

Two new species of the lacebug genus *Radinacantha* (Hemiptera: Heteroptera: Tingidae) from Australia

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Abstract - This paper describes the fourth and fifth species of *Radinacantha* (Tingidae), a lacebug genus endemic to Australia and Madagascar. *Radinacantha darwini* sp. nov. is restricted to southwestern Western Australia. In contrast, *Radinacantha dondiorum* sp. nov. is found on the mid north coast of New South Wales. A key to species of the genus is provided and host associations are discussed.

INTRODUCTION

In Australia, the Gondwanan lacebug genus *Radinacantha* Hacker, 1929 (Hemiptera: Heteroptera: Tingidae) is represented by two described species. *Radinacantha reticulata* Hacker, 1929 has been recorded from Queensland and Victoria (Hacker 1929; Drake and Ruhoff 1960, 1965; Cassis and Gross 1995), with recent new records for Western Australia and Tasmania (Moir, unpublished data). *Radinacantha tasmanica* Hacker, 1929 was originally described from Tasmania (Hacker 1929); however, Cassis and Gross (1995) extended the distribution to include Victoria, New South Wales, Northern Territory and Western Australia. *Radinacantha prudens* Drake and Poor is the only species represented outside Australia, being present in Madagascar (Drake and Poor 1937; Drake and Ruhoff 1960, 1965).

Here, I describe two additional species, *Radinacantha darwini* sp. nov., which is restricted to the southwest of Western Australia, and *Radinacantha dondiorum* sp. nov. from the mid north coast of New South Wales. In addition, a key to species of the genus is provided.

MATERIALS AND METHODS

The specimens examined here were collected in the field by beating or vacuum sampling (see Moir *et al.* 2005a for a description of these methods) and preserved in 75% ethanol or pinned. Specimens are deposited in the Western Australian Museum, Perth (WAM), the Agriculture Department of Western Australia, Perth (AGWA), the M.L. Moir personal collection, Kalgoorlie (MLM), the New South Wales Agricultural Scientific Collections Unit, Orange (ASCU), and the J.W. Evans collection, The Australian Museum, Sydney (JWE).

Specimens were examined with a Leica MZ6 stereo microscope, and all images were produced using a MZ16 stereo microscope and the package Auto-montage Pro version 5.02(p) (Syncroscopy, Cambridge, UK). A map of species distribution was produced in ArcGIS Version 9.1 (Environmental Systems Research Inc.). Tingidae terminology follows Froeschner (1996) and Lis (2003).

