BARK BEETLES, *PSEUDOHYLESINUS* SPP. (COLEOPTERA: SCOLYTIDAE), ASSOCIATED WITH AMABILIS FIR DEFOLIATED BY *NEODIPRION* SP. (HYMENOPTERA: DIPRIONIDAE)

BY

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RÉSUMÉ

Seul *Abies amabilis* (Dougl.) Forbes, sévèrement défolié par un Diprion (*Neodiprion* sp.) abritait des couvées de *Pseudohylesinus* spp. Bien que de nombreux sujets d'*Abies* ayant subi une défoliation moins grave alient montre des signes d'attaque par l'insecte, il s'agissait habituellement de diprions adultes construisant des hibernacles. *P. granulatus* se trouvait dans la partie inférieure du fût alors que *P. grandis* Swaine et *P. nobilis* Swaine se trouvaient dans la partie supérieure. Le Tsuga *heterophylla* (Raf.) Sarg. n'a pas subi l'attaque des scolytes de l'écorce.

ABSTRACT

Only *Abies amabilis* (Dougl.) Forbes heavily defoliated by a sawfly, *Neodiprion* sp., supported broods of *Pseudohylesinus* spp.. Although many trees with less defoliation showed evidence of attack, usually it was caused by adult beetles making overwintering niches. *P. granulatus* (Leconte) was found on the lower bole, whereas *P. grandis* Swaine and *P. nobilis* Swaine were found on the upper bole. Defoliated *Tsuga heterophylla* (Raf.) Sarg. were not attacked by bark beetles.

INTRODUCTION

Stands of amabilis fir (*Abies amabilis* (Dougl.) Forbes) and western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) near Kelsey Bay, B.C., were severely defoliated by a sawfly, *Neodiprion* sp., in 1978 and 1979 (Van Sickle and Fiddick 1979). Although the sawfly infestation subsided in 1980, the bark beetle *Pseudohylesinus granulatus* (Leconte)[1] attacked the lower bole of many of the amabilis fir trees. This study was carried out to assess the hazard of the bark beetle to nearby undefoliated trees and those trees recovering from defoliation and it also provides the first record of *Pseudohylesinus* associated with sawfly defoliation in B.C.

METHODS

On 23 to 25 September, 1980, the defoliated stands were examined along three cruise lines: two near Keta Lake (elev 400 m) and one near Big Tree Creek (elev 700 m). Tree species, diameter breast height, defoliation estimates and evidence of bark beetle attack were recorded for each tree on 25 and 7 prism (B.A.F. 5, m^2/ha) plots in the two locations, respectively. The defoliation data were derived from visual estimates of filiage missing from the tree.

Ten amabalis fir trees, averaging 45 cm dbh and 33 m ht and ranging from 71 to 100% defoliation, with boring dust on the lower bole were felled within the Keta Lake infestation. Four circular samples of bark (each 81 cm^2) were removed within 0.3 m of the ground and two were taken at each 3 m interval along the bole from 1.5 m height to a 20-cm-diameter top. Numbers of entrance holes, living parents, progeny and emergence holes were counted and gallery length was measured on each sample.

RESULTS AND DISCUSSION

On many trees over 90% defoliated, the only foliage remaining was that of the current 1980 growth. Although both *Abies* and *Tsuga* were defoliated, only the *Abies* were attacked by bark beetles. The attack appeared to be positively correlated with intensity of defoliation and tree diameter (Table 1).

In addition to *P. granulatus* attacks on the lower bole, two other species of *Pseudohylesinus*, *P. grandis* Swaine and *P. nobilis* Swaine[2], were found on the upper bole. Adults were not found in the brood galleries of any of the three species; the only adults were in holes, undoubtedly overwintering sites, excavated just to the cambium (Thomas and Wright 1961; Dyer and

[1]Identified by R. W. Duncan, Pacific Forest Research Centre, Victoria.

[2]Identified by D. E. Bright, Agriculture Canada, Biosystematics Research Institute, Ottawa.

Table. 1. Numbers of *Abies amabilis* along cruise lines and percent attacked by bark beetles (in parenthesis) arranged by defoliation and diameter classes, Kelsey Bay, September 1980.

