

Tardigrades of the Australian Antarctic: *Hypsibius heardensis* (Eutardigrada: Hypsibiidae: *dujardini* group) a new species from sub-Antarctic Heard Island

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Abstract

A new species, *Hypsibius heardensis* sp. nov. (Tardigrada: Eutardigrada: Hypsibiidae) is described from samples collected during the Australian National Antarctic Research Expeditions (ANARE) 1986-87 expedition to Heard Island, in the southern Indian Ocean. The new species belongs to the *dujardini* group and differs from similar species of *Hypsibius* by the absence of eyes, large apophyses, near equal macroplacoids, lack of a microplacoid, the presence of a small septulum, and cuticular bars near the base of all claws.

Key words: Tardigrada, *Hypsibius heardensis* sp. nov., Heard Island, Antarctica

Introduction

Heard Island (53° 06' S, 73° 30' E) (Figs 1A, B), is located in the southern Indian Ocean to the south of the Polar Frontal Zone, only 1650 km north of Antarctica, and about midway between Australia (4350 km to the east), and South Africa (4850 km to the west) (Clark *et al.* 1983). The island is mainly volcanic, built on pelagic limestone of Miocene age (Barling 1990; Clarke *et al.* 1983), and approximately 40 km long by 20 km wide (an area of 367 km²), with one main peak, Big Ben, rising to 2745 m (Allison & Keage 1986). Though extensively ice covered, between 1985 and 2000/01 there has been a substantial reduction in ice extent, which has reduced from over 80% to approximately 69% of total surface area (Ruddell, per. comm.).

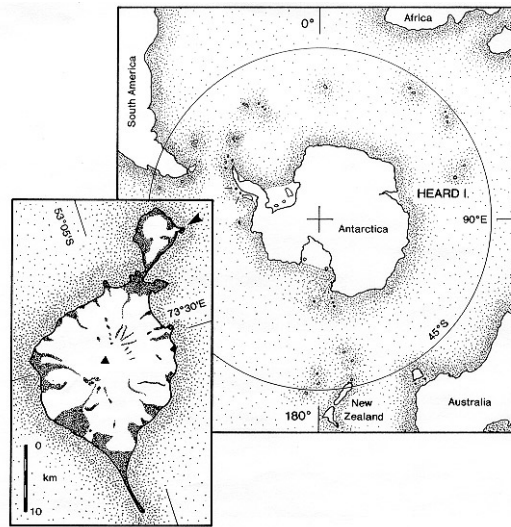


FIGURE 1. A, Antarctica and the sub-Antarctic islands in a polar projection, showing the position of Heard Island. B, Heard Island. Red Island, a promontory off Laurens Peninsula to the northwest indicated with an arrow.

Published information on tardigrades from Heard Island is extremely limited, with one species reported (*Macrobotus tetradactyloides* (Richters, 1907) now *Isohypsibius tetradactyloides*) by the 1901–1903 German Antarctic Expedition (Richters 1908), and more recently two tardigrades (*Hypsibius antarcticus* (Richters, 1904) (now *Acutuncus antarcticus*) and *Dactybiotus* sp.) recorded from freshwater pools (Dartnall 1995). An unspecified *Echiniscus* sp. has also been reported from nearby McDonald Island (Horne 1984).

Methods

During bryophyte studies of the Australian National Antarctic Research Expeditions (ANARE) 1986–87 expedition to Heard Island, plant samples were collected and field dried in paper bags. When returned to Australia the samples were soaked in water and squeezed to extract the tardigrades, which were mounted in Hoyer's medium on microscope slides.

The measurements given are those of the holotype, followed by the range of measurements obtained in parentheses (10 individuals in total). The buccal tube length is measured from the dorso-anterior apophyses to the proximal end of the tube, excluding pharyngeal apophyses, as described by Pilato (1981). The *pt* ratio (the ratio of the buccal tube length to the measurement from the dorso-anterior apophyses to stylet supports, expressed as a percentage) (Pilato, 1981) has also been included.

***Hypsibius heardensis* sp. nov. (Figures 2A–E)**

Diagnosis. Medium sized, pale *Hypsibius* with smooth cuticle. Average buccal tube width ending in oval pharynx with large apophyses, two macroplacoids, and very small septulum. External claws with large accessory points, cuticular bars present at the base of all internal claws.

Holotype. (Fig. 2A): Sex undet. 7 January 1988. Coll. D. Bergstrom. Deposited at The Australian National Insect Collection, CSIRO Division of Entomology, Canberra, ACT, Australia (ANIC).

