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RESEARCH NOTE

THE EFFECT OF FEEDING HISTORY ON RETREAT CONSTRUCTION IN THE WOLF SPIDER *HOGNA HELLUO* (ARANEAE, LYCOSIDAE)

A spider's energetic state has been shown to influence a variety of behaviors. Hungry spiders are more likely to cannibalize one another (Rypstra 1983; 1986), modify their web construction (Henschel & Lubin 1997), and/or may relocate more frequently than sated spiders (Turnbull 1964; Riechert & Tracy 1976; Olive 1982; Uetz 1992; Bradley 1993; McNett & Rypstra 1997). In many species, web site and/or microhabitat selection are also influenced by prey availability (reviewed in Wise 1993). Thus, hunger levels and prey availability influence the behavioral decisions made by spiders. However, not all studies report significant effects of hunger (e.g., Provencher & Riechert 1991). In this study, we investigate the effects of energetic state on retreat construction in the wolf spider *Hogna helluo* (Walckenaer 1837)(Araneae, Lycosidae).

Most wolf spiders are considered to be sit and wait predators which periodically change foraging site (Ford 1978; Stratton 1985). Sensory information from prey (Persons & Uetz 1996), as well as the recent consumption of prey, can increase patch residence time (Ford 1978; Wagner & Wise 1997). In two species of burrowing wolf spiders, Miller (1984) found that prey availability directly influenced burrow site selection.

The wolf spider, *H. helluo*, lives on the soil surface of disturbed riparian areas and is common in agricultural fields. Although it is a vagile hunter, females do construct burrows (Dondale & Redner 1990). In a previous study with this species, we found that hunger level influences locomotor activity (Walker et al. 1999). Hungry animals exhibit higher levels of activity than do satiated animals, which suggests that the time elapsed since last feeding may influence the degree of searching behavior exhibited and patch residence time. Since this species facultatively constructs burrows, we hypothesized that energetic state also influences burrow construction in this species. Since burrow construction is a potentially energetically expensive endeavor (Marshall 1995), we predicted that adult female *H. helluo* maintained with access to high levels of food would be more likely to construct burrows than would spiders maintained at lower prey levels.

To examine this question, 29 adult female *H. helluo* were randomly assigned to two treatments, high-fed (n = 14) and low-fed (n = 15). Spiders were fed crickets (*Acheta domisticus*) and were provided with water *ad libitum*. To standardize hunger, all spiders were fed to satiation then starved for one week prior to the experiment. To feed spiders to satiation, individuals were given 3–4 crickets per day for several days. Spiders were considered sated when they refused to consume all the available prey items. Following standardization of hunger levels *H. helluo* were placed individually into 1.4 liter round containers containing 7–11 cm of moist peat moss substrate which had been smoothed to make the surface flat. Animals were then fed either one large (mean = 82.5 ± 5.4 mg) or one small (mean 11.1 ± 0.62 mg) cricket once per week. These crickets were approximately 40% or 10 % of the body mass, respectively, of adult *Hogna*. Seven days later, the presence or absence of a burrow was determined by visually inspecting the containers. Burrows were visually conspicuous because of the presence of a large amount of silk and the disturbance of the soil which had been smooth prior to the introduction of the spider.

To verify that the treatments had an effect on hunger, we estimated body condition on a random sample of eight animals per treatment (a body-size free measure of nutritional state

Table 1.—Mean carapace width and abdomen width (mm) for high and low-fed *Hogna*. Carapace width was not significantly different between high and low-fed spiders; however, abdomen width and body condition of starved spiders was significantly less than fed spiders.

Trait	Treatment	Mean (S.E.)	*n*	Test statistic and *P*-value for comparing high and low-fed spiders
Carapace width	High-fed	11.54 (0.235)	8	$t = 1.383$, $df = 14$
	Low-fed	12.00 (0.234)	8	$P = 0.1884$
Abdomen width	High-fed	11.89 (0.252)	8	$t = 3.878$, $df = 14$
	Low-fed	9.792 (0.481)	8	$P = 0.0017$
Body condition	High-fed	12.127 (0.323)	8	$F_{(1,13)} = 29.65$
	Low-fed	9.559 (0.323)	8	$P < 0.0001$
Number of spiders with burrows	High-fed	12	14	Fishers Exact Test
	Low-fed	6	15	$P = 0.0209$

or fatness, Jakob et al. 1996). Abdomen and carapace width were measured using an ocular micrometer on a Wild dissecting microscope. Since the data were normally distributed, body condition was estimated as the analysis of covariance adjusted mean of abdomen width using carapace width as the covariate. We used Fisher's Exact test to test the hypothesis that high-fed spiders are more likely to burrow than low-fed spiders.

We found no significant difference in carapace width between high and low fed spiders (Table 1). However, high-fed spiders had wider abdomens than low-fed spiders. High-fed spiders also had significantly higher body condition than did low-fed spiders. These differences suggest that high-fed spiders were in a much better nutritional state than were low-fed spiders. Significantly more high-fed spiders (85%) constructed burrows than did low-fed spiders (Table 1).

Hunger level clearly influenced the probability of burrow construction in *Hogna helluo*. Animals in the high-fed group were much more likely to construct burrows than were animals in the low-fed treatment group. Previous studies have demonstrated that hunger influences locomotor activity in this species. Hungry individuals exhibit high levels of locomotor activity relative to sated individuals (Walker et al. 1999). Those data combined with data from this paper suggest that hunger can play an important role in the behavior of this species.

Hunger does not seem to affect the behavior of spiders equally (see discussion in Provencher & Reichert 1991). Several studies have suggested that hunger is not an important factor influencing spider behavior (Anderson 1974; Greenstone & Bennet 1978; Provencher & Riechert 1991; Walker et al. 1999). In particular, Anderson (1974) found that *Lycosa lenta* Hentz 1844, another species of lycosid, seem to exhibit normal behavior over a 30-day starvation period. Also, we have found that hunger does not affect locomotor behavior in *Pardosa milvina* (Hentz 1844)(Walker et al. 1999). However, we have found that *H. helluo* is sensitive to recent levels of prey consumption both in activity levels (Walker et al. 1999) and in burrow construction (Table 1). Since burrows represent a considerable energetic investment as their construction requires not only the excavation of soil but also the deposition of silk, the fact that well-fed spiders were more likely to construct them is not surprising. Our data make it tempting to predict that prey availability influences patch choice and residence time in this species. However, because our spiders were confined, we do not know whether well-fed *H. helluo* will build burrows wherever they are or if they are capable of connecting high prey capture with a particular site and using that information to decide whether to construct a burrow.

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