



FOREST ENTOMOLOGY AND PATHOLOGY LABORATORY

VICTORIA, B. C.

REPORT ON THE GREEN-STRIPED FOREST

LOOPER INFESTATION, QUEEN CHARLOTTE ISLANDS

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INTRODUCTION

Above average larval populations of the green-striped forest looper, Melanolophia imitata Wlk., were encountered during the general detection survey on the Queen Charlotte Islands in 1963. At this time the larvae were small, and noticeable feeding had not occurred. The first indication of serious damage was reported by Mr. W. Pearson of MacMillan, Bloedel, and Powell River in late November, 1963. A preliminary examination in February, 1964, indicated that the green-striped forest looper had reached outbreak proportions in the vicinity of Port Clements, and relatively high pupal counts indicated that the outbreak could be more extensive than originally believed. ^{1/} The problem was discussed at a Pest Control Committee meeting on February 18, 1964, at which time it was decided that further surveys were required to determine the extent and intensity of the outbreak and the outlook for 1964.

METHODS

An appraisal survey of Graham Island was carried out on March 16-24 by a party comprised of two members of the Federal Department of Forestry, consultant H. A. Richmond, and two men from MacMillan, Bloedel, and Powell River Co. Thirty-one hours flying time by a helicopter, provided by the B. C. Forest Service, were used to map defoliation and to obtain pupal samples from inaccessible areas.

Defoliation was classified from the air as light, medium, and heavy. Ground checks on defoliation were made at sample points, and several plots were established to obtain more accurate data on damage and tree mortality.

^{1/}

R. L. Fiddick and G. T. Silver. Report on the green-striped forest looper, Queen Charlotte Islands. Forest Ent. and Path. Lab. Feb. 1964.

Pupal samples were taken in the same manner as used in the February survey. One-foot-square duff samples were taken at the base of the tree and at a point mid-way between the base of the tree and the periphery of the crown on opposite sides of each tree. Three trees were sampled at each location. Pupal populations are the average number of pupae per square foot for the 12 samples.

Pupae collected from the infestation area in February were reared at Victoria to obtain information on biological control.

RESULTS

Extent and Intensity of Defoliation

The areas surveyed from the air are shown on Map 1. The extent of the infestation, as determined by visible defoliation, is confined to the east side of Graham Island and covers roughly an area bounded on the north by a line between the north end of Kumdis Island and Eagle Hill on the east coast, on the west by Masset Inlet and the Yakoun River, on the east by a fringe stand of spruce along the east coast, and on the south by a line from the east fork of the Yakoun River to Lawn Point.

No defoliation was observed in the mature stands west of the Yakoun River and Masset Inlet. Only a small number of larvae were collected in the stands west of the Yakoun River during the summer, indicating that only low looper populations are present in these areas.

The intensity of defoliation was estimated and mapped during the aerial survey. This was very difficult at this time of year as there was no discoloured foliage to indicate light feeding. Damage showed in the form of defoliated or thin crowns. The results are shown in Map 2. The area of defoliation by intensity rating is shown below. The area, in acres, is divided into production classes based on the B. C. Forest Service cover maps.

Degree of Defoliation	Area in acres				
	Mature	Immature	Non-commercial	Non-productive	Total
Heavy	9,000	7,600	1,040	17,400	35,040
Light to Medium	18,560	20,720	4,240	22,120	65,640
Total	27,560	28,320	5,280	39,520	100,680

There is a considerable amount of timber growing on the land classified as non-productive; much of this timber is heavily defoliated.

The ocular estimates of defoliation made at the pupal sample points are shown in Table 1. These estimates agreed fairly closely with the aerial estimates. As a rule areas classed as heavy contained trees which on the average had lost more than 50% of their total foliage in the upper half of the crown.

The heaviest damage in 1963 occurred at the west end of Lot 1828 near Port Clements. A 1 x 2 chain plot containing 108 cedar and 76 hemlock trees was established in this area. As shown in the summary below about 45% of the cedar are completely defoliated and the remaining trees are severely damaged. Damage to hemlock is also severe but fewer trees are completely stripped.

Species	No. trees	No. trees 100% defoliated	% defoliation for remaining trees		
			Top 1/3	Mid 1/3	Lower 1/3
Cedar	108	48	95	92	86
Hemlock	76	5	94	87	77

A second 1/5 acre plot of 57 trees, mostly hemlock, was established in a less heavily defoliated area in lot 412 east of Kumdis Bay. The timber is a mixture of hemlock and spruce with a few old cedar, growing on a relatively good site. Average defoliation of hemlock for the upper, mid, and lower crown levels was 27, 16, and 10% respectively.

