ONTOGENETIC CHANGES IN THE WEB OF *EPEIROTYPUS* SP. (ARANEAE, THERIDIOSOMATIDAE)

A recent summary of information on changes in spider web design during ontogeny showed that when ancestral as opposed to derived designs can be distinguished, adult webs are usually more derived than those of juveniles (Eberhard, W. G. 1985. Psyche 92:105-117). This note on an undescribed species in the theridiosomatid spider genus *Epeirotypus* demonstrates another possible example of this pattern of change, and documents further differences between the webs of young and old spiders.

Adult spiders in the genus *Epeirotypus* construct orb webs with a spring line that is out of the plane of the orb, and the spider reels the line in as it sits at the hub, thus pulling the web into a cone (J. Coddington pers. comm., pers. obs.). In some species the web is built near a more or less vertical object such as a tree trunk or a rock, and the spider reels in the entire spring line so that its body is very close to or perhaps in some cases actually in contact with the substrate as it waits at the hub (Fig. 1). These webs may be derived with respect to those in which the spider is not next to a substrate as it holds the web tight (other *Epeirotypus, Theridiosoma,* and *Ogulnius, Wendilgarda galapagensis*—see McCook, H. C. 1889. American Spiders and their Spinningwork. I. Webs and Nests. published by the author, Philadelphia; Coddington, J. in press, *in* Spider webs and Spider Behavior [W. Shear, ed.], Stanford Univ. Press, Palo Alto; pers. obs.), though other relationships are also feasible (J. Coddington, pers. comm.). Sudden sounds nearby usually cause *Epeirotypus* spiders to release the reeled-up spring line, thus making the web (and themselves) "snap" backward as in *Theridiosoma* (McCook, H. C. 1889). This response presumably aids in prey capture and defense against predators.

Sites and methods.—*Epeirotypus* sp. was studied 10-14 Feb., 1985 on mossy tree trunks just inside a long narrow pasture (estimated 300 x 50 m) in the midst of forest about 0.5 km down the road from the Tropical Science Center research

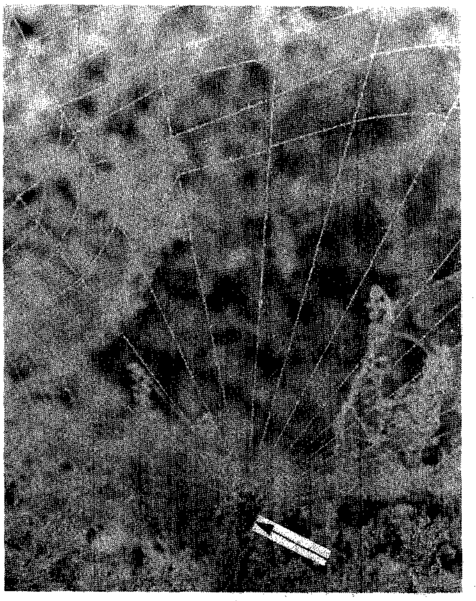

Fig. 1.—Large *Epeirotypus* sp. (probably fifth instar) at hub of web. The spider (arrow) has reeled in the entire spring line, and is touching or nearly touching the moss to which the line is attached.

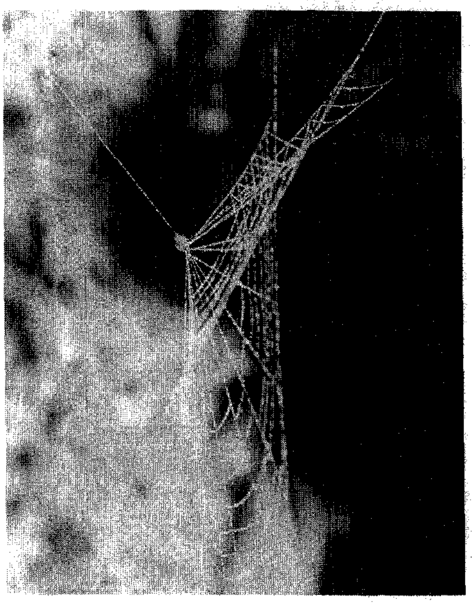

Fig. 2.—Small *Epeirotypus* sp. (probably first instar) at hub of web. Spider has reeled in only a small fraction of the spring line.

