely, Baldwin, Stark, Spy, Ben Davis, Gano, and Greening, the beetles showed preference (Fig. 2) for the Ben Davis, Gano, and Greening.

INJURY

During June and July the beetles attack the foliage and fruit of the host plants. On young apples the feeding scars appear as narrow, shallow cuts of variable length, extending thru the skin and slightly into the flesh. The scars resulting from these irregular cuts form fantastic figures of varying design. On the mature fruit the scars are quite noticeable, and on varieties such as Ben Davis and Gano the injury often develops into pronounced swellings.

Injury to the foliage (Fig. 3) appears as narrow, irregular cuts somewhat similar to the scars on the young fruits.

CONTROL

Up to the time of this investigation little was known regarding the susceptibility of the insect to spray practices adapted to the treatment of apple orchards, and for that reason special efforts were made to develop a satisfactory method of control. Cranberry rootworm injury on apples has been reported almost exclusively from Wayne County. In practically all cases the orchards were located on light, sandy soil and were not under cultivation. Some of the orchards had been worked a little between the rows, but the vegetation beneath the trees had been undisturbed for years, allowing the development of a mass of

[1]United States Dept. Agr. Bul. No. 263.

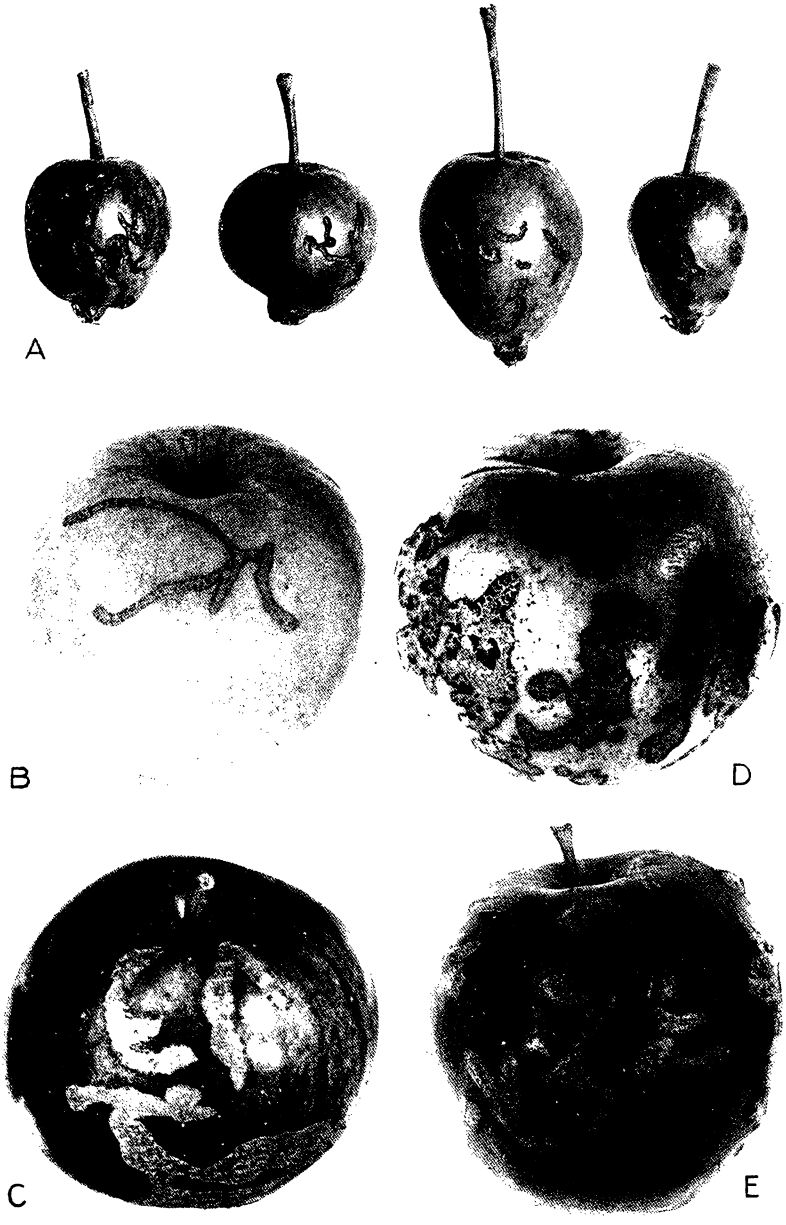

FIG. 2.—APPLES INJURED BY THE CRANBERRY ROOTWORM BEETLE.
A, immature Ben Davis; B, mature Ben Davis; C, McIntosh; D, Greening; E, Gano.

