SOME EFFECTS OF PINE OIL ON MOUNTAIN PINE BEETLE (COLEOPTERA: SCOLYTIDAE) AT DIFFERENT POPULATION LEVELS

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ABSTRACT

Two formulations of pine oil (BBR2 and Norpine 65) were tested for effectiveness in preventing attacks by mountain pine beetle and reducing brood production at different population levels on lodgepole pine trees. Pheromone-baited trees sprayed with BBR2 had a lower attack intensity than baited check trees and a lower brood success than either baited check trees or baited trees sprayed with Norpine 65. Only at a low population level was attack intensity reduced by both pine oil treatments. The proportion of attacked trees within 10m of the treated trees was lower in low than in high populations but showed no difference among treatments.

RÉSUMÉ

On a vérifié l'efficacité de deux préparations d'huile de pin (BBR2 et Norpine 65) pour prévenir les attaques des dendroctones du pin ponderosa et réduire la production d'une couvée chez les insectes à différents niveaux de population habitant des pins tordus. Avec le BBR2, l'intensité de l'attaque des arbres piégés avec des phéromones a été moins élevée que dans le cas des arbres témoins piégés, et les couvées ont été moins nombreuses que dans le cas des arbres témoins piégés ou des arbres piégés arrosés avec du Norpine 65. L'intensité de l'attaque a été réduite par les deux préparations à de faibles niveaux de population seulement. La proportion des arbres attaqués à 10 m de distance des arbres traités a été moindre à des faibles niveaux de population qu'à des niveaux élevés, mais l'emploi de l'une ou de l'autre préparation n'a fait aucune diffét rence.

INTRODUCTION

Pine oil (Norpine 65[1]) has been demonstrated to be effective in preventing attack on treated and untreated neighboring trees by three species of *Dendroctonus* bark beetles (Nijholt and McMullen 1980, Nijholt *et al.* 1981), and by ambrosia beetles on logs (Nijholt 1980). Another formulation of pine oil (BBR2[2]) appears to be effective also in preventing attack by mountain pine beetle, (*D. ponderosae* Hopk.), on lodgepole pine, *Pinus contorta* Douglas, (Nijholt, personal communication). However, BBR2 in fibreboard pieces distributed on the ground at the rate of 50 ℓ/ha (McMullen and Safranyik unpublished[3] 1983) or fastened on baited trees (Nijholt, personal communication) did not prevent attack on lodgepole pine by mountain pine beetle except in one location where population pressure might already have been low.

This report describes a study in which both pine oils, BBR2 and Norpine 65[4], were used in locations with different beetle populations to compare their effectiveness in preventing attacks on treated and neighboring untreated lodgepole pine trees.

MATERIALS AND METHODS

The study was carried out in mature (80 yrs. +), predominantly pure lodgepole pine stands of poor to medium site quality in the Cariboo Forest Region. The beetle population in each stand was rated as high or low on the basis of general tree mortality within the area. The locations of each stand and its population rating were as follows.

a) Alexis Lake Road, high population.
b) Tsuh Lake, high population.
c) Tyee lake, low population.

At each location 27 trees were selected for treatment in three 3 x 3 Latin squares. Treatment trees were at least 20 m apart and had a dbh of at least 20 cm. On July 4 and 5, 1984, before the attack period, BBR2 and Norpine 65 oils were sprayed on the lower 3.5 m of the bole of the respective treatment trees at the rate of approximately 2 ℓ per tree (0.55 ℓ/m² bark area) with a garden type pressure sprayer. The check treatment trees were left unsprayed. Each treatment tree was baited with 0.5 cc of trans-verbenol and 0.5 cc of myrcene in separate, size 00, BEEM® capsules. The treatment trees, as well as those trees within 10 m, were examined for attack (entrance holes) between August 3 and 13 (Table 1), after the attack period. The

[1]Northwest Petrochemical Corp., Anacortes, Wash.
[2]Safer Agro-chem. Ltd., Victoria, B.C.
[3]McMullen, L. H. and L. Safranyik. 1983. Effect of pine oil distributed in fibreboard on the ground for protecting lodgepole pine from mountain pine beetle attack. File Rpt. 2 pp, 1 table, 2 maps. Pacific Forest Research Centre, Victoria, B.C.
[4]Similar to that used by Nijholt (1980) but with α and β pinene removed.

TABLE 1. Effect of two pine oil formulations (Norpine 65 and BBR2) on attack and brood success by mountain pine beetle on pheromone-baited and adjacent[1] lodgepole pine trees in stands with different population levels.

Population Level	Treatment[2]	Treatment trees				Adjacent[1] trees	
		Dbh (cm) $\bar{x}$	Dbh (cm) $S_{\bar{x}}$	Mean Attack Index	Mean No. galleries with brood[3]	Number >10cm dbh	Mean Percentage attacked
High	Norpine 65	31.1	1.3	3.6	2.3	93	54
	BBR2	31.0	1.2	3.1	0.4	138	57
	Check	28.1	1.1	3.6	2.4	111	49
	All	30.1	0.7	3.4a[4]	1.7	342	50a
High	Norpine 65	31.8	1.8	3.1	3.4	101	51
	BBR2	30.3	1.0	2.1	1.2	144	46
	Check	31.3	2.6	2.8	3.3	136	39
	All	31.1	1.1	2.7a	2.7	381	46a
Low	Norpine 65	38.4	3.3	0.0	-	51	0
	BBR2	37.7	2.1	0.0	-	45	4
	Check	34.2	1.8	1.8	-	25	14
	All	36.8	2.5	0.6b	-	121	6b

[1]Within 10 m of treatment trees.
[2]9 trees/treatment/location.
[3]5 galleries of each attacked tree examined.
[4]Means of the same level in columns followed by different letters are significantly different, Student Newman Keul's range test ($P = \leq .05$).

number of attacks on each treatment tree was recorded in classes of 0, 1 to 5, 6 to 10, 11 to 15, and 16 or more, and indexed as 0, 1, 2, 3, and 4, respectively. To determine the impact of the pine oil on brood success, five galleries on each attacked treatment tree at the two locations with high population levels were examined for the presence of brood on 14 November. The indexed attack classes and the number of galleries with brood were transformed to $(X + .375)^{0.5}$. Analysis of variance and Student Newman Keul's range tests were used to compare means. Analysis of variance with arc-sine transformation was made on the percentage of trees attacked within 10 m of treated trees.

RESULTS AND DISCUSSION

Of the 425 adjacent trees with a dbh greater than 20 cm, 49.6% were attacked, and of 419 trees with a dbh less than 20 cm, 16.0% were attacked.

The indexed attack data showed a significant difference ($P \leq .05$) among locations and treatments (Table 1). The trees in the two high population areas had higher indices than those in the low population area and BBR2 had a lower index than the check treatment. Analysis of individual locations indicated that only at the low population location, where the check was higher than either pine oil treatment, was there a difference among treatments. Also, the percentage of attacked trees adjacent to the treated trees differed only among locations; the low population location had a smaller percentage of adjacent trees attacked. This result confirms the original population rating of the stand.

Brood success for the BBR2 treatment was significantly lower ($P < 0.01$) than either the Norpine 65 or check treatments (Table 1).

These data suggest that where the beetle population pressure is high, pine oil will not effectively prevent attack on trees baited with trans-verbenol and myrcene, but it will be effective where populations are low.

The data do not support any real differences between BBR2 and Norpine 65 in prevention of attack but BBR2, unlike Norpine 65, did reduce the brood success in terms of the number of galleries with brood in treatment trees.

A study is needed to determine if attacks on unbaited trees can be prevented.

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