

13. Of the genera with a coxal hook in the male, almost all except *Micrathena* and *Gasteracantha* have a tooth on the outside of the endite which faces a tooth on the proximal end of the palpal femur. This is a synapomorphy of these genera, although it is missing in isolated species, presumably a secondary loss.

A tubercle on the dorsum of the first coxa of the male is found in some genera, as is the paramedian apophysis. It is not certain if these characters will fit into a cladogram derived by using the previously mentioned characters.

14. The paramedian apophysis is a sclerite of the male palpus found in *Parawixia*, *Acanthepeira*, *Wagneriana*, *Verrucosa*, *Micrathena*, *Wixia* and *Eriophora*. This structure, whose function is not known, breaks off from the base of the embolus (LEVI 1971).

Acknowledgments. The information presented here comes from taxonomic revisions supported in part by National Science Foundation grants to H. W. LEVI: GB-36161, BMS 75-05719, DEB 76-15568, DB-703994 and 80-20492, and Public Health Service Research Grant AI-01949 from the National Institute of Allergy and Infectious Diseases; and grants to J. CODDINGTON from the Jessie Smith Noyes Foundation and Organization for Tropical Studies.

References

- CODDINGTON, J. (in press): The monophyletic origin of the orb web. — In: SHEAR, W. A. (ed.), *Spider Webs and Spider Behavior*. Stanford University Press.
- EBERHARD, W. G. (1982): Behavioral characters for the higher classification of orb-weaving spiders. — *Evolution*, 36: 1067-1095.
- HEIMER, S. (1982): Interne Arretierungsmechanismen an den Kopulationsorganen männlicher Spinnen. — *Entom. Abh. Dresden*, 45: 35-64.
- HOMANN, H. (1971): Die Augen der Araneae. — *Z. Morphol. Tiere*, 69: 201-272.
- LEVI, H. W. (1971): The *ravilla* group of the orb-weaver genus *Eriophora* in North America (Araneae: Araneidae). — *Psyche*, 77: 280-302.
- (1980a): The orb-weaver genus *Mecynogea*, the subfamily Metinae and the genera *Pachygnatha*, *Glenognatha* and *Azilia* of the subfamily Tetragnathinae north of Mexico (Araneae: Araneidae). — *Bull. Mus. comp. Zool.*, 149: 1-75.
- (1980b): Orb-webs: primitive or specialized? — *Proc. 8th Intern. Arachnol. Congress Vienna*,: 367-370.
- (1981): The American orb-weaver genera *Dolichognatha* and *Tetragnatha* north of Mexico (Araneae: Araneidae, Tetragnathinae). — *Bull. Mus. comp. Zool.*, 149: 271-318.
- PALMGREN, P. (1980): Some comments on the anatomy of spiders. — *Ann. Zool. Fennici*, 17: 161-173.

Authors' addresses: Prof. Herbert W. LEVI, Dr. Jonathan CODDINGTON, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138, United States.

Progress Report on the Phylogeny of the Orb-Weaving Family Araneidae and the Superfamily Araneoidea (Arachnida: Araneae) (Abstract)*

By

HERBERT W. LEVI & JONATHAN CODDINGTON, Cambridge, United States

With 1 figure

We should find synapomorph characters, characters which are not otherwise present in related and unrelated spiders, to unite groups and to construct phylogenies. But if they are absent in a related group, the character may have secondarily been lost, or may never have been present. Some uncertainty always remains.

The numbers here refer to the numbers on the cladogram. For the purpose of this paper, the family Araneidae does not include Tetragnathidae, Metinae and Nephilinae.

1. The orb-web present in most Uloboridae and many Araneoidea is homologous and a synapomorphy for the two taxa; the numerous movements to make the web are mostly the same (CODDINGTON in press). With respect to grouping within the orb-weavers, it has to be considered a plesiomorph character; it has been lost secondarily in various uloborid and araneoid lines, always in spiders with specialized genitalia. If plesiomorph within orb-weavers, it does not justify putting any orb-weaving groups together (LEVI 1980 b). An ancestor of the Araneoidea could have had both cribellate and aggregate silk glands (CODDINGTON in press). Spiders with aggregate glands can make the orb in less time, which is of selective value.