These plot records and the estimates in Table 1 support observations that cedar is as heavily, and in some stands more severely defoliated than hemlock, which has been considered the preferred host for the green-striped forest looper.

Pupal Counts

A total of 41 pupal samples, including the nine localities sampled in February, were taken on Graham Island. The number of pupae by locality, tree, and position under the trees is shown in Table 2. The average number of pupae per square foot by classes and locality is shown on Map 1.

Samples within the infestation area ranged from an average of slightly over one pupa per square foot in some of the lightly defoliated areas to a maximum of 14.5 per square foot in the more heavily defoliated areas. The highest pupal counts were north of the Tlell-Port Clements road. Samples south of the road, even in areas of heavy defoliation, were generally lighter. A few samples around Juskatla Inlet and south of Juskatla contained no pupae. Small numbers of pupae were found at Awun Lake, Naden Harbour, and on the northern portion of Graham Island.

Biological Control

A total of 377 pupae, collected in February, were caged and reared under greenhouse conditions to obtain data on parasites and possibly disease. To date parasites have emerged from 19% of the pupae. This is considerably less than the more than 30% parasitism recorded in pupae collected in November. Pupae in the latter group were collected from a heavily defoliated area; some of the pupae collected in February were from areas of lighter population.

No Cordyceps militaris (Fr.) Link., a fungus suspected of causing heavy pupal mortality in the green-striped forest looper outbreak on the West Coast of Vancouver Island in 1960, was reared from the pupae. This is a strong indication that Cordyceps is not present in the outbreak area.

Hazard Areas - 1964

The determination of hazard areas is based on two factors; 1) defoliation to date, and 2) pupal counts as an index of defoliation expected in 1964.

Sampling indicated that, in general, the highest pupal counts are in stands which have been moderately to severely defoliated. The major problem was arriving at a combination of existing defoliation and pupal counts which could result in severe damage in 1964.

Assessing the pupal counts in terms of predicted defoliation presented a problem. The only previous green-striped forest looper outbreak, on Vancouver Island in 1960, collapsed before sampling could associate pupal counts with resultant defoliation. Based on information obtained from the saddle-backed looper infestation at Kitimat it was assumed that an average of two sound green-striped forest looper pupae per square foot was capable of producing a damaging larval population. Although possibly on the conservative side, it was therefore decided that in the existing infestation a hazard exists in stands containing an average of four pupae per square foot. The hazard is increased in relation to the damage already existing from 1963 feeding. The hazard areas shown in map 3 are based on the conclusion that defoliation expected in 1964, in addition to defoliation already caused by previous feeding, could result in tree mortality.

About 30,000 acres are included in the hazard area of which over 13,000 are mature timber. A breakdown of the area in acres by timber classes based on B. C. Forest Service Cover Maps is as follows:

Compartment No.	Mature	Immature	Non-productive	Total
38	3,360	2,160	960	6,480
39, 42	9,920	560	13,080	23,560
Total	13,280	2,720	14,040	30,040

DISCUSSION

It appears that the current green-striped forest looper outbreak on Graham Island presents a serious threat to the stands of timber within the infestation area. The present outbreak is much more extensive than the previous one on Vancouver Island. Defoliation has occurred on 100,000 acres, and defoliation has been severe over some 16,600 acres of mature and overmature timber, and light to medium on nearly 40,000 acres of mature and overmature timber.

Much of the timber in the infestation area is immature hemlock and cedar. This is shown by the average dbh by species in Table 1. There is commercial pole-sized cedar on much of the area, and a potentially good crop of poles in the immature stands.

The infestation at the present time appears to be confined to the hemlock-cedar stands in the eastern central portion of Graham Island. It is believed that the extent, as mapped from the air based on visible damage at this time of year, is a minimum. An aerial survey in August, 1963, when the discoloured needles were still on the trees, would have given more accurate data on the extent of light defoliation which would not be noticeable in March. Nevertheless, the aerial survey in March was believed intensive enough to have detected any heavy defoliation in stands on the west side of Masset Inlet and the Yakoun River.

Sitka spruce was not fed on to any serious degree, so the outbreak will probably restrict itself to the hemlock-cedar stands. It is interesting to note that cedar is an acceptable, almost the preferred host, in the current outbreak. This is very different from the Vancouver Island outbreak where defoliation decreased in intensity as the percentage of cedar in the stands exceeded 30%, and populations were relatively low where the cedar exceeded the percentage of hemlock.

