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## The Life History of the Dewberry Fruit Worm *Cacoecia Rosaceana* (Harr.) in Utah

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This Thesis written by Merlin W. Allen has been approved

and accepted by:

THE LIFE HISTORY OF THE DEWBERRY FRUIT WORM  
CACOECIA ROSACEANA (HARR.) IN UTAH

A Thesis

Presented to

The Committee on Graduate Work  
Utah State Agricultural College

In Partial Fulfillment

of the requirements for the Degree  
Master of Science in the School of

Arts and Sciences

Department of Zoology

By  
Merlin W. Allen

May 1937.

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## THE LIFE HISTORY OF THE DEWBERRY FRUIT WORM

## CACOECIA ROSACEANA (HARR.) IN UTAH.

By Merlin W. Allen

## INTRODUCTION

The purpose of this study has been to determine the identity and the life history of certain larvae attacking dewberry fruits and foliage in a few sections of Utah. The dewberry fruit worm as it was called until it was definitely identified as the oblique-banded leaf-roller, was first observed by farmers at Granite and Butlerville in 1932. Since 1934 it has been found affecting dewberries in other parts of northern Utah.

This investigation was begun in the spring of 1935 and continued until the fall of 1936, being made possible through the Utah Agricultural Experiment Station, Department of Entomology, and with the cooperation of various farmers in the vicinity of Granite, Utah. Field studies were made at Granite, Butlerville and southeast Pleasant Grove during the course of the investigation. Overwintering studies were carried on at Logan during the winter of 1935-36.

Since this insect is one of the most important pests of dewberries in Utah a careful study of its life history and habits was considered necessary before control methods were undertaken.

## DISTRIBUTION

The dewberry fruit-worm, better known as the oblique-banded leaf-roller, is known to attack dewberry fruits in the following localities in Utah: Granite and east Butlerville in Salt Lake County; south Pleasant Grove, in Utah County; and south of Willard in Box Elder County. It was known to be present in the

state for several years but had never before been reared from dewberry fruits or foliage. Adult moths have been collected in the following additional localities in Utah: Bountiful, Circleville, Logan Canyon, Perry, Provo and Tooele. These collections seem to indicate its presence over a large portion of the cultivated area of Utah.

Cacoecia rosaceana has been reported as a pest of crops in many localities in the United States and Canada. Its distribution is listed by Sanderson and Jackson (31) as the United States and most of Canada. Miyake (24) reported the oblique-banded leaf-roller as a pest of apples in Japan.

#### REVIEW OF THE LITERATURE

The following brief review of the literature is presented to give some indication of the history of this insect and of its importance as a pest in the United States and Canada.

Sanderson and Jackson (31) state, "Cacoecia rosaceana was described by Harris in 1841. In 1894 Fletcher reported the oblique-banded leaf-roller injuring the foliage and young fruits of pear in Ontario. Piper in 1895 noted it causing considerable injury to prunes in Washington. In 1896 Lintner recorded serious damage to apple foliage and young fruits in eastern and central New York. The same year Luggar reported that Russian apples are sometimes defoliated in Minnesota by the oblique-banded leaf-roller". They further report, "It is a serious pest of roses in New Hampshire, often causing severe damage by its feeding habits, the larvae appearing in the spring attacking the young foliage and later the blossoms and fruit. The eggs are laid upon the leaves of the rose, an average of 305 eggs per moth was laid at a mean temperature of 70 degrees F. and as many as 650 eggs were recorded

for a single moth during the oviposition period." The incubation period of the eggs was given as "6.6 days at a mean temperature of 80 degrees F. and 10.0 days at a mean temperature of 70 degrees F." They reported the oblique-banded leaf-roller as having two broods per year on roses and listed more than 50 species of host plants.

Schoene and Fulton (32) in 1913 recorded the oblique-banded leaf-roller as one of the pests of apples found in the State of New York.

