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INFLUENCE OF TREE SPECIES ON FREQUENCY OF TRAP-NEST USE BY *PASSALOECUS* SPECIES (HYMENOPTERA: SPHECIDAE)

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ABSTRACT

Habitat selection by *Passaloecus* spp. based upon tree species used as stations for artificial nesting sites were studied. Data suggest that *Passaloecus areolatus* preferred *Juglans* and that *P. cuspidatus* preferred *Pinus*.

Wasps of the genus *Passaloecus* (Pemphredoninae) nest in hollow twigs or in beetle borings in wood, provisioning their cells with paralyzed aphids (Bohart and Menke 1976). Little is known about the ecological differences between sympatric species. The importance of habitat, such as trees to which trap-nest bundles are attached, has received little attention in previous research on the biology of *Passaloecus* spp. (Danks 1971, Fye 1965, Krombein 1967, Vincent 1978). Tree species might be important to these wasps for several reasons: the presence of suitable prey (e.g., aphids), availability of appropriate nesting cavities aside from trap-nests, and availability of closure materials.

METHODS AND MATERIALS

Trap-nesting biology of *Passaloecus* spp. was investigated from 1984 through 1987 on the campus of Concordia College, Ann Arbor, Michigan (Fricke 1991b). Trap-nest stations were established in a mixed hardwood forest edge between a small red pine plantation and an old field. The long axis of the edge ran from north-west to south-east. Bundles of trap-nests were positioned so that bore openings faced north-west, north-east, south-east, and south-west. Trap-nests were arranged in bundles presenting a mixture of regular and randomized patterns of drilled and blank trap-nest faces. Trap-nest design has been previously described (Fricke 1991a). Bore diameters, bundle configurations, tree species, and bundle heights are summarized in Table 1.

RESULTS AND DISCUSSION

Data from trap-nesting studies were examined for the possible influence of tree species on the selection of nesting sites by *Passaloecus* spp. In 1984, all trap-nesting stations were *Juglans*, and *P. cuspidatus* Smith was the only *Passaloecus* observed and reared. In 1986, 19 stations were *Juglans* and

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Table 1.—Bore diameters, bundle configurations, tree species, and bundle heights used in studies of *Passaloecus* spp. trap-nesting biology, 1984–1987.

Year	Bore Diameters	Number of Bundles and Bundle Configuration	Tree Species	Bundle Heights
1984a	3.2–4.8 mm	48 (3 × 3)	*Juglans*	0.5–1.5 m
1984b	3.2–8.0 mm	17 (3 × 3)	*Juglans*	0.5–1.5 m
1986a	1.6–4.8 mm	96 (3 × 4)	*Juglans* *Populus* *Fraxinus* *Prunus*	0.5–2.0 m
1986b	1.6–4.8 mm	36 (3 × 4)	*Juglans* *Fagus*	1.0–9.0 m
1987	2.4–7.2 mm	147 (3 × 4)	*Juglans* *Pinus*	0.75–1.75 m

another 9 stations were distributed as follows: 5 *Fraxinus*, 1 *Prunus*, 2 *Populus*, and 1 *Fagus*. Thirty trap-nests were provisioned by *P. cuspidatus*; 18 by *P. monilicornis* Dahlbom; 6 by *P. annulatus* (Say), and 51 by *P. areolatus* Vincent. Chi-square (X^2) (I) was used to test for differences in *Passaloecus* spp. tree selection between *Juglans* and all other tree species. The expected frequencies were based upon station deployment frequencies: *Juglans* (67.86%) and others (32.14%). Observed and expected frequencies of tree selection are given in Table 2. The X^2 statistic indicated that the differences in distribution of *Passaloecus* spp. among these trees was not random. These data suggest that *P. areolatus* has a strong preference for *Juglans*; few were observed on other trees.

