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A new species of *Carldrakeana* (Insecta: Heteroptera: Tingidae) from Western Australia

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Abstract - This paper describes the fifth species of lacebug (Tingidae) in the genus *Carldrakeana*, and the first to be recorded from Western Australia, *Carldrakeana karli* sp. nov. It is restricted to the southwest of Western Australia. In addition, a key to all species of the genus is provided.

INTRODUCTION

Carldrakeana was described by Froeschner (1968) to separate species of the genus *Gonycentrum* Bergroth, 1898 from those of the Australian region. *Carldrakeana* differs from *Gonycentrum* in lacking cephalic spines between the eyes. However, *Carldrakeana* has been assigned by Froeschner (1996) to Cantacaderini, while *Gonycentrum* belongs to Phatnomatini. *Carldrakeana* was considered of interest by Froeschner (1968, 1996) as the link between the two tribes Cantacaderini and Phatnomatini, forming the Cantacaderinae, one of the three subfamilies included in the Tingidae. The character linking these tribes was the presence of a stenocostal area, characteristic of the Cantacaderini, which is partially absent in *Carldrakeana*.

The relationships between these two tribes has been recently discussed (Lis 1999; Schuh *et al.* 2006), with the result of Phatnomatini being removed from Cantacaderinae. However, the position of Phatnomatini remains unclear. *Carldrakeana* is currently assigned in Cantacaderinae as basal, and a sister group of *Cyperobia* Bergroth, 1926 and *Stenocader* Drake and Hambleton, 1944, on the basis of a stenocostal area developed only ventrally (see Lis 1999; Schuh *et al.* 2006).

Carldrakeana is endemic to Australia and New Zealand, and currently consists of four species: *C. engista* (Drake and Ruhoff, 1961) from Queensland; *C. pallida* Lis from New South Wales; *C. tindalei* (Hacker) from South Australia and Victoria; and *C. socia* (Drake and Ruhoff, 1961) found in Tasmania, South Australia and New Zealand. Here, we describe a new species of *Carldrakeana*, the first to be recorded from Western Australia, and thus, the most western locality recorded to date for this genus.

MATERIALS AND METHODS

The specimens examined here were collected by beating or vacuuming (as described in Moir *et al.* 2005a), subsequently removed from any solutions and pinned. Specimens were examined under Leitz TS microscope and Leica MZ16 stereoscope, and images were photographed using the Auto-montage Pro version 5.02(p) (Syncroscopy, Cambridge, UK) at the Western Australian Museum. Illustrations were prepared using Photoshop(R) from penciled originals.

The following abbreviations have been used in this paper: AgWA, Department of Agriculture, Perth, Western Australia; WAM, Western Australian Museum, Perth, Western Australia; MNHN, Muséum National d'Histoire Naturelle, Paris, France. The list of abbreviations given after the site number of collection localities provides information on collection details. At Boddington the site code "SSBO2" indicates a forest control site and "WP90" a mine pit rehabilitated in 1990 (G. Oraby, pers. comm. 2006). Jarrahdale (32°16'S, 116°04'E) and Boddington (32°38'S, 116°25'E) are dominated by Jarrah/Marri forest (*Eucalyptus marginata* Sm. and *Corymbia calophylla* (Lindl.)). The site in the Ravensthorpe Ranges (Gully WAM35: 33°30'17'S 120°02'01'E) was dominated by a mallee *Eucalyptus* species (Harvey and Leng 2008). Specimens from Jarrahdale and Boddington have been donated from the private collection of the second author.

SYSTEMATICS

Family Tingidae Laporte, 1832

Subfamily Cantacaderinae Stål, 1873

Tribe Cantacaderini Stål, 1873

Genus *Carldrakeana* Froeschner, 1968

Carldrakeana Froeschner, 1968: 250.

Type species

Phatnoma tindalei Hacker, 1928, by original designation.

Carldrakeana karli sp. nov.

(Figures 1–2)

Material examined

Holotype

Australia: *Western Australia*: 1 ♂, site SSBO2 (vacuum), WP90 (vacuum), Boddington, July 2003, G. Oraby (WAM Entomology No. 71382).

Allotype

Australia: *Western Australia*: 1 ♀, site WP90, Boddington, July 2003, G. Oraby (WAM Entomology No. 71383).