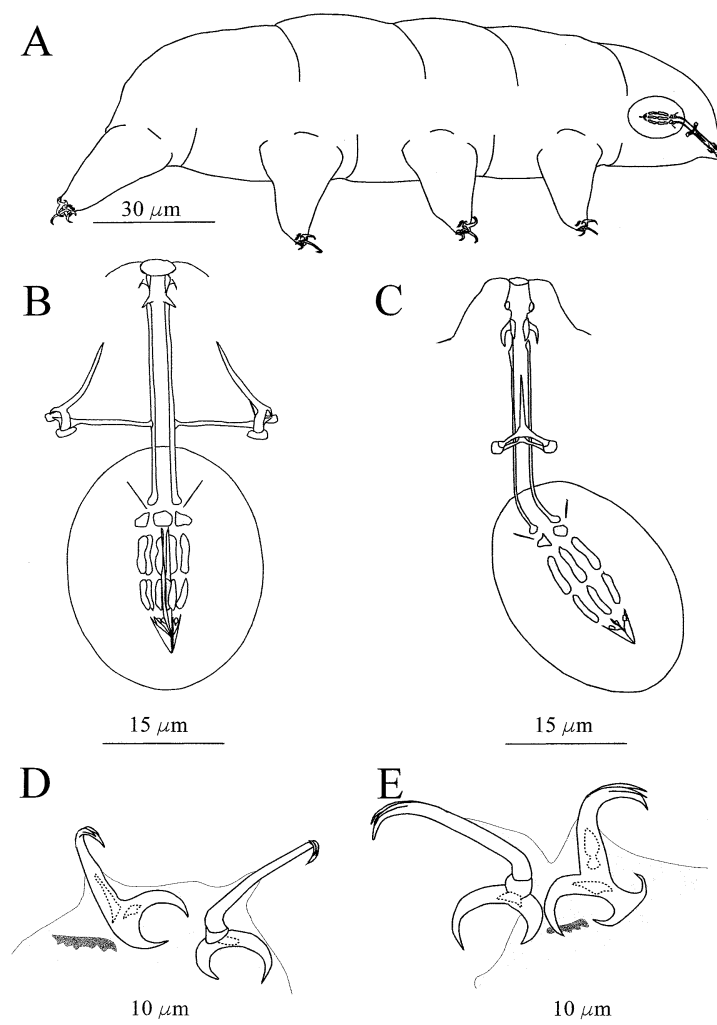


FIGURE 2. *Hypsibius heardensis* sp. nov. A, habitus (lateral view). B–C, buccal apparatus (B – dorsal view, C – lateral view). D, claws of legs III. E, claws of legs IV.

Type Locality: Three sites in the vicinity of Red Island (52° 58'S, 73° 18'E) (Fig.1B), a promontory off Laurens Peninsula on the northwest end of Heard Island, including lava field immediately south of lagoon, east of alluvial flats at 50 m a.s.l. Sample from lava substrate that was extremely craggy with numerous loose boulders, occasional patches of *Azorella selago* Hook. f. (Apiaceae). Quadrat sampled a shallow bryophyte layer of predominantly *Sanionia uncinata* (Hedw.) Loeske. The site was very free draining and moist, receiving wind-driven mist.

Paratypes. Data same as for holotype; eight individuals collected at the same locality. Paratypes are also deposited in ANIC, the British Antarctic Survey Data Resource Centre, and the Academy of Natural Sciences, Philadelphia.



FIGURE 3. *Hypsibius heardensis* sp. nov. A, dorsal view buccal apparatus. B, lateral view buccal apparatus. C, claws of legs III. D, claws of legs IV. Scale bars = 10 micrometers.

Etymology. The species is named in honour of the beautiful and remote Heard Island.

Description. Body slender, length 350.0 μm (200.0–382.0 μm) (Fig. 2A). Eyes absent. Mouth sub-terminal. Cuticle smooth. Buccal tube 24.0 μm (18.0–26.0 μm) long

and 2.0 μm (1.7–3.0 μm) wide with one bend in posterior portion (Figs 2C, 3B). In lateral view the margins of the apophyses for the insertion of the stylet muscles are in the form of “semi-lunular hooks”. Stylet supports are attached near middle of buccal tube 15.0 μm (10.0–16.0 μm), giving a stylet supports to buccal tube *pt* ratio of 62.5 % (56–63 %). Pharynx slightly oval with large apophyses 2.5 μm (1.5–3.0 μm), two rod-shaped, elongated macroplacoids, of which the first is slightly constricted in the middle, 5.5 μm (4.0–6.0 μm), and is marginally longer than second, 4.5 μm (3.0–5.0 μm). Microplacoids absent but a small septulum is present (1.0 by 0.5 μm) (Figs 2B–C, 3A–B).

Claws of legs IV slightly larger than claws of legs I–III (Figs. 2D–E, 3C–D). On leg IV the external claws have a short basal part 5.0 μm (3.0–7.0 μm), a long primary branch, giving a total claw length of 16 μm (11.0–19.0 μm), with a short smooth secondary branch. The internal claws on leg IV are shorter, 7.0 μm (7.0–13.0 μm), and broader. Accessory points are present on the primary branches of both claws. The base of internal claw of leg IV is extended and curved upward at ends. Light transmitting areas are visible on both claws. A heavy cuticular bar 2.0 x 8.0 μm (2.0–9.0 μm), which is smooth on top and ragged below, extends from base of the inner claws of legs I–III in most specimens (Figs. 2D–E, 3C). However, the bars are sometimes poorly sclerotized and lacking on legs I. A thin, 5.0 μm long (3.0–6.0 μm), cuticular bar is present between bases of claws of leg IV.

