

His close companion and collaborator, Arthur H. Bush, was never happier than when displaying the beauties of his wonderful collection to timid tyros among the younger group of entomologists, and in giving them assistance and advice. But to Capt. R. V. Harvey our society is particularly indebted for the impetus which his splendid personality gave to the initial growth of our organization. He had the rare faculty of inspiring and fostering enthusiasm in all who were associated with him. Having travelled with him over three hundred miles of mountain trails, I learned to value him as an ideal "guide, philosopher, and friend."

In conclusion, let me say that in our present society I believe we have men of whom any similar institution in America might well be proud. The least that we can do is to foster that spirit of comraderie and good-fellowship without which the fires of achievement turn cold and crumble into the ashes of disappointment. Give the word of praise and encouragement now, when it may bear fruit, not reserving it as a flourish at the end of an obituary.

LEAF-ROLLERS ATTACKING ORCHARD TREES IN THE OKANAGAN VALLEY

By E. P. VENABLES,

DOMINION ENTOMOLOGICAL BRANCH, VERNON, B. C.

The collection and breeding of larvae causing typical leafroller injury in the dry belt of British Columbia during the past few seasons has revealed the presence of four species of **tortricid** moths, viz.: the fruit-tree leaf-roller, **Cacoecia argyrospila** (Walker), the oblique-banded leaf-roller **Cacoecia rosaceana** (Harris), **Tortrix alleniana** (Fern.), and **Pero-nea maximana** (B. and B.). Prior to the year 1918 injury caused by leaf-roller larvae was as a rule attributed to **Cacoecia rosaceana** (Harr.). It was a matter of uncertainty as to whether the fruit-tree leaf-roller actually occurred in the Okanagan Valley at that time. This latter insect is included in the check list of British Columbia **Lepidoptera** published in 1906, being recorded from the coastal district, and at Kaslo. It is also listed by Dr. Dyar in his "Lepidoptera of the Kootenay District of British Columbia" as having been captured near Field in 1903. It was first actually bred from Okanagan material in 1922, though egg masses supposedly referable to this species were noted by Mr. R. C. Treherne in 1921 on apple trees at Kelowna. **Cacoecia rosaceana** (Harr.) has undoubtedly been present within the province for a number of years, and has been frequently mentioned in the lists of injurious insects of the Okanagan Valley. **Tortrix alleniana** (Fern.) was first detected as an orchard pest by the author in 1922, when larvae were bred from apple foliage at Vernon. The similarity of the life-history of this species to

that of the oblique-banded leaf-roller is a matter of interest, and the type of injury caused by both species is identical. *Peronea maximana* (B. and B.) was first bred from apple foliage in 1921 at Vernon; this constituted the first record of this insect as a species of economic importance in the Okanagan. Further notes of an historical nature regarding this insect will be given under the life history on a later page.

In considering the life histories of these four species of leaf-roller, we may take them in their order of importance.

The Fruit Tree Leaf-Roller, *Cacoecia argyrosbila*, (Walker).

The control of this insect may at present be considered the most serious problem facing the orchardists in the interior fruit growing sections of the Province. Extensive damage has been caused in many of the commercial orchards in the Okanagan Valley, and although in 1922 these areas were circumscribed, and fairly well defined, the insect, during 1923, spread throughout the whole of the orchard sections of the Valley, besides being reported from Creston in the Kootenays.

The life-history of the fruit-tree leaf-roller may be briefly outlined as follows: the winter is passed in the egg stage upon the trees, the eggs occurring in small, greyish-brown, oval patches upon the bark of the main limbs and twigs. The number of eggs in a single egg mass varies approximately from fifteen to one hundred, or possibly more. The hatching of the eggs from a single mass may extend over a period of from about 24 to 48 hours, and occurs in May just as the buds are commencing to expand. The young larvae at first attack the opening buds, and later the blossoms and fruit, much of which is entirely destroyed, or so severely mutilated as to produce only scarred and deformed specimens at picking time. During July the larvae become mature, at which time they appear as cylindrical, pale green caterpillars with dark heads. Foliage injury is extensive, and considerable quantities of silk are spun by the larvae, which conceal themselves in nests formed from leaves tied together with silken threads. Pupation takes place within the protection of the nest used by the caterpillar for concealment. Moths emerge, and are on the wing during the latter part of July, and are active chiefly at dusk. During the daytime the moths lie dormant amongst the foliage of the trees, but large numbers may be observed in flight if the trees are shaken, or disturbed. The eggs are deposited towards the end of the month, and by early August all adults have practically disappeared.

