

## Adhesive hairs in lycosid spiders of various life styles, including the occurrence of claw tufts in *Lycosa hentzi* Banks

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### Introduction

The presence of adhesive scopula hairs and claw tufts on the legs of some wandering species is well documented (Homann, 1957; Foelix & Chu-Wang, 1975). Scopula hairs extend along the ventral surface of one or more distal leg segments. Claw tufts are composed of tightly grouped hairs positioned near the claw, e.g., in Salticidae (Hill, 1977; Foelix *et al.*, 1984) and Philodromidae (Foelix & Chu-Wang, 1975). Generally, each hair of the scopula or claw tuft contains cuticular extensions ("filaments" *sensu* Hill, 1977). These extensions sometimes terminate in broadened, spatulate structures called end-feet. The end-feet permit the spider to adhere to smooth surfaces by creating additional surface area (Homann, 1957; Foelix & Chu-Wang, 1975). In the Lycosidae (wolf spiders), scopula hairs are loosely arranged on the ventral surface of the tarsi, metatarsi, and sometimes distal end of the tibiae. To date, no claw tufts have been reported for lycosids, and little is known of the nature of structural variation of scopula hairs among wolf spiders or how such variation might reflect different life strategies.

In this study, we describe the structure and distribution of the scopula hairs of the wolf spiders *Lycosa hentzi* Banks and *L. rabida* Walckenaer, which are wandering forms found in grass and herbaceous vegetation (see Rovner & Knost, 1974 and Greenquist & Rovner, 1976 for a detailed description of the habitat preferences of *L. rabida*). These two species are syntopic in areas of southern Mississippi, Georgia and Florida. In artificial situations, they have different climbing abilities: *L. hentzi* is able to climb vertical glass surfaces (A. Brady, pers. obs.) whereas *L. rabida* cannot. To determine the extent of variation in scopula hair morphology among wolf spiders of different life strategies, we also studied two burrowing forms: the obligate burrowing *Geolycosa micanopy* Wallace, and the facultative burrower, *L. georgicola* Walckenaer.

### Materials and methods

Specimens of mature female *Lycosa hentzi* and

*L. rabida* from Ware Co., Georgia and Oktibbeha Co., Mississippi respectively; *L. georgicola* from Oktibbeha Co., Mississippi; and *G. micanopy* from Alachua Co., Florida, were used in this study. All specimens are deposited in the Mississippi Entomological Museum, Mississippi State University.

Specimens were preserved and stored in 70% ethanol. For scanning electron microscopy (SEM), leg segments were hydrated in distilled water, post-fixed in 4% osmium tetroxide (approx. 24 hr, unbuffered), dehydrated in a graded series of ethanol, and then placed in pentane for at least 12 hours. Specimens were attached to aluminium stubs with double-sided sticky tape and then coated with AuPd. The claw hairs and scopulae were examined with a Hitachi HHS-2R SEM at 20 KV and images were recorded on Polaroid type 55 P/N film. Stereomicrographs of individual setae were examined to clarify the configuration of the cuticular extensions of the scopula hairs. We examined ventral and lateral aspects of tarsus I and IV of each species.

Concerning the terminology used in this paper, we adopt the conventions of Rovner (1978) with regard to the "type A" and "type B" scopula hairs. Rovner defines type A scopula hairs as "small, erectile, well-developed on all of the legs . . .", and type B scopula hairs as being "large, non-erectile, well-developed only on the posterior legs . . .". However, we observed type B scopula hairs on the anterior as well as the posterior legs; they were more abundant on the latter.

### Results

The ventral surface of tarsus I is similar in appearance for the three *Lycosa* species and *Geolycosa micanopy* (e.g., Fig. 1a). Narrow regions of type B scopula hairs are distinguishable in each species (see Rovner, 1978 for a representative ventral view of tarsus IV). Lateral views of tarsus I (not pictured) show that the type B scopula hairs are slightly longer than the ventrolateral type A hairs. The distal type B hairs are longer than those more proximal. The region of type B scopula hairs is much broader on tarsus IV, and the hairs are the same length along the entire segment.

Individual type A hairs of tarsus I are similar in form among the *Lycosa* species and *G. micanopy*, but the hairs of *G. micanopy* are much shorter than those of the *Lycosa* species. In general, the type A scopula hairs are composed of systematically arranged filaments (Fig. 1c-d); the ventral filaments are smaller and more densely packed than those on the dorsal and lateral surface of the hair. The terminus of each ventral filament is bent slightly (Fig. 1b). The arrangement and density of the filaments of the type A scopula hair varies from the medial to the lateral surface of the hair (Fig. 1b). The medial-lateral surface of the hair is a grid-like arrangement of shorter, curved, filaments, each sharply bent at the terminus. Examination of stereomicrographs revealed that the outer filaments in the grid are slightly longer, giving the entire formation a pad-like configuration. The filaments on the dorsal surface of the hair are fewer in number and much larger (Fig. 1 b-d).

