

**MALE RESIDENCY ON JUVENILE FEMALE  
*NEPHILA CLAVIPES* (ARANEAE, ARANEIDAE) WEBS**

Male orb-weaving *Nephila clavipes* leave their own individually-constructed orbs after the final molt and move about in search of mates. Males are likely to land on webs of females of various instars for it appears that they are not attracted to webs of sexually receptive females by distance-acting pheromones (Christenson et al. 1985). Once on the female's web, duration of male residency might be related to female instar because adult males are often found on webs of

larger than smaller juvenile females (Farr 1976; Brown et al. 1985). First, we asked if marked, unrestrained male *N. clavipes* remain longer on a web inhabited by a female in the penultimate instar, approaching sexual receptivity, than on a web of a relatively smaller juvenile, three or four instars from adulthood. We found that they do remain longer with the female in the penultimate instar.

Female responsiveness could be one factor underlying this variation in male residency. If so, one would expect juvenile females of different instars to respond differently to adult males. Second, we placed males onto juvenile female webs to determine if females in the penultimate instar respond less aggressively than females in earlier instars.

Observations were conducted at the F. Edward Herbert Center of Tulane University, located about 20 km south of New Orleans, Louisiana. To determine if duration of male residency on the web is affected by female instar, we examined census data gathered during July and August, 1980 and 1982 on paint-marked males, small juvenile females (12-15.5 mm in cephalothorax-abdomen length), and females in the penultimate instar (18-23 mm). Females in the latter group were observed to molt once and mate. To ensure that the duration of male residency was most likely determined by the subject male, we analyzed only those cases ( $N = 36$ ) in which the female remained on the web after the male had departed and in which no other male had come onto the web, possibly displacing the male in question.

Female response to an added male was observed during the mating season, from July to mid-August, 1980. Juvenile males in the penultimate instar were placed in Fiberglass-screened enclosures situated in the field and fed *Drosophila* daily. No sooner than four days after their final molt, twenty males were paint-marked and randomly assigned to a relatively small juvenile female (12-14 mm) or a female in the penultimate instar (18-20 mm). Other males already present on the females' webs were removed and the subject males were transported on a thin stick and gently placed on barrier strands, about 30 cm from the hub. Male and female behaviors listed in Table 1 were recorded serially for 20 minutes. Three males placed with small juveniles moved onto adjacent foliage within the first minute. In two cases this occurred before the female had made any behavioral response. In the other case the female response, one pluck, did not immediately precede the male's departure. A fourth male spent most of the observation period under a leaf at a silk attachment point. Data for these four males were excluded from statistical analyses.

Analysis of census data revealed that marked, unrestrained males remained an average of 2.6 days (SD = 2.6) with small juvenile females whereas males remained 9.1 days (SD = 5.2) with females in the penultimate instar ( $F = 17.84$ ,  $df = 1,34$ ,  $p = 0.0001$ ).

After the male was added to the web, large and small juvenile females strand-plucked while at the hub with about equal frequency (Table 1). However, the small females oriented to the male, strand-plucked while oriented, and chased the male more frequently (Table 1). Males slowly approached while probing both sizes of females with about equal frequency. Males with larger females spent more time within 10 cm of the female ( $x = 620.2$  s versus  $x = 242.5$  s;  $F = 5.343$ ,  $df 1,14$ ,  $p = 0.002$ ), abdomen vibrated and probed while stationary more frequently (Table 1), and, by the end of the 20 minute observation period, were more likely to be within 10 cm of the hub (9/10 LG, 3/7 SM; Chi Square = 4.41,  $p = 0.036$ ) than the males with smaller females. Most of the males of both groups remained for at

Table 1.—Behavior of small juvenile *N. clavipes* females (12-14 mm) and larger juvenile females in the penultimate instar (18-20 mm) and the adult males placed on webs of these females during a 20 minute serial record. a = multiple occurrences without a return to hub position were scored as one event; b = each pluck scored as a separate event; c = often occurring repeatedly in a prolonged sequence which was scored as one event; intermittent sequences separated by 5 s were scored as multiple events; d = bouts of rapid vibration of the posterior tip of the abdomen; and e = a sweeping, waving of the 1's while stationary in barrier strands.

	Small Juvenile (n=6)		Large Juvenile (n=10)		F	P
	x	SD	x	SD		
<b>FEMALE BEHAVIOR</b>						
Orient to male <sup>a</sup>	8.5	5.8	4.0	2.9	4.261	0.058
Strand-pluck in hub position <sup>b</sup>	4.7	2.3	5.5	5.5	0.120	0.734
Pluck while oriented to male <sup>b</sup>	14.2	12.1	5.0	4.4	4.854	0.045
Approach male <sup>a</sup>	3.3	4.1	0.9	1.4	3.101	0.100
Chase male <sup>a</sup>	1.3	1.4	0.2	0.6	5.214	0.039
<b>MALE BEHAVIOR</b>						
Slow approach and probe <sup>c</sup>	38.3	22.9	38.5	19.1	0.001	0.988
Probe with 1's while stationary <sup>c</sup>	9.7	9.7	63.6	52.9	5.943	0.029
Abdominal vibration <sup>c,d</sup>	0.3	0.8	16.2	14.4	7.118	0.018
Lateral leg sweeps <sup>c,e</sup>	2.7	4.8	1.9	1.8	0.211	0.653

least 24 hours (6/9 S, 8/9 L). This does not necessarily exclude female responsiveness as a factor contributing to duration of residency. Census data show that males on the webs of smaller females remained, on the average, two and one half days. Duration of male residency beyond the first day was difficult to assess for the added males because some females abandoned the web before the male did or a larger male came onto the web, possibly displacing the subject male.

We conclude that unrestrained males spend relatively more time on the web of a female approaching her final molt, which is probably adaptive for the male. We suggest that female response to the male might be one factor underlying this variation in male residency.

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