4, 6. All Araneoidea have primitively a full canoe tapetum (1) in the secondary eyes (HOMANN, 1971). The tapetum is absent in Uloboridae (which prevents us from making phylogenetic conclusions). In almost all Araneidae (including Cyrtophorinae, Argiopinae, Mastophorinae, Gasteracanthinae and Araneinae) the tapetum in the posterior median eyes is reduced to a sliver, in Argiopinae this is also the case in the posterior lateral eyes. In Tetragnathidae, there has been a loss of the tapetum in the posterior median eyes

*) Revised version of a paper read at the occasion of the ESRC/ESF workshop on "Taxonomy, Biology and Ecology of Araneae" in Gartow, May 7-12, 1982.

only in *Pachygnatha* and *Glenognatha*, and in all secondary eyes in *Tetragnatha*, *Azilia*, and *Dolichognatha*. Instead, the Tetragnathidae have the rhabdomes arranged in looping rows as is seen to the median side of the reduced canoe tapetum of Araneinae (LEVI 1980 a, 1981). (Many families also have a canoe tapetum: e. e., Amaurobiidae, Dictynidae, Agelenidae, Hahniidae, Clubionidae, Anyphaenidae and Gnaphosidae. The following have a grate-shaped tapetum which is derived from a canoe tapetum (HOMANN 1971): Psecridae, Lycosidae, Pisauridae and Ctenidae).

2. A synapomorphy of *Nephila*, *Herennia* and *Nephilengys* is the unique radius construction behavior (EBERHARD 1982).

3. The Metinae having an orb-web and full canoe tapetum (in the posterior median eyes) probably resemble most closely the ancestral group from which Tetragnathidae and Araneidae (and also, judging by the structure of the genitalia, the Theridiidae, Nesticidae, and Linyphiidae) may be derived. - The row of comb-setae found on the fourth legs of most Theridiidae and Nesticidae, and their viscid silk wrap attack are synapomorphies which may make it desirable to combine the families (CODDINGTON in press). The loss of colulus is autapomorphic in most Theridiidae.

A potential autapomorphy of Linyphiidae is the stridulating structure on the sides of the chelicerae.

5, 8. The rotation of the bulb within the cymbium of the male palpus is a synapomorphy of all Araneidae. (In the palpus the sclerites face submedially, the cymbium dorsally, and the hematodocha and parts of the tegulum and subtegulum face laterally. In the left palpus the cymbium is on the left of the sclerites, the tegulum, hematodocha, tegulum and subtegulum behind). The palpi of *Mecynogea* and *Cyrtophora* are intermediate (LEVI 1980 a).

