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Aphid Prey of *Passaloecus Cuspidatus* (Hymenoptera: Sphecidae)

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APHID PREY OF *PASSALOECUS CUSPIDATUS* (HYMENOPTERA: SPHECIDAE)

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ABSTRACT

Provisioning activity of *Passaloecus cuspidatus* extended from 29 May through 6 August 1987. Eighty trap-nests contained 281 provisioned cells containing 9,618 aphids. The average number of aphids per cell was 34.2 and the average number of cells provisioned per day was 0.73. *Passaloecus cuspidatus* stored the following aphids as provisions: *Cinaria* sp., *Euceraphis* sp., *Macrosiphum euphorbiae*, *Myzus* sp., *Myzus cerasi*, *Myzus monardae*, and *Sitobium avenae*. The number of aphids provisioned per cell was inversely related to aphid size. The number of aphids provisioned per cell varied significantly (9–74).

Passaloecus species provision their nests with aphids (Fye 1965 and Krombein 1955, 1956, 1958, 1960, 1961, 1967) and a certain *Passaloecus* sp. may prey on more than six different aphid species (Fye, 1965). Nesting sites include beetle borings in wooden cowshed walls, artificial borings in elderberry and chinaberry, pine trap-nests, and soda straws. Nests are linear and usually partitioned and closed with pine resin. Prey records of *Passaloecus cuspidatus* Smith provided by Fye (1965), Krombein (1956, 1958, 1963, 1967), and Vincent (1978) include the following aphids: *Cinara*, *Macrosiphum*, *Masonaphis*, *Myzus*, and *Rhopalosiphum*. Aphid predators are more closely associated with particular habitats than they are to particular aphids (Dixon 1973).

Passaloecus are flexible in their prey selection. The number of prey provisioned by *Passaloecus* spp. is extremely varied. Prey provisioned per cell ranged from 7 to 63; prey per nest ranged from 50 to 200. Corbet and Backhouse (1975) suggested that, in favorable conditions, a single female could capture 1500 aphids based upon one cell provisioned per day (30 aphids) and a wasp lifespan of 50 days. The mean number of aphids provisioned per cell has not been reported in the literature. Neither are there reports on whether the species of aphid provisioned influences the number of aphids provisioned.

METHODS AND MATERIALS

Passloecus cuspidatus Smith was selected for investigation of aphid provisioning because its large size, markings and behavior made field identification possible. *P. cuspidatus* rings nest openings with resin prior to provision-

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Table 1. Aphids provisioned by *Passaloecus cuspidatus*, 1987.

Aphid Species*	Number of Trap-nests	Mean Number of Cells	# of Aphids ± S.D.
Myzus monardae	46	160	37.0 ± 11.8
Cinaria sp.	9	35	26.8 ± 7.6
Macrosiphum euphorbiae	12	39	21.7 ± 8.2
Euceraphis sp., *Myzys* sp.	3	8	28.5 ± 7.7
Myzus cerasi	3	8	43.0 ± 17.5
Sitobium avenae.	1	6	34.8 ± 9.0

ing, facilitating field observations. The study site was located on the campus of Concordia College, Ann Arbor, Michigan during the summer of 1987.

Paraffin coated, pre-split trap-nests of seven bore diameters (2.4 – 7.2 mm, with 0.8 mm increments) were provided as nesting material. The available frequencies of bore diameters were as follows: 2.4 mm – 211; 3.2 mm – 307; 4.0 mm – 307; 4.8 mm – 307; 5.6 mm – 211; 6.4 mm – 211 and 7.2 mm – 211.

Trap-nests were removed from the field within one to two days of closure and were replaced with trap-nests of similar bore diameter. Closed trapnests were opened and the contents of each cell were removed, aphids counted and, with the wasp egg or larva, were transferred to a rearing vial. Two aphids from each provisioned cell were retained for identification.

Passaloecus cuspidatus was presumably active in the study area prior to site establishment on 29 May 1987. Five trap-nests were ringed with resin as of 1 June 1987. Trap-nest provisioning was observed on 1 June (4 trips, 2:39 pm – 3:20 pm); 3 June (7 trips, 12:31 pm – 1:35 pm); 18 June (16 trips, 10:17 am – 11:43 am); and 5 July (8 trips, 4:31 pm to 5:13 pm). Nesting activities continued through the first week of August with no trapnests ringed or closed with resin after 6 August 1987. Observations on 8, 14, and 21 August 1987 provided no evidence of additional activity. *Passaloecus cuspidatus* used trap-nests at the following frequencies: 2.4 mm – 9; 3.2 mm – 37; 4.0 mm – 28; 4.8 mm – 8; 5.6 mm – 1, and 6.4 mm – 1. The minimum provisioning period for this wasp population was seventy days. This corresponds well with the range of flight dates (14 June – 14 August) for *P. cuspidatus* material from the Museum of Zoology of the University of Michigan and the Entomology Museum of Michigan State University, and is supported by previous field observations of this species. In 1984, provisioning activity was first observed between 4 and 12 June and terminated between 4 and 13 August. In 1985, emergence of *P. cuspidatus* from a natural nest occurred 10 May and nesting activity ceased 20 August.

