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Diet influences mate choice selectivity in adult female wolf spiders

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Most studies of female choice have assumed that mating preferences are shared within a population or species. However, variation both within and among females exists in natural populations, and foraging history is among the many ways in which females may vary. Here, we used diet manipulations in an effort to understand how foraging history influences female mate choice. Immature *Schizocosa* wolf spiders collected from a mixed population of brush-legged and non-ornamented males were reared in the laboratory on two diets that varied in both quality and quantity (low/high diet). For low- and high-diet individuals, we recorded data on rates of development, adult size and adult mate choice. Consistent with previous work, we found that high-diet spiders matured more quickly and were significantly larger as adults than low-diet spiders. Males also matured earlier than females. Body condition varied with diet treatment and sex. High-diet individuals and females were both characterized by better body condition indexes. In addition, high-diet brush-legged males had larger brushes than low-diet brush-legged males. Upon maturation, females were paired simultaneously with a low- and a high-diet male of the same form (brush-legged or non-ornamented) in a mate choice trial. While no obvious differences were observed in courtship and/or mating effort between males, female mate choice varied with the female's diet treatment. High-diet females mated more frequently with high-diet males than with low-diet males, whereas low-diet females showed no selectivity.

Keywords: condition dependence; female plasticity; life history; mate choice; *Schizocosa*; sexual selection; spider

The importance of female mate choice in the evolution of male secondary sexual traits is unequivocal (reviewed in Andersson 1994), yet the extent of variation in female mate choice within and among populations remains unclear (Jennions & Petrie 1997; Widemo & Saether 1999). Although modern theories of sexual selection rely on consensus female mating preferences (reviewed in Andersson 1994), recent studies have highlighted the prevalence of variability in female mate choice both among and within populations (Kodric-Brown & Nicoletto 1996). In addition, individual females may vary over time in their mating preferences. Factors such as female parasite load (Poulin 1994; Lopez 1999; Pfennig & Tinsley 2002), female age (Moore & Moore 2001; Coleman et al. 2004; Uetz & Norton 2007), female experience (Collins 1995; Kodric-Brown & Nicoletto 2001; Hebets 2003; Hebets & Vink 2007), female self-perception (Little et al. 2001; Burley & Foster 2006; Little & Mannion 2006), and female–male compatibility can influence female preferences and/or choice. Environmental or ecological factors such as predation risk or time of year may also affect mating decisions (Hedrick & Dill 1993; Borg et al. 2006). The extent to which female mate choice varies in natural populations has strong implications for the strength of sexual selection and, thus, for the evolution of male secondary sexual traits.

Theory predicts that variation in both mate quality and mate choice costs will influence active mate choice (Parker 1983). Specifically, Parker's model of mate choice suggests that a female's level of choosiness is a function

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of her reproductive quality and, thus, we should expect to find condition-dependent mate choice (Parker 1983; Widemo & Saether 1999). Several recent studies have focused on how condition, or the pool of resources available to allocate to life history traits (Rowe & Houle 1996), influences mating behaviour. For example, in female guppies, diet influences female condition and sexual responsiveness (i.e. willingness to engage in active mate choice), but not female preference functions (Syriatowicz & Brooks 2004). In the black field cricket *Teleogryllus commodus*, females reared on high-protein diets are more sexually responsive and show stronger preference functions than those reared on low-protein diets (Hunt et al. 2005). In the stalk-eyed fly *Cyrtodiopsis dalmanni*, females fed on corn express stronger preferences for large-eyespan males than those fed on sucrose (Hingle et al. 2001) and female preferences in the stalk-eyed fly *Diasemopsis meigenii* are positively associated with female eyespan, a condition-dependent trait (Cotton et al. 2006). However, not all studies of diet manipulations have led to observable differences in mate choice (Archard et al. 2006).

Here, we explore the extent to which diet influences a series of life history traits and reproductive behaviour in a predatory arthropod, *Schizocosa* wolf spiders. For predatory arthropods, food quality as well as availability may vary tremendously throughout an environment, both spatially and temporally. In arachnids, variation in prey quality leads to significant variation in survivorship, development, body condition and secondary sexual traits (Toft & Wise 1999; Uetz et al. 2002), all of which may have important implications for reproductive success.