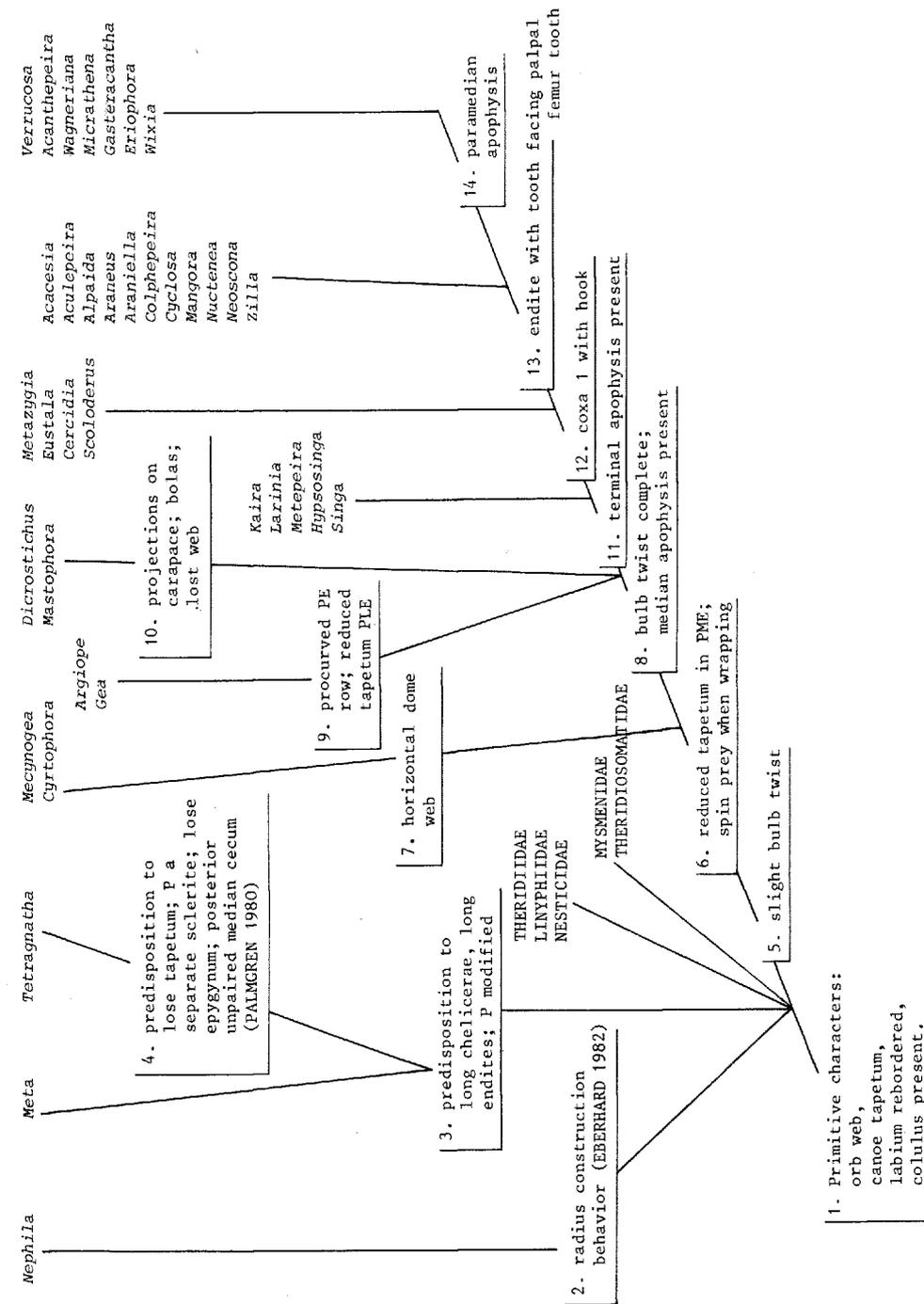
The median apophysis of the male palpus is present in all genera of Araneinae except for some species of *Cyrtophora* and *Mecynogea*, where its absence might be a secondary loss (this will be investigated by a revision of the tropical American species). It is a synapomorphy. (This structure may not be homologous to the structure with that name in theridiid and linyphiid palpi; it may, however, serve the same function (HEIMER 1982)). - There is a shortening of the abdomen, a synapomorphy of most Araneida (except *Larinia* and some *Eustala*).

9. *Argiope* and *Gea* have a procurved posterior eye row, and the tapetum in the posterior lateral eyes reduced.

10. Tubercles on the carapace are a synapomorphy of various genera placed in the Mastophorinae.

11. All remaining araneid genera have a terminal apophysis in the male palpus, a synapomorphy not homologous with structures of the same name in the theridiid and linyphiid palpus.

12. All araneine and gasteracanthine males except in the genera *Hypsosinga*, *Kaira*, *Larinia*, *Metepeira* and *Singa* have a first coxa with a hook on its distal margin that fits into a groove on the proximal end of the second femur. This is a synapomorphy; the structures are lost in *Gasteracantha* and in individual species of *Araneus* and *Micrathena*.



Tab. 1: Cladogram of the family Araneidae. - Abbreviations: P, paracymbium; PE, posterior eyes; PME, posterior lateral eyes; PME, posterior median eyes.