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SILK USE DURING MATING IN *PISAURINA MIRA* (WALCKENAER) (ARANEAE, PISAURIDAE)

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ABSTRACT

The mating behavior of the nursery web spider *Pisaurina mira* is described for the first time. These spiders mate while suspended from draglines as in *Oxyopes heterophthalmus* (Latr.) and *Peucetia viridans* (Hentz). The unique feature of the mating in *P. mira*, however, is the male's use of a veil of silk to wrap the female's legs I and II into a flexed position prior to copulation while her legs III and IV are held in a flexed position by the male's embrace. Mating is accomplished in a version of position II with body axes in a right angle as the female is cradled by the male's legs. The use of silk to "tie" the female is reported elsewhere only in *Xysticus*.

INTRODUCTION

Pisaurina mira (Walckenaer) is known to use silk in the construction of the nursery, egg sac, and juvenile web (Carico 1972, 1985). The purpose of this paper is to describe for the first time the mating sequence of *P. mira* which includes the unique use of silk to bind the female's legs I and II during copulation.

MATERIALS AND METHODS

Observations were made in the laboratory on spiders that were collected at night in Lynchburg, Virginia, and in Fairhaven, New Jersey, during the months of May and June during 1984-85. One field observation of mating revealed no differences from those observed in the laboratory. Male and immature female spiders were kept in glass jars and plastic containers begween mating bouts. Mature females were kept in separate aquaria, and some matings were observed in these containers. All spiders were fed blowflies (*Sarcophaga* sp.) and houseflies (*Musca domestica*) on alternate days.

To observe and record the mating sequence in the laboratory, a non-enclosed mating arena was devised using potted philodendron (*Philodendron scadens oxycardium*) or English ivy (*Hedra helix*) set in large, shallow trays of water. The water discouraged escape, and thus made possible an unobstructed view of behavior. Events were recorded with color video cameras and 35 mm cameras.

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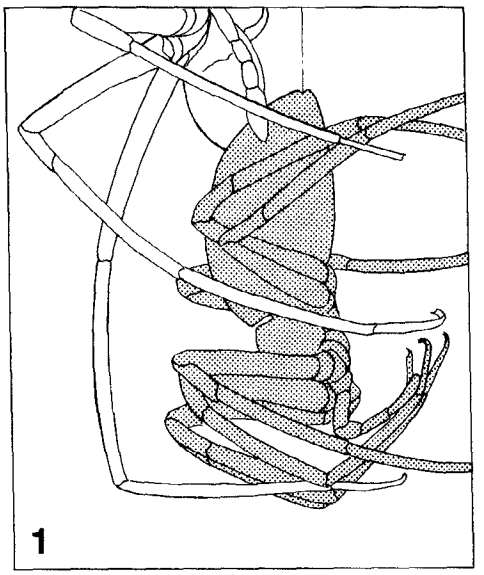
RESULTS

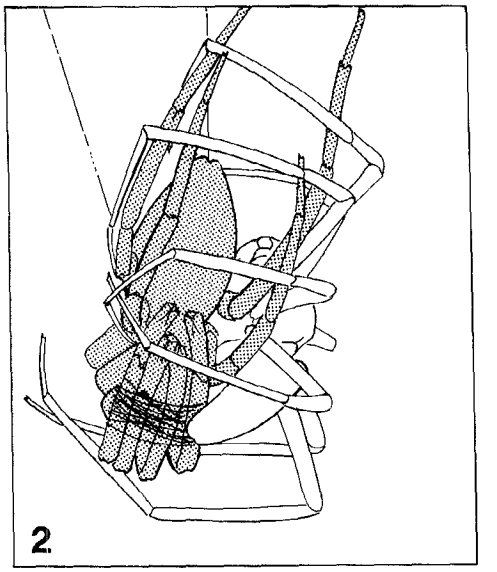
Communication before mating.—In a typical observational session, the female was first introduced onto the plant, upon which she subsequently laid down a series of draglines, by moving upward and across the outer parts of the plant. The male was introduced onto the plant 15 minutes to 3 hours after her wandering activity subsided. He wandered randomly across the plant, climbing and descending until he contacted her dragline. He then followed the dragline, passing the prolateral surface of each palpus alternately over it in a lycosid-like manner, similar to that reported for *Lycosa rabida* Walckenaer (Tietjen and Rovner 1980). During the process of his trail-following behavior, the male periodically stopped, released the dragline, and raised and extended either leg I. The time duration of each pause (30 sec-5 min) increased inversely with the distance to the female (20.3 cm-2.5 cm). There was no visible response by the female. Gradually, the distance between members of the mating pair decreased until the male touched her hind legs with his legs I and II, resulting in leg interplay between the sexes. In each instance, the tarsal portion of the male's leg made contact with her tibiae, metatarsi and sometimes patellae.

