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SHORT COMMUNICATION

VISCID GLOBULES IN WEBS OF THE SPIDER *ACHAEARANEA TESSELATA* (ARANEAE: THERIDIIDAE)

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ABSTRACT. We describe the presence and dimensions of viscid globules in both the sheet and tangle portions of the webs of *Achaearanea tesselata* (Keyserling 1884). We found viscid globules in all sheets and tangles of the webs examined. The globules were very small and water soluble. The globules were present in the sheet of the first web built by a juvenile ($n = 1$), but their density was lower than in webs of mature females ($n = 6$).

Keywords: Spider webs, viscid silk, web construction

The designs of spider webs and many of their properties probably serve to increase prey capture, the web's principal function (Comstock 1948; Eberhard 1990). For instance, viscid threads typically increase the probability of prey capture since they readily adhere to insects or other prey types that contact the viscid globules present on such threads (Craig 1987). Viscid globules are present on lines of webs of at least eight families in the superfamily Araneoidea (Bristowe 1958; Foelix 1996; Agnarsson 2004) and in Pholcidae (Briceño 1985).

The webs of theridiids are typically described as a three-dimensional mesh with or without a retreat, with long, more or less vertical lines connected to substrates nearby (Nielsen 1932). These long lines are the main trapping portion of the web. In webs of some species of the family Theridiidae, e.g., *Latrodectus* spp., *Nesticodes rufipes* (Lucas 1846), *Achaearanea tepidariorum* (C. L. Koch 1841), these long lines are coated with viscid globules near the ends connected to the substrate (Nielsen 1932; Szlep 1965; Lamoral 1968), but in other species, such as *Theridion evexum* Keyserling, 1884 (Barrantes & Weng in press) and *Chrysso intervales* (n. sp.; Gonzaga et al. 2006) the viscid globules are present along nearly the entire length of the capture lines. However, in the web of *Achaearanea tesselata* (Keyserling 1884), which consists of a dense, more or less horizontal sheet and a dense tangle with a retreat above, viscid globules have not been reported (Eberhard 1972; Benjamin & Zschokke 2003). In this note we report the presence of viscid globules in both the sheet and in the upper tangle of *A. tesselata*. We also describe the size and density of viscid globules in the sheet of this spider's web. Voucher specimens of the spiders were deposited in the Museo de Zoología, Universidad de Costa Rica.

We estimated the density of viscid globules in the sheets of six webs of mature females in the field and in the sheet of the first web constructed by a juvenile, possibly third or fourth instar. Samples from the sheets were collected on slides framed with strips of double-sided adhesive tape (1.5 mm thick × 2.5 mm wide). The slide was carefully placed against the threads of the sheet from below, and the threads were cut once they adhered to the tape. This method allows observation of threads in the sheet with minimum modification of their original arrangement. Similarly, between three to five threads from the upper mesh were collected from each web. Because the upper mesh in these webs has a three-dimensional arrangement, its threads adhered to the slide and were cut one at a time to reduce any further modification. Slides were placed under the light microscope (40 X) and 10–15 segments of threads were randomly chosen from each sheet; each segment being the length of thread within the diameter of the field of view (0.45 mm). We counted the viscid globules in all segments to estimate their density (number of globules/mm) in the sheet, and measured the width and length of 10–12 of them in each sheet using a micrometer (relative humidity when globules were measure was between 40–50%). We searched for viscid globules on the tangle lines and measured them, but did not estimate their density. We tested whether viscid globules were water-soluble by placing drops of water on slides holding globule-containing sheet threads. The water was allowed to evaporate and when

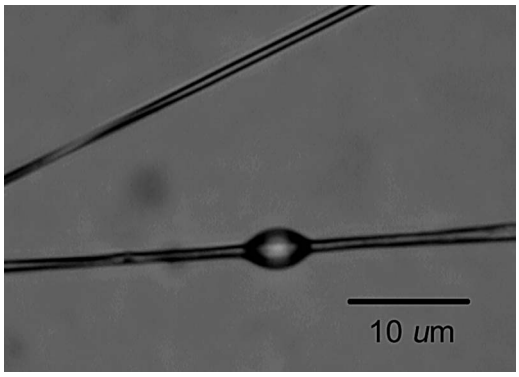

Figure 1.—Viscid globule in a sheet thread of *Achaearanea tesselata*.

threads were again checked the viscid globules had disappeared (Briceño 1985). We also placed some slides with sheet threads, which had been maintained at a relative humidity of about 40%, in a chamber saturated with water vapor. After 2 h, we examined them for any change in size of the viscid globules. These threads were collected during the dry season, following a two-month drought. All samples were collected on the campus of the Universidad de Costa Rica, San José, Costa Rica (9°54′N, 84°03′W; elevation 1200 m).

Viscid globules were present in the sheet (Fig. 1), and the upper tangle of all webs that were examined. The density of viscid globules varied among the sheets examined, and the length of these tiny globules varied more than their width, given a general ellipsoidal shape to the globules (Table 1). The lowest density of viscid globules was in the first web constructed by a juvenile (0.12 globules/mm). In contrast, the highest density (0.62 globules/mm) was observed in a web that had been inhabited for two months by a mature female (time of construction was unknown for the other webs). Otherwise, the web design of the juvenile was indistinguishable from webs of mature females.

The function of the viscid globules in webs of *A. tesselata* is unclear. The tiny size of the viscid globules suggests that they are of little help in prey retention. However, if viscid globules restrain prey's movements in the sheet, the success of the extremely rapid attack of this spider (Barrantes & Weng unpublished data) would likely increase. Benjamin et al. (2002) proposed that similarly small and sparse globules produced by substance from the aggregate glands in the webs of some linyphiids function as a cementing substance, but this is unlikely given the position of the viscid globules in the web. If the function of the globules is to cement the threads of the sheet they would be expected to be primarily at the intersection or connecting points of the threads. However, the globules in webs of *A. tesselata* (Fig. 1) and most globules in webs of some lyniphiids (Benjamin et al. 2002) were not found at the intersection of threads. Furthermore, the viscid globules in *A. tesselata* were water-soluble as were viscid globules of other groups of spiders (Briceño 1985; Townley et al. 1991); such a condition is not expected for substances that cement the threads of the sheet and tangle of this spider.

Viscid globules in threads from the sheet of *A. tesselata* that were maintained for more than 2 h at a relative humidity of about 40%, increased as much as two times in size after being placed in a humid chamber (ca. 40 min), suggesting the presence of hygroscopic organic compounds, similar to the viscid globules of some orb spiders (Vollrath et al. 1990; Townley et al. 1991). Measuring the stickiness of the globules (Opell 1989, 2002) as well as detailed studies of prey capture in webs at different stages of construction, and in webs that have been washed with water might help to elucidate the function of the viscid globules in *A. tesselata*.

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Table 1.—Overall mean length and width (μm) of viscid globules in the sheet and tangle of webs of *Achaearanea tesselata*; 10–12 droplets were measured to calculate the mean per sheet, and means of the seven sheets were combined to calculate the overall mean. Values in parentheses correspond to the juvenile web (these values were included to calculate overall means). Density (number of globules/mm) of viscid globules is also presented for sheet lines.

	Sheet (n = 7)			Tangle (n = 5)	
	Length	Width	Density	Length	Width
Mean	9.2 (7.0)	5.2 (5.1)	0.49 (0.12)	9.8	4.6
SD	5.4 (3.8)	2.3 (1.7)	0.20 (0.15)	4.8	0.8
Range	6.3–15.5	5.2–2.3	0.12–1.1	5.0–18.0	4.0–5.3

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