Parasites, although present, do not appear numerous enough to give effective control in 1964. The absence of Cordyceps rules out any hope of this disease affecting the existing population. Unless some unforeseen factors exert control, the looper population in 1964 is expected to be high enough to cause severe defoliation within the hazard areas. Hemlock-cedar stands outside the hazard areas could also be heavily defoliated and will bear careful watching during the summer of 1964.

Predictions based on pupal counts are subject to factors which could alter the situation. Some of these are adult emergence or the percentage of pupae from which adults emerge. Unfavourable weather conditions during the mating and oviposition period could reduce the population. However, in at least six localities the number of pupae are double or more than double what is considered to represent a potentially damaging population. Dispersal of adults is another factor which cannot be predicted with certainty; a moth flight from an area of heavy population could result in a larval population of tree killing intensity in an area now regarded as relatively safe in 1964. However, moths of this looper are not considered to be strong flyers. This is one reason for believing that

the population in the predicted hazard area may be high. Based on existing information and our present knowledge of the looper there is reason to believe that defoliation will be sufficiently severe to result in tree mortality in 1964. This is particularly true in areas where severe defoliation occurred in 1963. Even if there was no feeding in 1964, heavy tree mortality can be expected at the west end of Lot 1828 where a high percentage of the trees are completely defoliated, and many of the remaining trees have lost over 90% of their total foliage.

SUMMARY

1. The green-striped forest looper outbreak extends over 100,000 acres of hemlock-cedar stands on Graham Island. Defoliation in 1963 was severe on 35,000 acres; 16,600 acres of this are classed as mature and immature timber, the remainder are classed as non-commercial and non-productive.
2. The pupal population present in areas of heavy defoliation is high. Barring unforeseen control factors defoliation is expected to be severe on about 30,000 acres. Heavy tree mortality could result within the outlined hazard areas.
3. Moderate to severe defoliation could result in stands where there are from 2.0 to 4.0 pupae per square foot.
4. Parasitism is not considered high enough to appreciably reduce the 1964 population.
5. Any increase in the extent of the outbreak in 1964 is expected to occur in hemlock-cedar stands.
6. Co-operative surveys by the Companies concerned, the B. C. Forest Service, and the Federal Department of Forestry, should be planned for the summer and fall of 1964 in order that the status and trend of the outbreak can be appraised.

ACKNOWLEDGEMENTS

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Table 1

Ocular estimate of percentage defoliation caused by
green-striped forest looper. Graham Island, March 1964

Locality	Host	No. trees	Average per cent defoliation		Ave. DBH	Site Index
			upper 1/2	lower 1/2		
Lot 831A	H	10	0	0	10	
W. of Tow Hill	S	10	0	0	12	
Lot 883	H	10	0	0	24	
Masset	S	10	0	0	30	
Lot 804	H	10	0	0	12	
Masset Sound	S	10	0	0	20	
Lot 1746	H	10	0	0	18	
Masset Sound	C	10	0	0	30	120
Lot 1770	H	10	0	0	14	
S. of Spence L.	C	10	0	0	20	90
Lot 225	H	10	Tr	Tr	20	
Watun River	C	10	Tr	Tr	24	
	S	10	0	0	24	
Lot 1517	C	10	0	0	24	140
Masset Sound	H	10	0	0	24	
Lot 1804	H	10	Tr	Tr	28	140
N. end Kumdis Is.	S	10	0	0	36	
Lot 1808	H	10	0	0	20	140
W. side Kumdis Is.	C	10	0	0	24	
Lot 1819	H	10	18	4	20	130
E. side Kumdis Is.	C	10	0	0	-	
Lot 1825	H	10	0	0	14	120
S. end Kumdis Is.	C	10	0	0	16	
Lot 424	H	10	50	26	14	100
N. of Kumdis Bay	C	10	51	33	20	
Lot 398A	H	10	82	50	16	90
N. of Mayer Lake	C	10	76	47	16	
Cape Ball	H	10	17	7	16	120
River Forks	C	10	45	18	14	
W. of Cape Ball	H	10	52	27	16	110
River	C	10	81	50	12	