Paratypes

Australia: *Western Australia*: 1 ♂, site MO4J, Boddington, April 2004, G. Oraby (MLM 00199); 1 ♀, same as Holotype (MLM 00198); 3 ♀, on *Mirbelia dilatata* (vacuum), Jarrahdale, August 2001, M. Moir (WAM Entomology No. 33045, Entomology No. 33046, Entomology No. 71384); 1 ♀, site B88R3a (vacuum), Jarrahdale, August 2001, M. Moir (MLM 00195); 3 ♂, 1 ♀, Ravensthorpe Range, Site Gully WAM35, 33°30′17″S 120°02′01″E, 23 May 2007, M.L. Moir & M.C. Leng, ex. *Rhadiothamus rudis* (beat) (2 ♂, MNHN; 1 ♂, 1 ♀, MLM 00692, 00693).

Diagnosis

Carldrakeana karli differs from all other previously named species within the genus by the paranota, which is reduced to three or four cells opposite the calli, and by the presence of a pseudo-protuberance at the anterior end of the lateral carinae, just behind the calli.

Description

Body coleopteroid, small, dark brown, shiny, glabrous; frontal spines, front of bucculae, posterior margin of pronotum, anterior apex of median carinae, spots on hemelytra on costal and subcostal areas and veins on discoidal area whitish. Male body length, 2.26–2.50 mm; width, 1.03–1.20 mm. Female body length, 2.73–2.83 mm; width, 1.40–1.53 mm.

Head small, short, abruptly shortened in front, glabrous, punctate, armed with two pairs of spines, a jugal pair of very short spines, a pair of short frontal spines directed downwards; bucculae long, extending in front of clypeus, joined in front, widening posteriorly, with two rows of areolae; rostrum very long, extending beyond metasternum; antennae very slender, antennal segment measurements, I, 0.08 mm; II, 0.07 mm; III, 0.90 mm; IV, 0.18 mm.

Pronotum short, convex, truncate posteriorly, tricarinate; median carina slightly raised, irregularly uniseriate, areolae small; lateral carinae short, extending on to calli but not to collar, less elevated than median carina except anterior apex which is raised to form a small protuberance; calli slightly raised anteriorly but not forming a hood, three areolae wide; paranota reduced to a row of three to four small, round areolae opposite calli; sternal laminae straight and narrow, uniseriate. Visible part of scutellum reduced to an erect protuberance.

Hemelytra oval, strongly swollen; clavus fused with the rest of the wing; hindwings absent; stenocostal and costal areas sharply raised, almost vertical, stenocostal vein thickened ventrally but indistinct dorsally, uniseriate; costal area regularly uniseriate, areolae slightly smaller than stenocostal area; subcostal area sharply raised and almost vertical, much wider than costal area, five to six areolae wide at widest part, areolae wider than on costal and stenocostal areas, divided by three prominent cross veins; RM vein sharply raised; discoidal area divided by cross veins in three subareas, four to five areolae deep; sutural area narrow, two areolae wide at widest part; hypocostal area uniseriate, reaching apex of hemelytra, posteriorly interrupted on distal two thirds, areolae as small as stenocostal area.

Etymology

This species is named in honour of Dr Karl Brennan, who has worked on invertebrates across Australia for many years, but in particular, at Jarrahdale, where the first specimens of this species were discovered.

Common name

Karl's lacebug.

Remarks

This species clearly belongs to the genus *Carldrakeana* as distinguished by the straight posterior margin of the pronotum (not angularly concave as for *Cyperobia* Bergroth, 1927), the absence

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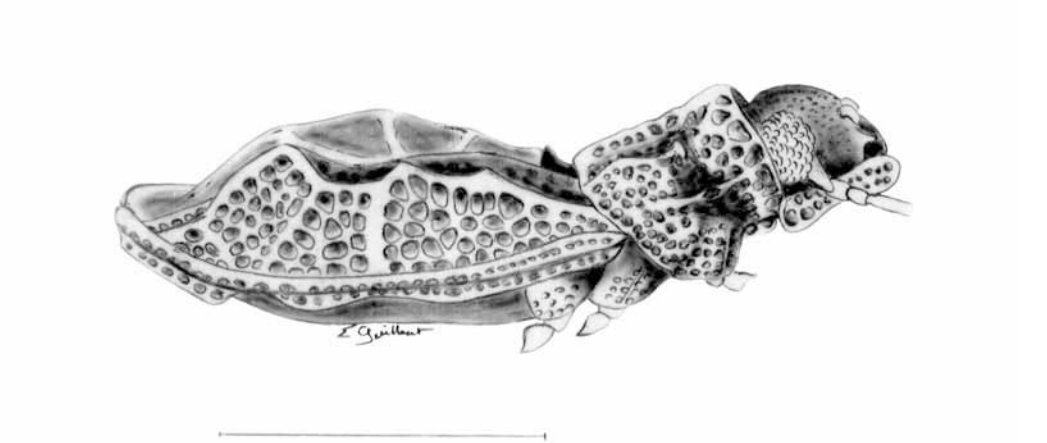