station in Monteverde, Costa Rica (elevation about 1200 m). The planes of most orbs were more or less vertical, but angles were not measured. Webs were gently coated with cornstarch before being measured with a ruler held near the web. The angle between the web plane and the spring line was estimated visually. The number of loops of sticky spiral was the average of the numbers of loops directly above and directly below the hub, and the average space between sticky spiral lines was calculated by dividing the number of loops by the distance from the innermost to the outermost loop of sticky spiral directly above the hub and directly below it. Spiders often replaced part or all of the spring line after the web was powdered, then reeled in the new line and tensed the web again; otherwise they did not usually alter their webs while I measured them. This

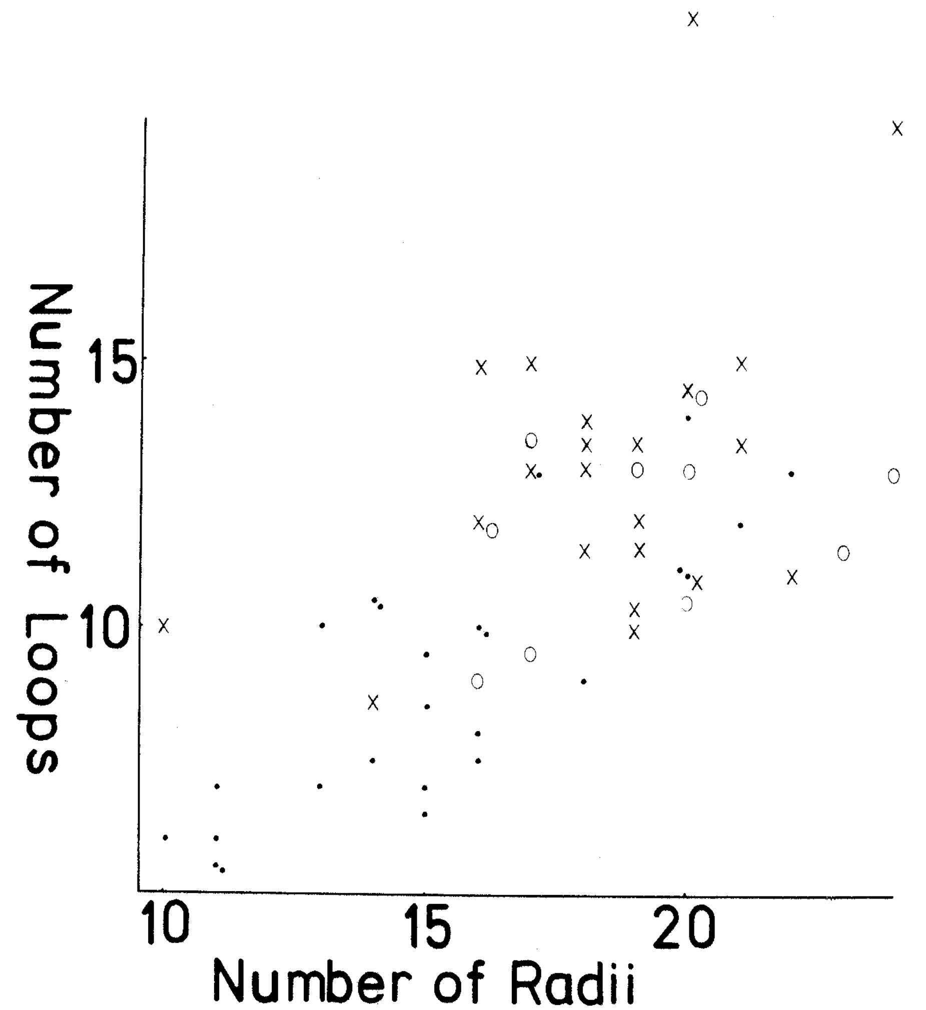

Fig. 3.—Number of radii versus average number of loops of sticky spiral in webs of small (dots), medium (circles), and large (x) *Epeirotypus* sp. spiders.

species apparently passes through four or five instars before reaching maturity (unpub. analysis of the distribution of sizes), but in this study spiders were classified as "small" (av. max. carapace width 0.45 ± s.d. 0.05 mm — probably corresponding to instars 1 and 2), "medium" (carapace width 0.67 ± 0.03 m — probably instar 3), and "large" (carapace length 0.77 ± 0.24 mm — probably instars 4 and 5). No other spiders with similar webs (orbs with spring lines and hub loops) were found on these trees, so the species identity of even the younger instars is relatively certain. Voucher specimens of adults are deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts, and the U. S National Museum in Washington, D.C.

