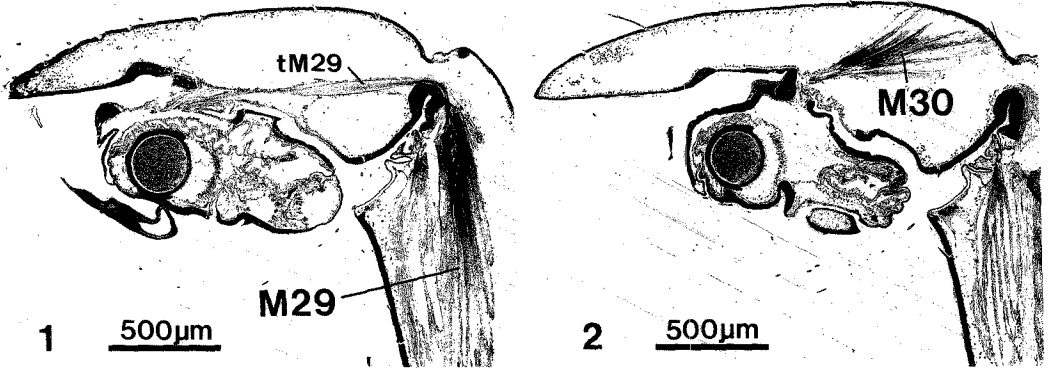


GENITAL BULB MUSCLES IN ENTELEGYNE SPIDERS

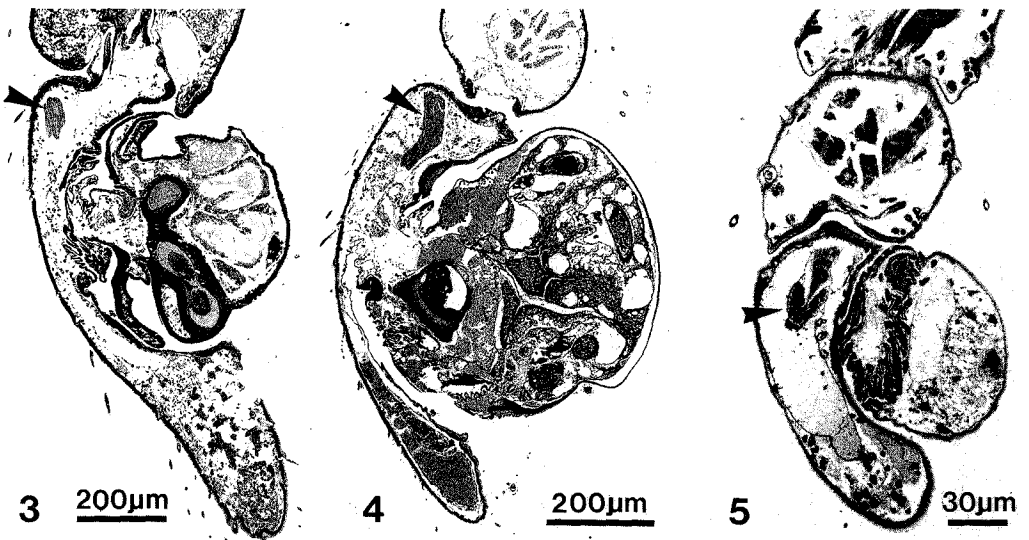
Ontogenetically, the male copulatory organ of spiders is a derivative of the pedipalpal "claw fundament" (see Coddington 1990). These are hypodermal cells which also secrete the tendons of two muscles. According to the nomenclature of Ruhland & Rathmayer (1978) these muscles are called M29 (claw flexor) and M30 (claw extensor). M29 originates at the tibia, M30 at the cymbium (Figs. 1, 2). The tendons of both muscles are attached to the basal part of the genital bulb.

In the plesiomorphic condition, which is re-

alized in all spiders with the exception of Entelegynae, these muscles are both still present in adult males. They are always well developed and, although little is known about their exact function, it is obvious that they play an important role in directing the male genital bulb into the female copulatory orifice (e.g., Harm 1931; Cooke 1966; Haupt 1979). These muscles have been considered to be absent in the adult males of all Entelegynae (Cooke 1970). In these spiders the positioning of the bulb is primarily accomplished by the inflation of one or more folded



Figures 1, 2.—Sections through the male pedipalp with genital bulb of *Gradungula sorenseni* (Gradungulidae). The existence of both muscles (M29 and M30) marks the plesiomorphic condition. tM29 = tendon of muscle M29.



Figures 3-5.—Sections through male pedipalps and genital bulbs of entelegyne spiders with the muscle M30 (arrows). 3, *Hersilia* sp.; 4, *Tama* sp.; 5, *Uroecobius ecribellatus*.

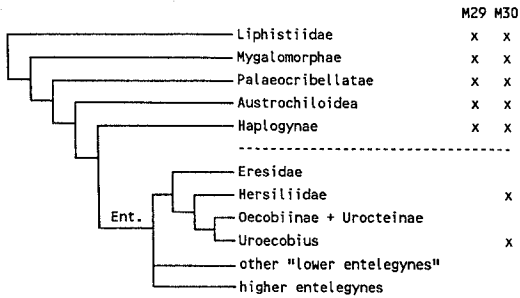


Figure 6. —Systematic distribution of genital bulb muscles in spiders. The phylogenetic tree is derived from Coddington & Levi (1991) and Kullmann & Zimmermann (1976). Ent. = Entelegynae.

membranes, the hematodochae (e. g., Osterloh 1922; van Helsdingen 1965; Grasshoff 1968).

A broad comparative investigation of the anatomy of spider genitalia revealed that the systematic distribution of the muscle M30 is not that simple. The bulbs from representatives of more than 50 families (35 entelegyne families) were embedded in ERL-4206 epoxy resin and histological serial sections (1 μ m) were prepared. In all entelegyne species examined, the muscle M29 is absent. In three of these species, the muscle M30, however, is present (Figs. 3–5): *Hersilia* sp. indet., *Tama* sp. indet. (both: Hersiliidae) and *Uroecobius ecribellatus* (Oecobiidae). The closest relatives (according to Coddington & Levi 1991) (Fig. 6) of these three species that were examined are: *Oecobius cellariorum*, *Uroctea durandi* (both: Oecobiidae) and *Eresus niger* (Eresidae). They all lack both muscles. This is also true of the other "lower entelegynes" (*sensu* Coddington & Levi 1991) that were examined (representatives of Nicodamidae, Zodariidae, Miturgidae, Homalonychidae).

These results are surprising from a phylogenetic point of view. If we assume the existence of M30 in the stemline of Entelegynae we face its independent loss at least three times (according to the phylogenetic tree of Coddington & Levi) (Fig. 6): in (1) Eresidae, (2) Oecobiinae + Urocteinae and in (3) other "lower entelegynes" + higher entelegynes. The distribution of the muscle M30 may provide evidence that Eresidae is closer to other entelegynes than to Oecobiidae + Hersiliidae, in which case only two steps are needed.

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