Sanders (28) in 1915 listed Cacoecia rosaceana as one of the four species of bud-moths attacking apples in Nova Scotia. He listed it as third in importance and said that it overwintered as a larva, the adult laying its eggs in masses, and there being a single brood in Nova Scotia each season.

Dustan (8) in 1915 listed the oblique-banded leaf-roller as having the following habits in Nova Scotia, "doing considerable damage to the foliage of apples in the spring; passing the winter as a partly grown larva in small nests found at the tips of twigs and fruit spurs, hidden under pieces of bark and beneath bud scales; feeding upon the leaves as they show green in the spring and boring into the center of the buds; and having only one brood each year."

In 1916 Caesar (5) reported the oblique-banded leaf-roller attacking apples and pears in Ontario, Canada. He said, "The eggs are laid upon the upper surfaces of the leaves, hatching at the time of the bursting of the buds in the spring."

In 1916 the Weekly Press Bulletin (43) reported that Cacoecia rosaceana was present in several orchards in Pennsylvania, the larvae maturing in June and the adults appearing about a month later, the winter being passed in the egg stage.



Severin (33) in 1919 reported two generations a year on currants and gooseberries in South Dakota.

In 1919 Sanders and Dustan (30) reported the oblique-banded leaf-roller as a bud moth of apples in Canada, which oviposited on the leaves, hibernated as a partly grown larva, and fed upon the buds and foliage in the spring.

In 1921 Severin (34) reported the oblique-banded leaf-roller as one of the commonest leafrollers attacking raspberries in South Dakota.

Fracker (11) in 1921 reported Cacoecia rosaceana doing slight damage to cranberries in Wisconsin.

In 1924 Venables (41) found the life history of the oblique-banded leaf-roller on orchard trees in British Columbia to be: Passing the winter as partly grown larvae within tightly woven cocoons; emerging to feed upon the new foliage in the spring; and the adults flying during July.

Hall (19) in 1933 stated that the oblique-banded leaf-roller was responsible for a small amount of damage in many apple orchards in southern Ontario. He reported a full first generation and a partial second in Ontario. He found the number of larval instars in each generation to be seven, and said that hibernation occurred in September. He said, "The pupation period averaged 11.2 days for the first generation and moths laid an average of 293.1 eggs per female." The major portion of the injury was reported done to the foliage.

#### HOST PLANTS

Sanderson and Jackson (31) listed more than 50 species of host plants of the oblique-banded leaf-roller of which the following are common in Utah: Apples, apple blossoms and leaves, ash, boxelder, black currant, blackberry, burdock, clover, cherry, Crataegus, Cornus stolonifera, celery, elm, Geranium, gooseberry, maple, plum, ragweed, raspberry, rose, strawberry and thistle.

These furnish an abundance of host material for Cacoecia rosaceana in this state.

In Utah the oblique-banded leaf-roller has been collected from several host plants.

The egg masses have been collected from the upper surfaces of the leaves of dewberry, pigweed, wild lettuce and ground cherry. The latter weeds are common to many of the dewberry fields in the Granite area and are often found in close proximity to dewberry plants.

The larvae of Cacoecia rosaceana were collected from the foliage of dewberry, wild rose and black currant during the summer of 1936. The black currants were growing near several rows of infested dewberry plants.

Adult moths were collected upon the foliage of dewberry and wild rose during the investigation.

Pupae were collected only from the foliage of the dewberry plant.

#### DESCRIPTION OF THE LIFE STAGES

##### Systematic Position

Specimens of the larvae which were reported attacking the fruits of the dewberry plant in Granite and the surrounding area were reared and the adult moths identified as Cacoecia rosaceana (Harris).\* The oblique-banded leaf-roller, Cacoecia rosaceana belongs to the order Lepidoptera, family Tortricidae, the adults being commonly known as the leaf-roller moths. It was described in the genus Loxotoenia and later placed in the genera Tortrix and Archips; systematists now place it in the genus Cacoecia.