Schizocosa wolf spiders are ground-dwelling predatory arthropods found commonly throughout most of North America. The genus encompasses approximately 23 described species in North America and harbours tremendous variation both among and within species with respect to male secondary sexual traits and behaviours as well as female mate choice (Stratton 2005). Because of their abundance and diversity, considerable research has focused on the evolution of male secondary sexual traits and female choice among various *Schizocosa* species (Hebets 2003, 2005; Stratton 2005; Hebets et al. 2006; Hebets & Vink 2007; Uetz & Norton 2007; reviewed in Uetz & Roberts 2002). Despite the plethora of studies focusing on *Schizocosa*, however, there is only one study to date that has examined the influence of diet on life history and secondary sexual traits. Uetz et al. (2002) found that *S. ocreata* wolf spiders raised on different lifelong feeding regimes (high- versus low-quantity food) varied significantly in mortality, development time, size, condition and brush size. While this study was the first to show condition-dependent secondary sexual traits in *Schizocosa*, it did not assess how feeding regime might influence female mate choice.

In the present study, we use a diet manipulation experiment to examine whether variation in female diet leads to variation in female mate choice. We use spiders from a recently discovered mixed population in Mississippi, U.S.A., where both brush-legged (similar to *S. ocreata*) and non-ornamented (similar to *S. rovneri*) males are found syntopically. In this mixed population, both behavioural as well as mitochondrial data suggest that these spiders encompass a freely interbreeding population (Hebets & Vink 2007). We found that diet influenced development time, size and body condition. In addition, we found that diet influenced female mate choice: females fed a high-nutrient diet discriminated among potential mates, whereas females fed a low-nutrient diet showed no mate selectivity.

METHODS

Spider Collecting and Rearing

We collected immature male and female spiders from rock and leaf litter substrates on 19 and 21 March 2005 at the University of Mississippi's greenhouse in Oxford, MS, U.S.A. Spiders at this locality occur as a mixed population of brush-legged and non-ornamented male forms, which resemble *Schizocosa ocreata* and *S. rovneri*, respectively, in morphology and behaviour (Hebets & Vink 2007). While mitochondrial sequence data distinguishes all other *Schizocosa* species examined to date, it does not distinguish between brush-legged and non-ornamented males from this mixed population (Hebets & Vink 2007). In addition, prior research on this population revealed that the mating frequency for each male form depends on a female's prior experience, providing behavioural evidence that these forms freely interbreed and thus probably represent discrete male phenotypes of a single species (Hebets & Vink 2007).

Individuals were brought back to the laboratory where they were immediately weighed and assigned to a diet treatment (high- versus low-nutrient diet; see below). Upon recording their initial weights, spiders were housed individually in 6 × 6 × 8 cm AMAC Plastic Products boxes (Petaluma, CA, U.S.A.). They were kept on a 12:12 h light: dark cycle and provided with a constant source of water. All spiders were fed crickets (*Acheta domesticus*) once per week following the diet treatments described below. Feeder crickets arrived weekly from Bassett's Cricket Ranch, Inc. (Visalia, CA, U.S.A.) and were immediately separated into one of two plastic tubs: high-nutrient feeder crickets or low-nutrient feeder crickets (see below).

High-nutrient diet

High-nutrient feeder crickets received Fluker's High-Calcium Cricket Feed (Port Allen, LA, U.S.A.), TetraColor Tropical Fish Flakes and Fluker's Calcium Fortified Cricket Quencher ad libitum. The spiders assigned to the high-nutrient diet were fed two times their body weight once per week in high-nutrient crickets.

Low-nutrient diet

Low-nutrient feeder crickets received Fluker's Calcium Fortified Cricket Quencher. Spiders assigned to the low-nutrient diet were fed one-half of their body weight once per week in low-nutrient crickets. Our diet manipulations purposefully involved both quantity and quality differences to ensure observable differences in diet treatment.