Table 1 - continued

Locality	Host	No. trees	Average per cent defoliation		Av. DBH	Site Index
			upper 1/2	lower 1/2		
Lot 475	H	10	70	41	10	80
Mayer Lake	C	10	83	47	12	
Lot 388	H	13	67	42	12	90
Loon Lake	C	2	38	18	14	
Lot 2512	H	14	52	29	12	110
E. of Hickey L.	C	13	53	30	16	
Lot 2510	H	10	79	63	12	110
Hickey Lake	C	10	90	69	8	
Lot 2408	H	10	27	10	8	90
Mayer River	C	10	48	24	12	
Lot 413	H	20	26	15	12	110
Kumdis Bay						
Lot 412	H	20	46	21	14	140
Kumdis Bay						
Lot 1828	H	17	61	29	10	110
East end	C	3	42	33	12	
Lot 1828	H	24	93	81	10	100
West end	C	20	92	86	10	
Lot 995	H	10	Tr	Tr	30	140
SW of Port Clements	S	10	0	0	30	
Lot 405	H	20	48	22	12	110
Kumdis Creek						
Lot 362	H	20	28	13	10	100
SW corner Mayer L.						
Lot 4	H	10	0	0	14	
Yakoun River	C	10	0	0	10	
Lot 355	H	10	0	0	18	130
Yakoun River	C	10	0	0	30	
Lot 2383	H	10	36	15	8	70
E. of New Year L.	C	10	43	16	8	
Lot 1748	H	20	10	Tr	14	130
Tell						

Table 1 - continued

Locality	Host	No. trees	Average per cent defoliation		Av. DBH	Site Index
			upper 1/2	lower 1/2		
Lot 1380	H	10	0	0	12	100
Black Bear Cr	C	10	30	13	10	
Lot 117 North of Lawn Pt.	H	10	0	0	12	130
Lot 1450	H	10	0	0	30	140
Upper Yakoun	C	10	0	0	-	
Marie Lake	H	10	0	0	20	
Branch 30	C	10	0	0	24	
Lot 842	H	10	0	0	24	140
South Bay	S	10	0	0	40	
Lot 1527	H	10	0	0	26	110
Harrison Is.	S	10	0	0	26	
Bird Lake	H	10	0	0	30	140
S. of Harrison Is.	C	10	0	0	48	
Lot 1079	H	10	0	0	38	120
W. end of Awun Lake	C	10	0	0	66	
Lot 2359	H	10	0	0	18	140
Naden Harbour	C	10	0	0	24	

Table 2

Number of green-striped forest looper pupae per square
foot of duff at sample locations, Graham Island, March 1964.

Locality	Tree no.	<u>base</u>		<u>Mid crown</u>		Total	Av. no. pupae per sq. ft.
		1	2	1	2		
Lot 831A	1	0	0	0	0	0	
W. of Tow Hill	2	0	0	0	0	0	
	3	0	0	1	0	1	.08
Lot 883	1	0	0	0	0	0	
E. of Masset	2	1	1	0	0	2	
	3	0	0	0	0	0	.17
Lot 804	1	1	0	0	0	1	
Griffith Pt.	2	0	0	0	0	0	
Masset Sd.	3	2	2	2	3	9	.83
Lot 1746	1	2	0	0	0	2	
West side	2	0	0	0	0	0	
Masset Sd	3	0	0	0	0	0	.17
Lot 1770	1	0	0	0	0	0	
South of	2	1	1	0	0	2	
Spence Lake	3	0	0	0	0	0	.17
Lot 225	1	0	0	0	0	0	
Watun R.	2	1	3	3	0	7	
Masset Sd.	3	0	0	0	0	0	.58
Lot 1517	1	0	0	2	0	2	
Allan Pt.	2	0	0	0	0	0	
Masset Sd.	3	0	0	0	0	0	.17
Lot 1804	1	0	0	0	2	2	
N. end of	2	0	1	3	0	4	
Kumdis Is.	3	2	4	0	0	6	1.00
Lot 1808	1	0	0	0	2	2	
W. side of	2	0	0	0	0	0	
Kumdis Is.	3	0	0	0	0	0	.17
Lot 1819	1	22	4	1	2	29	
E. side of	2	3	0	1	3	7	
Kumdis Is.	3	1	1	2	0	4	3.33
Lot 1825	1	1	1	1	0	3	
S. end of	2	0	0	0	0	0	
Kumdis Is.	3	0	1	1	0	2	.42

