The Great Lakes Entomologist

Volume 24
Number 2 - Summer 1991 *Number 2 - Summer 1991*
Article 10

June 1991

Trap-Nest Bore Diameter Preferences Among Sympatric *Passaloecus* Spp. (Hymenoptera: Sphecidae)

John M. Fricke
Concordia College

TRAP-NEST BORE DIAMETER PREFERENCES AMONG SYMPATRIC *PASSALOECUS* SPP. (HYMENOPTERA: SPHECIDAE)[1]

John M. Fricke[2]

ABSTRACT

Five species of *Passaloecus* used trap-nests in a study area in southern Michigan. Significant differences in trap-nest bore diameter selection were noted among *P. annulatus*, *P. areolatus*, *P. cuspidatus*, and *P. monilicornis*. *P. annulatus* and *P. areolatus* selected bore diameters 1.6 to 2.4 mm, *P. cuspidatus* used bore diameters of 2.0 to 6.4 mm, and *P. monilicornis* selected diameters of 1.6 to 3.6 mm.

It is questionable whether previous reports of trap-nesting data indicate bore diameter preferences of *Passaloecus* spp. or that they are artifacts due to the bore diameter selection of the investigators. Fye (1965), Krombein (1967), and Vincent (1978) reported on *Passaloecus* spp. and gave data on bore diameters selected. Vincent (1978) noted *P. annulatus* (Say) reared from a 1.5 mm bore trap-nest and *P. areolatus* Vincent from two 1.5 mm bore trap-nests. All of these authors reported trap-nest bores used by *P. cuspidatus* Smith and their pooled data (bore diameters and numbers of nests) are as follows: 3.2 mm—20; 4.0 mm—83; and 6.4 mm—3. Fye (1965) reported that *P. monilicornis* Dahlbom preferred 6.4 mm bores and Krombein (1967) noted *P. monilicornis* from four 3.2 mm and two 4.8 mm borings.

Bore diameters most frequently used by these authors were 4.8 mm or greater, with increments of 1.6 mm. Fye used 6.4 and 8.0 mm drillings; Krombein also used these sizes and included a few 3.2 mm bores. Ratios or actual frequencies were not reported. Vincent was the only author to report use of bores as small as 1.5 mm. *Passaloecus* are small wasps (4–9 mm long) and bore diameters used in trap-nesting survey studies may be inappropriate for studies focused on this genus, because bore sizes usually presented may be too large to be used by the majority of these small wasps.

MATERIALS AND METHODS

Bore diameter preferences among *Passaloecus* spp. were investigated from 1984 through 1987 on the campus of Concordia College, Ann Arbor, Michigan. 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,

---

[1]Adapted from a dissertation submitted to Michigan State University by the author in partial fulfillment of the requirements of the Ph.D. degree in Entomology.

[2]Natural Science and Mathematics Disivion, Concordia College, Ann Arbor, MI 48108.

Table 1. Bore diameters, bundle configurations, and bundle heights used in studies of *Passaloecus* trap-nest bore diameter preferences, 1984–1987.

Year	Bore Diameter (mm)	Number of Bundles & Bundle Configuration	Statiaons	Bundle Heights (meters)
1984a	3.2–4.8	48(3 × 3)	*Juglans*	0.5–1.5
1984b	3.2–8.0	17(3 × 3)	*Juglans*	0.5–1.5
1985	1.6–8.8	64(4 × 5)	*Juglans*	0.5–2.0
1986a	1.6–4.8	96(3 × 4)	*Juglans* *Populus* *Fraxinus* *Prunus*	0.5–2.0
1986b	1.6–4.8	36(3 × 4)	*Juglans* *Fagus*	1.0–9.0
1987	2.4–7.2	147(3 × 4)	*Juglans* *Pinus*	0.75–1.75

Table 2. Bore diameter selections for five *Passoloecus* spp., 1984–1986.

	Bore Diameters (mm)										
	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.6	6.4
	Bore Diameter Frequencies										
	256	128	256	128	430	128	430	128	430	128	158
Species											
annulatus (Say)	3	1	7	0	0	0	0	0	0	0	0
areolatus Vincent	18	20	9	0	0	0	0	0	0	0	0
cuspidatus Smith	0	1	4	6	32	7	19	3	21	0	1
monilicornis Dahlbom	2	3	13	2	2	2	0	0	0	0	0
singularis Dahlbom	0	0	1	0	0	0	0	0	0	0	0

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, 1991). Bore diameters, bundle configurations, stations, and bundle heights are summarized in Table 1.

Table 2 summarizes data for 1984–1986 on frequency of bore diameter availability and selection as nesting sites by five *Passaloecus* spp. The Kruskal-Wallis test for differences in ranks of trap-nest bore selection by four of these species (*P. annulatus*, *P. areolatus*, *P. cuspidatus*, and *P. monilicornis*) is very significant (H = 120.9749, df = 3, $p < .0005$). The chi-square (I) test for differences of bore diameter selection by *P. cuspidatus* (based upon three bore diameter classes: 2.0–2.8, 3.2–4.0, and 4.4–6.4 mm) and the t(II) test for differences of bore diameter preferences between *P. cuspidatus* and *P. monilicornis* are both very significant (χ^2 = 15.2583, df = 2, $p < .0005$ and t = 7.4316, df = 116, p < .0005).

P. cuspidatus trap-nest selection data from 1984–1987 were pooled for analysis and are given in Table 3. Expected and observed frequencies of bore selection are significantly different indicating that *P. cuspidatus* prefers trap-nest bore diameters ranging from 2.8 to 4.8 mm.

https://scholar.valpo.edu/tgle/vol24/iss2/10
DOI: 10.22543/0090-0222.1739

Table 3. *Passaloecus cuspidatus* bore diameter selections, 1984–1987.

Bore Diameter Class (mm)	Diameter Frequency	Expected Selection Frequency	Observed Selection Frequency*
2.0–2.4	595	27.17	14
2.8–3.2	865	39.50	75
3.6–4.0	865	39.50	54
4.4–4.8	865	39.50	32
5.6–6.4	708	32.33	3

*$\chi^2 = 71.6456$, df = 4, $p << .0005$)

DISCUSSION

A possible factor influencing bore diameter selections among *Passaloecus* spp. is wasp size. A relatively simple index to wasp size is head width. Head width measurements, to the nearest 0.1 mm, were taken from samples of ten females of *P. cuspidatus*, *P. monilicornis*, and *P. areolatus*. The respective average head widths for these samples were 1.46, 1.19, and 1.0 mm. *Passaloecus* spp. appear to partition nesting sites on the basis of bore diameter and wasp size may limit the minimum acceptable bore diameter. An additional factor in this regard may be the size of aphids selected as prey. Aphids are carried in the mandibles with the prey's body lying below the wasp's head. Under these circumstances the dorsal-ventral dimension of the wasp's head plus an aphid will be greater than head width and may possibly influence acceptable bore diameters.

LITERATURE CITED

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

Fye, R. E. 1965. The Biology of the Vespidae, Pompilidae and Sphecidae from trapnests in northwestern Ontario. Canadian Entomol. 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(1–2):127–198.