\*Dr. August Busck, of the United States National Museum, kindly identified the moths as Cacoecia rosaceana (Harris)

## EGGS

The eggs of the oblique-banded leaf-roller, (Plate I, Fig. 2), were laid upon the upper surface of the leaves of dewberry plants. They were deposited in masses containing 46 to 279 eggs. The masses were oval in shape and placed along the midrib or over one of the larger accessory veins of the leaves. Each mass was covered by a tough, resistant, protecting material, gelatinous in nature and translucent. The individual eggs in a mass overlapped each other much as fish scales do, the whole mass of eggs having a reticulated appearance.

The eggs are disc-shaped, approximately 1.0 mm. long, 0.6 mm. wide and 0.2 to 0.3 mm. in thickness.

## IMMATURE LARVA

Immature larvae, (Plate II, Fig. I), infesting the dewberry fruits during the middle of the summer were 1 to 4 mm. in length and had the same general appearance of the more mature larvae except that there was somewhat less variation in their color. The small over-wintering larvae, as they emerged from hibernation, were usually darker in color than those found in the foliage later in the summer; they changed to greenish-yellow after feeding upon the foliage.

## MATURE LARVAE

The larvae matured after feeding upon the foliage of dewberry during the spring and early summer. They varied in color from a mottled light greenish-yellow to yellow, the general color being broken by the lighter color of the piliferous tubercles bearing the setae. The head is brown with the pronotum lighter brown to grayish in color. The lateral and posterior

margins of the pronotum are bounded by a dusky dark line. This margin is bisected by a faint white median line extending nearly to the anterior margin of the pronotum. The posterior margin of the head is notched or crenate in shape and often marked by a faint dark line. Extending down the dorsum are two rows of piliferous tubercles bearing one to three setae, usually one. Laterally the larvae have three rows of tubercles each bearing one or two setae. Setae upon the anal plate usually are longer than those on the other segments of the body. The skin of the mature larva has a wrinkled and leathery appearance.

The number of instars during the larval period was determined to be seven by measurements of the width of the head capsules of larvae preserved in alcohol. Collections of larvae were made at intervals of a few days through the course of the larval period. The head widths of material collected fall into six well defined groups (Table 1), indicating the presence of seven instars. Using Dyar's method for determining the hypothetical width of the head of each instar a close correlation is noted between the actual measurements and the hypothetical measurements, (Table 2).

Mature larvae, (preserved in 70 percent alcohol) varied in length from 18 to 28 mm., the average length being 23 mm.

#### PREPUPAE

During the latter part of June the mature larvae underwent a rather distinct change in color, length and appearance. The body became shorter, stouter and darker yellow in color. The most noticeable change in the insect was its reduced activity. When disturbed it did not move readily, appearing to be very sluggish and slow. This condition is characteristic of the prepupal stage, and constitutes a resting stage preparatory to

Table 1. Width of head capsules of Cacoecia rosaceana measured in millimeters.

Group I	Group II	Group III	Group IV	Group V	Group VI
.2	.32	.5	.8	1.36	1.8
.2	.33	.56	.75	1.2	1.7
.22	.34	.65	.96	1.1	2.0
.23	.36		.8	1.44	2.05
.23	.38		.88	1.44	2.1
.24			.9	1.3	2.0
.24			.8	1.35	1.9
.24				1.35	2.08
.24				1.3	2.1
.24				1.3	2.4
.24				1.4	2.08
.24				1.3	2.1
					2.0
					2.1
					2.0
					2.0
					1.9
					1.9

Table II. Comparison of actual head widths with hypothetical widths calculated by Dyar's method.

Actual Measurements	.227	.36	.57	.83	1.30	1.97
Hypothetical Measurements	.227	.35	.54	.832	1.28	1.97

pupation.

#### PUPAE

The pupae of Cacoecia rosaceana, (Plate 11, Fig. 2) are shining dark brown in color with two rows of dorsal tubercles running the length of the abdomen. The region of the head and thorax is darker brown than the abdomen, which is brownish-yellow during the first part of the pupal period. The abdomen often has a ringed appearance due to the posterior margin of each segment being darker in color than the adjoining margin. Near the end of the pupal period the color became dark, shining brown. The pupae varied from 11 to 15 mm. in length, averaging 13.5 mm. long.