It will be seen that from 9 to 10 months are passed by the fruit-tree leaf-roller in the egg stage, and it is during this period of its existence that control measures should be applied. Applications of miscible oil at an 8 per cent. dilution, put on in early spring, before any bud development has started, will give a good control, especially if thoroughness is observed. Where oil sprays are not used, it will be necessary to apply

sprays containing arsenate of lead after the caterpillars have hatched. In the control of the fruit-tree leaf-roller, thorough covering and high pressure are essentials.

The Oblique-banded Leaf-Roller, *Cacoecia rosaceana* (Harris).

The past two seasons have witnessed a very considerable increase in the numbers of this pest, and numerous enquiries have been received regarding its depredations.

The life-history of the oblique-banded leaf-roller affords a good example of the necessity of a clear understanding of the habits of an insect in order that repressive measures may be intelligently applied in any given locality. Prior to the year 1922 certain phases in the development of this insect were not well understood, at least in so far as the interior fruit-growing sections of the province were concerned.

It was generally believed that the winter was passed in the egg stage, and that the newly hatched larvae immediately attacked the opening buds, and that its life history was more or less identical with that of the fruit-tree leaf-roller. Recent observations, however, have shown that this is not the case. The oblique-banded leaf-roller passes the winter in the Okanagan Valley as a partly grown caterpillar upon the trees, within the protection of a closely woven silken cocoon. Over-wintering cocoons occur beneath flakes of dead bark, under bud scales attached to the fruit spurs, or in other protected situations. These over-wintering larvae emerge from their hibernating quarters in early spring, as soon as the buds begin to expand, and feed in much the same manner as do the larvae of the fruit-tree leaf-roller, which they closely resemble. Maturity is reached in July, and the adults are on the wing about the middle of that month.

The eggs of the oblique-banded leaf-roller are deposited upon the upper surface of the leaves of apple and other orchard trees during the month of July. A number of eggs are laid together in a flattened oval mass, and are of a pale green colour, closely resembling the leaf surface to which they are attached. Individual egg masses appear as blots of tinted wax, and each mass may contain from 15 to 100 eggs or more. A short time before hatching, the black heads of the larvae may be distinctly seen within the eggs, the masses appearing as though finely stippled with black dots, arranged in symmetrical lines. An interesting point regarding the hatching of the eggs of the oblique-banded leaf-roller is the brief period covered by the emergence of the larvae from a single egg mass, all of which appear to mature at the same time, and emerge within a few minutes of each other. The hatching of a fully incubated egg mass may sometimes be brought about at a given time by jarring the leaf to which the eggs are attached.

The newly hatched caterpillars migrate to the under surfaces of the leaves, and spin fine silken webs in close proximity to the main veins,

beneath which they feed during the entire period of their activity before entering hibernation quarters. In many cases a caterpillar will attach a leaf to an apple with silk, and feed upon the surface of the fruit, eating out small holes in the skin, and causing injury identical with that of the larvae of the bud moth, **Tmetocera ocellana** (Schff.) In late August the tiny caterpillars leave their feeding grounds and spin their cocoons for hibernation upon the twigs and limbs of the trees.

In controlling this insect, the same arsenical applications as are employed against the fruit-tree leaf-roller in early spring should prove effective. The possible value of late summer sprays against the newly hatched larvae is a matter for further experiment.

Tortrix alleniana, Fern.

This insect was first recorded as an orchard pest, in the Okanagan Valley, in the summer of 1922, when larvae were bred from apple foliage. Our notes for the past two seasons indicate that this insect has a life history very similar to that of the oblique-banded leaf-roller, inasmuch as the eggs are laid in July in flattened oval masses upon the upper surface of the leaves of apple trees. Eggs have also been taken upon the foliage of alfalfa, and snowberry. The egg mass of **Tortrix alleniana** differs from that of **Cacoecia rosaceana** in being a pale lemon yellow color, and of more delicate structure. As the hatching period approaches, the mass becomes more or less transparent in appearance, with the heads of the larvae clearly visible. There is no difficulty in distinguishing the eggs of the two species at hatching time, owing to the cloudy appearance of the egg mass of **Tortrix alleniana** as compared with the very regular arrangement of the larval heads in the mass of **Cacoecia rosaceana**.

