NOTES ON THE CHEMICAL CONTROL OF ECTROPIS CREPUSCULARIA SCHIFF, AT KITIMAT, B.C.[1]

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The saddle-backed looper, *Ectropis crepuscularia* Schiff., has not been regarded as a serious defoliator of hemlock stands in coastal British Columbia, and there is only one record of damage in the Interior. Populations started building up in 1951 in the hemlock-cedar stands of the North Thompson River Valley, and in 1953 nearly all the ground cover plants in the Thunder River area were completely defoliated. The population declined in 1954 with no apparent damage to overstory trees.

The saddle-backed looper then remained at a low level in British Columbia until 1958 when larvae became common in Forest Insect Survey collections. The population build-up continued in 1959, but there was no indication of an impending outbreak. A heavy moth flight was reported at Kitimat in May, 1960, and by the end of July hemlock stands at Kitimat were severely defoliated.

Only the general life history of this species is known. The moths emerge in early or mid-May, mate, and lay eggs. The larvae apparently feed on the understory and ground-cover plants before moving to the larger trees. In August the larvae drop to the ground and pupate in the duff beneath the trees, where they overwinter.

The full-grown larvae are about 1¼ inches long. The head is brownish, often mottled. The body is dark grey to brown, sometimes reddish in colour. The first three instars have a distinct inverted V marking on the dorsal side of the 2nd abdominal segment, but this marking becomes indistinct and is often missing in the last instar. The light grey moth has a wingspan of about 1¾ inches. The general mottled and indistinct markings of this species makes identification difficult. The wings appear to have scalloped edges and many fine transverse lines, often poorly defined.

The number of larval instars has not been definitely established. About 1,400 larval head capsules collected in the fall of 1960 were measured and plotted. When these data were combined with rearings conducted during the winter there appeared to be five instars. However, three of 16 larvae reared individually through to maturity had six instars. More work will be required to resolve the number of instars; the discrepancy could be a sex difference or a result of forced rearing.

Extent and Intensity

Heavy defoliation extended from about two miles south of the Smelter site to about three miles north of Kitimat Station, and from the Kitimat River westward up the mountain slopes to about 1,500 feet. All merchantable timber in the Anderson and Moore Creek valleys was also heavily defoliated. The total area was 10,500 acres, and was remarkably well defined. There was no gradual decrease in defoliation or number of larvae towards the edge of the infestation but rather an abrupt line, in places only ¼ mile wide, separating infested and non-infested stands. The area of heavy population coincided remarkably well with the extent of the "fume" cloud from the smelter. The reason for this is not understood yet.

With few exceptions the undergrowth, including devil's club, elder-

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berry, and other deciduous bushes was defoliated. Most of the coniferous reproduction, regardless of species, was completely stripped. Defoliation was heaviest on the southern slope of Sand Hill, and the northern slopes of Anderson and Moore Creek valleys, all southern exposures. This species feeds from the forest floor up, and feeding was stratified to the extent that when defoliation was heavy in the upper third of the crown of intermediate trees feeding was also heavy on the lower and mid-crowns of co-dominant and dominant trees. This pattern is illustrated in Table 1 which summarizes data from one of six plots examined in the infestation area.

TABLE 1—Ocular estimate of defoliation caused by saddle-backed looper in Fume Plot 2. Anderson Creek, Kitimat, B.C. September, 1960.

Tree species	Crown class	No. trees	Average defoliation by crown levels (%) Top ⅓	mid ⅓	lower ⅓	Total	No. trees 100% defoliated	No. Trees 70-99% defoliated
Hemlock	Dom	4	38	46	73	51	0	1
	CoD.	3	39	52	77	52	0	1
	Int.	5	81	81	81	81	3	1
	Sup.	4	100	100	100	100	4	0
Balsam	Dom.	1	50	80	100	80	0	1
	CoD.	7	14	31	47	29	0	0
	Int.	5	81	92	92	91	2	2
	Sup.	10	100	100	100	100	11	0
Cedar	Dom.	1	0	0	10	3	0	0
	CoD.	3	0	2	13	4	0	0
	Int.	2	8	35	55	30	0	0
	Sup.	1	30	30	10	30	0	0

Chemical Control

In an effort to prevent further defoliation to the stands bordering the highway and facing the townsite it was decided on July 29 to spray. Approximately 1,800 acres were sprayed on August 1 by a Grumman Avenger aircraft from Skyway Air Services, Langley. Dosage was ½ lb. of DDT per U.S. gallon of fuel oil, applied at the rate of one gallon per acre. Lack of time did not permit the organization of a proper appraisal, but 32 one-tree sample stations were established in the spray area, and 10 check trees were established outside the spray area. All samples were from reproduction trees or the lower crown level of larger trees which could be reached with clippers from the ground. Two 18-inch branch samples were taken from each tree at each sample date, measured, and the larvae counted. Population was expressed as number of larvae per 10 square feet of foliage surface. Spray deposit cards were set out at each station, and were analysed by the Chemical Control Section, Forest Entomology and Pathology Branch, Ottawa.

The amount of DDT recovered was considered adequate at only two stations where the deposit was 0.28 and 0.29 gpa (Table 2.). The average survival at these stations after 24 hours was 21.4 per cent, but increased to 65.5 per cent 48 hours after spraying. No larvae were found after seven days, but overwintering pupae averaged three per square foot of duff, indicating that some larvae survived. The percentages of larval survival for the other stations are shown in Table 2. In many cases more larvae were found 48 hours after spraying than before spraying. It was impossible to obtain larvae at some stations after seven days because the trees were completely defoliated, and the larvae had left the trees.