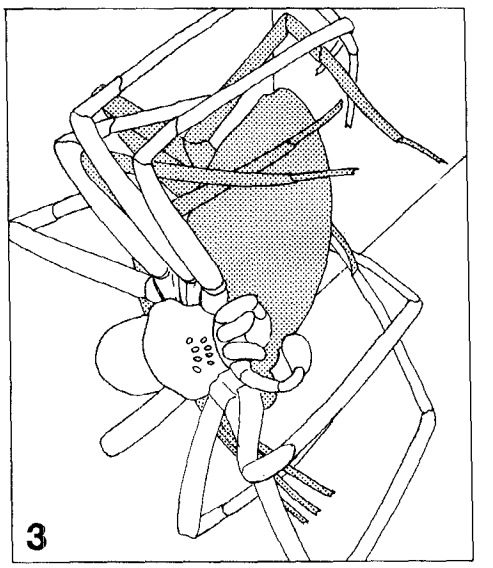
Mating.—When she was not receptive, the female climbed a short distance and descended immediately on a line to the lower branches of the plant. When she was receptive, the pair remained in contact while in a stationary position for a period of 5-20 sec. She then climbed the remaining distance to the mating area (a leaf or stem) where she attached a dragline and moved to a position beneath. Without pause, he approached from her posterior and moved to a location directly above her. He moved laterally across the edge of his perch as she drew her legs I and II against her carapace and descended freely (1.6-3.8 cm) on her dragline. She was thus suspended free in space, face downward, inactive (possibly in a cataleptic state) and tethered only by a dragline (Fig. 1). He descended after her on his dragline, while following her dragline with his leg I. He moved across the dorsal surface of her abdomen, using his legs I and II and palps to rotate her as he moved to her ventral surface. As he rotated her three to five times, he pulled a veil of silk across her legs and bound them in a flexed position (Fig. 2). After he completed the veil, he attached his dragline to her legs I and II, which left her suspended on two draglines.

To prepare for copulation he cradled her body with his legs, "folded" her legs III and IV into a flexed position, and assumed a version of position II with body axes at right angles (Fig. 3). While in this position he paused to pass his palps through his chelicerae to moisten them before insertion. The left palpus was then applied to the left atrium of her epigynum, and, after shifting his body to the other side, the right palpus was applied to the right atrium. The palpal bulb remained expanded 20-30 sec during each insertion of the embolus. There was a total of three to five insertions with a shift of the body between each insertion.

The female became increasingly active during the final insertion, which indicated that the state of receptivity had ended. He discontinued cradling her with his legs, and her legs III and IV assumed an extended position. He wrapped her legs I and II with an additional veil of silk, climbed over her ventral surface and onto her dragline, leaving her bound and suspended on the line. He retreated to the lower portion of the plant while she freed herself from the silken veil and descended on her line to another location on the plant.







Figs. 1-3.—Mating in *Pisaurina mira*: 1, female (shaded) suspended on a dragline while the male approaches from above; 2, male rotates female and wraps her legs I and II with a veil of silk; 3, pair suspended *in copula* with male holding legs III and IV of female in a flexed position.

DISCUSSION

Because of the prevailing tendency towards agonistic behavior among spiders—even conspecifics—it seems likely that binding of the female's legs with silk prior to copulation, an apparent advantage for the survival of the male, would be a widespread phenomenon among spiders. To our knowledge, however, wrapping of the female with silk prior to copulation has been described previously only for *Xysticus* (Bristowe 1958). (However, female wrapping by the male has been recently discovered in a Neotropical pisaurid, *Ancylometes bogotensis*; Merrett 1988). In *Xysticus*, the male spins a "bridal veil" of silk across the legs and body of the female to bind her to the substratum, but in *P. mira*, binding of the female occurs in a wrapping fashion while she is suspended free from a dragline. The known differences in detail of the behaviors, along with the well-known

morphological differences between these two spiders, suggest that silk binding of the female was probably derived separately.

The aspect of mating while suspended in space on a dragline is known in some species of Oxyopidae. The descriptions of mating in *Oxyopes heterophthalmus* (Latreille) (Gerhardt 1933) and *Peucetia viridans* (Hentz) (Whitcomb and Eason 1965) agree with our observation of *P. mira* (but with the absence of silk wrapping). In particular, *P. mira* shows the rotation, or "twirling" of the female that is described for *P. viridans*. This agreement may help support the conclusion by Brady (1964) on morphological grounds that there may be a close phylogenetic relationship between the Oxyopidae and Pisauridae.

The wrapping of the female's legs causes, at most, a brief restraint of the female as she becomes active following mating. As a result of subsequent repeated attempts at mating by the male, the additional silk causes the female to be further immobilized. The functional outcome of this wrapping procedure may serve to reduce predation on the male. Because the female's legs are free from any substrate during mating, contrary to the case in most mating spiders, it seems probable that the male's body would be the first object that the female would contact, and therefore, would immediately place him in jeapardy. Having the female's legs restrained, even for a short time, provides what may be the critical opportunity for the male to escape predation by his mate.

Published work on mating behavior in other pisaurids is known to us only for the genera *Dolomedes* and *Pisaura*, and the features of suspension and wrapping of the female are not included in any of these. We suggest that the mating behavior in representative species of other pisaurid genera be investigated for this character along with other characters which could aid in a better understanding of the systematics of this complex family.

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