The newly hatched larvae feed exclusively upon the under surface of the foliage, and also upon the surface of the fruit, in much the same manner as do the larvae of **C. rosaceana**. The young larvae appear to be somewhat gregarious in their habits during the late summer, three or four individuals occasionally being found within the same web beneath a single leaf. Individual larvae may cause injury of an extensive nature during their early life, their work, at this time, being in the majority of cases, more apparent than that of either the bud-moth, or the oblique-banded leaf-roller, both of which insects occur in the same situation, and at the same period of the year.

The young larvae construct hibernating cocoons upon the limbs and twigs during the latter part of July and early August, within which they remain until the following spring, emerging just as the buds begin to expand.

The injury in early summer, by the maturing larvae, is identical with that of the other leaf-rollers already mentioned. The mature larvae measures 23 mm. in length. The head is pale yellowish, with dark brown

markings: thoracic shield pale yellowish, with a dark brown, triangular mark on the caudo-lateral margin on each side. The thoracic shield is divided by a narrow pale line, which is bounded on each side by a narrow pale brown stripe which is considerably wider posteriorly. The whole of the dorsum above the spiracles is very dark green in colour, with the tubercles conspicuous, and of a dull yellowish white. Below the spiracles the body is pale yellowish, with the tubercles of that region light in colour and prominent. In the centre of each tubercle there is a dark brown circular spot, from the centre of which arises a single pale seta. The anal plate is paler than the dorsum, and bears eight setae. There is a pronounced anal fork beneath the posterior margin of the anal plate. The thoracic legs are pale brown; prolegs concolorous with venter. Spiracles dark brown.

The pupa is 12 to 15 mm. in length, very dark brown above, and somewhat paler beneath. Pupation takes place within folded apple leaves in the same manner as with the other leaf-rollers mentioned in this paper. The pupae under observation spent from 12 to 15 days in this stage. Adult emergence from pupae taken in the field covered a period of approximately two months.

***Peronea maximana* B. & B.**

In **Scientific Agriculture**, March, 1921, we find the first authentic record of this insect as an orchard pest in the Okanagan Valley. In this article, "Some notes on the fruit worms of British Columbia," by Mr. R. C. Treherne, Dominion Entomological Branch, Ottawa, this insect is included among the fruit worms of the province, and is remarked upon as follows: "***Peronea*, (***Alceris***) ***maximana*** has proved an interesting insect attacking orchard trees in the Okanagan Valley, not so much from its economic importance, which is slight, but from its identity and discovery. The early authors on British Columbia insects record the presence in the province of ***Teras minuta***. Much of the work ascribed to the bud moth, ***T. ocellana*** and the lesser apple worm has been placed to the credit of ***Teras minuta*** in the minds of field inspectors. Its presence is popularly believed to exist, and doubtless some moths were originally identified as referable to this species. The writer has, however, been unsuccessful in recovering ***Teras minuta***, and all efforts to collect it or its near relatives have failed, until this year, when ***Peronea maximana*** was bred from the North Okanagan. Its identity was proved by Dr. J. McDunnough, Dominion Entomological Branch, Ottawa."**

The life-history of this insect has only been slightly studied, and beyond the fact that larvae were taken on the terminal shoots of apple during the early summer of 1920, and that moths developed from these in August and September nothing is known. Mr. E. H. Blackmore reports that the insect is more or less common on Vancouver Island, and that in some seasons it is extremely common at Fraser Mills, in the lower

Fraser Valley, in September and October, and that supposedly the larvae feed upon alder. The mature larvae measure 14 mm. in length, with the dorsum pale yellowish-green throughout, with no markings apparent. The head is pale yellowish, with the mouth parts of a dull purplish tinge. The ventral surface is paler than the dorsum. Tubercles inconspicuous, bearing short setae.

No mention has been made in this paper of certain other well-known foliage and fruit feeding larvae which are known to occur in the Okanagan Valley, attention being merely drawn to the four species mentioned, all of which cause what is commonly referred to as "leaf-roller injury," and which is distinctive from the work of most other lepidopterous larvae inhabiting the orchard.