#### ADULT

The adult moths, (Plate 1, Fig. 1), are reddish brown; the anterior wings are darker than the posterior wings and have many fine darker lines and a wide oblique band near the proximal portion. They vary in length from 12 to 16 mm. and have a wing spread of 18 to 26 mm. Males are noticeably smaller than females. Moths at rest fold the wings over the body, forming a triangular outline.

#### LIFE HISTORY AND HABITS

##### Equipment and Methods of Study

The identity of the larvae attacking dewberry fruits was determined by collecting larvae from fruits during the summer of 1935 and confining them in cages upon dewberry leaves at Logan. The cages used were quart fruit jars with a cloth sleeve attached to the mouth of the jar. Within these cages the larvae fed upon the dewberry plant, and when ready to hibernate they crawled up into the cloth sleeve. The jars containing the hibernating

larvae were wrapped in burlap and left in the field all winter. The following spring the surviving larvae were placed upon dewberry foliage and allowed to complete their development. Adults obtained in this manner proved to be Cacoecia rosaceana (Harr.), the oblique-banded leaf-roller.

During the summer of 1936 two large cages four feet square, covered with light weight, white factory, were placed over entire dewberry plants in the field. These cages were stocked with pupae collected from rolled dewberry leaves. All moths which emerged proved to be Cacoecia rosaceana (Harris).

Overwintering habits were determined by observations in the field and in the large stock cages described above. Larvae and pupae that appeared to be parasitized were placed in individual containers and all parasites reared were pinned and retained for identification.

#### EGGS

Incubation. The incubation period of the eggs lasted from 8 to 13 days, the average time being 10.5 days. During this time eggs underwent marked changes in coloration. Newly laid eggs were light yellow but soon became darker yellow tinged with pink spots. The spots turned a darker color as incubation progressed and it was soon possible to discern the dark head and thorax of the embryonic worm through the translucent covering of the egg mass.

Hatching. At the end of the incubation period the young larvae began breaking through the surrounding egg shell and the protective covering of the egg mass. Each larva under observation emerged head foremost and slowly worked its way through the covering. Several minutes were required for the larva to complete emergence.

Time of Hatching. During the summer of 1936 hatching was first observed in the field on July 1. The eggs in cages began hatching July 7, and continued to hatch until about July 20.

#### Activities of Larvae

After hatching the larvae soon began to crawl over the leaves and stems of the dewberry plant in search of a suitable place to feed. One young larva was observed to crawl 20 inches in one hour. In crawling these 20 inches several leaves and stems were visited. After such a period of activity larvae usually attacked a leaf or a fruit.

On Fruits. When a larva attacked a fruit it usually crawled underneath the calyx to start feeding. Some were observed to crawl directly between the outer drupelets in the surface of the berry. In either case the larva spun a bit of silken webbing which served as a protection during the time it was in the berry. Larvae feeding upon the fruit usually ate into one or two of the drupelets immediately underneath the calyx, causing them to become shriveled and discolored. In cases of severe infestations as many as five small worms were found to be feeding underneath the calyx of one berry. One larva was found beneath the calyx of a berry having worm-injury on several drupelets, indicating that one larva may feed in several places upon one berry. The young larva tunnels toward the center of the fruit, eating a path either between two drupelets or into a drupelet. At the entrance of each tunnel there is usually an inconspicuous bit of white silken material spun by the larva, evidently to serve as a place of concealment. This silk along with the discoloration of the drupelet served to indicate which berries had been attacked by the larvae.

At the time many of the larvae were entering the fruits, most of the

3



berries were green. Larvae seemed to make no choice between ripe and green fruit, feeding readily upon either.