Data from four stations (3 *Juglans* and 1 *Fagus*) with bundles of trap-nests distributed at 1 meter intervals to a height of 9 m were particularly interesting. Each bundle consisted of 12 trap-nests in a 3×4 configuration; hence each tree received 108 trap-nests. Of 432 trap-nests, 259 were used by trap-nesting wasps and bees. Respective frequencies of trap-nest use at these stations were 75, 71, 52 (*Juglans*), and 61 (*Fagus*). The chi-square test indicated no significant difference in the frequency of trap-nest use among these trees by either wasps or bees. However, 55 trap-nests were provisioned by *Passaloecus* spp. determined by closure materials, aphid remains, and prepupae. *P. areolatus* was found in 40 trap-nests and *P. cuspidatus* was found in 5 trap-nests. The respective distribution of *Passaloecus* among these trees was 17, 28, 10 (*Juglans*), and 0 (*Fagus*). While 61 trap-nests were provisioned by trap-nesting wasps and bees at the *Fagus* station, none was used by *Passaloecus*. The X^2 (I) test for differences in frequency of habitat selection among tree species by *Passaloecus* was highly significant ($X^2 = 30.03$, df = 3, p .001). Competition is an unlikely explanation for the absence of *Passaloecus* from the *Fagus* station. The arrays of trap-nest users, other than *Passaloecus* spp., among these stations were similar. Other factors may account for the absence of *Passaloecus*

Table 2.—Tree selection by three *Passaloecus* species, 1986.

Passaloecus species	*Juglans*		*Others*	
	Obs.	Exp.	Obs.	Exp.
cuspidatus	18	20.36	12	9.64
monilicornis	16	12.21	2	5.79
areolatus	49	34.61	2	12.64

$X^2 = 23.66$, df = 2, $p < .0005$

Table 3.—Tree species frequency and frequency of trap-nest use by *Passaloecus cuspidatus*, 1987.

	Tree species			
	Pinus	*Juglans*	*Fraxinus*	Others
Tree Frequency	14 (28.57%)	22 (44.90%)	8 (16.33%)	5 (10.20%)
Use Frequency	55 (66.27%)	19 (22.89%)	5 (6.02%)	4 (4.82%)

$X^2 = 57.99$, df = 3, $p < .0005$

spp. from *Fagus*, e.g. a lack of natural nesting cavities, lack of appropriate closure material (resin, frass, and loose bark), or absence of aphids.

During the 1987 season the establishment of trap-nesting stations was based upon the relative abundance of tree species at the study site. This differed significantly from station selection in 1986, when *Pinus* were systematically excluded. Tree species distribution for 49 trap-nesting stations established in 1987 was: *Pinus*—14, *Juglans*—22, *Fraxinus*—8, and others (*Ulmus*, *Acer*, and *Populus*)—5. The respective frequencies of trap-nest use by *P. cuspidatus* among these trees were: *Pinus*—55, *Juglans*—19, *Fraxinus*—5, and others—4 (Table 3). The chi-square (I) test statistic indicated a highly significant habitat selection among tree species by *P. cuspidatus*. *Pinus* stations were clearly preferred by this sphecid.

LITERATURE CITED

Bohart, R. M. and A. S. Menke. 1976. Sphecid wasps of the World. University of California Press, ix + 695 pp.

Danks, J. V. 1971. Biology of some stem-nesting aculeate Hymenoptera. Trans. Roy. Entomol. Soc. London. 122:323-399.

Fricke, J. M. 1991a. A trap-nest design for small trap-nesting Hymenoptera. Great Lakes Entomol. 24(2):121-122.

Fricke, J. M. 1991b. Trap-nest bore diameter preferences among sympatric *Passaloecus* spp. (Hymenoptera: Sphecidae). Great Lakes Entomol. 24:123-125.

Fye, R. E. 1965. The biology of the Vespidae, Pompilidae and Sphecidae from trapnests in northwestern Ontario. Canadian Ent. 97:716-744.

Krombein, K. V. 1967. Trap-nesting Wasps and Bees: Life Histories, Nests, and Associates. Smithsonian Press, Washington D.C. vi + 570 pp.

Vincent, D. L. 1978. A revision of the genus *Passaloecus* (Hymenoptera: Sphecidae) in America north of Mexico.Wasmann J. Biol. 36:127-198.