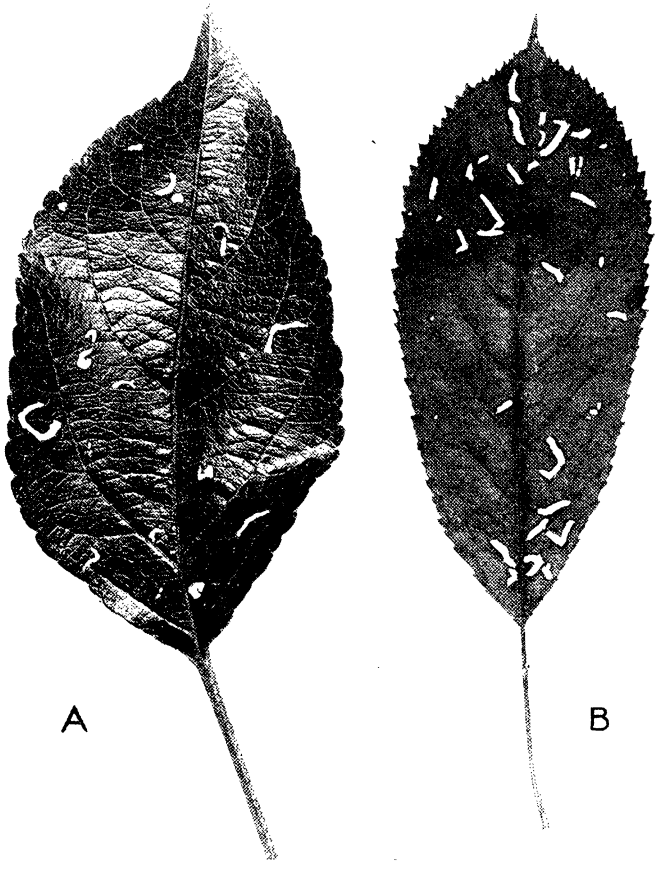

FIG. 3.—FOLIAGE INJURED BY THE CRANBERRY ROOTWORM BEETLE.
A, apple; B, cherry.

fibrous roots which in all probability served as food for the beetle larvae.

The orchard selected for the control work was just outside the village of Red Creek and owned by Milton Jenkins. The crop had been sold to the canning factory for years for the reason that the large amount of beetle damage necessitated peeling the fruit. A block of 250 34-year-old Ben Davis trees was selected for the control tests. Applications were made with a standard type orchard sprayer using approximately 250 pounds pressure. The sprays were applied from

the ground, the man with the gun walking completely around each tree. The trees were not drenched, but were simply sprayed to a point where dripping was about to commence. The amount of material averaged 8 gallons per tree per application.

Of the various insecticides tested lead arsenate proved to be most effective. The more important results of experiments carried out during 1930 and 1931 are given in Tables 1 and 2.

DISCUSSION

Observations made over a period of years indicated that the beetles appear in large numbers within a few days' time and commence feeding almost at once. A crop, clean and uninjured on one day, may a few days later show feeding scars of the beetles on a large percentage of the fruit.

In the vicinity of Red Creek, where the tests were conducted, the beetles appeared about the third week in June and were found on the fruit and foliage of the apple until late in July. (See life history chart, Fig. 4.)

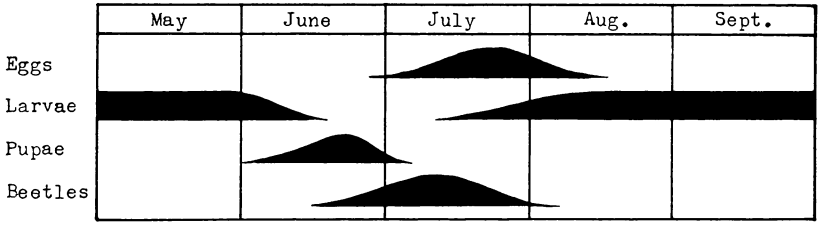

FIG. 4.—LIFE HISTORY CHART OF THE CRANBERRY ROOTWORM.

By referring to Table 1 it will be noted that considerable injury by the beetles occurred following an application of lead arsenate on June 11, whereas with double strength lead arsenate applied on the 11th or with a second application on the 23rd, the injury was noticeably checked. Observations on the activity of the beetles proved they were not abundant until after June 20, and for this reason the June 23rd spray was much more effective than the first application. Apparently the spray on June 11 was too early to afford adequate protection to the fruit.

TABLE 1.—CRANBERRY ROOTWORM CONTROL ON BEN DAVIS APPLES AT RED CREEK, N. Y., 1930.

MATERIALS AND AMOUNTS IN 100 GALLONS	DATES OF APPLICATIONS	NUMBER TREES COUNTED*	INJURY, PERCENTAGE			
			Light	Medium	Severe	Total
Lead arsenate, 2½ lbs.; hydrated lime, 15 lbs.	June 11–	2	7.6	14.3	10.2	32.1
Lead arsenate, 3 lbs.; bordo 1–6–50	June 11–	2	6.0	6.2	2.0	14.2
Lead arsenate, 3 lbs.; fish oil, 1 qt	June 11–	2	7.2	8.3	4.0	19.5
Lead arsenate, 5 lbs.; dry mix lime and sulfur	June 11–	1	1.5	0.8	0.2	2.4
Lead arsenate, 6 lbs.; fish oil, 1 qt	June 11–	2	1.0	0.7	0.0	1.8
Lead arsenate, 3 lbs.; bordo 1–6–50	June 11; June 23	2	4.2	1.9	2.8	8.9
Lead arsenate, 3 lbs.; dry mix lime and sulfur	June 11; June 23	2	1.4	1.1	0.3	2.9
Lead arsenate, 3 lbs.; fish oil, 1 qt	June 11; June 23	2	2.5	1.3	0.2	3.9
Lead arsenate, 6 lbs.; fish oil, 1 qt	June 11; June 23	2	1.5	0.5	0.1	2.1
Hydrated lime, 30 lbs.; Kayso, 1 lb	June 11; June 23	2	4.2	4.2	1.6	10.0
Check, no spray	———	5	13.0	15.9	8.4	37.3

*Crop averaged 21 bushels per tree.

