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First instar tibiotarsal chaetotaxy supports the Entomobryidae and Symphypleona (Collembola) forming a cluster in a phylogenetic tree

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Abstract

Tibiotarsi, particularly their chaetotaxy, vary from species to orders in Collembola. Symphypleona, Poduromorpha and Isotomidae have been shown to possess characteristic patterns of tibiotarsal chaetotaxy, but the patterns in Entomobryidae and Tomoceroidae, where a strong plurichaetosis is the rule, remains undocumented. The tibiotarsal chaetotaxy of first instars of 11 species of the main Entomobryidae subfamilies is described here for the first time. A basic pattern of five whorls with eight chaetae per whorl was found to occur in all examined species of Entomobryidae, with limited variations in the distal and proximal whorls. This pattern is similar to that of Symphypleona. Two hypotheses appear possible according to existing phylogenies, making it difficult to determine whether this obvious homology in tibiotarsal chaetotaxy is a plesiomorphy, which appeared independently in both superfamilies, or is a synapomorphy. We conclude that the primary chaetotaxy of tibiotarsus appears to be of high taxonomical value at suprafamilial but not at generic or tribal level.

Key words: primary chaetotaxy, systematics, nomenclature, leg

Introduction

The phylogeny of Collembola remains obscure, although several hypotheses have been published. D'Haese (2002) and Xiong *et al.* (2008) separated Collembola into Symphypleona and Arthropleona (Poduromorpha+Entomobryomorpha) (Fig. 1A). Hennig (1981) considered Arthropleona as paraphyletic, and Poduromorpha as the sister group of the remaining springtails (Fig. 1B). His hypothesis was later supported by morphological cladistic analyses (D'Haese, 2003a), and is widely accepted in present classification (Bellinger *et al.*, 1996–2015). Misof *et al.* (2014) found both the above hypotheses depending on which transcriptomic supermatrices were used, but only five taxa were sampled. Analyses published by Carapelli *et al.* (2014) complied with Hennig's tree, but Symphypleona and Entomobryidae were clustered as sister taxa based on mitogenomes (Fig. 1C).

The tibiotarsal chaetotaxy of Collembola is diversified at several levels from species to orders, has provided phylogenetic information at higher levels and is of taxonomical value for some groups (Deharveng, 2004). Published data has shown that tibiotarsal chaetae are arranged in whorls, in seven chaetae per whorl in Poduromorpha and Isotomidae (Deharveng, 1983), and in eight chaetae per whorl in Symphypleona (Greenlade, 1982; Nayrolles, 1988). They were first described by Yosii (1962) for Hypogastruridae, Lawrence (1977) for *Anurophorus* (Isotomidae), Deharveng (1983) for Isotomidae and Poduromorpha, and Nayrolles (1988) for Symphypleona, Fjellberg (1991a) for Tullbergiinae and (1991b) for *Willemia*, but there are very few studies for the largest family of Collembola, the Entomobryidae.

Barra (1975) provided figures of the tibiotarsus III of *Pseudosinella decipiens* Denis, 1924, but made no comment on their pattern. Pan *et al.* (2011) described tibiotarsal chaetae in both first instar juveniles and adults of *Homidia jordanai* Pan, Shi & Zhang with several whorls labelled in the figures, but did not analyse the pattern he described.