SYSTEMATICS

Family Tingidae Laporte, 1832

Subfamily Tinginae Laporte, 1832

Tribe Tingini Laporte, 1832

Genus *Radinacantha* Hacker, 1929

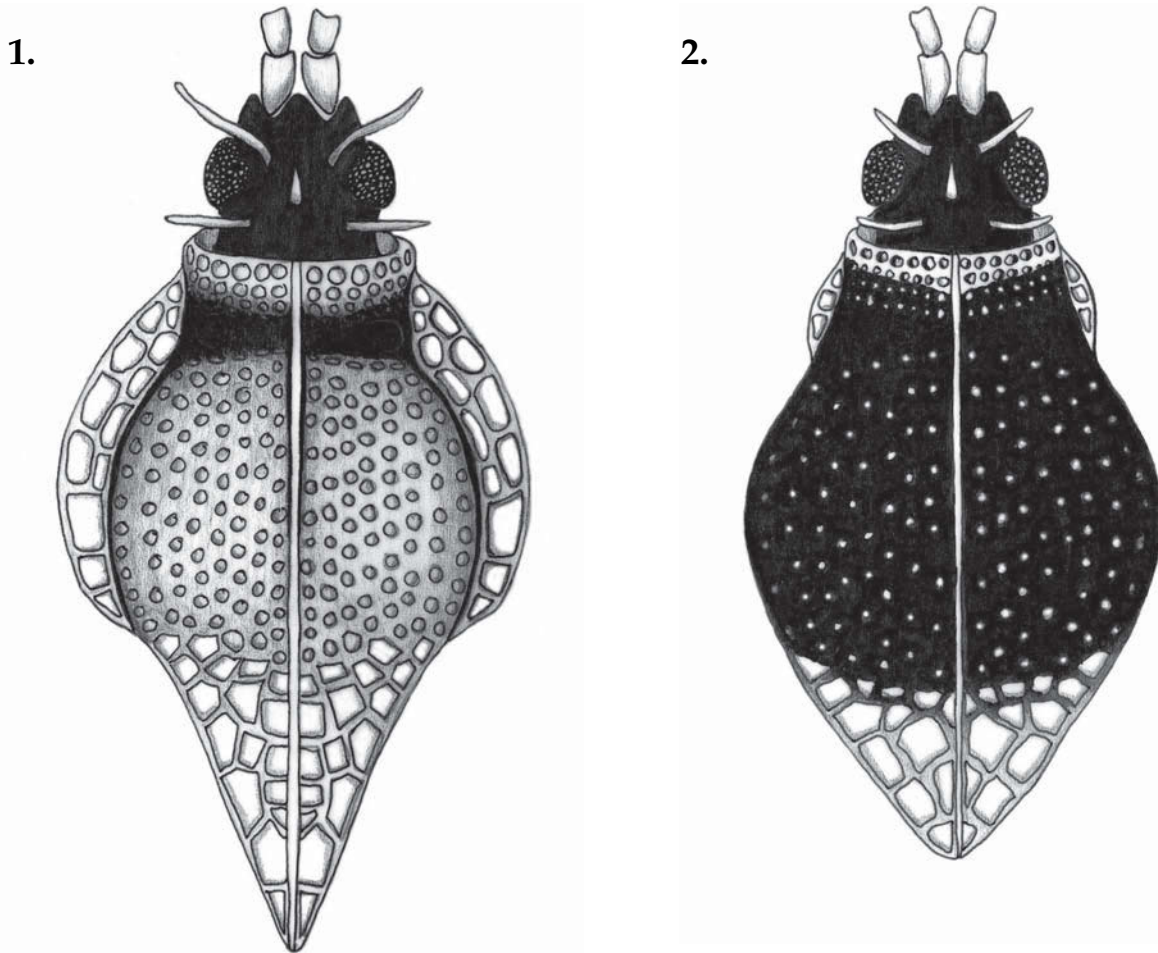
Radinacantha Hacker, 1929: 330.

Type species

Radinacantha reticulata Hacker, 1929, by original designation.

Remarks

Tingid taxonomy is based solely on the external morphology, often without any description of the genitalia, that are minimally diagnostic (e.g. Lis 2000; Guilbert 2006, 2007; Schuh *et al.* 2006). *Radinacantha* is distinguished from other genera within the subfamily Tinginae present in Australia by the lack of inflated regions, spines or hairs on the dorsal surface, five cephalic processes, a single median pronotum carina, and very large costal areolae, especially when compared with those areolae of the subcostal area (e.g. Figures 3–6; Hacker 1929).



Figures 1–2 Head, collar and pronotal regions of 1, *Radinacantha darwini* sp. nov.; 2, *Radinacantha dondiorum* sp. nov.

KEY TO SPECIES OF RADINACANTHA

- 1. Paranota large, encompassing both pronotum and collar (Figures 1, 3).....
 *Radinacantha darwini* sp. nov.
- Paranota small, or appearing absent, restricted to collar and/or calli region (Figures 2, 4).....
 2
- 2. Costal region with two rows of areolae on anterior half, a single row of areolae for remainder of length (Figure 4).....
*Radinacantha dondiorum* sp. nov.
- Costal region with a single row of areolae (Figures 5, 6)..... 3
- 3. Posterior cephalic (occipital) spines at least twice as long as other cephalic spines.....
*Radinacantha prudens* Drake & Poor
- All cephalic spines approximately equal in length..... 4
- 4. Paranota visible from dorsal view, consisting of a single row of areolae, cephalic spines longer than eyes and 1st antennal segment (Figure 5)

..... *Radinacantha reticulata* Hacker

Paranota visible only as a raised ridge, cephalic spines small, not exceeding eyes or 1st antennal segment (Figure 6).....

..... *Radinacantha tasmanica* Hacker

Radinacantha darwini sp. nov.

