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Revision of the Dysmorphoptilidae with emarginate tegmina (Hemiptera: Auchenorryncha: Cicadomorpha: Prosboloidea) of the Queensland Triassic

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Abstract

Species of the extinct family Dysmorphoptilidae with distinctly punctate and emarginate tegmina are one of the most characteristic elements of the hemipteran fauna of the three Queensland Triassic fossil insect-bearing formations—the Middle Triassic (Anisian) Gayndah Formation at Gayndah, the Late Triassic (Norian) Mount Crosby Formation at Mount Crosby, and the Late Triassic (Norian) Blackstone Formation at Mount Crosby and Dinmore. Eight species in five genera have been identified: *Mesocixius triassicus* Tillyard, 1919 (Denmark Hill), *Mesocixius parvus* (Evans) **comb. nov.,** 1956 (Mount Crosby), *Triassocixius australicus* Tillyard, 1919 (Denmark Hill), *Carsburgia knezouri* **gen. et sp. nov**. (Dinmore), *Dysmorphoptiloides elongata* Evans, 1956 (Mount Crosby), *Dysmorphoptiloides ellisi* **sp. nov.** (Gayndah), *Tennentsia princeps* **sp. nov.** (Mount Crosby), and *Tennentsia evansi* **sp. nov.** (Gayndah). Synapomorphies are proposed to suggest that *Triassocixius*, *Carsburgia*, *Dysmorphoptiloides* and *Tennentsia* are monophyletic. *Mesocixius* may be paraphyletic, its two species sharing only apparently plesiomorphic characters. The limits and relationships of the over 15 described world genera of the Dysmorphoptilidae remain poorly known, but examination of the Queensland species has identified several characters which may be of cladistic value: the presence or absence of a strigil, the degree of tegmen emarginations and form of the resultant apical lobe, the presence and form of swellings on the claval margin, the pattern of tegmen punctation, the relativities of the primary forks of R and RA, the branching pattern of RA1, the branching and orientation of RA2,and the presence or absence of a fusions between RA and RP distally and between M and CuA basally.

Key words: *Mesocixius*, *Triassocixius*, *Dysmorphoptiloides*, *Tennentsia*, Denmark Hill, Dinmore, Gayndah, Mount Crosby

Introduction

The Dysmorphoptilidae includes over 15 described genera from the Late Permian to the Late Jurassic of Australia, Europe, Central Asia, Siberia, South Africa and South America (Shcherbakov 1984, 2000; Martins-Neto *et al.* 2003; Martins-Neto & Gallego 2006), and was a dominant element of the Triassic hemipteran fauna (Shcherbakov 2000; Wang *et al.* 2010). As noted by Shcherbakov (1996, p.37), dysmorphoptilids were particularly distinguished by their "tough, punctate, often oddly shaped tegmina with a strigil on the underside of the costal area", the latter considered by Shcherbakov and Popov (2002, p.150) as "the earliest evidence of insect acoustical communication". The family was established over a century ago to receive the European *Dysmorphoptila* Handlirsch, but its relationships have only been clarified more recently through the work of Shcherbakov (1984), who provided a concise diagnosis and placed it with three other families in the extinct superfamily Prosboloidea of the Cicadomorpha.

Shcherbakov (1984) ascribed seven Australian genera to the family: the late Permian *Belmontocarta* Evans (Belmont, New South Wales), and the late Triassic *Triassocixius* Tillyard (Denmark Hill, Queensland), *Alotrifidus* Evans, *Dysmorphoptiloides* Evans, *Eoscarterella* Evans, *Eoscartoides* Evans, and *Trifidella* Evans (Mount Crosby, Queensland). Of these, only *Dysmorphoptiloides* was known to have unusually-shaped tegmina, distinctly emarginate at the apices of RA and CuA. Since Evans pioneering works on the Triassic Hemiptera of Queensland (Evans 1956, 1961, 1971), many new dysmorphoptilid specimens with similar emarginate tegmina have been collected by the author and local fossil collectors Allan Carsburg and Robert Knezour, both from Mount Crosby

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The colour patterns of the tegmina seem to be reasonably well preserved in five of the eight species and show interesting similarities and contrasts. Even though considered as generically distinct, three species, *M. parvus* (Fig. 5), *C. knezouri* (Fig. 11), and *D. elongata* (Figs 13,15) show a basically similar pattern comprising a basal transverse fascia or blotch, a central single or bilobed spot, and spots or blotches apically. In the two species of *Tennentsia*, on the other hand, the colour pattern seems to be related to the differential areas of fine and coarse punctation (Figs 23,26). Whether the patterns have systematic value or in the case of the three former species simply reflect a camouflage convergence as a result of similar habitats and biology is not yet known.

The relationships of the over 15 described genera of the Dysmorphoptilidae are still poorly known. Martins-Neto and Gallego (2006) took a narrower view of the composition of the family than Shcherbakov (1984) and included only those forms with oddly-shaped tegmina. They proposed a division into two subfamilies based mostly on whether RA and RP were fused distally (as in the Australian *Dysmorphoptiloides*). The determination of generic relationships requires much further and more comprehensive analysis, including a re-examination of many of the type specimens. In the meantime, however, the present study of the Australian Triassic fauna suggests several characters which may be of value to such an analysis, *viz*. the presence or absence of a strigil, the degree of tegmen emarginations and form of the resultant apical lobe, the presence or possible absence of swellings on the hind margin of the clavus, the pattern of tegmen punctation, the relativities of the primary forks of R and RA, the branching pattern of RA1, the number and orientation of the branches of RA2, the presence or absence of a distal fusion between RA and RP, and the presence or absence of a basal fusion between M and CuA. As far as the Australian genera are concerned, the present study has proposed synapomorphies to suggest that *Triassocixius*, *Carsburgia*, *Dysmorphoptiloides* and *Tennentsia* are monophyletic. On the other hand, *Mesocixius* may be paraphyletic, its two species sharing only apparently plesiomorphic characters.

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