TABLE 2—Percentage survival of saddle-backed looper larvae and estimated DDT spray deposit, Kitimat, B.C. 1960.

Number of stations	Deposit gpa	Percentage survival 24 hrs.	48 hrs.	7-10 days	No. pupae per sq. ft. of duff
2	0.28	21.4	65.5	0	3.0
8	0.03-0.09	84.5	47.0	74.2	15.2
22	less 0.01	83.6	93.7	—	6.7
10	check	95.2	95.0	38.5	12.1

From the standpoint of larval mortality the operation does not appear to have been very successful. However, during a survey by helicopter in October it was observed that the trees within the spray area appeared to be in better condition than the unsprayed stands, so that the operation is believed to have saved a considerable amount of foliage.

Several possible explanations for the high larval survival are: the advanced stage of the larvae at the time of spraying, insufficient dosage of DDT, and the insects' habit of feeding from the ground cover up.

On July 31, 76.4 per cent of the larvae were in the ultimate instar, and 22.7 per cent in the penultimate instar. There was some indication that the younger instars were more susceptible to DDT as the percentage of larvae in the last instar increased at the spray stations whereas the distribution of larval instars did not alter greatly in the check stations.

The recovery of DDT at the 32 stations indicated that coverage was neither heavy nor uniform. Only two stations recorded a deposit heavy enough to be effective, 0.28 and 0.29 gpa. Eight stations received from 0.03 to 0.09 gpa, and the remaining 22 stations received less than 0.01 gpa. Some of the reason for the low DDT recovery could be that as *Ectropis* feeds from the ground cover up most of the upper crown levels were not defoliated, and a large portion of the spray would be caught and held in the tree crowns. Nevertheless the amount of spray deposited after allowing for foliage screening was still very small. It could be significant that the two stations receiving the heaviest dosage were on the edge of stands. The feeding habits of the larvae thus offer them a certain amount of protection, and this presents a difficult problem of obtaining spray penetration through a dense, undefoliated forest canopy to where the larvae are feeding. This problem is even greater if spraying is conducted during the early instars when larvae are still on the understory plants and not on the overstory trees as was the case during 1960 at Kitimat.

An hour after spraying was completed thousands of larvae were observed dropping by silk threads from the trees. By afternoon the larvae were crawling up the trees again and few dead larvae were observed. Larvae continued to drop the day after spraying; two days after spraying larval drop was still quite heavy but many of the larvae were free-falling, i.e., not on silk threads. Larvae on the ground were sluggish and many appeared unable to crawl back up the trees.

The assumption is that as larvae continued feeding after the initial knockdown and returned up the trees they were exposed to more DDT in the upper crown levels and gradually accumulated a lethal or sub-lethal dose of insecticide causing them to drop again to the ground and understory. This would also explain the large numbers of larvae counted on the lower crown levels on the second day after spraying.

The high survival of the looper is clearly shown by the large number of pupae per square foot of duff found in October, 1960 (Table 2). Pupal samples within the infestation area averaged 7.8 per square foot of duff. There was no significant difference in the number of pupae inside and outside the area sprayed in 1960. Barring any unforeseen mortality a heavy population is expected in 1961.

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MYZOCALLIS WALSHII MONELL (HOMOPTERA: APHIDIDAE) ON RED OAK AND A METHOD OF CONTROL[1]

PETER ZUK

Introduction

The aphid *Myzocallis walshii* Monell is a major nuisance on the red oak, *Quercus borealis* Michx. f. (*Q. rubra* auth.), a boulevard tree in Vancouver.

The aphids excrete large amounts of honeydew which falls as droplets over the leaves and eventually on sidewalks, lawns, and cars parked beneath the trees. Another objectionable feature is the sooty mould that grows on the honeydew. Repeated sprayings are necessary to alleviate the nuisance.

During the 1930's the red oak was commonly planted as a boulevard tree in Vancouver. In recent years, the Parks Board, who are responsible for planting and maintaining these trees, have planted smaller flowering species in preference to the larger oaks, maples, horse-chestnuts, catalpas and birches. Another reason for this change was that the red oak in particular supported a dense population of the aphids.

This paper deals with investigations on the life-history and control of this aphid in Vancouver.

Biology

M. walshii has been recorded on the leaves of various oaks (*Quercus alba, Q. bicolor, Q. imbricaria, Q. palustris, Q. rubra, Q. velutina*) (2), and hickories (*Carya* spp.) (1). It has no alternate host.

During the two years of this study, apterous viviparae appeared in the first week in June, when honeydew was found on the leaves on the high branches. A few alate viviparae were found on the lower leaves about the middle of June. The numbers of aphids increased slowly until the second or third week in July after which there was a rapid increase. In 1960, the peak was reached in the first week of September. The previous year there were two peaks: in the middle of July and at the end of August. At the peak of the infestation average counts in untreated trees ran as high as 54 alatae, 107 apterae, and 343 nymphs per leaf. At this time, the honeydew could actually be seen as it fell.

In late September and early October eggs were laid upon the bark of the larger limbs, and on the trunk in the vicinity of the first crotch, in which area the bark was rough, but not so rough as on the trunk below. Distally the limb bark was smooth. After the apterous oviparae had mated with alate males they moved from the undersides of the leaves to the crotch area where they deposited eggs in the cracks of the bark. In 1961, the eggs hatched in the middle of May.

CONTROL EXPERIMENTS

Materials and Methods

The experiment was conducted on mature red oak trees in plantings of

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