Table 2 - continued

Locality	Tree no.	base		Mid crown		Total	Av. no. pupae per sq. ft.
		1	2	1	2		
Lot 424	1	20	13	5	9	47	
N. of Kumdis	2	10	9	18	10	47	
Bay	3	0	1	1	1	3	8.08
Lot 398A	1	1	4	0	1	6	
N. of Mayer L	2	4	0	0	0	4	
	3	11	3	7	9	30	3.33
W. of Cape Ball	1	0	9	6	25	40	
River near small	2	33	14	19	16	82	
lake Comp. 42	3	23	24	5	0	52	14.50
Lot 475	1	0	22	4	2	28	
Mayer Lake	2	3	6	7	1	17	
	3	8	4	5	9	26	5.92
Lot 388	1	3	2	0	0	5	
Loon Lake	2	2	2	1	2	7	
	3	4	1	5	0	10	1.83
Lot 2512	1	6	6	0	3	15	
E. of Hickey L.	2	2	6	3	0	11	
	3	13	13	2	1	29	4.58
Lot 2510	1	15	22	0	2	39	
Hickey Lake	2	16	7	1	3	27	
	3	43	13	15	0	71	11.42
Lot 2408	1	3	1	1	0	5	
Mayer R	2	1	1	1	0	3	
S. of Hickey L.	3	2	7	3	6	18	2.17
Lot 413	1	9	12	0	9	30	
Kumdis Bay	2	14	19	7	5	45	
	3	2	5	0	1	8	6.92
Lot 412	1	2	13	14	2	31	
Kumdis Bay	2	18	13	0	5	36	
	3	15	3	13	8	39	8.83
East end of	1	-	-	-	-	11	
Lot 1828	2	-	-	-	-	9	
Port Clements	3	-	-	-	-	44	5.33
Junction of	1	2	3	2	0	7	
Cape Ball River	2	4	1	2	4	11	
Forks Comp. 42	3	1	2	2	0	5	1.83

Table 2 - continued

Locality	Tree no.	base		Mid crown		Total	Av. no. pupae per sq. ft.
		1	2	1	2		
Center of Lot 1828	1	8	6	25	10	49	10.75
	2	-	-	-	-	37	
West end of lot 1828	1	-	-	-	-	14	3.75
	2	-	-	-	-	19	
	3	-	-	-	-	12	
Lot 995 1 1/2 miles SW of Port Clements	1	0	0	0	0	0	.75
	2	0	1	0	0	1	
	3	3	1	1	3	8	
Lot 405 Kumdis Cr.	1	7	9	0	4	20	7.92
	2	8	16	8	22	54	
	3	1	3	8	9	21	
Lot 362 SW corner Mayer Lake	1	1	5	1	0	7	2.25
	2	1	10	2	2	15	
	3	2	3	0	0	5	
Lot 4 Yakoun River	1	0	0	1	0	1	.17
	2	0	0	0	0	0	
	3	1	0	0	0	1	
Lot 355 Yakoun River	1	0	0	0	0	0	.08
	2	1	0	0	0	1	
	3	0	0	0	0	0	
Lot 2383 E of New Year Lake	1	0	0	0	0	0	.17
	2	0	1	0	1	2	
	3	0	0	0	0	0	
Lot 1748 Tlell	1	0	0	2	6	8	1.42
	2	2	0	1	0	3	
	3	2	0	0	4	6	
Lot 1380 Blackbear Cr.	1	0	0	0	0	0	0.
	2	0	0	0	0	0	
	3	0	0	0	0	0	
Lot 117 North of Lawn Pt.	1	0	6	0	1	7	1.17
	2	0	0	0	0	0	
	3	0	5	0	2	7	

Table 2 - continued

Locality	Tree no.	base		Mid crown		Total	Av. no. pupae per sq. ft.
		1	2	1	2		
Lot 1450	1	0	0	0	0	0	
Upper Yakoun	2	0	0	0	0	0	
	2	0	0	0	0	0	0
Marie Lake	1	0	0	0	0	0	
Branch 30	2	1	0	0	0	1	
	3	1	0	0	0	1	.17
Lot 842	1	0	0	0	0	0	
South Bay	2	0	0	0	0	0	
	3	0	0	0	0	0	0
Lot 1527	1	0	0	0	0	0	
Harrison Island	2	0	0	0	0	0	
	3	0	0	0	0	0	0
Bird Lake	1	0	0	0	0	0	
S of Harrison	2	0	0	0	0	0	
Island	3	0	0	0	0	0	0
Lot 1079	1	0	1	0	0	1	
W. end of	2	0	2	0	0	2	
Awun Lake	3	0	0	0	0	0	.25
Lot 2359	1	0	0	0	1	1	
Naden Harbour	2	0	0	0	0	0	.08
	3	0	0	0	0	0	