During the berry season from July 5 to 25, in 1936, larvae were observed crawling over picked fruit in boxes and crates, especially late in the season. The increase in the number of worms during the latter part of the season may be accounted for by the fact that the height of the egg hatching period occurred several days after the berry-picking season had begun.

On Foliage. A very large number of the newly hatched larvae located a suitable place for feeding on the foliage of the plant. They often were found in a folded leaf or at a point where two leaves touched. Here they spun some silken webbing as a protection under which they could feed. When feeding upon the leaves the small larvae destroyed only the surfaces of the leaves which were next to them. The larvae apparently eat the leaf cells containing the green coloring matter, leaving the skeleton veins which die and become brown. Because of the small size of the larvae the damage done to the foliage in the late summer was found only upon close observation.

Late Summer Activities. The larvae usually continued to feed upon the fruit until it became dry and fell from the plant. Some of the larvae evidently moved to the foliage from the fruit for new food because larvae were seldom found in the old dry berries remaining on bushes late in the summer.

The larvae on the foliage moved only when disturbed or in search of fresh food. They remained upon the foliage until September, at which time they were first observed in hibernation.

Hibernation. Cacoecia rosaceana overwinters on dewberry in Utah as an

immature larva, 2 to 4 mm. in length. In 1936 the first larvae were found in hibernation during the latter part of September. When in hibernation the larvae completely surround themselves with a tightly woven silken chamber. They usually concealed these chambers beneath the bud scales and occasionally in narrow crotches where protection was available underneath loose pieces of bark. Old leaf petioles were also used as a place of concealment when in close proximity to a larger cane. Larvae were found hibernating in all of the places described above during the fall of 1936.

During the fall and winter of 1935, larvae hibernated in the cloth sleeves of cages. However, the percentage of larvae surviving the winter under these conditions was very low. One larva survived the winter of 1935-36 within a silken tube in a dried berry.

Description of Hibernating Larvae. The larvae in hibernation were pale, almost colorless and seemingly lifeless. They responded slowly or not at all when disturbed, and their response to stimuli was noticeably slower at lower temperatures. Larvae in hibernation which were brought into a warm room and left for several hours, became active, sometimes leaving their hibernaculae. When again placed in cooler temperatures they began spinning new hibernaculae; they worked very slowly and if temperatures were too low, failed to finish the hibernaculae.

Spring Emergence. The larvae were found to have emerged from their overwintering quarters during the middle of April in 1936, at the time dewberry plants were beginning to put out new foliage. The overwintering larvae were 2 to 4 mm. in length and had the same general appearance as when they entered the period of hibernation.

Spring Feeding. On leaving their hibernacula in the spring the larvae

began feeding upon the foliage, tying and folding the new leaves together and feeding inside the leaf mass, held together by silken threads spun by the larvae. The larvae grew rapidly during the spring and as they became larger they consumed large amounts of foliage during each feeding period. As the flowers, buds and fruit began to appear they also were tied in with the leaflets as it was not uncommon to find 2 or 3 blossoms or buds entirely eaten or damaged enough to prevent the setting of fruits. As many as eight leaflets were found tied into one bundle and practically all of them fed upon by the larva.

Because of their voracious feeding and an apparent wandering instinct, the larger larvae searched for food several times during the spring. When the food supply in a tied bunch of leaflets approached exhaustion, and sometimes before, the larvae crawled out in search of new food. Larvae usually crawled outward from the center of the bush, along the cane whose leaves they had previously been feeding upon. After locating a suitable place they again tied and folded the leaflets into a protective covering before extensive feeding occurred. Because of this habit it was often possible to locate several places where the same larva had fed during the spring.

In severe infestations many of the plants had five or more larvae feeding upon them at one time. In one instance 15 larvae were collected from the foliage of one dewberry bush in the spring of 1936.

Duration of Spring Feeding Period. The spring feeding period lasted from the time the larvae emerged from hibernation, about the middle of April, until late in June. The first prepupae were found in the field on June 11, 1936, and larvae could be found all during the month of June. In rearing cages pupation was in progress from June 11 to July 1, 1936.