The eggs are smooth shelled and 2–5 were observed laid inside the exuvium.

Distribution. Known so far only from Heard Island and Macquarie Island.

Comments. *Hypsibius heardensis* sp. nov. belongs to a group of *Hypsibius* species referred to as the *dujardini* group, which exhibit a colourless, smooth cuticle, and an oval pharynx with two rod-shaped macroplacoids. Other members of this group include *H. allisoni* Horning, Schuster, & Grigarick, 1978, with a type locality in New Zealand and distribution including South America and Antarctica, *H. convergens* (Urbanowicz, 1925), a species complex of cosmopolitan distribution, *H. dujardini* (Doyère, 1840), with a mainly Northern Hemisphere distribution, *H. pachyunguis* Maucci, 1996, from Greenland and *H. pedrotti* Bertolani, Manicardi & Gibertoni, 1987 from Italy (see McInnes, 1994). Details of the comparative morphology of the *dujardini* group are tabulated in Table 1.

In addition to the differences in physical characters, *H. dujardini* is described as hygrophilous or hydrophilous, having been reported from aquatic and wet terrestrial habitats (e.g., Argue 1974; Petersen 1951; Ramazzotti & Maucci 1983; Bertolani 1982, Bertolani *et al.* 1987). *H. heardensis* was collected from a range of habitats from discontinuous bryophyte dominated vegetation, which while not dry was never water-logged, to a continually ‘wet’ site bordering a meltwater lake. This indicates a marginally more eurytropic preference than *H. dujardini*. Of those species that have, or include, Southern Hemisphere distributions, *H. allisoni* (a possible synonym of *H. convergens* (Ramazzotti & Maucci, 1983)), was originally found in a eurytropic habitat of lawn moss in New Zealand (Horning *et al.* 1978), and *H. convergens* in the Southern Hemisphere has most commonly been described from the more eurytropic to xerotrophic habitats of epiphytic or epilithic mosses and lichens (e.g., Horning *et al.* 1978).

Though superficially similar, *H. heardensis* can also be differentiated from *Acutuncus antarcticus* (Richters, 1904) by the mouth, buccal structure and claws typical of the genus *Hypsibius*. The elliptical structures surrounding the mouth, the shape and armature of the buccal cavity, along with the dissimilar claws and free laid, sculptured eggs which led Pilato & Binda (1997) to erect a new genus *Acutuncus* for the species *A. antarcticus*, are not found in *H. heardensis*.

TABLE 1. Comparative characters of species within the *Hypsibius dujardini* group.

	<i>Hypsibius allisoni</i>	<i>Hypsibius convergens</i>	<i>Hypsibius dujardini</i>	<i>Hypsibius heardensis</i> sp. nov.	<i>Hypsibius pachyunguis</i>	<i>Hypsibius pedrotti</i>
Body length	170–365	400	500	200–382	340–424	132–201
Eyes	Present	Present	Present	Absent	Absent	Present
Buccal tube length	30	-	-	18.0–26.0	33.2	19.6
Buccal tube - width	4	-	-	1.7–3.0	2.4	-
Stylet support	11	-	-	10–16	-	-
Pt ratio (%)	37	-	-	56–63	-	62.11–68.33
Apophyses	-	-	-	1.5–3.0	-	-
Macroplacoid - first	6	-	-	4.0–6.0	8	3.2
Macroplacoid - second	4.5	-	-	3.0–5.0	6	2.5
Microplacoid	Present very small	Absent	Absent	Absent	Absent	Present
Septulum	Absent	Absent	Present - large	Present 1.0 by 0.5	Absent	Present
Claw IV length	15	-	-	11.0 19.0	25	6.9
Cuticular bars at base of claw IV	Between	Absent	Between	Between 3.0 6.0	Between	Absent
Cuticular bars at base of claw I–III	Absent	Absent	Absent	Inner 2.0 9.0	Between	Absent

- No data

The current authors have previously commented on the inconsistencies between animals found in the sub-Antarctic and maritime Antarctic in comparison with the published descriptions of *Hypsibius dujardini*, inserting “cf” into some references (*e.g.*, McInnes 1995). Specimens of *H. cf. dujardini* collected from the maritime Antarctic and from sub-Antarctic South Georgia, though similar to *H. heardensis*, have eyespots, and differ in the type and form of the cuticular bars and claws on the legs. The description of this maritime Antarctic/South Georgia species will be discussed in a later paper.

Miller *et al.* (2001) listed *Hypsibius* sp. from Macquarie Island and following re-examination this has been confirmed as *H. heardensis*. Thus the current distribution for *H. heardensis* encompasses the type locality, Heard Island, in the South Indian Province and Macquarie Island, in the South Pacific Province (see Smith 1984).

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