

A CLOSE RELATIONSHIP BETWEEN TWO SPIDERS  
(ARACHNIDA, ARANEIDAE):  
*CURIMAGUA BAYANO* SYNECIOUS  
ON A *DIPLURA* SPECIES\*

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Spiders are known to be strictly carnivorous and, moreover, often cannibalistic as well. Yet some animals have achieved a status of close coexistence with several spiders, notably web spinners. Web-building spiders do not change web sites frequently. They are rather sedentary (Turnbull, 1964), which makes their webs a suitable habitat for associates. Some wasps (*Eumenidae*, for example) build their mud nests within the webs of the "social" spider *Anelosimus eximius* (Vollrath, in prep.) whose webs also harbor certain moth larvae (Robinson, 1977a) and Hemiptera (Vollrath, in prep.). The most striking examples of coexistence, however, are the kleptoparasitic spiders of the genus *Argyrodes* (Theridiidae) that inhabit the snares of many web-building spiders (Brignoli, 1966; Robinson and Robinson, 1973; Vollrath, 1977).

In this article I describe some aspects of the biology of another spider that lives in close association with a web-building spider. It is the only spider known so far that is unable to capture its food but has to rely on its host to catch and, even further, to predigest the prey.

*CURIMAGUA AND DIPLURA*

*Curimagua bayano* (Symphytognathidae; Forster and Platnick, 1977) has only been found riding on the cephalothorax and crawling on the webs of *Diplura* sp. (undescribed species of Mygalomorphae, specimen in the American Museum of Natural History) in Panama. Although the diplurid host is not uncommon in different localities in the monsoon forest at Pipeland Road (Canal Zone), only in the Bayano limestone cliffs (the stream banks of the Río Majé and Río Tigre) did their webs harbor *Curimagua*. On a recent trip to Iquitos,

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Peru, I found a similar association between a *Curimagua* and a *Diplura* in the "white sand forest" of Mishana.

*Diplura* sp. is a beautifully colored spider that measures up to 4 cm in length and builds sheet- or funnelwebs spreading up to 50 × 50 cm. The spider rests in the entrance of its retreat, a silken tube, waiting for prey to fall onto or crawl over the sheet. The prey is bitten in a sudden lunge and dragged into the retreat for consumption. In a few minutes the prey (e.g., a cricket) will be a mushy and liquified body, due to the combined action of the masticating movements of the relatively large chelicerae and the regurgitated digestive enzymes of the spider. *Diplura's* prey, as judged from the remains, seems to consist mainly of beetles (Coleoptera), crickets (Gryllidae), and ants (Hymenoptera). Millipedes (Diplopoda) and tailless whipscorpions (Amblypygi) were also found, as was a partly digested dendrobatid frog (Anura, *Dendrobatas auratus*).

In contrast to the diplurid host, *Curimagua bayano* is a tiny, mitelike spider. The pale body of the adult female is globular and measures not more than 1.3 mm in length. The male is equally small; for exact measurements, see Forester and Platnick (1977). *Curimagua bayano* was found in the retreats of several webs of *Diplura*. The highest number per host was three females and one male, all in the relatively small web (30 × 30 cm) of a male *Diplura*. An egg case which was also found in the host's retreat, and which was assumed to be of curimaguan origin, consisted of four small eggs incorporated into a transparent and fluffy sphere (diameter 0.8 mm) of loosely spun silk. *Curimagua* crawls about between the silken threads of the host retreat, several centimeters behind the entrance, near the place where the host feeds. Because of its minute size, *Curimagua* has no difficulty in negotiating the fine mesh of silk. Often the animals were observed riding on the diplurid, perched on the center of its cephalothorax, apparently clinging to the fine hairs that cover it. Even their host's violent lunge for prey does not shake them off. I never saw the host react to *Curimagua* crawling about in the web or traversing the body of the host, even when it moved across the host's eyes (Figure 1). *Diplura* collected on Pipeline Road (where *Curimagua* was absent in ten *Diplura* webs inspected) also showed no hostile reaction when *Curimagua* climbed "aboard," suggesting that instead of being ignored the associate may not be perceived by its host.



Figure 1. The mygalomorph spider *Diplura* sp. in its silken retreat, feeding on a grasshopper. Perched on its eyes and on its chelicerae is the symphytognathid associate *Curimagua bayano*.

When I brushed *Curimagua* off the dipluran cephalothorax, they crawled about in the web and, as soon as contact was made with an extremity of the host, they started to climb it to regain their former position. During an experiment, a *Curimagua* female was taken from the back of a *Diplura* and confined to a Petri dish (diameter 5 cm) with another mygalomorph spider of approximately the same size as the diplurid. The *Curimagua* did not attempt to mount this spider.

#### FOOD OF *CURIMAGUA*

Scanning photographs of a female *Curimagua* taken in frontal view of the "head" region (frontal ridge of cephalothorax: clypeus) show the distinct feature of this group, that is, the pedipalpal coxae lack the palpa (Figure 2). The coxae and the clypeus form a circular depression which is densely covered with fine hairs as well as trichobothria. The chelicerae — which in spiders are normally

used to hold and kill prey — are tiny and fused at the bases (see also Forester and Platnick, 1977). Moreover, the chelicerae are located deep inside the mouthlike basin. Therefore, I consider it unlikely that they could be used to hold or tear even the smallest prey, thus restricting *Curimagua* to liquid food. I confined *Curimagua* to Petri dishes (diameter 5 cm) which contained a variety of small arthropods (Collembola, Coleoptera, Ricinulei) found in *Diplura* webs, as well as dead food items, but never did I find the spiders feeding on any of these offerings. *Curimagua bayano* shares fused chelicerae with its congeners (Forster and Platnick, 1977), some of which construct very finely meshed orbicular webs with a diameter of only several mm (Eberhard, pers. comm.). The prey of these free-living congeners are unknown. Their nets with a mesh size of approximately 125  $\mu$  (Patu saladito) may serve to filter for aerial plankton such as pollen and fungus spores (Vollrath, in prep.).