RESULTS AND DISCUSSION

Passaloecus cuspidatus provisioned its cells with *Cinaria* sp., *Euceraphis* sp., *Macrosiphum euphorbiae* (Thomas), *Myzus* sp., *Myzus cerasi* (Fabricius), *Myzus monardae* (Davis), and *Sitobium avenae* Fabricius (Table 1). Multiple t(II) tests for differences in number of aphids provisioned were significant for *Myzus monardae*, *Cinaria* sp., and *Macrosiphum euphorbiae*, [*Myzus monardae* and *Cinaria* sp., t(II) = 7.05053, df = 193, $p < .001$; *Cinaria* sp. and *Macrosiphum euphorbiae*, t(II) = 3.62055, df = 72, $p < .001$; and *Myzus monardae* and *Macrosiphum euphorbiae*, t(II) = 10.7478, df = 197, $p < .001$]. Differences in number of aphids provisioned per cell were inversely related to

Table 2. Aphids provisioned by *Passaloecus cuspidatus* during Summer 1987. Provisioning period is divided into 14 5-day intervals beginning 24 May and ending 11 Aug. Upper # is number of aphids; lower # is number of cells.

	Ending Dates For 14 Consecutive 5-day Provisioning Periods														
	May	June						July					August		
Aphids	28	2	7	12	17	22	27	7	12	17	22	27	1	6	11
Myzus			263	652	555	424	845	1056	556	669	871	35			
monardae			7	20	16	13	24	29	17	14	19	1			
Cinaria sp.	356	441	163												
	15	15	5												
Macrosiphum							76	374	182	45	89	37	9	38	
euphorbiae							2	14	9	2	6	3	1	2	
Euceraphis sp.	158	70													
and *Myzus* sp.	6	2													
Myzus							63	202	82						
cerasi							3	4	2						
Sitobium	27	182													
avenae	1	5													
undetermined	71			41	43			112	562	90	170	30			
aphids	31			1				2	9	2	5	1			
Total Aphids	550	734	426	693	598	424	984	1744	1382	804	960	242	39	38	
Total Cells	22	25	12	21	17	13	29	49	37	18	25	9	2	2	

aphid size, with *Myzus monardae* the smallest and *Macrosiphum euphorbiae* the largest.

Two trap-nests had an extraordinarily high number of provisions. One contained 430 aphids (eight cells, 53.75 aphids per cell) and another contained 334 aphids (five cells, 66.80 aphids per cell). Unfortunately, aphid samples for identification were not taken from these trap-nests.

Table 2 summmarizes data on the seasonal changes in aphid provisioning by *P. cuspidatus* and relative numbers of aphids provisioned. *Passloecus cuspidatus* was not restricted to a particular aphid species. Peaks in provisioning rates are assumed to be related to increased aphid numbers. Between 29 May and 7 June, *Cinara* sp., *Euceraphis* sp., *Myzus* sp., and *Sitobion avenae* Fabricus were used as provisions. From 8 June through 27 July *Myzus monardae* (Davis) was the preferred prey while *Macrosiphum euphorbiae* (Thomas) and *Myzus cerasi* (Fabricius) were provisioned in significant numbers between 28 June and 17 July .

Provisioning rates were varied and estimated on the basis of number of cells provisioned and dates of bore ringing and closure. Trap-nests with estimated provisioning periods of one to three days contained from one to ten provisioned cells. Trap-nests with estimated provisioning periods of six to eight days contained two to eight provisioned cells. Trap-nests with provisioning periods of 10 to 21 days contained one to five provisioned cells. The estimated number of cells provisioned per day ranged from 0 to 5.

Several variables could influence provisioning rates. Exceptionally high provisioning rates could be the result of close proximity of aphids, closure materials and the nesting site. Aphids and closure materials somewhat distant from the nesting site could result in low provisioning rates. A possible cause for low provisioning rates is a temporary cessation of provisioning activity. This cessation might be necessary to allow the development of additional ova following a period of provisioning and oviposition. Other factors including inclement weather, low aphid population levels and disruptive behavior of parasitoids could influence provisioning rates. Cells (281) were provisioned during a cumulative provisioning period of 381 days. The average provisioning rate per trapnest was 0.73 cells per day. Trap-nests used less than four days had a higher than average provisioning rate and trap-nests used longer than four days had lower than average provisioning rates.

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