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Integrative taxonomy of araneomorph spiders: Breathing new life into an old science

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Summary

Taxonomy as a science has accumulated data and knowledge for more than 250 years. The quality and usefulness of the facts recorded in taxonomic literature has greatly improved from the early descriptive texts to the modern data-rich, hypothesis-driven works. Our work illustrates the application of some of the “e-taxonomic” tools and the “New Taxonomy” thinking explored in the introduction. Here, we analyzed specimen data contained in legacy taxonomic literature in **Chapters 2 and 3** — to observe species distribution of one spider group and genital evolution, respectively — and also explored an integrative perspective that involves describing new taxa and testing phylogenetic hypotheses using molecular and morphological data, as done in **Chapter 4 and 5**.

In **Chapter 2** we extracted data from taxonomic legacy literature and analyzed the temporal and spatial distribution of the so-called *Teutamus* group — a group of spiders mostly distributed in Southeast Asia — based on the abundances of specimens reported in literature. These results were used to plan fieldwork that optimized the collection of this spider group. This sampling was carried out in six National Parks in Thailand during the summer of 2018. Some of the specimens collected during this expedition were used in the other three chapters that make up this dissertation. **Chapter 3** can be divided in two parts: a literature based survey of the rare cases of genital asymmetry in spiders; and a behavioral study that used the specimens caught in the field. The review of taxonomic literature allowed us to observe and formulate evolutionary hypotheses for the origin and evolution of spider genital asymmetry. Live specimens of the species *Teutamus politus* were observed to investigate male-female interactions in a species with Directional Asymmetry in both male and female genital morphology. Although we were not able to observe courtship or other mating behaviors, we were able to thoroughly document the genital morphology of this species and its intra-specific variation.

As a result of our fieldwork in Thailand, we collected specimens from 35 spider families; from these, two — Hahniidae and Symphytognathidae — had never been reported for the country. We described a total of five new species and one new genus from these families based on an integrative approach. **Chapter 4** documents and describes the genus *Hexamatia* gen. nov. and two new species *Hexamatia seekhaow* sp. nov. and *Hahnia ngai* sp. nov. (Hahniidae) giving morphological and molecular information of these new and one previously described taxa. The multi-loci molecular data obtained from our samples was used together with available sequences from Genbank to test the phylogenetic relations of this family and the position of the newly described species. Also, this work briefly reviewed the taxonomy of the (apparently multiple) origins of eye loss and eye reduction in this family.

Finally, **Chapter 5** used a similar approach to describe and test the phylogenetic relations of three new species of the family Symphytognathidae: *Anapistula choojaiae* sp. nov., *Crassignatha seeliam* sp. nov., and *Crassignatha seedam* sp. nov. The male genital morphology of *C. seeliam* and *C. danaugirangensis* Miller et al. 2014 was doc-

umented using X-ray micro-CT scans allowing the observation of external and internal features and a better circumscription of the genus *Crassignatha*.

The integrative perspective used in this thesis gives evidence of the great deal of information that has been accumulated by traditional taxonomic work. When unlocked and analyzed properly, this data can allow the discovery and observation of biological patterns that range from taxa geographical distribution to interesting evolutionary phenomena. Furthermore, the application and analysis of multiple sources of information (e. g. molecules and morphology) favor the production of more robust phylogenetic hypotheses that can be easily tested and built on.