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SPATIAL DISTRIBUTION OF JACK PINE CONES AND THOSE ATTACKED BY INSECTS[1]

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ABSTRACT

The middle crown and south quadrant of 6-m-tall jack pines, *Pinus banksiana* Lamb., produced significantly more cones than the rest of the tree. The number of cones attacked by *Eucosma monitorana* Heinrich was also highest in the middle crown and south quadrant. *Laspeyresia toreuta* (Grote) attacked the most cones in the middle crown. A positive, linear correlation existed between the number of cones attacked by insects and cone abundance per tree, indicating a response of the insect population to increased food supply.

Insects pests commonly infesting and causing serious economic loss to second-year cones of jack pine, *Pinus banksiana* Lamb., in Wisconsin include the following: a cone borer, *Eucosma monitorana* Heinrich; the eastern pine seedworm, *Laspeyresia toreuta* (Grote); the webbing coneworm, *Dioryctria disclusa* Heinrich; the jack pine budworm, *Choristoneura pinus pinus* Freeman; a cone midge, *Asynapta hopkinsi* (Felt); and the red pine cone beetle, *Conophthorus resinosae* Hopkins (Rauf et al. 1981). The spatial distribution and the relationship between attacks of the foregoing insects and cone abundance per tree are reported in the present paper.

METHODS

Fourteen jack pines were randomly selected in an open stand in the Little Rice area, Oneida County, Wisconsin, in late August 1980 after the insect attacks had been completed. No additional attacks by *L. toreuta* were likely. The trees were 5 to 6 m tall and 7 to 10 cm in dbh. Tree crowns were divided into lower, middle, and upper thirds. The crowns were also divided into north, west, south, and east quadrants with the aid of plastic ribbons radiating out from the base of the crown, along NE, SE, SW, and NW compass bearing (DeBarr et al 1975). Thus, each crown was divided into 12 cells. The cones were harvested with a pruner and placed in separate plastic bags according to their location on the crown. The number of undamaged cones and cones infested by specific insects were recorded in the laboratory.

Analyses of variance were performed to test for differences in the distribution of cones and insect attacks among strata and quadrants. Duncan's New Multiple range test was applied to determine the statistical significant differences within strata and quadrants. A scatter diagram was used to relate the distribution of insect attacks among trees to cone abundance.

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RESULTS AND DISCUSSION

The number of cones differed significantly ($P < 0.01$) among strata (Table 1). About 2 to 3 times more cones were produced in the middle crown than in the upper and lower crowns. Among cardinal directions, the south quadrant supported significantly ($P < 0.05$) more cones. The same distribution pattern was reported from other pines (Hard 1964, DeBarr et al. 1975, Mattson 1979).

The number of cones attacked by *E. monitorana* was significantly ($P < 0.01$) higher in the middle crown than in the upper and lower crown, and was significantly ($P < 0.05$) higher in the south quadrant. Attack by *E. monitorana* also tended to be higher in the middle crown of red pine (Barras and Norris 1969). Significantly ($P < 0.01$) higher numbers of cones attacked by *L. toreuta* were detected in the middle crown, but not among the quandrants. DeBarr et al. (1975) and Coyne (1968) also reported that *Laspeyresia* spp. did not favor any particular crown cardinal direction on southern pines. The number of cones damaged by the other insects (*D. disclusa, A. hopkinsi, C. resinosae*, and *C. pinus pinus*) was significantly ($P < 0.01$) higher in the middle crown; no significant difference was detected among quadrants. In general, the distribution of cones attacked by insects follows the distributional pattern of the cones, i.e., the greatest number of cones attacked by insects occurred in those crown areas of highest cone concentration (Table 1).

The number of cones per tree attacked by six insect species exhibited a significant ($P < 0.05$) positive, linear relationship to cone abundance (Fig. 1). The correlation implies that 52% of the variation in damage can be attributed to variation in cone abundance. Infestation percentage, however, was poorly ($r = -0.32$) correlated with the number of cones per tree. These data agree with the studies on other pines (Lyons 1957, Merkel et al. 1965, DeBarr and Barber 1975, Mattson 1976), and suggest that although the number of cones attacked by insects increased as the number of cones per tree increased, the percent infestation decreased slightly with the increasing cones. Therefore, higher number of undamaged cones can be collected from trees harbouring more cones.

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Table 1. Spatial distribution of jack pine cones and frequency of insect infestations within the crown.

Items	Mean number of cones						
	Cardinal direction				Crown stratum		
	N	W	S	E	Lower	Middle	Upper
Second-year cone	121.50a[1]	122.07a	194.07b	121.36a	100.29a	290.00b	168.71c
Attacked by:							
E. monitorana	15.14a	16.86a	33.29b	16.86a	21.43a	45.29b	15.42a
L. toreuta	27.50a	27.64a	39.86a	29.64a	20.14a	67.21b	37.29c
Other insects[2]	5.71a	7.79a	9.29a	7.29a	6.14a	17.21b	6.71a

[1]Within a row in each box, values followed by different letters are significantly different according to Duncan's New Multiple Range test, $\alpha = 0.05$ or 0.01.

[2]*D. disclusa, C. resinosae, A. hopkinsi, C. pinus pinus.*

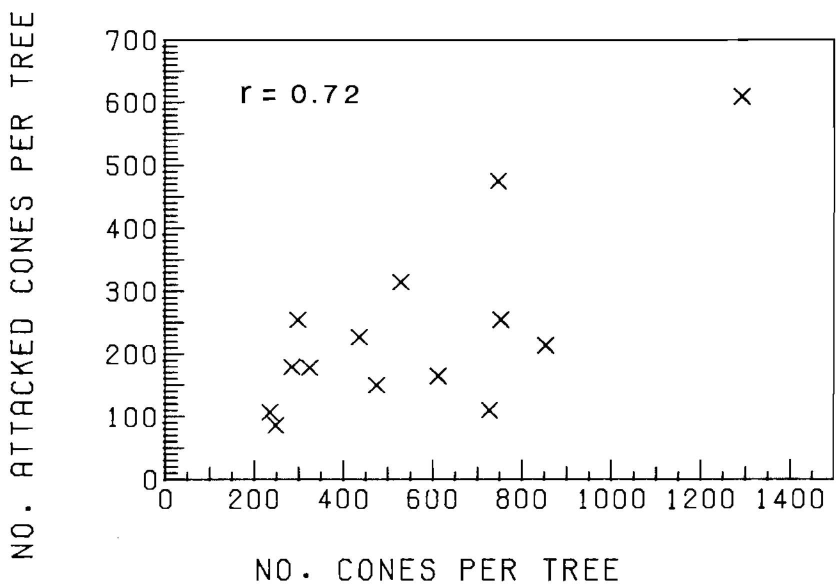

Fig. 1. Number of cones per tree attacked by six insect species in relationship to total cones available per tree.

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