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The general form of the type B scopula hairs is similar among the species examined (Fig. 2 a-b). The hairs are stout and pointed at the tip and contain rows of filaments that are uniform in length around the circumference of the hair (Fig. 2 a-b). *Geolycosa micanopy* differs from the other species somewhat by having relatively fewer, shorter, filaments (Fig. 2 b). Type B hairs are longer and more numerous on the hind legs of all the species we examined.

The tarsal regions of the forelegs of *L. hentzi* contain groups of tightly packed hairs, or claw tufts (Fig. 2 d). The tarsal hairs of *L. rabida* are loosely arranged (Fig. 2 c). Additionally, the terminal ends of the tarsal scopula hairs of *L. hentzi* are distinctly blunted (Fig. 2 d), in contrast to the pointed ends of the tarsal hairs of *L. rabida* (Fig. 2 c).

### Discussion

The distribution and morphology of wolf spider scopula hairs is thought to reflect evolutionary

pressures related to either prey capture (Rovner, 1978) or locomotion (Foelix *et al.*, 1984). If scopula hair morphology reflects adaptive pressures related to locomotion, differences in form between groups with vastly different tendencies or abilities to move (e.g., between burrowers and non-burrowers) might be expected. However, our observations are conflicting with regard to the importance of adaptive pressures related to locomotion.

In general, the morphology of the scopula hairs of the highly mobile *L. hentzi* and *L. rabida*, the more sedentary facultative burrower *L. georgicola*, and the obligate burrower (and most sedentary) *G. micanopy* differ little (but *Geolycosa* scopula hairs are stockier than the other species). The erectile type B scopula hairs, which probably serve primarily a locomotory function (Rovner, 1978) are better developed (longer), more numerous, and more widely distributed on the hind legs of all four species. Thus, differences in locomotory tendency within this spectrum of life

