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RESEARCH NOTE

THE COURTSHIP OF A KANSAS POPULATION OF *HABRONATTUS BOREALIS* (ARANEAE, SALTICIDAE)

The *coecatus* group of the jumping spider genus *Habronattus* consists of 23 described species, all found in the Western Hemisphere (Griswold 1987). The structure of the palpi in the male is generally diagnostic (see Griswold 1987, figs. 187–188). The epigynum of the female includes a central, elongated bell-like structure (see Griswold 1987, fig. 113–115). Courtship in the *coecatus* group is poorly known, although perhaps better known than in some other groups. Most of the species in the group have modifications on the third leg of the male at the patella-tibia junction, and these are displayed to the female during courtship (Griswold 1976; Richman 1982; Cutler 1988). Of the five species previously observed, *H. coecatus* (Hentz 1846), *H. borealis* (Banks 1895), *H. brunneus* (Peckham & Peckham 1900), *H. captiosus* (Gertsch 1934) and *H. pyrrithrix* (Chamberlin 1924), several usually have relatively long courtships, with periods approaching 30 min not uncommon with *H. brunneus* and *H. pyrrithrix*. During this time the male crouches low with his front legs raised and the palpi lowered. The third legs are raised and lowered, usually alternately; the patellae are rotated in and out and are nearly touching each other at the beginning and end of the sequence. Because *H. borealis* lacks any modification of the third leg we thought that the courtship might be different from the other species. Maddison & Stratton (1988) indicated that specimens of *H. borealis* from Michigan did have a courtship more typical of the species group, but also would twitch the abdomen down and up during courtship, producing a buzzing or purring sound below 500 Hz. They also noted an alternate shuffling of the left and right third legs. However, our observations on specimens of *H. borealis* from Kansas seem to confirm the hypothesis that members of this population have a much faster courtship with much less embellishment than the other four species, or *H. borealis* from Michigan.

Live specimens of *H. borealis* were collected during May 1990, 1991 and late April and May in 1992 and 1993, at the University of Kansas, Lawrence, Douglas County, Kansas. These were maintained in vials and small petri dishes at room temperature in the laboratory, both at the University of Kansas and at New Mexico State University. Specimens were fed leafhoppers and *Drosophila*. At New Mexico State University males were placed in plastic petri dishes first, followed by the female. This procedure was established as standard because some salticid females (although not usually *Habronattus* females) may attack males as prey if they are placed in the dish first. Observations were then made directly, and courtship details were recorded by notes made during the observations. A total of 25 males was observed in courtship with 19 virgin, 5 gravid and 5 penultimate females (16 males, 13 virgin, 5 gravid and 4 penultimate females observed at Lawrence and 9 males, 6 virgin females and 1 penultimate female at Las Cruces). The spiders were all preserved and voucher specimens deposited at the American Museum of Natural History (New York), the Florida State Collection of Arthropods (Gainesville) and at the Arthropod Museum, New Mexico State University (Las Cruces). A video film of *Habronattus borealis* courtship made by Wayne Maddison and Gail Stratton using specimens collected in Michigan was analyzed and compared with our observations of this species from Kansas.

Specimens of *H. borealis* from Franconia, Grafton County, New Hampshire (type series in Museum of Comparative Zoology); Bergen County, New Jersey; Suffolk County, New York; Berrien County and Emmet County, Michigan; and Niagara County, Ontario, Canada, were compared morphologically with specimens from Douglas County, Kansas.

Epigyna of representative females from the Kansas population were removed and examined from both ventral and dorsal aspects. All appeared to belong to the same species based on morphology.

Other midwestern USA records of *H. borealis* (Bruce Cutler Collection) include ILLINOIS: 1♀, Cook County; KANSAS: 2♀ (penultimate) & 2♂ (males matured in laboratory), Chautauqua County; 2♂ & 2♀, Coffey County; 1♂, Wabaunsee County; and 1♂, Anderson County. Also 1♂ & 3♀ were examined from Morris County. NEBRASKA: 3♀ & 2♂ (penultimate), Saunders County.

