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Note on taxonomic history, thoraco-abdominal articulation, and current placement of Millieriidae (Insecta: Lepidoptera)

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Ditrysia are the largest lepidopteran clade comprising about 99% of the order's species richness (Kristensen & Skalski 1998). Currently, the group is classified into three superfamilies (Tineoidea, Gracillarioidea, and Yponomeutoidea) plus the large clade Apoditrysia (van Nieukerken *et al*. in press). A number of 20th century authors have studied morphological features of the second abdominal sternum (sternum II) in Ditrysia, particularly how the various sternal processes articulate with the metathorax (e.g., Börner 1939; Brock 1968, 1971; Kyrki 1983; Minet 1983, 1991). In the clade Apoditrysia, sternum II is highly modified, and this structure is considered the principal morphological synapomorphy supporting the monophyly of the clade (review: Kristensen 2003; see below for details).

The microlepidopteran family Millieriidae, with only three genera and four species, is one of the smallest families of Lepidoptera. Until recently, the monotypic *Millieria* Ragonot, together with *Nyx* Heppner (2 spp.) and the monotypic *Phormoestes* Heppner, were classified in Millieriinae, one of three subfamilies of Choreutidae. Recent molecular phylogenetic studies (Mutanen *et al*. 2010; Rota 2011), as well as examinations of the morphology of the millieriid and choreutid immature stages (Rota 2005, 2008), strongly suggest that including Millieriinae in Choreutidae results in a non-monophyletic family. Hence, to render Choreutidae monophyletic, Millieriinae were excluded and elevated to the family level (Rota 2011).

While the abovementioned molecular results provided strong evidence against a close relationship between millieriids and choreutids, these studies did not provide clues as to the position of this group in the lepidopteran tree. This enigmatic placement of millieriids and a lack of detailed morphological studies focused on this group prompted us to examine a character system that has been shown to have potential for illuminating phylogenetic relationships among ditrysian superfamilies, namely ventral thoraco-abdominal articulation.

Review of Taxonomic History. Choreutidae, as well as *Millieria*, have been moved from one taxon to another throughout their taxonomic history. Originally described in Tortricidae, *Choreutis* Hübner [1825] was moved to Pyralidae by Treitschke (1835) and then to Glyphipterigidae by Staudinger (1870). Brock (1968) realized that choreutids possess the tortricoid type of thoraco-abdominal articulation, whereas glypthipterigids have the tineoid type, and he proposed the family Choreutidae and suggested that it be placed in Tortricoidea. Brock later (1971) suggested a close association between choreutids and sesioids. This placement was also short lived – in 1991 Minet, unable to firmly associate choreutids with other lepidopteran groups, proposed the superfamily Choreutoidea. Based on the presence of the modified thoraco-abdominal articulation typical of Apoditrysia in the three choreutid genera in which this character was examined (*Anthophila* Haworth, *Choreutis*, and *Prochoreutis* Heppner) (Brock 1968: fig. 1, Minet 1983: figs. 7–8; Fig. 1), Choreutidae belong in Apoditrysia (Minet 1991). This placement is supported by molecular data (Mutanen *et al*. 2010).

Millieria dolosalis was described as *Choreutis dolosalis* Heydenreich, 1851. Its original assignment to *Choreutis* was based on superficial similarities with members of that genus. In 1874, Ragonot described the monotypic genus *Millieria* to accommodate this species that obviously differed from other species of *Choreutis*. A century later Heppner (1982) described the subfamily Millieriinae, to which he also assigned his new genera *Nyx* and *Phormoestes*. Given the weak morphological evidence, it is not surprising that molecular data failed to support the monophyly of Choreutidae with Millieriinae included (Mutanen *et al*. 2010; Rota 2005, 2011). All the characters suggested by Heppner (1982) as potential synapomorphies uniting Millieriinae with Brenthiinae and Choreutinae are likely symplesiomorphies (Rota 2005).

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