Detritus camouflage in webs of *Helvibis longicauda* (Araneae: Theridiidae)

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Summary

Adult females of *Helvibis longicauda* accumulated tiny pieces of vegetation in the mesh of their webs. The amount of debris accumulated was much greater in webs of spiders with either egg sacs, spiderlings or juveniles than in those of adult females without eggs or offspring. The debris possibly serves to camouflage the spider's egg sac and offspring.

Introduction

Predators and parasites of spiders attack eggs, spiderlings, juveniles, and adult spiders (Nielsen, 1923; Wise, 1993; Eberhard, 2000). In response to this selective pressure, spiders have evolved diverse defensive strategies (Foelix, 1996). The stabilimentum, a silken structure present in the webs of several orb-weaving spiders, probably serves as camouflage or predator distraction for young and adult spiders, and their egg sacs (Gertsch, 1949; Eberhard, 1973; Lubin, 1975; Herberstein *et al*., 2000). Other spiders incorporate prey carcasses, old and new egg sacs, and bits of debris into the silken stabilimentum of their orb-webs (Bristowe, 1958; Lubin, 1986; Herberstein *et al*., 2000), possibly to enhance the camouflage.

The active addition of debris for camouflage in three-dimensional webs has not previously been described for any spider species. I report here the presence of debris for camouflage on webs of the theridiid *Helvibis longicauda* Keyserling. The web of *H. longicauda* is built below an unmodified leaf that the spider uses as a retreat, resting near its lower surface. It consists of a mesh constructed with dry and sticky lines just under the leaf, and long, more or less vertical, sticky lines that extend downward from the mesh to other leaves (details of web in Gonzaga *et al*., 2006). These long lines are frequently interconnected by a few lines and have viscid globules along their entire length. Many webs have small pieces (3–7 mm long) of vegetation, such as bamboo leaves, tendrils, small flowers, and seeds attached to the mesh under the leaf retreat (pers. obs.) (Fig. 1).

Material and methods

Helvibis longicauda is common in the wet forest in the Parque Estadual Intervales, Atlantic Forest, in south-eastern São Paolo State, Brazil (24°16′S, 48°25′W, elevation 850 m; see Gonzaga *et al*., 2006 for further details). I counted the webs of this spider in the forest along a stream on 13–16 December 2005. In each web I recorded the spider's status (juvenile, adult female, or adult female with either egg sac, spiderlings or juveniles), and the number of pieces of debris attached to the mesh.

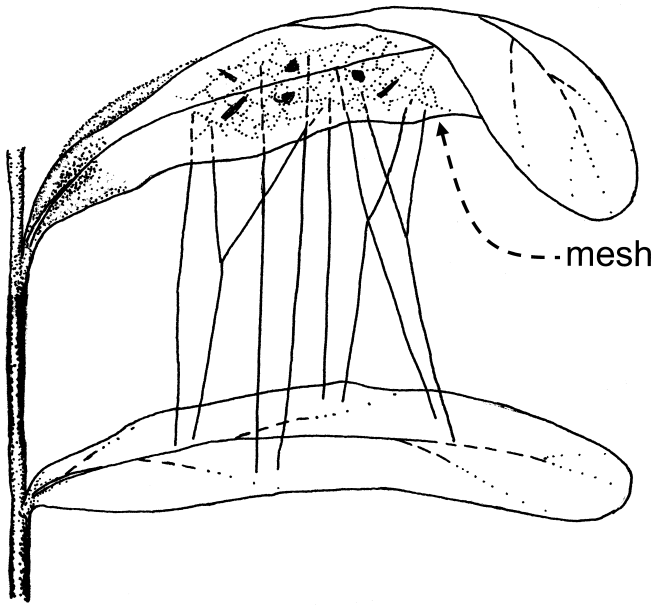

Fig. 1: Capture threads and mesh of the web of *Helvibis longicauda*. Note the pieces of debris (in black) scattered in the mesh near the lower surface of the leaf used as a retreat by the spider.

Results

The majority of spiders found were adult females: 19 with an egg sac, 20 with spiderlings or juveniles, and 25 without eggs, spiderlings or juveniles; only three webs were occupied by large juvenile spiders. Four webs out of 20 had spiderlings, the rest had juveniles that varied from second to possibly third or fourth instar; in one web juveniles were more than half the size of their mother. This indicates a long persistence of young spiders in their mother's web, as occurs in *Theridion evexum* Keyserling (Barrantes & Weng, submitted). The egg sacs were globular with a white outer layer, and were commonly attached just below the central vein of the leaf or near to it. Pieces of vegetation or debris were more abundant in the mesh of those webs in which the spider had an egg sac or young spiders ($F_{(2,61)}=10.43$, $p<0.001$, Fig. 2).

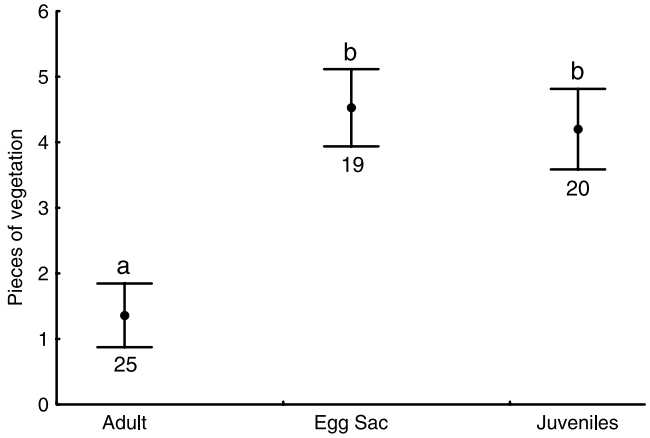

Fig. 2: Average number (± SE) of pieces of vegetation and debris counted in the mesh of webs of *Helvibis longicauda* for solitary adult females (Adult), females with an egg sac (Egg sac), and females with spiderlings or juveniles (Juveniles). Different letters above the means indicate significant differences ($p<0.001$), and the number below is the number of webs.

The small pieces of vegetation were scattered near the lower surface of the leaf, especially near the central portion of the leaf and the central vein. The spiderlings and juveniles were in the mesh, scattered among the pieces of vegetation, and were difficult to find (sometimes it was necessary to use a flashlight during the day to distinguish the spiderlings and juveniles from the small pieces of vegetation). The greater numbers of pieces of vegetation attached to the mesh of those spiders with spiderlings, juveniles or an egg sac indicate that these objects probably serve as camouflage for the egg sacs and young spiders. The accumulation of debris in the webs of *H. longicauda* may play a similar protective role to that of the retreat in many other theridiids (e.g. *Theridion evexum*, *Achaearanea tesselata* (Keyserling), where offspring remain in the retreat until their dispersal. Theridiids are well known for the large variation in their web designs (Agnarsson, 2004; Eberhard & Agnarsson, in prep.), but the use of debris for camouflage has not previously been reported in these spiders. This is also the first report of a camouflage that is apparently designed to protect the spider's offspring.

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