Observed courtship displays were very short, usually over in 30–45 sec, often in shorter time. Only two courtships resulted in mating (one observed in Lawrence and one in Las Cruces), as the females, even when virgin, appeared to be highly resistant to male advances. Males often started tracking females before they saw them, sometimes drumming palpi on areas where females had been. Upon seeing the female, a male would raise its front legs, spread them 45°, elevate palpi about 45° and do a few (up to 3–4) brief zigzags, advancing toward the female, while moving the palpi up and down alternately. The female would typically raise her front legs as well. In all but two of the encounters, the male then jumped at the female; or, if the female advanced toward the male, he retreated. The first observations made us think that this might be accidental, the male mistaking the female for prey and becoming confused. However, in one trial the male went further. In this case the male turned upside down after jumping on the female and attempted to go under her from the front, with one palpus extended toward her epigynum. The female was able to push him off and retreat at this point. One male (collected 30 April 1993 and molted to maturity 10 May 1993) mated successfully at NMSU on 29 May 1993 with a female collected 4 May 1993 and matured 15 May 1993. This courtship was also very short, less than 30 sec in duration. In this case the female lowered her cephalothorax and allowed the male to climb over her and insert his palpus. The male alternately inserted his left palpus into the female's epigynum (2 min), shifted to the right (33 min) and then to the left (32 min). He then held on for another 4 min, as the female slowly turned. Finally they separated after 71 min.

Table 1.—Summary of courtship duration times (in seconds) for 33 trials of *Habronattus borealis* from Kansas. See text for details of type I and type II courtship.

	Type I	Type II	Type I and II	No display
Percent of total	42%	18%	18%	21%
Time	5–30	10–30	15–45	—

There seemed to be no opisthosomal bobbing as reported by Maddison & Stratton (1988) for Michigan *H. borealis*. Later attempts to get this same male to repeat his courtship with two other females resulted in the same sequence as seen in earlier courtships; *i.e.,* he jumped at the apparently very resistant, but virgin, females. A complete mating was also observed at Lawrence in 1993, but in this case no courtship was observed at all. The male over a period of about 1 min slowly approached the female from the rear, climbed on top with no interference from the female. After 30 sec the male turned around to face the rear of the female, tilted the female opisthosoma, and inserted his right embolus into the female epigynum. After 40 min, the male switched sides using his left palpus. After another 50 min, the female became active and the male shifted to full dorsal rear-facing position and released the female opisthosoma. The female moved or ran actively for 30 min, after which they broke apart. At least one female laid eggs after mating. One egg sac with 15 eggs was produced on 22 July 1993. Thirteen spiderlings hatched from this clutch on 24 August 1993, and a second egg sac with 9 eggs was produced 26 August 1996. It is not known whether the second egg sac hatched.

A summary of courtships observed is presented in Table 1. As in the observations described above, courtship was usually minimal. Type I courtship is initiated when the male is about 3 cm from the female, male zigzags, first leg raised about 45° and may be waved, palpi splayed to side and waving. Type II display initiated when male is about 1 cm from female, first legs raised at right angle to body, held somewhat forward, tarsi flicking down periodically, palpi elevated slightly and third legs may be shuffled.

The series of courtships filmed by Maddison & Stratton had a few early movements in

common with the Kansas population; the front legs spread and the palpi raised. However, the courtship continued and in at least one instance, prior to a male mounting a chilled or dead female, the male raised and lowered his third legs alternately, much as in other members of the species group. Maddison (pers. comm.) also observed a few courtships in the population of *H. borealis* from the Boston Mountains of Arkansas, as well as at least one courtship using a male from Kansas. He noted that type I courtship or type II courtship might be used, but he never saw both used by the same individual in the same courtship display. As in our observations, type I was used more than type II.

The Michigan males seem to have a courtship that is intermediate between the Kansas population and other members of the species group. The male bobs his palpi in unison and does use his third pair of legs in the display, despite the fact that there is no special ornamentation on the tibiae or patellae. As far as we can ascertain, the Kansas population has dispensed with this movement entirely. Even so, the Michigan courtship may be generally faster than reported in published records of the courtships of other members of the species group. It was difficult to be sure of this as the female filmed by Maddison & Stratton was apparently chilled, or dead.

Females of other species of *Habronattus*, including the members of the *coecatus* group in which courtship is known, have also been observed to be highly "resistant" to mating, even when virgin (Griswold 1976; Richman 1982). In these cases, however, the males continued courting for as much as a half-hour. The passivity of one female during one successful mating may point to a narrow window of physiological "readiness" in the Kansas populations. Even so, there was almost no courtship on the part of the male. The question now arises as to why the courtship of the Kansas populations has deviated so much from those of other members of the species group. On the other hand, why have at least some other members of the species group evolved such time-consuming and complicated courtships? Why spend up to a half-hour exposed to possible predators or parasites while courting an apparently very resistant female? The question is a difficult one to answer and requires much more research.

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