Diameter class (cm)	Percent defoliation class				
	25-50	51-80	81-90	91-100	Total
15-30	4 (0)	8 (0)	2 (50)	6 (50)	20 (20)
31-50	7 (0)	27 (40)	15 (33)	41 (63)	90 (47)
51-70	5 (0)	37 (62)	2 (50)	16 (62)	60 (57)
71-100	3 (33)	8 (38)	2 (100)	5 (100)	18 (61)
Total	19 (5)	80 (46)	21 (43)	68 (65)	188 (48)

Nijholt 1965; Bright 1976). Although *P. grandis* and *P. nobilis* were probably responsible for the attack producing brood in the upper bole, identification was made only from beetles in these overwintering sites. Based on their large size, the gallery systems of *P. granulatus* were easily distinguished from those of the other two species. *P. granulatus* galleries occurred from the base of the trees only up to 10.5 m on the bole. The remaining two species occurred from 7.5 m upward (Table 2) but, on any individual tree, were not mixed with *P.*

Table 2. Number of *Pseudohylesinus* attacks and progeny and egg gallery length (cm), per 0.1 sq m of bark in 10 *Abies amabilis* defoliated by *Neodiprion*, Keta Lake, September 1980.

Percent defoliation classes	No. of trees	Height1/	No. of samples	*P. granulatus* Number of Attacks2/	*P. granulatus* Number of Progeny	*P. granulatus* Gallery length	*P.* spp. Number of Attacks2/	*P.* spp. Number of Progeny	*P.* spp. Gallery length
71-80	4	1	40	2.8	0.0	5.1	0.0	0.0	0.0
		2	32	0.0	0.0	0.0	0.0	0.0	0.0
		3	22	0.0	0.0	0.0	7.3	0.0	12.3
		All	94	1.2	0.0	2.2	1.7	0.0	2.9
81-90	2	1	20	1.8	3.1	0.9	0.0	0.0	0.0
		2	16	0.0	0.0	0.0	4.6	0.0	1.2
		3	10	0.0	0.0	0.0	9.9	2.5	18.9
		All	46	0.8	1.3	0.4	3.8	0.5	4.5
91-100	4	1	40	3.1	20.4	15.0	0.6	1.5	1.3
		2	32	0.8	6.6	3.3	5.8	29.7	20.9
		3	14	0.0	0.0	0.0	8.8	43.2	89.3
		All	86	1.7	11.9	8.2	3.9	18.8	22.9

1/ 1 = base to 7.5 m, 2 = 9.0 to 19.0 m, 3 = 22.5+ m.

2/ Includes attack made by beetles in overwintering niche.

granulatus. The association between *P. granula-* and *P. grandis* is well known (Thomas and Wright 1961; Bright 1976), but the role that *P. nobilis* may play in such an association is unknown.

The progeny of *P. granulatus* were all larvae and that of the other two species were larvae and pupae, and some exit holes were present. The number of exit holes was combined with the number of living progeny to provide the total of progeny for the data collected from the bark samples (Table 2).

Neither progeny nor larval mines were found in trees in the lowest defoliation class examined (71 to 80%), although a few aborted egg galleries were present (Table 2). Trees in the intermediate defoliation class (81 to 90%) contained a few successful galleries with a few progeny, but many attacks were unsuccessful. Successful beetle broods were present primarily in trees in the most severe defoliation class. These trees essentially had only 1980 foliage and often this was sparse.

Based on the presence of boring dust observed during the cruise of standing trees a relatively high proportion (48%, Table 1) of the *Abies* were attacked by bark beetles. The bark samples and the literature (Thomas and Wright 1961; Dyer and Nijholt 1965; Bright 1976) suggest that most of these attacks would have been beetles making overwinering niches rather than beetles attempting to construct brood galleries. The species responsible would have been primarily *P. granulatus,* although *P. grandis* could have contributed (Dyer and Nijholt 1965).

Only the severely defoliated trees were supporting successful bark beetle broods. These trees were already dead or dying, and the beetles appeared to be an unlikely source of serious hazard to nearby undefoliated trees or to those recovering from the effects of defoliation.

This note is the first record of *Pseudohylesinus* spp. associated with sawfly defoliation in B.C. However, *Pseudohylesinus* spp. were implicated following the western hemlock looper (*Lambdina fiscellaria lugubrosa* (Hults)) outbreak of 1944-46 (Kinghorn 1954) and were often associated with the balsam woolly aphid (*Adelges piceae* (Ratz.)) (Shea *et al.* 1962; Harris *et al.* 1966).

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