Figures 1, 3, 7

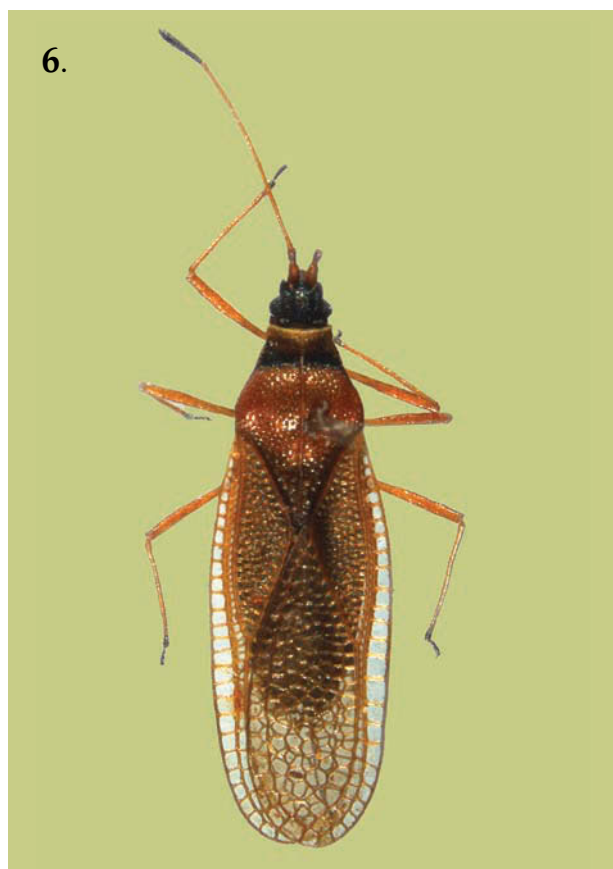
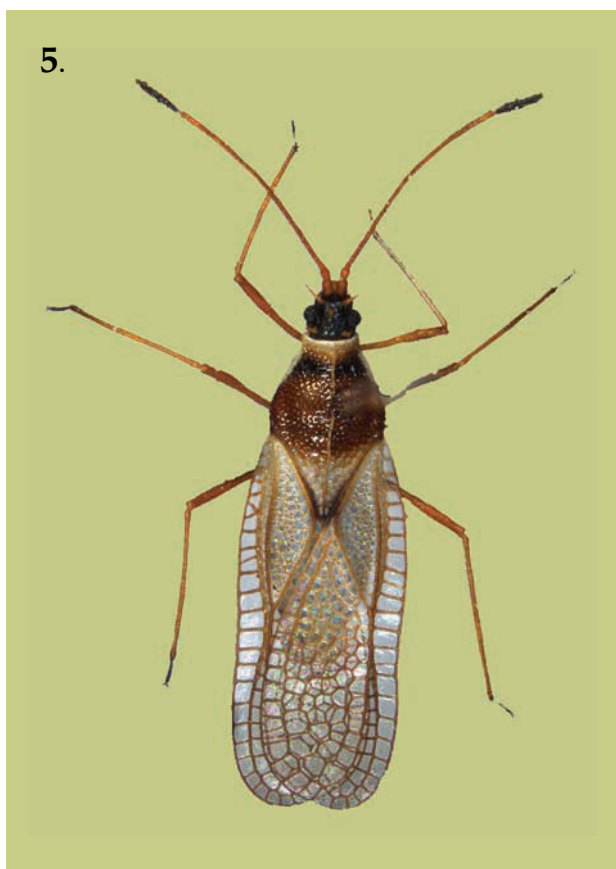
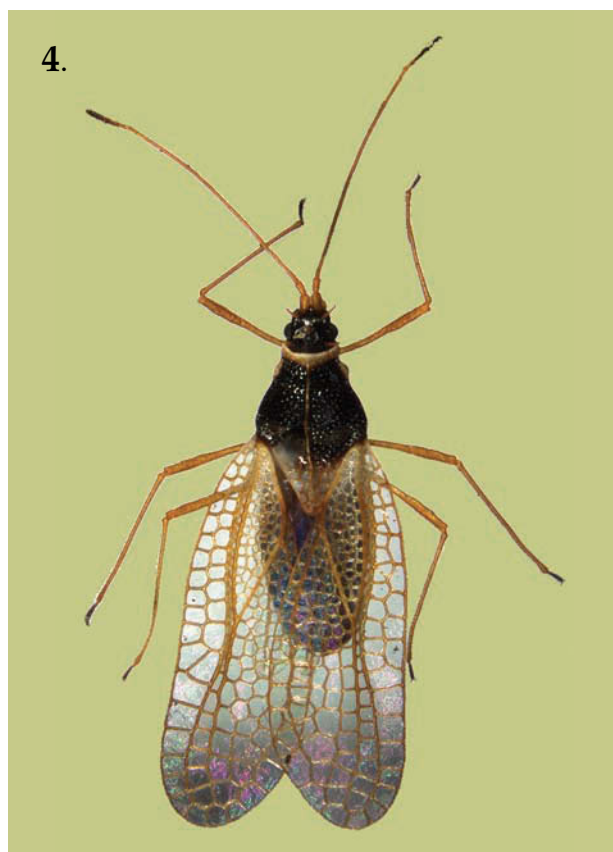
Material examined