### Prepupal Period

No accurate check was made of the prepupal period, but it appeared to last only two or three days; pupation taking place two or three days after the beginning of the period of reduced activity. This stage of the insect was found in the tied-up bunches of foliage, as were the larvae, no special chamber being prepared in which to spend the prepupal period. The prepupa was found where the larva happened to be feeding at the time it matured.

### Pupal Period

Time. In the summer of 1936 the first pupae were found in the field June 12. In rearing cages the first pupation occurred June 11.

Place. Each pupa was enclosed in a loosely woven silken chamber surrounded by a bunch of tied or folded leaves prepared by the larva.

Length of Period. An empty pupal case was found in the field June 19, 1936, seven days after the first pupa was found. In rearing cages the first adult emerged June 22, ten days after pupation had occurred. The length of the pupal period under cage conditions varied from nine to sixteen days, the average being twelve days. During this pupal period the pupae were active when disturbed; they wriggled very actively if removed from their place of pupation in the foliage. The end of their abdomen had a small spine, (Plate II, Fig. 2), bearing hooks with which they anchored themselves to the silken lining of the pupal chamber.

### Adult Emergence

Time. The first moths of the 1936 brood were collected June 22, in a dewberry field. Several empty pupal cases were found on this date. Under cage conditions the first moths emerged on the same date and the last one

emerged July 7. After the adult had emerged the empty pupal case was often left protruding from the bunch of leaves where the pupal stage was spent.

Sex Ratio. Of moths reared from larvae collected in the field, 23 were females and 21 were males, indicating that the sexes were present in approximately equal numbers.

#### Adult Activities

Flight. The moths of Cacoecia rosaceana could be found resting, partly concealed, on the foliage of the dewberry plant during the day. When disturbed they flew in a short, rapid, darting fashion to another dewberry bush. The distance covered in one of these flights was seldom more than 25 feet and usually less.

Moths were not observed flying in the field during the day unless they had been disturbed. However, they were collected in sufficient numbers in trap lights to indicate nocturnal activity.

Mating. Mating was not observed to take place during the day in spite of the fact that moths were under observation much of the time. Although no definite time can be given for mating, it must occur within two days after emergence because female moths usually laid fertile eggs within two days after emerging from the pupae. Oviposition occurred during the night in cages; no eggs were found that had been laid during the day.

Caged moths invariably laid their eggs upon the celluloid sides of the cages. Moths placed in a large brown paper sack and placed upon a cane, having foliage and berries, deposited their eggs upon the paper sacks. A possible explanation for this habit is that the moths prefer a smooth surface for oviposition. Moths in the large stock cages laid their eggs upon dewberry and ground cherry foliage growing in the cage.

Number of Eggs per Female. The number of eggs laid by individual female moths over the entire oviposition period, under caged conditions, varied from 240 to 900; the average being 420. The number of eggs laid on any one day by a single moth varied from 35 to over 200. Egg masses collected from the field contained from 46 to 279 eggs.

Egg-laying Period. One moth began ovipositing on the night of June 28, and laid eggs every night up to and including the night of July 5. During this eight day period a total of approximately 900 eggs was laid. Most females laid eggs only three or four nights when confined within a cage. In cages the egg laying period began June 28 and lasted until July 15 during 1936.

#### Length of Adult Life

The length of life for adult males under caged conditions varied from 3 to 16 days, averaging 7.2 days. Adult females survived from 3 to 17 days, averaging 8.1 days.

#### Generations

The oblique-banded leaf-roller attacking dewberries had only one generation in Utah during 1936, overwintering as immature larvae, emerging from hibernation in the spring, laying eggs in June and July and the young larvae feeding upon the host plant until September, when it entered hibernation. No evidence of a partial second brood was observed during the summer of 1935 and 1936,

### BIOLOGICAL CONTROL

#### Parasites

Several species of parasites were reared from Cacoecia rosaceana

during the summer of 1936. No definite record of the per cent of parasitism was obtained, but data from the incomplete records indicate approximately ten per cent of the larvae of the oblique-banded leaf-rolled were parasitized during 1936. The following is a list of the parasites reared from Cacoecia rosaceana during the summer of 1936.