NEW RECORDS OF HEMIPTERA FROM BRITISH COLUMBIA

BY W. DOWNES.

Since the year 1921, when a report on collections of **Hemiptera** from British Columbia was published in this journal by Dr. H. M. Parshley, little has been recorded regarding the **Hemiptera** of this province. Much collecting has been done, however, and I have recently had an opportunity of working over the accumulated material. The present list adds 46 species of **Heteroptera** and 68 species of **Homoptera**, making 115 additional species. This brings the number of species of **Heteroptera** known to occur in the Province up to 252 and of **Homoptera** 152. When we consider the restricted areas in which collecting has been carried on, it will be seen that these figures probably fall far short of the actual number of species occurring in our territory. Most of the collecting has been done in the neighbourhood of Victoria, and those records from such places as Penticton, Summerland and Vernon are usually the result of short collecting trips of not more than one or two days duration, usually in late summer or early fall. Very little collecting has been done in the neighbourhood of Vancouver and the Lower Fraser Valley generally, but that district has yielded many species that find a favourable environment in the humid coastal area. In 1920 and 1921 Mr. Buckell collected in the Chilcotin and Barkerville districts and provided many new records and some new species.

I am greatly indebted to Mr. E. P. Van Duzee for his kindness in giving me access to the collections at the California Academy of Sciences and for much generous assistance in the determination of material, and to the following gentlemen who have determined species in various groups: Dr. D. M. De Long, **Cicadellidae**; Dr. H. B. Hungerford, **Aquatic Hemiptera**; Dr. H. H. Knight, **Miridae**; and Mr. W. L. McAtee, **Reduviidae**.

The names of the collectors are: K. F. Auden, E. H. Blackmore, E. R. Buckell, N. L. Cutler, W. Downes, R. Glendenning, A. W. Hanham, George Hopping, T. A. Moilliet, M. H. Ruhmann, R. C. Treherne, E. P. Venables, O. Whittaker.

LIST OF SPECIES.

HeteropteraFamily **Pentatomidae**

Brochymena 4-pustulata (Fabr.). Wallhachin, 6/17. (E.R.B.)

Trichopepla aurora Van D. Vernon, 20/6/19. (E.P.V.) Victoria 12/5/22. (E.H.B.)

Tricopepla californica Van D. Mt. Garibaldi, 10/9/23. (K.F.A.) Taken on fruiting heads of **Anemone occidentalis** at a height of 6,000 feet.

Corizus viridicatus Uhl. Summerland, 18/7/23. (W.D.)

Aradus parvicornis Parsh. Midday Valley, 19/7/21. (G. H.) From **Pinus ponderosa**.

Nysius californicus Stal. Duncan, 29/6/22. (W.D.)

Ligyrocoris diffusus (Uhl.). Penticton, 16/8/20. (W.D.)

Stignocoris rusticus (Fall.). Vernon, 24/9/19. (W.D.)

Trapezonotus arenarius (Linn.). Goldstream, 12/8/23. (K.F.A.)

Scolopostethus pacificus Barb. Kelowna, 19/1/23. (W.D.) Taken hibernating under bark.

Family **Tingidae**

Corythuca morilli O. and D. Penticton, 18/7/23. (W.D.) Abundant on **Artemisia dracunculoides**.

Physatocheila ornata Van D. Chilliwack, (O. W.) On alder.

Family **Reduviidae**

Ploiariola vagabunda var. **pilosa** Fieb. This was originally recorded as **P. canadensis** (Parsh.). but Mr. McAttee informs me it is identical with the first named, a European species. I have taken it on tree trunks in the city of Vancouver and in Stanley Park, and in Victoria on the shady side of board fences in company with **P. hirtipes**, but not as commonly as the latter.

Ploiariola californica Banks. Victoria, 24/5/21. (W.D.) This was abundant in an old henhouse in Victoria among the cobwebs. One specimen was taken in flight at Keatings, B. C., 30/5/22.

Pseliopus spinicollis (Champ.). Lillooet, 7/7/19. (A.W.H.) Taken by Mr. Hanham on Mt. McLean.

Fitchia spinosula Stal. Oliver, 23/8/22. (E.R.B.)