Holotype

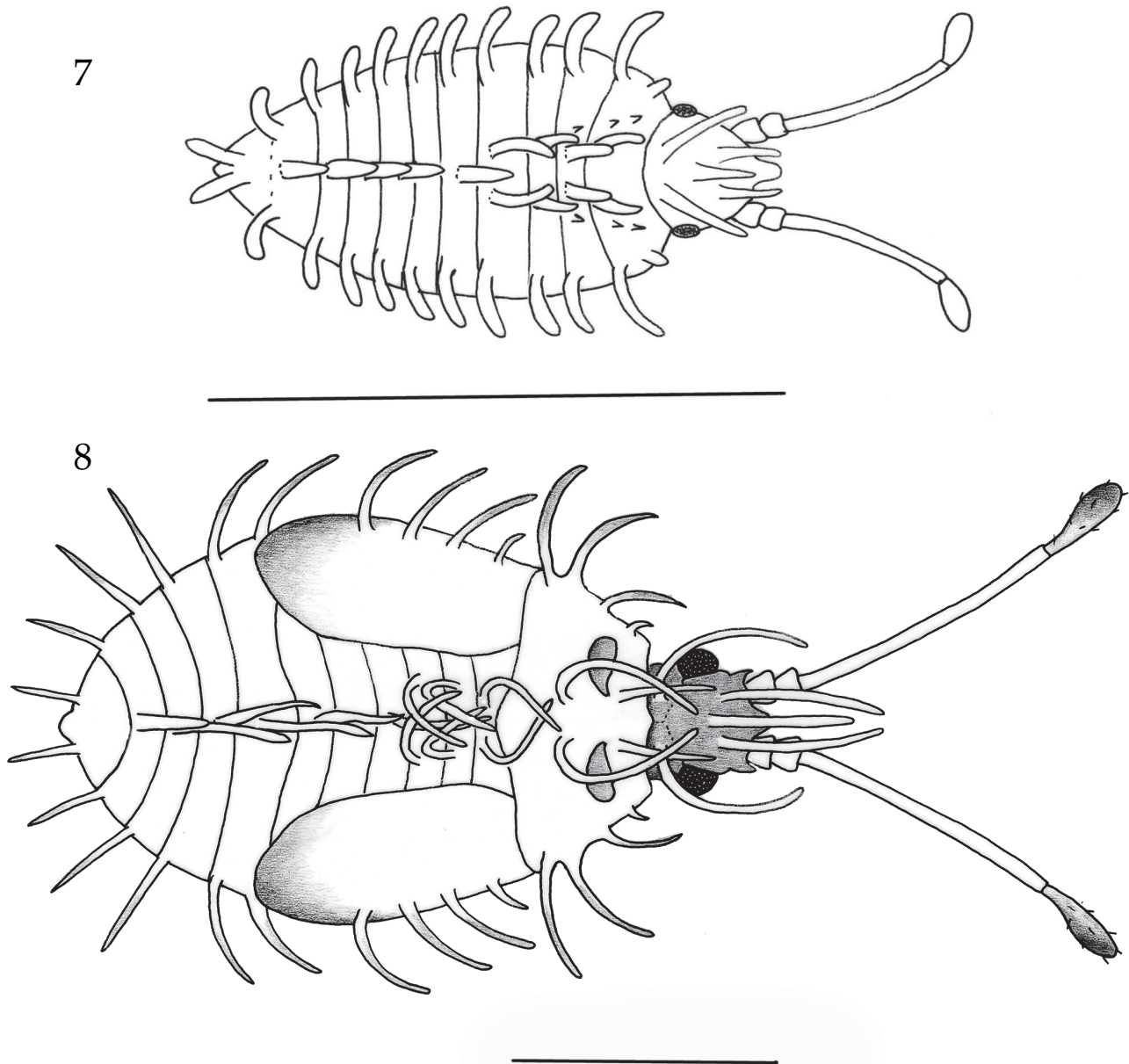
Australia: Western Australia: ♂, Stirling Range National Park, Mt Trio, 722m, 34°21'07"S, 118°06'19"E, ex *Gastrolobium tetragonophyllum*, beat, 7 November 2007, M.L. Moir (WAM T71385).

