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Editorial

Precopula and female-biased sex ratio in *Iphiolaelaps* Womersley (Acari: Mesostigmata: Iphiopsidae)

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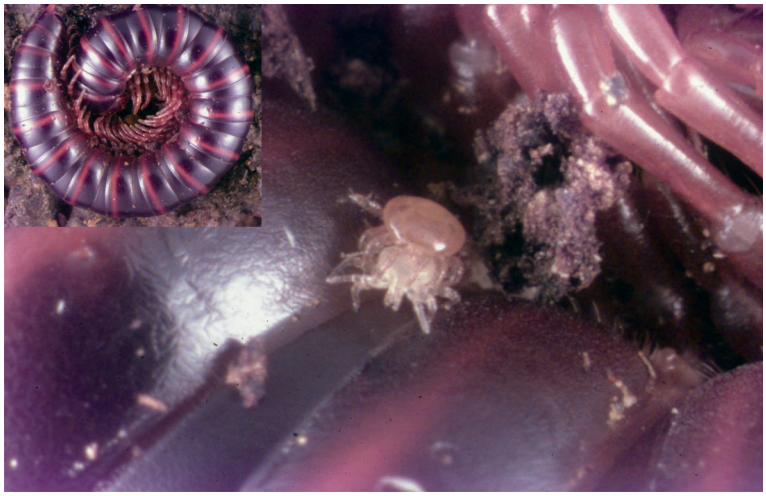

Iphiopsid mites are highly regressive dermanyssoid mites that are intimately associated with cockroaches, spiders, terrestrial crustaceans, and myriapods (Halliday 1993; Lindquist *et al.* 2009). Seven of the 11 genera of Iphiopsidae are associated with millipedes, with the genera *Jacobsonia*, *Julolaelaps*, *Narceolaelaps* and *Scissuralaelaps* represented by several species each, and *Iphiopsis*, *Iphiolaelaps* and *Trichaspis* being monotypic (Farfan & Klompen 2012).

The only published records of *Iphiolaelaps myriapoda* are Womersley's (1956) description of an adult male and female collected from "millipedes from Mt Lamington, Queensland, December 1948", and those reported by Seeman & Nahrung (2000). These mites, however, can be collected readily from paradoxosomatid millipedes (Myriapoda: Polydesmida). The host species in the cover photograph is either *Heterocladosoma* or *Solaenodolichopus*, common and beautiful genera found in wet forests around Brisbane, Australia. An undescribed species of *Iphiolaelaps* occurs on the paradoxosomatid *Phyllocladosoma annulatipes* (Verhoeff), exhibiting an even greater reduction in sternal shields and the fixed digit compared with *I. myriapoda*, presumably representing further adaptations to their assumed parasitic lifestyle.

The biology of Iphiopsidae is poorly known. All active life stages of *Iphiolaelaps* spp. were found on their hosts. The most mites recorded on a single millipede was 59 individuals of the undescribed *Iphiolaelaps* (36 females, 10 males, 11 nymphs, 2 larvae). When numbers of adults mites were low (< 6 on a millipede), the sex ratio was approximately two-thirds female (20 females, 12 males, 65 ± 11 % female; n = 14 millipedes). With increasing numbers of adult mites, the sex-ratio was more female-biased (92 females, 22 males, 81% ± 5 % female; n = 6). This significant increase (χ^2_1=4.63, P=0.03) in female-bias seems to follow the models of Bulmer and Taylor (1980)

and Wilson and Colwell (1981), who predicted greater female bias when more generations were spent in a patch. The less female-biased ratio found on millipedes with few mites (i.e. colonisation is recent) may arise if founding females have control over sex determination, with sons being produced by before daughters (via arrhenotoky or pseudoarrhenotoky). The change in sex ratio bias as populations increase could also occur via differential adult mortality or dispersal. Earlier male emergence (protandry) may also lead to this pattern over time, and enable the precopula described below.

The cover image shows an adult male and deutonymph *I. myriapoda* in precopula. Precopulatory guarding of deutonymphs is common in mites and likely involves arrestant pheromones (Sonenshine 1985). In the Mesostigmata, this behaviour has been recorded in several groups including the Ameroseiidae, Ascidae, Laelapidae, Macrochelidae and Phytoseiidae (Hoy & Smilanick 1979; Yasui 1988; Walter & Proctor 1999; pers. obs.).

In mites, precopula likely favours first-male sperm precedence, i.e., the first male to mate fertilises most or all of the female's eggs (e.g., Yasui 1988). However, in some other animals, such as crustaceans, precopula may also reflect a short period of receptivity by the female. Further, precopula removes the time required to find a mate, which may be critical for species that occupy ephemeral habitats. For example, *Hattena panopla* Domrow occupies flowers that provide food for just a few days (Seeman 1996), so migrating as a mated female almost immediately after moulting would presumably be advantageous. Additionally, male mites are often seen not only guarding an immature female, but fighting off competing males. Such competition amongst males is commonplace in animals, and is often regarded as a means for females to mate with the fittest suitor.

References

Bulmer, M.G. & Taylor, P.D. (1980) Sex ratio under the haystack model. *Journal of Theoretical Biology*, 86, 83–89.

Farfan, M.A. & Klompen, H. (2012) Phoretic mite associates of millipedes (Diplopoda, Julidae) in the northern Atlantic region (North America, Europe). *International Journal of Myriapodology*, 7, 62–91.

Halliday, R.B. (1993) A new species of *Scissuralaelaps* Womersley (Acari: Laelapidae) associated with large Australian cockroaches. *Journal of the Australian Entomological Society*, 32, 347–353.

Hoy, M. A. & Smilanick, J.M. (1979) A sex pheromone produced by immature and adult females of the predatory mite, *Metaseiulus occidentalis*, Acarina: Phytoseiidae. *Entomologia Experimentalis et Applicata*, 26, 291–300.

Lindquist, E.E., Krantz, G.W. & Walter, D.E. (2009) Order Mesostigmata. *In*: Krantz, G.W. & Walter, D.E. (Eds.) *A Manual of Acarology, Third Edition*. Texas Tech University Press, Lubbock, Texas, pp. 124–232.

Seeman, O.D. (1996) Flower mites and phoresy: the biology of *Hattena panopla* Domrow and *Hattena cometis* Domrow (Acari: Mesostigmata: Ameroseiidae). *Australian Journal of Zoology*, 44, 193–203.

Seeman, O.D. & Nahrung, H.F. (2000) Mites as fungal vectors? The ectoparasitic fungi of mites and their arthropod associates in Queensland. *Australasian Mycologist*, 19, 3–10.

Sonenshine, D.E. (1985) Pheromones and other semiochemicals of the Acari. *Annual Review of Entomology*, 30, 1–28.

Walter, D.E. & Proctor, H.C. (1999) *Mites: Ecology, Evolution and Behaviour.* University of New South Wales Press Ltd, Sydney. 322 pp.

Wilson, D.S. & Colwell, R.K. (1981) The evolution of sex ratio in structured demes. *Evolution*, 35, 882–897.

Womersley, H. (1956) On some new Acarina-Mesostigmata from Australia, New Zealand and New Guinea. *Journal of the Zoological Society, Zoology*, 42, 505–599.

Yasui, Y. (1988) Sperm competition of *Macrocheles muscaedomesticae* (Scopoli (Acarina: Mesostigmata: Macrochelidae), with special reference to precopulatory mate guarding behaviour. *Journal of Ethology*, 6, 83–90.

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