2

Figures 1–2 *Carldrakeana karli* sp. nov.: 1. habitus (Paratype WAM T71384), 2. lateral view (Holotype WAM T 71382). Scale bar = 1 mm.

of fine, black, oblique sutures on the interocular area of the head (which separate *Carldrakeana* from *Cyperobia*), the pronotum tricarinate (while pentacarinate in *Cyperobia* and *Stenocader*), and the Cu vein almost indistinct and not fused with R+M (while fused in *Cyperobia* and not fused but distinct in *Stenocader*). However, it has a narrow paranota similar to that of *Cyperobia carectorum* Bergroth, 1927. This species also shares the lack of any tubercles on the first visible abdominal sternite with *Cyperobia*, while other species of *Carldrakeana* have these tubercles. Here, the development of the stenocostal area is quite complete but visible only from the ventral view, not the dorsal view; a character that justifies the inclusion of the genus in Cantacaderini, according to Froeschner (1968, 1996). In *C. karli*, the vein between the two rows of areolae is not thickened dorsally but is ventrally, a character shared with *Stenocader* and *Cyperobia* (Lis 1999). Also, as stated by Froeschner (1996), the costal area of species with a single row of cells does not show differentiation between an outer and inner part. It is thus difficult to state if the row belongs to the costal or the stenocostal area. There is also a degree of sexual dimorphism; females are larger than the males and they have a continuous hypocostal area, whereas it is interrupted in males.

Carldrakeana karli differs from the other known species of the genus by the swollen pronotum and the narrower paranota that are reduced to a few areolae opposite the calli. Other species of *Carldrakeana* have paranota that are at least uniseriate. Also, it differs by the pseudo-protuberance at the anterior end of the lateral carinae, just behind the calli.

The other species of the genus can be separated as follows:

Carldrakeana engista has a uniseriate costal area; flat, narrow and uniseriate paranota, and unicarinate pronotum.

Carldrakeana socia has a second row of areolae on the apical third of the costal area. The paranota are similar to that of *C. engista* and are slightly raised.