Paratypes

Australia: Western Australia: 4 ♂, 1 ♀, Pingelly [32°32'02"S, 117°05'10"E], October 1966, J. W. Evans (JWE, currently on loan to ASCU, numbers ASCT00172695 - ASCT00172699); 2 ♂, Stirling Range National Park, Mt Trio, 493 m, 34°20'38"S, 118°06'37"E, ex *Gastrolobium tetragonophyllum*, beat,



Figures 3–6 Dorsal views of the Australian species of *Radinacantha* 3, *Radinacantha darwini* sp. nov. paratype (MLM 00701); 4, *Radinacantha dondiorum* sp. nov. paratype (ASCU ASCT00024955); 5, *Radinacantha reticulata* Hacker, 1929; 6, *Radinacantha tasmanica* Hacker, 1929.



Figures 7–8 Dorsal view of nymphs of *Radinacantha darwini* sp. nov. 7, 1st instar; 8, 5th instar. Scale line = 1 mm.

7 November 2007, M.L. Moir (AGWA 140628–9); 2 ♂, 9 nymphs, Stirling Range National Park, Mt Talyuberlup, 351 m, 34°24'51"S, 117°57'26"E, ex *Gastrolobium bilobum*, beat, 29 October 2007, M.L. Moir (WAM T71386, T71389–98); 1 ♂, Stirling Range National Park, Mt Trio, 493 m, 34°20'38"S, 118°06'37"E, ex *Gastrolobium tetragonophyllum*, vacuum, 7 November 2007, M.L. Moir (MLM 00703); 1 ♂, 1 ♀, Stirling Range National Park, Central Lookout, 354 m, 34°25'20"S, 117°56'00"E, ex *Mirbelia dilatata*, beat, 28 November 2007, M.L. Moir (WAM T71387–8); 1 ♀, 7 nymphs, Stirling Range National Park, creek SE of Bluff Knoll, 296 m, 34°22'52"S, 118°17'21"E, ex *Gastrolobium leakeanum*, vacuum, 20 November 2007, M.L. Moir (MLM 00705–00708); 1 nymph, Stirling Range National Park, Mt Trio,

722 m, 34°21'02"S, 118°06'50"E, ex *Gastrolobium crenulatum*, vacuum, 4 November 2007, M.L. Moir (AGWA 140630).

Other material examined

Australia: Western Australia: 1 nymph, Stirling Range National Park, creek SE of Bluff Knoll, 296 m, 34°22'52"S, 118°17'21"E, ex *Gastrolobium pulchellum*, vacuum, 19 October 2007, M.L. Moir and K.E.C. Brennan (MLM 00711); 1 nymph, Stirling Range National Park, Bluff Knoll, 1039 m, 34°22'51"S, 118°18'02"E, ex *Gastrolobium pulchellum*, vacuum, 17 November 2007, M.L. Moir (MLM 00709); 2 ♂, 2 ♀, 6 nymphs, Jarrahdale, ex *Mirbelia dilatata*, vacuum /beat, November 2001, M.L. Moir (MLM 00861–6); 1 adult, Nannup [33°58'55"S, 115°45'54"E],

ex aphid trap, F. Berlandier (AGWA 18922); 1 adult, Albany [35°01'05"S, 117°53'02"E], 19 January 1990, F. Berlandier (AGWA 18923 – specimen damaged).