TABLE 2.—CRANBERRY ROOTWORM CONTROL ON BEN DAVIS APPLES AT RED CREEK, N. Y., 1931.

MATERIALS AND AMOUNTS IN 100 GALLONS	DATES OF APPLICATIONS	NUMBER TREES COUNTED*	INJURY, PERCENTAGE			
			Light	Medium	Severe	Total
Lead arsenate, 3 lbs.	June 17 —	3	3.0	0.5	0.1	3.6
Lead arsenate, 3 lbs.; fish oil, 1 qt	June 17 —	3	2.9	1.1	0.1	4.2
Lead arsenate, 6 lbs.	June 17 —	3	3.0	0.5	0.4	3.9
Lead arsenate, 3 lbs.	June 17; June 26	3	2.0	0.2	0.0	2.2
Lead arsenate, 3 lbs.; fish oil, 1 qt	June 17; June 26	3	1.3	0.4	0.0	1.7
Lead arsenate, 6 lbs.	June 17; June 26	3	0.9	0.1	0.0	1.1
Check, no spray	——— ———	4	11.0	5.5	2.9	19.4

*Crop averaged 6 bushels per tree.

The following year (Table 2), the first application on June 17 preceded the appearance of the beetles by only a few days and was very effective.

The time for making the first spray for the beetles was determined by digging for pupae in the sod beneath the trees in the orchard. During May the beetle larvae were found a few inches below the surface among the fine roots of the orchard vegetation. Early in June the larvae commenced changing to pupae and by the middle of the month the latter stage predominated. A few days prior to emerging as adult beetles the dark eye spots were noticeable on the pupae. One method of collecting the beetles was to place sheeting or similar material on the ground beneath the branches, after which the beetles were dislodged by jarring. Late in the afternoon they were most active and difficult to collect as they took wing readily when disturbed.

Judging from the control as indicated by the data appearing in the tables, lead arsenate when applied just preceding the emergence of the beetles afforded satisfactory protection. The success of the treatment depended for the most part on timing the applications accurately with reference to the appearance of the beetles. The use of fish oil as a sticker and more than 3 pounds of arsenical in 100 gallons made little difference in control provided the applications were properly timed. Increasing the amount of arsenical appeared to prolong the period of protection afforded by the spray. It is of interest to note that the addition of 1 quart of fish oil to 100 gallons of spray caused a spotted type of spray injury on the foliage.

Practically all reports of important injury were from uncultivated orchards. This would indicate that cultivation may play an important part in control. As the larval form subsists on the roots of orchard cover, the destruction of all vegetation other than the orchard trees would be expected to influence the abundance of the insect. A 1-acre block of the orchard was cultivated for 2 years, but judging by the amount of injury to the fruit had little influence on the infestation. The apparent failure of this test to reduce the insect population was not surprising as the cultivated block, relatively speaking, was only a small section of the orchard and the beetles were free to migrate in from all sides. Also, it is possible that the larvae may include apple roots in their diet. It is true, however, that the soil population of the insect appeared to be reduced following cultivation as it was more difficult to procure specimens of larva from the cultivated area. Possibly cultivation of the entire orchard for several years to destroy

all root growth other than that of the apple trees would tell a different story.

Orchards in the vicinity of Red Creek were, up to the time of the experiment, seldom troubled with the codling moth, and for this reason there was very little summer spraying practiced. The calyx application was usually considered the final spray in the Jenkin's orchards except when an additional treatment was desirable for scab or apple maggot. This abbreviated spray program is probably one explanation for the large population of cranberry rootworm. Generally speaking, the first and second cover sprays for the codling moth are applied at times when they should be of considerable value as a control for the beetles.

SUMMARY AND CONCLUSIONS

Altho primarily a pest of the cranberry, the adult or beetle stage of the cranberry rootworm may assume the role of an orchard pest. It was observed attacking both fruit and foliage of apple trees during late June and July.

Tests conducted over a 2-year period in apple orchards demonstrated that two sprays of lead arsenate, the first applied when the beetles were first appearing in the orchard followed by a second spray in about 10 days, provided adequate protection. Generally speaking, the first cover spray for the codling moth is applied by the third week in June and in all probability is of considerable value in preventing the cranberry rootworm from becoming a common pest in apple orchards. In plantings where the species is causing damage, the mid-June spray should be timed with special reference to the emergence of the beetles.

The studies indicated that the cranberry rootworm prefers a light, sandy soil in uncultivated orchards, and the beetle was found to be a general feeder on orchard vegetation.