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Reification, Matrices, and the Interrelationships of Goblin Spiders (Araneae, Oonopidae)

NORMAN I. PLATNICK
Division of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th Street, New York NY 10024 USA. E-mail: platnick@amnh.org

In a recent review of the interrelationships of goblin spiders (the family Oonopidae), Platnick *et al.* (2012) presented a new subfamily-level classification of the family, replacing older arrangements that included at least one paraphyletic group. That analysis was based heavily on new evidence obtained, by an international consortium of researchers, through scanning electron microscopy of the tarsal organs, tiny chemoreceptors found near the tips of the legs and pedipalps.

The tarsal organ data supplied new information supporting the monophyly of the family, as well as characters relevant to understanding relationships among its genera (the family currently includes over 1000 species in over 85 genera; see Platnick, 2012). These data also supplied an example of a kind of character variation that creates problems with the conventional application of clustering algorithms to matrices. Most oonopids show a pattern of 3-3-2-2 raised receptors on legs I–IV, respectively. However, members of two genera seem to have a pattern of 4-4-3-3 receptors instead, and members of at least one other genus probably have a 2-2-1-1 pattern.

Obviously, there is some state of the tarsal organ that is plesiomorphic for the family, but outgroup comparison doesn't provide a simple answer to the question of which state that is. The members of the putative sister group of oonopids, the family Orsolobidae, as well as those of the other two families currently placed in the superfamily Dysderoidea (the Dysderidae and Segestriidae), have very differently constructed tarsal organs, with different kinds of receptors whose homologies with those of oonopids are unclear. Indeed, in the absence of detailed studies of their histology and innervation, we are unable to homologize individual receptors across all the oonopid genera, much less across all four families.

Nevertheless, Platnick *et al.* (2012) hypothesized that the 4-4-3-3 pattern is plesiomorphic for oonopids; it is found, for example, in the subfamily Orchestininae, which has long been considered among the most basal of oonopids. In our view, the 3-3-2-2 pattern represents a reduction from the plesiomorphic pattern (i.e., the loss of one receptor on each leg). Previous and current studies of the interrelationships among the genera of Orsolobidae indicate that a more pronounced reduction in receptor numbers has also occurred within that family (Forster and Platnick, 1985; Szűts, in prep.). Some reviewers of our original manuscript suggested that when summarizing our observations in the form of a matrix, the presence of a 4-4-3-3 pattern could be construed as a feature uniting just two genera, the nearly worldwide genus *Orchestina* and a New Zealand endemic, *Kapitia*. It is indeed true that those two genera show a form of tarsal organ not known in any other spiders. However, we chose instead to present our data as two characters, viewing all oonopids as sharing a "tarsal organ with raised receptors only, in serially dimorphic pattern (either 4-4-3-3 or a modified, reduced form of that pattern, i.e., 3-3-2-2 or 2-2-1-1)." We also included, as a second character, the reduction to the 3-3-2-2 pattern.

Our analysis was recently critiqued by Nixon and Carpenter (in press), in the context of responding to comments by Platnick (in press) on an earlier paper (Nixon and Carpenter, 2012) in which they presented an idiosyncratic concept of homology. That concept exemplifies a fallacy, reification, that philosophers frequently detect—the treatment of an abstraction, such as a hypothetical construct, as if it were a real entity or event. As it happens, spiders are united by at least two putative synapomorphies – features found in all spiders and in no other organisms: abdominal spinnerets, through which their silk in emitted, and male pedipalps that are modified for sperm transfer. According to Nixon and Carpenter (in press), declaring "that spinnerets are a synapomorphy of spiders … is also declaring that giraffes and hippos lack spinnerets because their common ancestor also lacked them—not because an ancestor had spinnerets and they have been lost." Whether or not Nixon and Carpenter wish to admit it, they have no actual knowledge about what the common ancestor of giraffes and hippos was, or of whether it did or did not have spinnerets. They, like everyone else,

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