Diagnosis

Radinacantha darwini is most similar to *Radinacantha reticulata*, but differs from the latter by the large paranota, which extend posteriorly to encompass both the pronotum and collar, whereas the paranota only reaches the anterior margin of the pronotum in *R. reticulata* (see Figures 3 and 5).

Description

Body measurements. ♂ 6.00 ± 0.15 mm (n = 6), ♀ 6.12 ± 0.25 mm (n = 6).

Colour. Head, eyes, collar at calli region, body, genital capsule, 4th antennal segment, and tarsi black. Remaining leg and antennal segments golden brown. Cephalic spines and reticulated veins of forewings also golden brown (Figure 3). Pronotum golden brown, with black lateral edges. Anterior margin of collar yellowish white.

Head and antennae. Head with five very long, cephalic spines, extending to end of 2nd antennal segment (Figure 1). Antennophore short and rounded. Antennae slender, antennal segments measurements: I, 0.10 mm; II, 0.08 mm; III, 1.90 mm; IV, 0.40 mm. Fourth antennal segment pilose. Rostrum extending to mesosternum.

Body. Macropterous. Collar four small areolae wide. Pronotum convex, large; single, median carinae consisting of one row of areolae. Paranota large, consisting of two rows of large areolae and encompassing most of the length of the collar and all of pronotum (Figure 1). Posterior margin of paranota recurved. Forewings (or hemelytra) slightly wider than pronotum. Lateral margins slightly convex, constricted at end of abdomen, and expanding again on posterior third (Figure 3). Posterior margin angulate. Costal and subcostal regions each consisting of one row of rectangular areolae, with those of the costal region very large. Hind wings narrow and relatively short, reaching end of abdomen, half the length of forewings.

Nymphs. All instars white, with antennae and legs yellow and tarsi black. Additionally, 5th instar with 4th antennal segment, head, tips of abdominal tubercles (or spines), and posterior half of wing pads black (Figure 8). Head armed with five long tubercles; an occipital pair, a median unpaired and a posterior pair. Fourth antennal segment of 5th instar slightly pilose, with sparse short hairs (Figure 8). Pronotum, mesonotum, metanotum, and tergite I of 1st and 2nd instars with one long simple tubercle on posterior lateral margin, and central pair of dorsal tubercles (Figure 7). Pronotum of remaining instars slightly produced posteriorly

over abdomen, with three long tubercles plus one short tubercle on lateral margins, and two central pairs of dorsal tubercles (Figure 8). Wing pads apparent in 3rd, 4th and 5th instars. Mesonotum, metanotum, and tergite I of 2nd, 3rd, 4th and 5th instars with one long simple tubercle on posterior lateral margin and pair of long medium tubercles (Figure 8). Abdominal tergites of all instars with single long tubercle on posterior lateral margins. Tergites I, IV, V, VI, and VII with long central tubercle.

Etymology

This species is named in honour of Charles Darwin for his ground-breaking theories on evolution (e.g. Darwin 1859).

Common name

Darwin's lacebug.

Radinacantha dondiorum sp. nov.

Figures 2, 4 and 7

Material examined

Holotype

Australia: New South Wales: ♂, Bulls Ground State Forest, 31°20'20"S, 152°23'20"E, ex *Podolobium ilicifolium*, beat, November 2005, M.L. Moir (ASCU ASCT00024954).

Paratypes

Australia: New South Wales: 2 ♀, collected with holotype (ASCU ASCT00024955, MLM 00701).

Diagnosis

Radinacantha dondiorum could be confused with either *R. reticulata* or *R. tasmanica*, but differs from both species by the double row of areolae on the anterior half of the costal region, whereas a single row of areolae is present for the entire length in the other species (see Figures 4–6).

Description

Body measurements. ♂ 5.60 mm (n = 1), ♀ 5.65 ± 0.07 mm (n = 2).