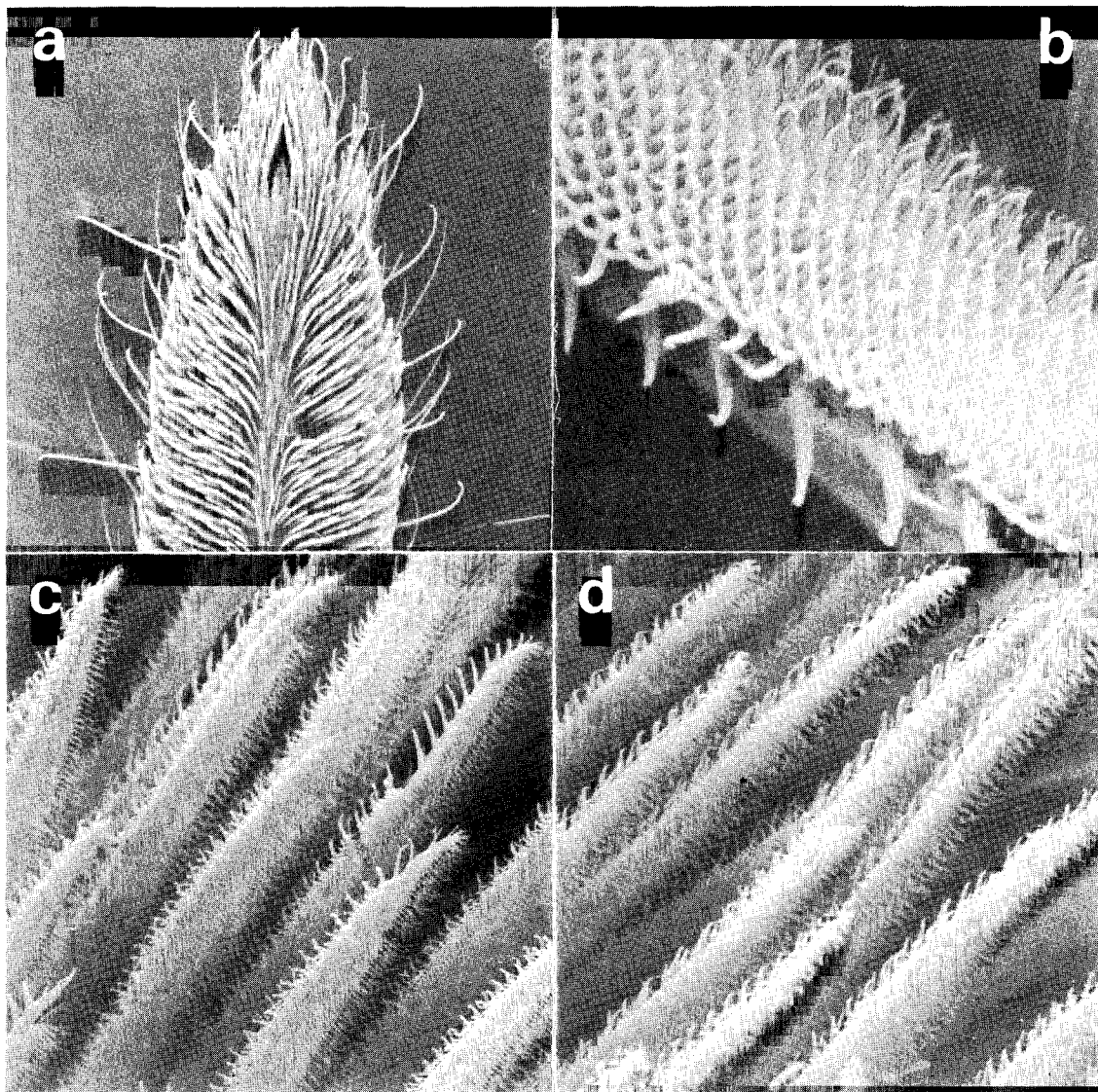


Fig. 1: (a) Ventral view of tarsus I, *L. rabida*, mature female,  $\times 50$ . (b) Type A scopula hair showing ventral to lateral variation in filament size and density, tarsus I, *L. rabida*, mature female,  $\times 4930$ . (c) Type A scopula hairs, *L. hentzi*, mature female,  $\times 925$ . (d) Type A scopula hairs, *L. rabida*, mature female,  $\times 850$ .

strategies are not reflected in overall scopula hair morphology. However, some differences do exist between species of different locomotory tendencies. The sedentary *G. micanopy* shows reduction in the size and number of filaments on the type B scopula hairs. Also, there is a distinct difference in the density of the foreleg tarsal scopula hairs of *L. hentzi* and *L. rabida* that does appear to be related to one attribute of locomotion that can be demonstrated in the laboratory — the ability to climb smooth surfaces such as glass. The presence of the claw tuft on the tarsi of *L. hentzi*, perhaps coupled with an overall smaller body size, is apparently sufficient to create conditions more favourable for adhesion.

The ecological significance of the difference in scopula hair morphology in *L. hentzi* and *L. rabida* is uncertain. Our field observations suggest that when *L. hentzi* and *L. rabida* co-occur, *L. hentzi* is more frequently observed in the higher herbaceous vegetation, whereas *L. rabida* is more frequently

encountered on the ground. However, *L. rabida* is known to be a good climber (Kuenzler, 1958) and, thus, careful experimental studies will be required to determine the precise relationship between the variation in scopula hair morphology and habitat preference.

It should be noted that the absence of scopula hairs does not preclude climbing in spiders (e.g., Oxyopidae), and, thus, their mere presence may not necessarily indicate a better climbing ability. Moreover, glass climbing (which is also an ability of other spiders with claw tufts) has no apparent adaptive value, and the correlation of this ability with overall climbing ability is unclear. Nevertheless, the relative abilities of spider species to negotiate smooth surfaces implies ecological differences related to locomotion (e.g., habitat preference).

Rovner (1978) showed the importance of adhesive hairs in capturing and holding prey. As morphological evidence for this, he pointed out that, in *L. rabida*, the

