

RESEARCH NOTES

WEB ORIENTATION IN THE SPIDER

MANGORA GIBBEROSA (HENTZ) (ARANEAE, ARANEIDAE)

Diurnal orb-weaving spiders which maintain a position at the web-hub may be exposed to direct sunlight. Many orb-weavers use a variety of adaptations to control insolation while on or near the web, including reflective body colors (Robinson and Robinson 1978; Tolbert 1979), body orientations (Coventry 1967; Krakauer 1972; Robinson and Robinson 1974, 1978; Moore 1978; Carrel 1978; Tolbert 1979), and web orientations (Coventry 1967; Carrel 1978; Tolbert 1979; Biere and Uetz 1981). Apparently light is the cue used to direct these thermoregulatory behaviors (Robinson and Robinson 1973).

This study examines the compass orientation of webs of the orb-weaver *Mangora gibberosa* in young pine plantations in Northern Florida in October. This habitat is relatively open and spiders utilizing it may be exposed to high levels of insolation for all or part of the day.

Data were collected on October 2nd and 7th. On both days, the compass angle of the sun at sunrise was recorded and then the pine plantation was traversed and orientations taken of the first 25 *Mangora* webs encountered. On October 7th, 10 of the webs were checked again at noon to determine if *Mangora* rebuilds its web or remains at the web-hub when the sun is at its zenith. Web orientation was defined as the compass direction that the side of the web, on which the spider was sitting, faced. The web orientations were determined by projecting a hypothetical line through the middle of the spider and the web-hub with a compass and recording the resulting angle. For data collection and analysis, north was arbitrarily set at 0°.

The compass orientations of the webs on both days were unimodally distributed (Rayleigh's Test; both $p < 0.01$), with mean orientations of $116 \pm 7^\circ$ and $128 \pm 32^\circ$, respectively (Fig. 1). These orientations were not significantly different from each other (Wheeler and Watson Test), and not significantly different from the compass direction of the sun (110°) at sunrise (Stephan's Test). There were no changes in the observed web orientations when the webs were checked at noon, and the spiders were found at the hubs of their webs. This suggests that *M. gibberosa* does not rebuild its web over the course of the day with respect to light, and does not use a retreat to control insolation.

We suggest *Mangora gibberosa*, like other orb-weavers, uses early morning light as a cue to orient its web. Such orientations to sunrise would maximize the surface area of the body exposed to insolation and allow the spiders to warm quickly during the coolest part of the day (Fig. 2). A quick warmup in the morning may be advantageous to prey capture, particularly during the cooler months of the year such as October. Nothing is known about the web orientation of *M. gibberosa* during other months of the year. However, a web orientation toward early morning light, in conjunction with the vertical position of the spider

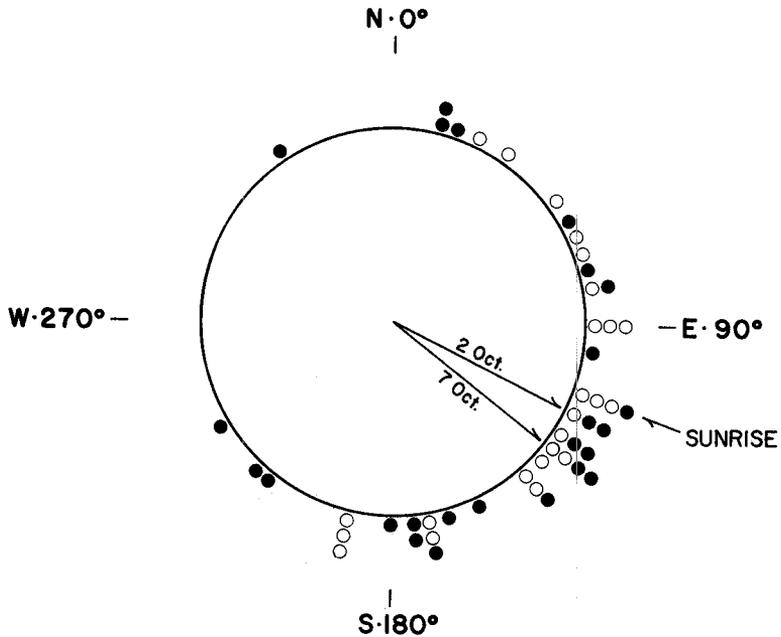


Fig. 1.—Web orientation by the spider *M. gibberosa*. The mean compass orientation (\pm circular deviation) of *M. gibberosa* webs for Oct. 2 (white circles) was $116 \pm 7^\circ$ ($n = 25$ webs); for Oct. 7 (black circles) it was $128 \pm 32^\circ$ ($n = 25$ webs). Sunrise was at 110° both days.