Colour. Head, eyes, collar at calli region, body, genital capsule, pronotum, 4th antennal segment, and tarsi black. Remaining leg and antennal segments golden brown. Cephalic spines and reticulated veins of forewings also golden brown. Anterior half of collar white.

Head and antennae. Head with five long, cephalic spines, extending to anterior margin of 1st antennal segment (Figure 2). Antennophore short and rounded. Antennae slender, antennal segments measurements: I, 0.10 mm; II, 0.09 mm; III, 1.40



Figure 9 Map of Australia with collection localities of Australian *Radinacantha* species. Symbols represent the following: diamonds - *R. darwini*; star - *R. dondiorum*; circles - *R. reticulata*; and crosses - *R. tasmanica*. Empty symbols with a question mark represent state records presented by Cassis and Gross (1995) without specific localities provided.

mm; IV, 0.35 mm. Fourth antennal segment pilose. Rostrum extending to mesosternum.

Body. Macropterous. Collar four small areolae wide. Pronotum convex, single median carinae consisting of one row of areolae. Paranota very small, consisting of one row of small areolae, extending from second row of areolae on collar to posterior margin of calli (Figure 2). Forewings (or hemelytra) two times wider than pronotum. Lateral margins almost straight, slightly convex. Costal region consisting of double row of trapezoid and pentagonal areolae on anterior half, and one row of large, square areolae on posterior half (Figure 4). Subcostal region consisting of one row of square areolae. Hind wings narrow and relatively short, reaching end of abdomen, half the length of forewings.

Nymphs. Nymphs unknown.

Etymology

This species is named in honour of my parents, Donald and Dianne Moir, who have encouraged my love of animals from a young age.

Common name

Don and Di's lacebug.

DISCUSSION

A survey of the recolonisation of Hemiptera into restored bauxite mines (see Moir *et al.* 2005b) led to the discovery of *R. darwini* in jarrah (*Eucalyptus marginata* Sm.) forest at Jarrahdale (ca. 40 km south of Perth). Subsequent work has discovered *R. darwini* approximately 300 km further south in heathland and *Eucalyptus* forest of the Stirling Range National Park. Further specimens in other collections extend the distribution to as far south as Albany and west to Nannup (Figure 9). I have

unsuccessfully searched for this species in other possible locations east of current records, including along the south coast, the Wheatbelt and Goldfields regions of Western Australia. Thus, it appears that *R. darwini* is restricted to western regions with rainfall exceeding 400 mm/per annum. The two studies at Jarrahdale and the Stirling Ranges has revealed that adults of *R. darwini* tend to be present from October through to February, and nymphs are most abundant in August through to November.

Radinacantha dondiorum prefers a region with even higher rainfall, having only been found inland from Port Macquarie, in coastal blackbutt (*Eucalyptus pilularis* Sm.) forests (1288 mm/per annum). The recorded host species *Podolobium ilicifolium* (Andrews) has a wide distribution along the East coast of Australia, including northeastern Victoria and southeastern Queensland (CHAH 1995–2002); therefore, it is possible that further range extensions will occur with additional sampling, or may be discovered in other entomological collections.

All species of *Radinacantha* may be restricted to Fabaceae, particularly within the tribe Mirbelieae. In addition to *R. dondiorum* feeding on *P. ilicifolium* (Mirbelieae: Fabaceae), I have found *R. tasmanica* feeding on *Pultenaea glabra* Benth. and *P. stipularis* Sm. (Mirbelieae: Fabaceae) in New South Wales. *Radinacantha reticulata* has been found commonly on *Daviesia villifera* Cunn. (Mirbelieae: Fabaceae) in Queensland, plus *Templetonia retusa* (Vent.) (Brongniartieae: Fabaceae) in Western Australia (Moir unpubl. data). *Radinacantha darwini* feeds, and completes its life-cycle, on *Mirbelia dilatata*, *Gastrolobium leakeana*, *G. bilobum*, *G. tetragonophyllum* and *G. crenulatum* (Mirbelieae: Fabaceae) (Moir unpubl. data). Such close phylogenetic links between insect herbivores and their host plants is not surprising; however, these are the first published records of any host associations for the genus *Radinacantha*.

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