DIPTERA Family Tachinidae

Phorocera erecta Coq. reared from C. rosaceana pupae June 30, 1936, at Granite, Utah.

HYMENOPTERA

Hoplectis alvocoxalis (Cress.) reared from C. rosaceana larvae, Pleasant Grove, Utah, June 6, 1936 (Knowlton).

Microdontomerus fumipennis (Grwfd) reared from C. rosaceana larvae, Granite, Utah, July 5, 1936.

Family Braconidae

Macrocentrus amicroploides (Vier.) reared from C. rosaceana larvae, Granite, Utah, June 6, 1936, and July 1936, at Pleasant Grove, Utah. (Knowlton, Smith, Allen).

Family Ichneumonidae

Glypta simplicipes (Cress.) reared from C. rosaceana larvae, Granite, Utah, July 5, 1936.

Predators

Spiders commonly frequenting dewberry patches in the Granite were the only predators observed. A spider gained entrance into one of the small rearing cages. Examination revealed that it had attacked one of the larvae, leaving it in a paralyzed condition. Several other larvae were found in the field in a similarly paralyzed condition and it was thought that they, also,

might have been attacked by spiders.

#### Summary

1. The identity of the Lepidopterous larvae attacking dewberry fruits in Utah has been established as Cacoecia rosaceana (Harr.), the oblique-banded leaf-roller.
2. There was only one generation during the year 1936 in Utah, upon dewberry plants.
3. Larvae frequently feed upon both fruits and foliage during their larval development.
4. The oblique-banded leaf-roller survives the winter in Utah as immature larvae in tightly woven cocoons, which are concealed beneath bud scales or loose bark.
5. The moths of Cacoecia rosaceana are usually inactive during the daytime, being active only in the evening and night.
6. The oblique-banded leaf-roller is attacked by several species of parasites, and by at least one predator.