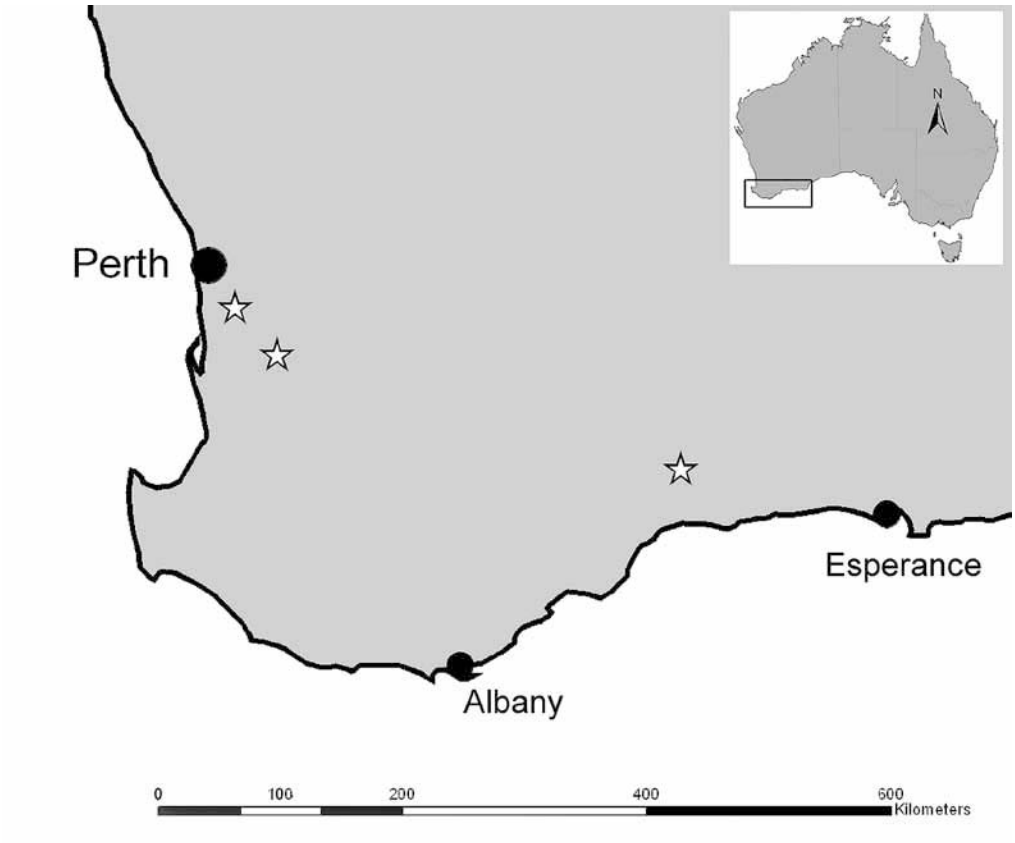

Figure 3 Map of southwestern Western Australia with collection localities of *Carldrakeana karli* sp. nov.

The pronotum is tricarinate. The cephalic spines are short but longer than the ones on *C. karli*. The hypocostal area is truncated posteriorly on the holotype.

Carldrakeana tindalei (Hacker, 1928) has an irregularly biseriate costal area. The paranota are flat (not raised or reflexed), wider than that of *C. engista* and *C. socia*, and partly biseriate. It has short cephalic spines.

Carldrakeana pallida Lis, 2000 has a uniseriate costal area partly absent on basal two thirds, a tricarinate pronotum, and longer cephalic spines than the other species.

IDENTIFICATION KEY TO SPECIES

Here, we present a modified version of the key to *Carldrakeana* species as proposed by Froeschner (1996) to include *C. pallida* and *C. karli*:

1. Pronotum unicarinate ..... ***C. engista***

   Pronotum tricarinate **2**

2. Paranota reduced to three or four cells opposite to calli ..... ***C. karli***

   Paranota developed all along the pronotum and mainly uniseriate **3**

3. Costal area irregularly biseriate at base* .....
   ..... ***C. tindalei***

   Costal area biseriate only on apical third or less. **4**

4. Cephalic spines long, surpassing 1st antennal segment ..... ***C. pallida***

   Cephalic spines short, not surpassing 1st antennal segment ..... ***C. socia***

* Costal and stenocostal areas are considered together, following Froeschner (1996).

DISCUSSION

Carldrakeana is thought to be an older Cantacaderinae genus because of its occurrence in both Australia and New Zealand, the latter being the first landmass to break away from Gondwana about 125 MYBP (see Lis 1999; Wappler 2006). The genus includes species that have been recorded feeding on moss and/or lichens (Hacker 1928; Lis 2000). Most species appear to prefer wet, predominantly southern habitats where moss and lichens are readily available. However, *C. karli* differs considerably from other species in the genus, clearly preferring the host plants *Mirbelia dilatata* (Papilionaceae) in the Jarrah forest and *Rhadinothamnus rudis* (Rutaceae) in the Ravensthorpe Ranges. Despite 18 months of

sampling at Jarrahdale (> 50 plant species sampled including various *Papilionaceae* species – see Moir *et al.* 2005b, Moir 2006), and a month sampling in the Ravensthorpe Ranges by two people, no other host was recorded. Furthermore, other methods used during the Boddington study (pitfall traps and Tullgren funnels) failed to yield additional specimens.

It is interesting that males appear to be found only during winter (late May-July), but are absent in spring. Females have been found from late May through to November, but are most abundant in August (at Jarrahdale). No specimens were found during summer or autumn (December-April) and no nymphs have been discovered to date. This suggests that *C. karli* has only one generation per year, with mating occurring in winter.

All species are known only from coleopteroid forms, and *C. engistum* and *C. socia* are recorded as brachypterous (Drake and Ruhoff 1961). For *C. karli* the lack of hindwings indicates an inability to fly, which likely inhibits dispersal. At Jarrahdale and Boddington, specimens were discovered as part of projects to determine if the native insect fauna were returning to restored mine pits. *Carldrakeana karli*, however, did not appear to be dispersal limited, with individuals discovered in relatively young restored mine pits (4–6 years old) at Jarrahdale (Moir 2006).

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