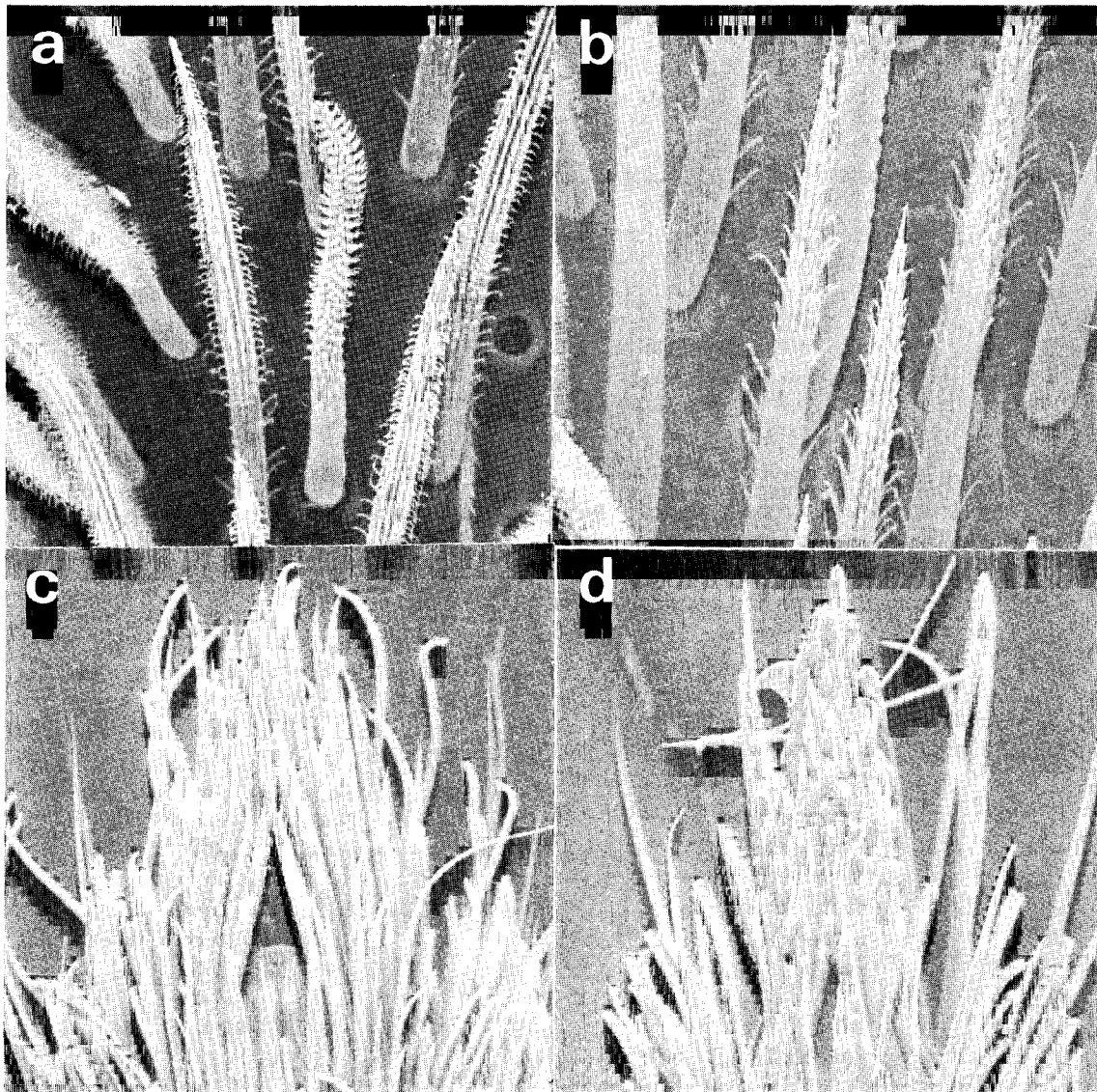


Fig. 2: (a) Type B scopula hairs, *L. hentzi*, mature female,  $\times 860$ . (b) Type B scopula hairs, *G. micanopy*, mature female,  $\times 950$ . (c) Ventral view of tip of tarsus I, *L. rabida*, mature female,  $\times 150$ . (d) Ventral view of tip of tarsus I, *L. hentzi*, mature female,  $\times 210$ , showing claw tuft.

type A scopula hairs (which serve to hold the prey) are more numerous on the anterior legs. Our observations indicate that this is also true of *L. hentzi*, *L. georgicola* and *G. micranopy*. With the exception of some differences in *Geolycosa micranopy* related to feeding from a burrow, the prey capture behaviour of these species is similar (G. L. Miller, pers. obs.). The similarity in scopula hair arrangement (presence of greater numbers of type A hairs on tarsus I vs. tarsus IV) may, thus, reflect similar adaptive pressures related to prey capture as Rovner (1978) suggested. Whether or not the claw tufts of *L. hentzi* function in prey capture is unknown.

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#### Genus *Prinerigone*, gen. nov. (Araneae: Linyphiidae)

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*Erigone longipalpis* (Sundevall, 1830) has recently been designated as the type species of *Erigone* Audouin, 1826 (I.C.Z.N., 1987). *Erigone vagans* Audouin, 1826, which was previously the type species of *Erigone*, does not fit into *Erigone* as now defined by the new type species (Millidge, 1984), and a new genus is required to accommodate this species.

The purpose of this short note is to erect the new genus *Prinerigone* (derivation: from the Greek, *prin*,

formerly, and *Erigone*), with type species *Erigone vagans* Audouin. This genus is defined by the genital characters of both sexes of the type species (Millidge, 1984); these characters differentiate *Prinerigone* from both *Erigone* and *Eperigone* Crosby & Bishop, 1928.

I have not examined every reported *Erigone* species, but it is probable that *Erigone afroalpina* Holm, 1962 and *Erigone aethiopica* Tullgren, 1910 should be transferred to *Prinerigone*.

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