



The hyperdiverse oribatid mite genus *Scapheremaeus* (Acari: Oribatida: Cymbaeremaeidae) in Australia, with descriptions of new species and consideration of biogeographical affinities

MATTHEW J. COLLOFF

CSIRO Entomology, GPO Box 1700, Canberra, ACT 2601, Australia
Matt.Colloff@csiro.au

Table of contents

Abstract	1
Introduction	2
Materials and Methods	3
Descriptions of New Species	3
<i>Scapheremaeus alisonae</i> sp. nov.	3
<i>Scapheremaeus allmani</i> sp. nov.	5
<i>Scapheremaeus baylyi</i> sp. nov.	8
<i>Scapheremaeus bulbosensillatus</i> sp. nov.	11
<i>Scapheremaeus euthemellus</i> sp. nov.	14
<i>Scapheremaeus minjambuta</i> sp. nov.	16
<i>Scapheremaeus nivalis</i> sp. nov.	18
<i>Scapheremaeus notoverrucatus</i> sp. nov.	20
<i>Scapheremaeus tegulatus</i> sp. nov.	22
<i>Scapheremaeus truncatus</i> sp. nov.	24
<i>Scapheremaeus tuberculosus</i> sp. nov.	26
<i>Scapheremaeus walteri</i> sp. nov.	28
<i>Scapheremaeus zephyrus</i> sp. nov.	30
Key to Australian species of <i>Scapheremaeus</i>	32
Results—Species-description Rates	33
Discussion	34
Acknowledgements	36
References	36

Abstract

This paper contains descriptions of thirteen new Australian species of *Scapheremaeus* Berlese, 1910, belonging to the species groups Carinatus from New South Wales and Victoria (*S. alisonae* sp. nov., *S. allmani* sp. nov., *S. nivalis* sp. nov., *S. tuberculosus* sp. nov. and *S. zephyrus* sp. nov.), Patella from Western Australia and Tasmania (*S. baylyi* sp. nov. and *S. tegulatus* sp. nov.), Petrosus from New South Wales, Tasmania, Victoria and Western Australia (*S. bulbosensillatus* sp. nov., *S. euthemellus* sp. nov., *S. minjambuta* sp. nov., *S. notoverrucatus* sp. nov. and *S. truncatus* sp. nov.) and Emarginatus from Queensland (*S. walteri* sp. nov.). Only members of the predominantly Neotropical and Australasian Carinatus species-group have been described from Australia hitherto, and Australian species constitute a third of this group. The Patella species-group is mostly Afrotropical (four spp.), with one Palaeartic and three Australasian species, including the two new species described herein. The Petrosus species-group, previously known from three Palaeartic, two Oriental and one Neotropical species, is now dominated by five new Australian species described herein. The Emarginatus species-group contains one species each from Australia, New Zealand, Java and Cuba. A key to Australian species is provided. The genus *Scapheremaeus* contains some 112 species, and can be

considered hyperdiverse by oribatid standards. Morphological traits are considered that may relate to the ecological diversification and adaptive radiation of *Scapheremaeus*, particularly those related to species living on leaves and stems within rainforest canopies.

Key words: Oribatida, biogeography, taxonomy, Australia, hyperdiversity, species-groups.

Introduction

Scapheremaeus Berlese, 1910 is a cosmopolitan genus of 112 species (including those described herein) of small to medium-sized lenticulate oribatid mites (median length 420 μm , range 260–660), typically with elaborate cuticular ornamentation of plications, tubercles, ridges and foveolae. The cuticle is often covered by a well-developed cerotegument. The notogastral setae are short, spiniform or bacilliform and may be covered with layers of darkened cerotegument rendering the setae club-shaped. Most species are quite markedly dorsoventrally flattened and have a circumdorsal scissure separating the centrodorsal plate from the dorsal and ventral circumnotogastral plates, though this is reduced or lost in a few species. The sensillus is darkly pigmented, invariably with a short, strongly club-shaped head. The legs have truncated, broad tarsi and porose areas may be present on the femora. The few species that have been investigated are sexual, with little in the way of secondary sexual differences other than smaller body size of the males (Travé & Fernandez, 1986). Immatures, where known, are plicate and apherodermous (Hammer, 1958; Pérez-Iñigo & Subías, 1974; Travé & Fernandez, 1986; Fernandez & Cleva, 1997; 2009; Norton *et al.*, 2010). Three quarters of the species-diversity is found in the Neotropical, Australasian and Oriental regions and some 60% of species have been recorded from tropical latitudes. The fossil record includes two arboreal species as inclusions in Baltic amber (Sellnick, 1918; 1931), considered to be mid-Eocene (ca. 44 Mya.). Norton (2006) gives further details of Sellnick's Baltic amber fossil oribatids. A third arboreal species, also mid-Eocene, was found in leaf domatia of 'mummified' *Sloanea australis parvifolia* (Elaeocarpaceae) from clay lenses from Victoria, Australia (O'Dowd *et al.*, 1991).

The genus *Scapheremaeus* can be considered hyperdiverse by oribatid standards. Hyperdiverse genera are those that contain a considerably greater number of species than the most closely-related genera (Moreau, 2008). *Scapheremaeus* is by far the most speciose genus of the Cymbaeremaeoidea, the nearest being *Ametroproctus* Higgins & Woolley, 1968 with only seven species (Subías, 2004), and it is one of the most speciose genera within the Oribatida. Such hyperdiverse taxa, considered to have undergone multiple adaptive radiations, may be characterised as ecologically diverse but morphologically relatively conservative (Pie & Traniello, 2007). Morphological traits that are considered to have promoted rates of speciation, adaptive radiation and, hence, ecological diversification are known as 'key innovations' (Rohde, 1996). Such adaptive traits of hyperdiverse arthropod taxa have been exemplified for weevils (Oberprieler *et al.*, 2007) and for the ant genus *Pheidole* (Pie & Traniello, 2007; Moreau, 2008).

Evidence that *Scapheremaeus* has undergone multiple adaptive radiations includes its global distribution, the presence of biogeographically discrete species-groups, and that it has one of the broadest microhabitat ranges of any oribatid genus, though with a strong tendency towards life above-ground, particularly on plants. Woas (2002) considered that *Scapheremaeus* spp. showed a preference for epiphytic and epilithic habitats and are presumed to feed on lichens and algae. Just under half of the species for which relevant data has been recorded are known from arboreal microhabitats including tree canopies, suspended leaf litter, foliage, epiphytes such as *Tillandsia* spp. ('air plants'), corticolous mosses and lichens and bark. A further 22% are known from saxicolous mosses and lichens and 6% from freshwater or maritime habitats. The remainder are from leaf litter or soil. Several species inhabit dry microhabitats or those subject to periodic inundation or other environmental extremes, such as lichens on exposed basalt (Perez-Iñigo & Peña, 1995), xerophytic shrubs in coastal dunes (Perez-Iñigo & Subías, 1974), dead coral in a salt lake (Willmann, 1936), semi-arid *Eucalyptus* and *Casuarina* woodland litter (Colloff, 2009), adjacent to thermal springs (Hammer, 1966), nests of seabirds (Aoki, 1964; 1966), in stream beds (Hammer, 1971; Mahunka, 1978; 1983; 1987) and temporary pools on granite outcrops (Norton *et al.*, 2010, and as described herein). Macrohabitat range is similarly