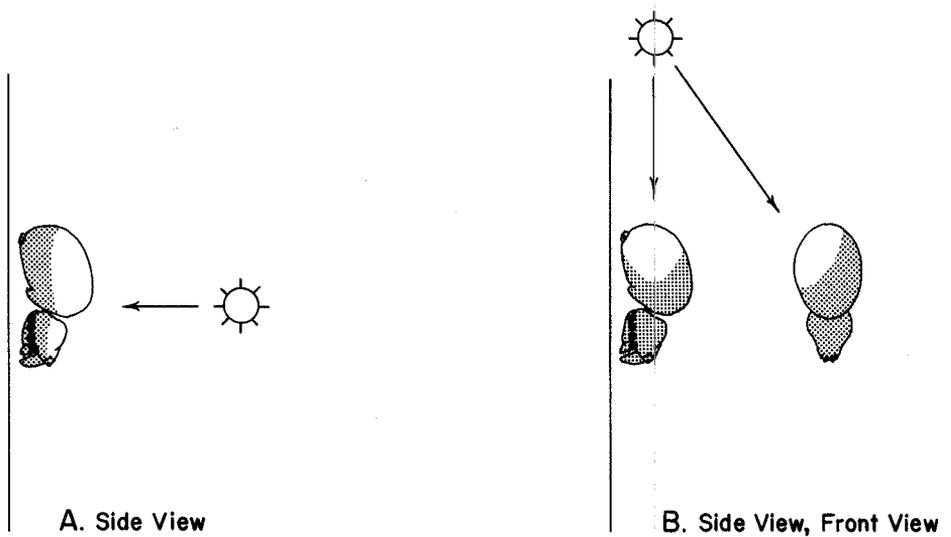


Fig. 2.—A side view of the web of *M. gibberosa* oriented to early morning light showing the surface area of the spider exposed to insolation (A), and in the same orientation showing a side and front view of the surface area of the spider exposed to insolation when the sun is at or near its zenith (B). Non-stippled areas represent exposed body surface. The spider drawings are modified from Kaston (1981).

on the web, would present the side of the spider to the sun, thereby minimizing the surface area of the spider exposed to insolation when the sun is overhead (Fig. 2). In open habitats, such as pine woods, where this spider is commonly found (Gaddy and Morse 1985), such an orientation would be advantageous during the summer months when temperature and insolation are high (Biere and Uetz 1981). The orientation to light demonstrated by *M. gibberosa* is consistent with those observed for other diurnal orb-weavers using open habitats (*Nephila*: Krakauer 1972; Robinson and Robinson 1973, 1974, 1978; Carrel 1978; *Argiope*: Coventry 1967; Tolbert 1979; *Micrathena*: Biere and Uetz 1981).

We would like to thank J. Reiskind for identification of *M. gibberosa* and for his interest in the project. All statistical tests are from Batschelet (1965).

LITERATURE CITED

- Batschelet, E. 1965. Statistical Methods for the Analysis of Problems in Orientation and Certain Biological Rhythms. Amer. Inst. Biol. Sci. 57 pp.
- Biere, J. M. and G. W. Uetz. 1981. Web orientation in the spider *Micrathena gracilis* (Araneae: Araneidae). Ecology, 62:336-345.
- Carrel, J. E. 1978. Behavioral thermoregulation during the winter in an orb-weaving spider. Symp. Zool. Soc. London, 4:41-51.
- Coventry, S. J. 1967. Web-orientation in the banded garden spider, *Argiope trifasciata*. M.S. Thesis, Univ. Wisconsin, Madison.
- Gaddy, L. L. and J. C. Morse. 1985. Common Spiders of South Carolina. S. Carolina Agr. Exp. Stat. Tech. Bull., 1094:1-182.
- Kaston, B. J. 1981. The Spiders of Connecticut, 2nd ed. Connecticut State Geol. Natur. Hist. Survey. Bull. No. 70.
- Krakauer, T. 1972. Thermal responses of the orb-weaving spider *Nephila clavipes* (Araneae: Araneidae). Amer. Midland Natur., 88:245-250.
- Moore, C. W. 1977. The life cycle, habitat, and variation in selected web parameters in the spider *Nephila clavipes* (Koch) (Araneidae). Amer. Midland Natur., 98:95-108.
- Robinson, M. H. and B. C. Robinson. 1973. Ecology and behavior of the giant wood spider *Nephila clavipes* (Fabricus) in New Guinea. Smithsonian Contrib. Zool., 149:1-76.
- Robinson, M. H. and B. C. Robinson. 1978. Thermoregulation in orbweavers: new descriptions of thermoregulatory postures and experiments on the effects of posture and colouration. Zool. J. Linnaean Soc., 64:87-102.
- Tolbert, W. W. 1979. Thermal stress of the orb-weaving spider *Argiope trifasciata* (Araneae). Oikos, 32:386-392.

Linda A. Caine, Department of Wildlife and Range Sciences, and **Craig S. Hieber**¹, Department of Zoology, University of Florida, Gainesville, FL 32611.

¹New address: Department of Biology, Saint Anselm College, Manchester, NH 03102.

Manuscript received March 1986, revised June 1986.