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A revision of the *Pauropsalta annulata* Goding & Froggatt species group (Hemiptera: Cicadidae) based on morphology, calling songs and ecology, with investigations into calling song structure, molecular phylogenetic relationships and a case of hybridisation between two subspecies

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Abstract

The *Pauropsalta annulata* Goding & Froggatt species group is distributed (widely) in eastern Australia. This group comprises *P. annulata*, *P. rubristrigata* (Goding and Froggatt) and *P. ayrensis* Ewart, with *P. annulata* sens. lat. containing the greatest diversity in calling songs, ecology and distribution. Previous studies have revealed that this diversity is due to the presence of several cryptic species, which together make up the *Pauropsalta annulata* species complex. The present study provides a revision of the *Pauropsalta annulata* species group and includes redescriptions of *P. annulata* s.str., *P. rubristrigata* (Goding & Froggatt) and *P. ayrensis* Ewart, as well as descriptions of 11 species new to science: *P. blackdownensis* **sp. nov.**, *P. corymbiae* **sp. nov.**, *P. decora* **sp. nov.**, *P. granitica* **sp. nov.**, *P. inversa* **sp. nov.**, *P. kobongoides* **sp. nov.**, *P. notialis* **sp. nov.**, *P. simplex* **sp. nov.**, *P. subtropica* **sp. nov.**, *P. torrensis* **sp. nov.** and *P. tremula* **sp. nov.** In addition, two new subspecies are also described: *P. n. notialis* **subsp. nov.** and *P. n. incitata* **subsp. nov.**, along with extensive areas of hybridisation, which justifies their subspecific status. Within the *P. annulata* species group, the *P. annulata* species complex is redefined to contain *P. annulata* s. str., *P. notialis* **sp. nov.** and *P. tremula* **sp. nov.** These species have a number of apomorphies in common and are expected to have had a single point of origin (i.e. represent a monophyletic group). To facilitate the identification of taxa in the *P. annulata* species group, separate keys are provided for specimens and field recordings based on morphology and calling song structure respectively. Morphological descriptions or diagnoses and descriptions of calling song structure are provided for each species and subspecies (and the hybrids between the subspecies). The descriptions are followed by a comprehensive statistical analysis of calling song specificity in the *P. annulata* species complex. A preliminary molecular phylogenetic analysis, focusing on species-level relationships and divergence times within the *P. annulata* species group, is also included.

Key words: acoustic signalling, duets, introgression, song function, species limits, species specificity, systematics, taxonomy