Results.—The distance (measured along the spring line) from the spider to the substrate while the spider held the web tensed varied with spider size. Averages were 0.2 cm for large (N = 21), 0.4 cm for medium (N = 12), and 1.6 cm for small spiders (N = 21); small spiders rested significantly farther from the substrate than did large spiders ($p < 0.01$ with Mann-Whitney U Test).

The angle between the web plane and the spring line apparently increased with spider size. Average estimated angles for small, medium and large spiders were 44, 49, and 65 respectively; the difference between small and large were significant ($p < 0.01$ with G Test when angles were grouped in categories of 20-39, 40-60, and 70-90, and with Mann Whitney U Test). One small spider had an orb without a spring line.

Webs of small spiders had fewer radii and sticky spiral loops, and their sticky spiral lines were closer together than those of larger spiders ($p < 0.01$ for all three with Mann-Whitney U Test; average distances between loops of sticky spirals were 0.16, 0.21, and 0.23 cm for small, medium and large spiders). As shown in Fig. 3, the relationship between numbers of radii and sticky spiral loops in small and large spiders' webs did not change (analysis of covariance showed that the relationship was not significantly different in the two groups).

There was no difference in the degree of above vertical asymmetry (above hub vs. below hub) in the webs of large and small spiders. In both groups the average space between sticky spiral loops was usually slightly larger below the hub than above (totals 26 larger vs 14 smaller, $p < 0.05$ with Chi Squared Test), and usually there were fewer loops below the hub (total 9 webs) than above (24 webs) ($p < 0.01$ with Chi Squared Test; 21 webs had equal numbers of loops above and below the hub).

Discussion.—One of the differences between the webs of small (younger) and large (older) spiders is that the distance between smaller spiders and the substrate measured along the spring line as the spider rests at the hub is larger—a character that is probably less derived (more nearly like that of the probable ancestor of this group) than is that of large spiders. Another difference, the angle the spring line makes with the web plane, may follow this same pattern if spring lines were derived from radial lines (spring lines and other lines running out of the orb plane from the hub are laid as part of radius construction by some theridiosomatids and anapids—Eberhard, W. G. 1982. Evol. 36:1067-1095; Coddington, J. in press; pers. obs.). The polarity (primitive vs derived) of the other web characters mentioned is not known. If further studies continue to follow the trend for juvenile characters to be less derived, ontogenetic changes in web design may be useful in deducing the direction of evolution in orb web design in this and other groups.

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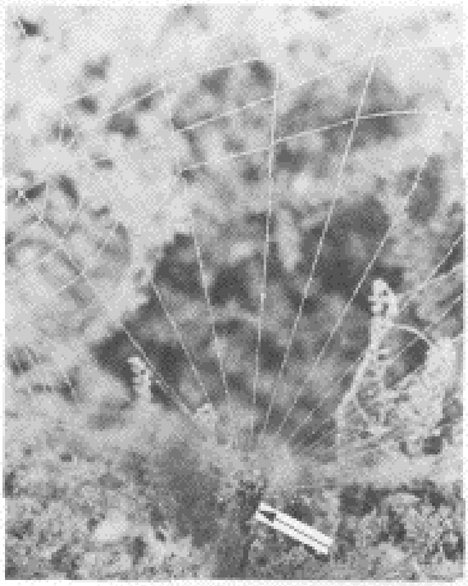

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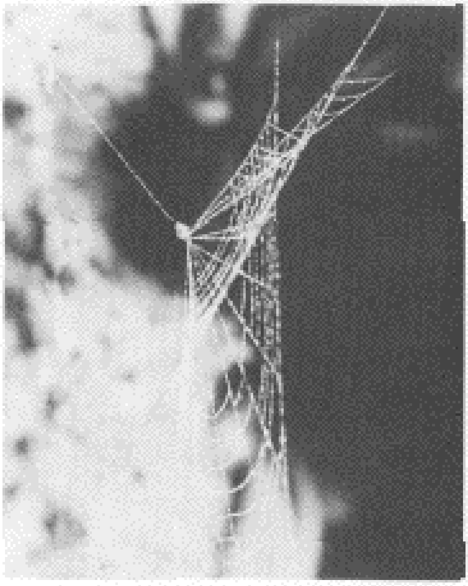

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