



Family-group names proposed in the family Pseudococcidae (Hemiptera: Sternorrhyncha: Coccoidea)

D.J. WILLIAMS¹ & P.J. GULLAN^{2,3}

¹Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, U.K

²Department of Entomology, University of California, One Shields Avenue, Davis, California 95616-8584, U.S.A.

³Corresponding author. E-mail: pjgullan@ucdavis.edu

Introduction

Since Cockerell (1905) erected the family-group name Pseudococcini, the name has become widely used for all mealybugs. Lobdell (1930) raised the status of the group to family level as the Pseudococcidae, but it was not until Borchsenius (1949) and Ferris (1950) accepted the family level that the rank of Pseudococcidae became more widely accepted within the superfamily Coccoidea. Various tribes and subtribes have been introduced without any reliable classification of the family.

In an extensive study of the mouthparts of scale insects, Koteja (1974a, b) recognised the four mealybug subfamilies, Pseudococcinae, Trabutininae, Rhizoecinae and Sphaerococcinae, although later he (Koteja, 1988) modified this to only the subfamilies Pseudococcinae, Phenacoccinae and Rhizoecinae. Phylogenetic analyses of DNA sequence data from three nuclear genes obtained from 64 mealybug species representing 35 genera (Downie & Gullan 2004) recovered three major clades comprising the three subfamilies Pseudococcinae, Phenacoccinae and Rhizoecinae, and suggested various groupings that agreed with some tribal names. The type species of the genus *Trabutina* Marchal, the nominal genus of the subfamily Trabutininae, and the type species of the genus *Sphaerococcus* Maskell, the nominal genus of the subfamily Sphaerococcinae, were not included in the study by Downie & Gullan (2004). These two genera represented by the type species *Trabutina mannipara* (Hemprich & Ehrenberg) and *Sphaerococcus casuarinae* Maskell, were available later in an extensive study of 57 mealybug genera by Hardy *et al.* (2008) based on integrated molecular and morphological data. Two primary clades representing the subfamilies Pseudococcinae and Phenacoccinae were recovered from this study, with the Phenacoccinae containing *Phenacoccus* Cockerell and related genera as well as the genus *Rhizoecus* Künckel d'Hercule and related genera.

The following list shows the family-group names that have been proposed within the family Pseudococcidae, separated into those belonging to each of the subfamilies Pseudococcinae and Phenacoccinae. Some of these names will no doubt be used in future classifications but others may fall into synonymy. Other new names may be needed for further genus groups. The left column lists the names and dates of nominal genera on which family-group names have been based, and the right column lists the family-group names that have been proposed with their first published dates. The list supplements those in Williams (1969) and Ben-Dov (1994), and full references to the genus and family-group names cited in the list can be found in those publications or in the database ScaleNet (Ben-Dov *et al.*, 2009).

As noted by Williams (1969) and Hardy *et al.* (2008), the family-group name Sphaerococcinae has priority over Pseudococcidae. The name Sphaerococcinae has been used rarely, although Hendricks & Kosztarab (1999) used the name to discuss all the legless mealybug genera even though these authors indicated that the subfamily did not represent a monophyletic group. The non-monophyly of the legless mealybugs was confirmed by Downie & Gullan (2004) and Hardy *et al.* (2008). Precedence of the family-group name Pseudococcidae over Sphaerococcinae is not covered under Article 35.5 of the International Code of Zoological Nomenclature (1999) because the type genera of these two family-group names appear to be in the same subfamily and tribe, as shown in the analyses of Hardy *et al.* (2008). Hardy & Gullan (2008) submitted an application to the International Commission on Zoological Nomenclature to preserve the usage of both names and to request that the family-group name Pseudococcini be given precedence over Sphaerococcini whenever their type genera are placed in the same family-group taxon. The Commission received no comments on the case and in late 2009 made a ruling (Opinion 2236 (Case 3424)) that conserved usage of the family-group name Pseudococcini Cockerell, 1905 (type genus *Pseudococcus* Westwood, 1840), by giving it precedence over the senior

family-group name Sphaerococcini Cockerell, 1899 (type genus *Sphaerococcus* Maskell, 1892). At the same time, the name *Sphaerococcus* Maskell was placed on the Official List of Generic Names in Zoology (International Commission on Zoological Nomenclature, 2009).

List of family-group names in the family Pseudococcidae

Subfamily Phenacoccinae

<i>Coccura</i> Šulc, 1908	Coccurini Borchsenius, 1948
<i>Geococcus</i> Green, 1902	Geococcina Kozár, 2007
<i>Heterococcus</i> Ferris, 1918	Heterococcina Tang, 1992
<i>Phenacoccus</i> Cockerell, 1893	Phenacoccinae Šulc, 1944
<i>Rhizoecus</i> Künckel d'Hercule, 1878	Rhizoecini Williams, 1969
<i>Ripersiella</i> Tinsley, 1899	Ripersiellina Kozár, 2007
<i>Ritsemia</i> Lichtenstein, 1879	Ritsemiini Kozár & Vinis, 1980
<i>Xenococcus</i> Silvestri, 1924	Xenococcini Tang, 1992

