

SEXUAL BEHAVIOR IN *DICTYNA VOLUCRIPES* (ARANEAE, DICTYNIDAE)¹

Christopher K. Starr²

Department of Entomology
University of Kansas
Lawrence, Kansas 66045 USA

ABSTRACT

Courtship and mating in *Dictyna volucripes* Keys. are described on the basis of laboratory observations of 13 virgin pairs. Their behavior conformed well to the general pattern within the family. Various features of both female and male behavior are consistent with the view that courtship functions mainly in influencing mate-choice by females, rather than in inhibiting predatory attack upon males.

Laboratory and field observations show that pairs commonly remain together for some days after mating. While the function of such cohabitation is unknown, it can evidently provide an important preadaptation in the evolution of spider sociality.

INTRODUCTION

The Dictynidae is a widespread family of small to medium-sized, cribellate spiders which make irregular webs. In recent years much attention has focused on the permanently social *Mallos gregalis* (Simon), which has in turn called comparative attention to the behavior of more typically solitary or intermediate species (Honjo 1977; Jackson 1977-1979; Uetz 1983).

Observations of courtship and mating have been reported from about 12 species of Dictynidae (Karpinski 1882; Montgomery 1903; Berland 1916; Gerhardt 1924; Locket 1926; Billaudelle 1957; Leech 1966; Bristowe 1971; Jackson 1979). Before Jackson's (1979) analysis of sexual behavior in two *Mallos* species and *Dictyna calcarata* Banks, observation was mostly rather superficial, with few quantitative data. As a result, comparisons based on the older literature are often inconclusive.

Jackson (1979) has reviewed sexual behavior in the family. In this paper I describe courtship and mating in an additional species, with some remarks on post-mating cohabitation.

Dictyna volucripes Keys. is widespread in eastern North America (Chamberlin and Gertsch 1958) and often locally abundant. In eastern Kansas I have found the web typically in the upper part of a small plant, where it forms an irregular tent over a flowerhead or several twigs. A small region of the interior is

¹Contribution no. 1974 from the Department of Entomology, University of Kansas, Lawrence, Kansas 66045. This paper is dedicated to Willis J. Gertsch on the occasion of his 80th birthday, 4 October 1986. Dr. Gertsch has been very generous to me and many other amateur arachnologists.

²Present address: Department of Horticulture, University of Georgia, Athens, Georgia 30602 USA.



Fig. 1.—Part of a *D. volucripes* web with a mating pair in the retreat area. The opening to the retreat is in the middle foreground.

reinforced with silk to form a distinct, tubular retreat (Fig. 1). The spider is most often found motionless within the retreat. For a clear illustration of web structure in a related species, see Bristowe (1971: Fig. 41).

Preliminary observations in old fields in eastern Kansas indicate that *D. volucripes* usually overwinters in the subadult stage and that males molt to adulthood a few days before females. Sexual dimorphism is not pronounced, with adult females only slightly larger than males. Scheffer (1905) reported the appearance of egg-sacs in the webs from late June to late September in this area, with 15 eggs/sac and usually 1-5 sacs/web.

MATERIALS AND METHODS

Female and male subadult spiders were collected in northeastern Kansas in March-April of 1975 and 1976. Individuals were reared to adulthood in separate vials, so that all were known to be virgin when first paired. Both as subadults and adults, spiders were provided with flies (*Drosophila* sp.) as prey and appeared well fed, except as otherwise noted. Newly emerged females were introduced onto separate dry, tree-like plant stalks (henceforth called "trees") which simulated wild web-sites and then left to spin webs. Each tree was held upright in sand and covered with a large glass jar, so that it was free on all sides. After 1-3 days, the jar was removed, an adult male introduced at the tree base, and behavior noted with the aid of a tape recorder and hand lens. After a pair had shown no apparent sexual behavior for at least 30 min, we ended observation and replaced the jar. The pair was checked daily for the next four days for a general indication of its condition.

Specimens from Kansas collected and determined by C. K. Starr in 1975-1976 can serve as vouchers. These are deposited in the Snow Entomological Museum at the University of Kansas and the Canadian National Collection in Ottawa.