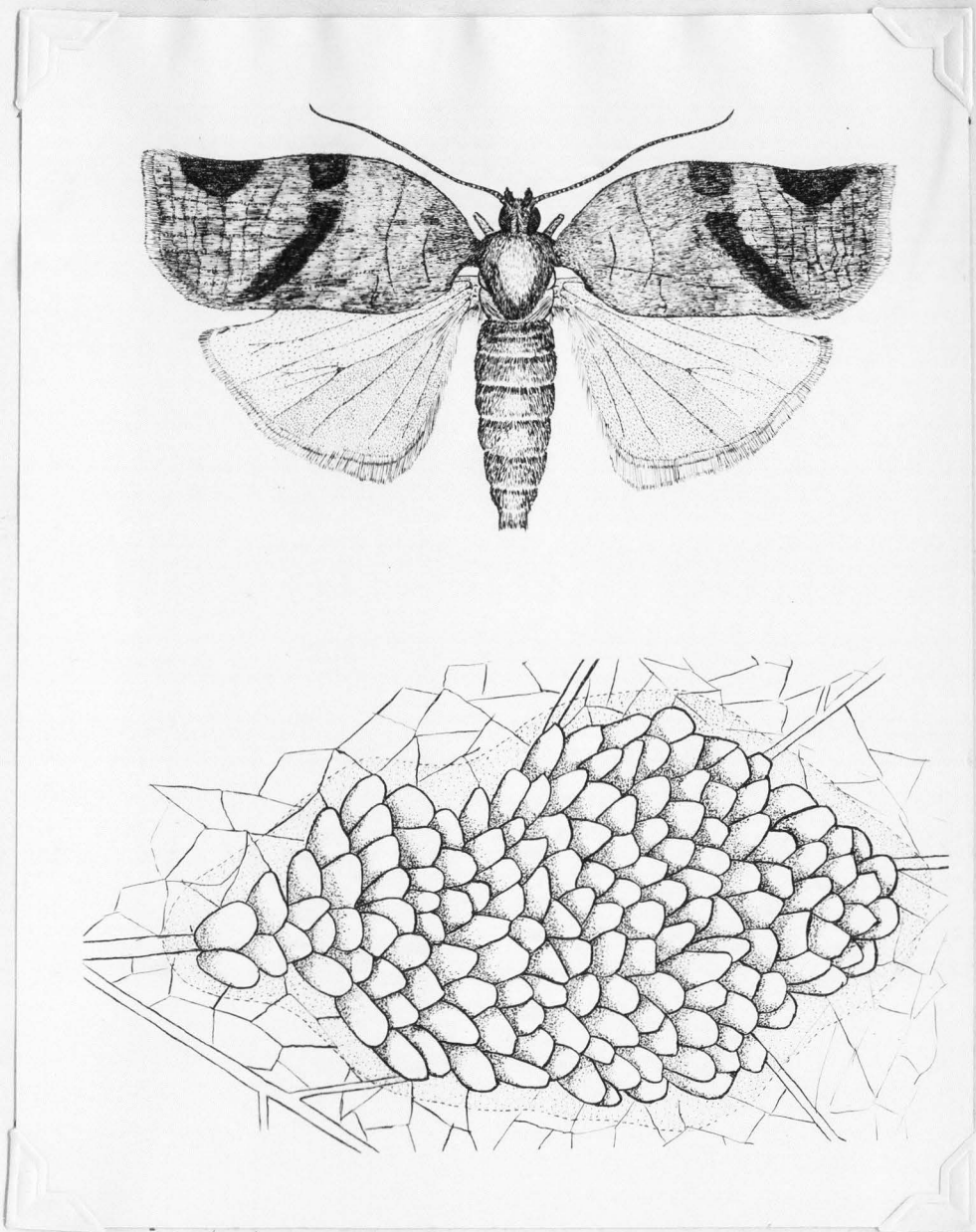


Plate I. Cacoecia rosaceana (Harris).

Figure I. Adult female moth. ( x 7)

Figure II. Egg mass on upper surface of dewberry leaf. (x 14)

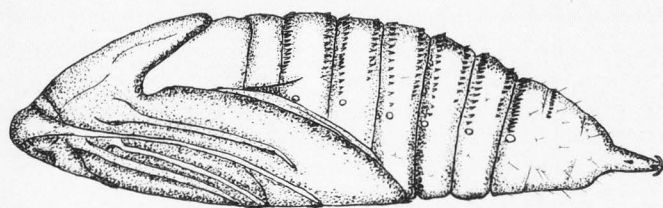
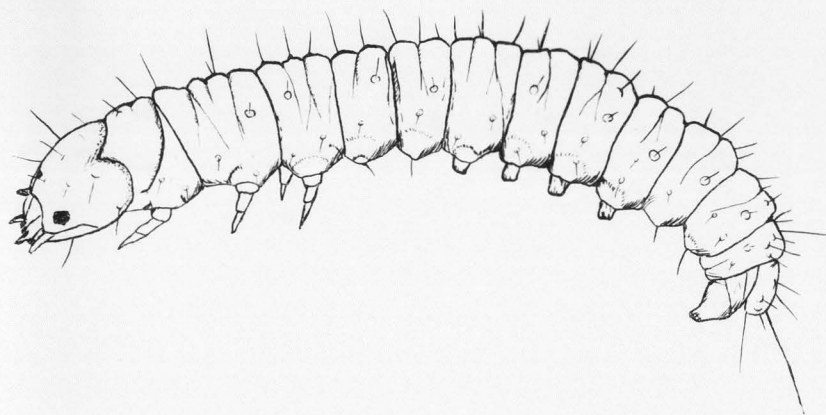


Plate II. Cacoecia rosaceana (Harris).

Figure I. Immature larva from berry. (x 40)

Figure II. Pupa. (x 7)

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