Subfamily Pseudococcinae

<i>Allomyrmococcus</i> Takahashi, 1941	Allomyrmococcini Williams, 1978
<i>Antonina</i> Signoret, 1875	Antoninini Borchsenius, 1949
<i>Dysmicoccus</i> Ferris, 1950	Dysmicoccina Tang, 1992
<i>Humococcus</i> Ferris, 1953	Humococcina Tang, 1992
<i>Mirococcopsis</i> Borchsenius, 1948	**Mirococcopsiini Tang, 1992
<i>Paraputo</i> Laing, 1929	Paraputoina Tang, 1992
<i>Planococcus</i> Ferris, 1950	Planococcini Ezzat & McConnell, 1956
<i>Pseudococcus</i> Westwood, 1840	Pseudococcini Cockerell, 1905
<i>Serrolecanium</i> Shinji, 1935	Serrolecaniinae Shinji, 1935
<i>Sphaerococcus</i> Maskell, 1892	Sphaerococcini Cockerell, 1899
<i>Trabutina</i> Marchal, 1904	*Trabutini Silvestri, 1939
<i>Trionymus</i> Berg, 1899	Trionymini Tang, 1992

* This name was formed incorrectly by Silvestri (1939) but later corrected to Trabutinae when used as a subfamily name by Bodenheimer (1949).

** We now amend the spelling of the name Mirococcopsiini to Mirococcopsidini Tang.

Acknowledgements

We thank Takumasa Kondo (CORPOICA, Colombia) for reading a draft of the manuscript and an unknown reviewer for useful suggestions.

References

- Ben-Dov, Y. (1994) *A Systematic Catalogue of the Mealybugs of the World (Insecta: Homoptera: Coccoidea: Pseudococcidae and Putoidae) with Data on Geographical Distribution, Host Plants, Biology and Economic Importance*. Intercept Ltd., Andover, U.K., 686 pp.
- Ben-Dov, Y., Miller, D.R. & Gibson, G.A.H. (2009) ScaleNet. <http://www.sel.barc.usda.gov/scalenet/scalenet.htm>
- Bodenheimer, F.S. (1949) *The Coccoidea of Turkey. Diaspididae. A monographic study*. Güney, Ankara, 264 pp.
- Borchsenius, N.S. (1949) Sucking insects, Volume 7, Suborder mealybugs and scale insects (Coccoidea), family mealybugs (Pseudococcidae), *Fauna SSSR, Novaya Seriya*, 33, 383 pp.
- Cockerell, T.D.A. (1905) Tables for the identification of Rocky Mountain Coccidae (scale insects and mealybugs).

Colorado University Studies, 2, 189–203.

- Downie, D.A. & Gullan, P.J. (2004) Phylogenetic analysis of mealybugs (Hemiptera: Coccoidea: Pseudococcidae) based on DNA sequences from three nuclear genes, and a review of the higher classification. *Systematic Entomology*, 29, 238–259.
- Ferris, G.F. (1950) *Atlas of the Scale Insects of North America, Series V, The Pseudococcidae (Part 1)*. Palo Alto, California, Stanford University Press, 278 pp.
- Hardy, N.B. & Gullan, P.J. (2008) Case 3424. Pseudococcini Cockerell, 1905 (Insecta, Hemiptera): proposed precedence over Sphaerococcini Cockerell, 1899. *Bulletin of Zoological Nomenclature*, 65(1), 24–26.
- Hardy, N.B., Gullan, P.J. & Hodgson, C.J. (2008) A subfamily-level classification of mealybugs (Hemiptera: Pseudococcidae) based on integrated molecular and morphological data. *Systematic Entomology*, 33, 51–71.
- Hendricks, H.J. & Kosztarab, M. (1999) Revision of the tribe Serrolecaniini (Homoptera: Pseudococcidae). *Das Tierreich* 113, xiv, 210 pp.
- International Commission on Zoological Nomenclature (1999) *International Code of Zoological Nomenclature*, Fourth Edition. International Trust for Zoological Nomenclature, London. 306 pp.
- International Commission on Zoological Nomenclature (2009) Opinion 2236 (Case 3424) Pseudococcini Cockerell, 1905 (Insecta, Hemiptera): precedence given over Sphaerococcini Cockerell, 1899. *Bulletin of Zoological Nomenclature*, 66(4), 367–368.
- Koteja, J. (1974a) Comparative studies on the labium of the Coccinea (Homoptera). *Zeszyty Naukowe Akademii Rolniczej w Krakowie*, 27, 1–162.
- Koteja, J. (1974b) On the phylogeny and classification of the scale insects (Homoptera, Coccinea) (discussion based on morphology of the mouthparts). *Acta Biologia Craoviencia*, 19, 267–325.
- Koteja, J. (1988) Reviewer's remark, pp. 60–61. In: Kosztarab, M. & Kozár, F. (eds), *Scale Insects of Central Europe*. Akademiai Kiado, Budapest, 456 pp.
- Lobdell, G.H. (1930) Twelve new mealybugs from Mississippi (Homoptera: Coccoidea). *Annals of the Entomological Society of America* 30, 209–236.
- Silvestri, F. (1939) *Compendio di Entomologia Applicata. Parte speciale*. Tipografia Bellavista, Portici, 974 pp.
- Williams, D.J. (1969) The family group names of the scale insects (Hemiptera: Coccoidea) *Bulletin of the British Museum (Natural History) Entomology*, 23, 315–341.