RESULTS

The following account is based on observation of 13 pairs. In three of these the female had been kept without food for up to two weeks; in all others both partners were well fed. An additional pair which showed no apparent pattern of sexual behavior is disregarded.

Courtship.—At the time of male introduction, the female was usually in the retreat in the **at-rest** posture (Fig. 4): motionless, body lying against the substrate and the legs drawn in close. The male usually began immediately to climb the tree and always reacted strongly upon touching the female's silk. Typically, he walked extensively on the outside of the web, laying down silk. Such **ranging-spinning** was usually rapid and often had a notably agitated appearance. The abdomen twitched up and down, and the pace of walking was very uneven. The palps were held in front, alternately lowered and raised.

The female's first reactions to ranging-spinning could in each case be interpreted as alertness to a potential prey or intruder. She came out of at-rest, extending her legs and raising her body off the substrate. Often she walked out of the retreat, and in some cases rushed toward the male, though without coming very close. As ranging-spinning proceeded, the female showed less and less reaction, and in most cases she entered the retreat and returned to at-rest within a very few minutes.

After several minutes, ranging-spinning gave way to a new phase, **local-spinning**, in which the male walked much more closely around the female and sometimes came to walk directly upon her. In two trials the female moved a short distance away from the male, but in others she remained still. Local-spinning evidently added silk to the retreat, as this came to appear denser. When the male walked upon the female, it appeared from movements of his abdomen that he bound her very lightly with silk.

During both ranging-spinning and local-spinning, males showed little response to female behavior. I could see no reaction when a female simply became alert inside the retreat or walked just outside it. The few times that a female rushed at the male, he retreated on the web, to remain briefly inactive before resuming ranging-spinning. In no case did the female chase a retreating male.

Two trials were performed with a male released at the base of a tree from which the female was newly removed, in order to see his reactions to the web alone. In each case, he went through ranging-spinning and local-spinning as if a female were present.

Local-spinning was followed by a phase in which the pair remained in direct physical contact. In all trials this began with the male coming face to face with the female, their faces apparently touching. This was followed by a period, usually lasting a few minutes, in which the male stroked the female's cephalothorax and parts of her legs with his palps, forelegs, second legs, and occasionally his third legs. As this proceeded, he appeared to attempt to raise her venter away from the substrate with his legs, and in trials which included mating



Fig. 2.—Mating pair of *D. volucripes*.

the **stroking-phase** ended with her rising up. In some trials, this phase was interrupted by a brief return to local-spinning, and in some the female broke contact and moved slightly away, in which case the male local-spun for a time before resuming face-to-face contact and stroking.

Female behavior in the stroking-phase, where she did not break contact, appeared almost entirely passive. She never stroked the male and at most drew her legs in still closer to the body.

Mating.—Raising of the female by the male was always quickly followed by a palpal insertion and was evidently a necessary prelude to it. In three trials without raising there was no insertion, even though in one of these the male courted for more than an hour. In 10 trials with insertion, courtship (comprising the ranging-spinning, local-spinning and stroking phases) lasted for 10-93 min, with a mean of 30 min. In five of nine trials the first insertion was with the left palp, while in four it was the right; in the 10th trial it was not noted.

The mating position in all cases was a variant of Gerhardt and Kaestner's (1937) position I (Figs. 2-3). The male's face was toward the female's sternum, so that the two bodies formed an approximately right angle. The male was rotated to one side, so that one palp was closer than the other to her epigynum, and this palp was inserted. The period of first continuous insertion was very variable, lasting 1-109 min (mean = 56 min, SD = 36 min).

During mating, the hematodocha of the palp pulsated rhythmically. Most of the time it was dilated, with very brief, strong contractions at intervals. In 15 insertions in which a sample of pulsations was timed, the mean interval between contractions was 6.7 s (range = 2-12 s, SD = 2.2 s), with most samples in the 7-9 s range. One male showed an unusual pattern of pulsations during two insertions: after a series of regular, brief contractions, the hematodocha remained contracted for several seconds before the next series of regular contractions.