When a *Diplura* that is carrying *Curimagua bayano* is fed an insect, the *Curimagua* climbs forward from its resting position on the central cephalothorax, over the eyes, and down the mighty chelicerae of its host until it reaches the digestive fluids enveloping the prey item. The abdomen of the pirating associate visibly swells and only a few minutes pass before the *Curimagua* climbs back onto the cephalothorax. Individuals moving about in the silk of the retreat are also attracted to a feeding *Diplura*, perhaps alerted by the vibrations generated by the masticating movements of the host.

#### OTHER ASSOCIATES OF *DIPLURA*

*Curimagua* is not the only associate of *Diplura* webs. Other spiders (*Mysmenopsis* ssp.; Platnick and Shadab, 1978) have been found by Kraus (1955) in Guatemala, and three species of *Mysmenopsis* (*M. dipluroamigo*, *M. ischnamigo*, and *M. gamboa*) were observed by Kirkendall (in prep.) in Panama in the webs of three differently sized diplurid spiders. These associates move about in the sheet region of the diplurid web, approaching and catching small insects that failed to attract the host. Some individuals might also move toward a feeding host, but I rarely saw them sharing its prey. Most often their approach is detected by the *Diplura*, which then turns around in the retreat, spreading silk with its long spinnerets and thus hindering the advance of the would-be pirates. I never observed this behavior of *Diplura* directed toward *Curimagua*. The

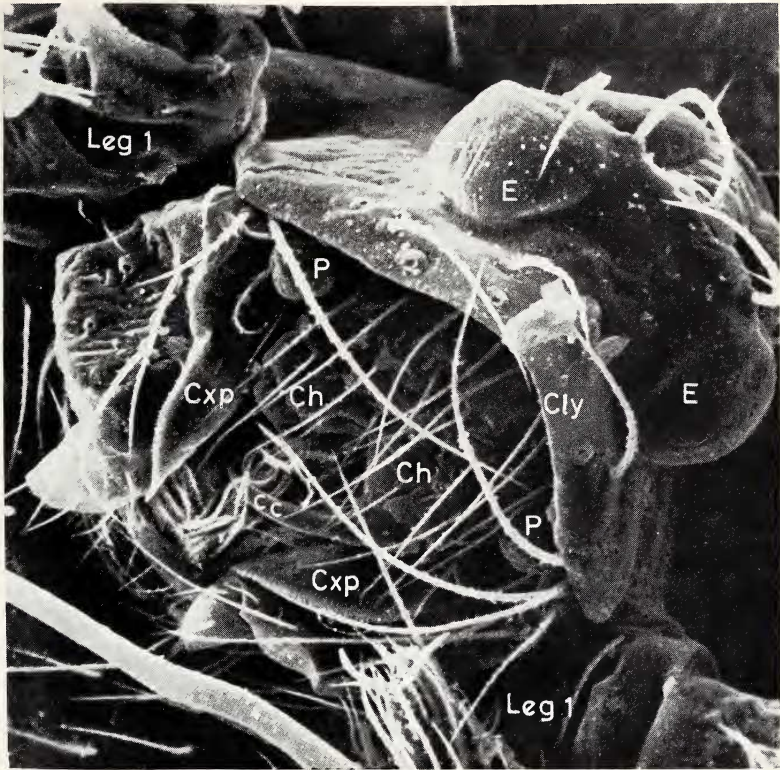


Figure 2. Scanning electron microscope photograph (350X) of the frontal cephalothorax of *Curimagua bayano* showing the two frontal eyes (E), the coxae and trochanter of legs 1, the frontal ridge of the cephalothorax (the clypeus = Cly), the coxal processes (Cxp) of the pedipalpa with the reduced pedipalp (P), and, finally, the chelicerae (Ch) with the cheliceral claws (CC).

ability of *Mysmenopsis dipluroamigo* to survive without the "proper" host is shown by the fact that Kirkendall and I found a complex space web in a bush, resembling the web of the "social" spider *Anelosimus eximius* (Simon, 1892). This web (34 × 37 × 27 cm) contained 9 females, 10 subadult females, 16 males, 2 subadult males and 25 juvenile *M. dipluroamigo*, in addition to 2 *Ischnothele guianensis* (Walck.). Other associates of *Diplura* webs encompass Coleoptera, dipteran larvae (Kirkendall, in prep.), lepidopteran larvae (Robinson, 1977), and theridiid spiders of the genus *Argyrodes* (Vollrath, 1977).

## DISCUSSION

*Curimagua bayano* is an extreme case of specialization in spiders. It is the first spider described which is not a predator and not even a carnivore *sensu strictu*, but an ectoparasite or — in the terms of Robinson and Robinson (1977) — a dipsoparasite, resembling, in a way, representatives of another and most successful Arachnid order, the mites (Acarina) which produced many parasite genera (Vollrath, E., 1978). *Curimagua bayano* should not be called a commensal (Gray, 1967) since the fluids imbibed are either the host's costly digestive enzymes (5% protein solution in *Tegenaria atrica*; Mommsen, 1977) or liquefied prey tissue. In both cases, *Curimagua* deprives its host of nutritive proteins, thus reducing its fitness.

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