



A new, but possibly extinct, species of *Semanopterus* Hope, 1847 from Lord Howe Island, in the southwestern Pacific Ocean (Coleoptera: Scarabaeidae: Dynastinae)

CHRIS A.M. REID¹ & NATALIE A. TEES²

Australian Museum, 1 William Street, Sydney, New South Wales 2010, Australia

¹ [✉ chris.reid@australian.museum](mailto:chris.reid@australian.museum); [ORCID](https://orcid.org/0000-0003-1899-9839) <https://orcid.org/0000-0003-1899-9839>

² [ORCID](https://orcid.org/0000-0003-0367-2876) <https://orcid.org/0000-0003-0367-2876>

Abstract

A new and brachypterous species of *Semanopterus* Hope, 1847 (Coleoptera: Scarabaeidae: Dynastinae: Pentodontini) is described: *S. kingstoni* Reid & Tees, **new species**. The species is based on a single female specimen, collected on Lord Howe Island in the southwest Pacific Ocean. It is the sixth species of dynastine known from Lord Howe Island; a key is provided for identification of all of the species known from this small island.

Key words: scarab, brachyptery, extinction, oceanic island, Australia

Introduction

The scarab subfamily Dynastinae (Coleoptera: Scarabaeidae) includes about 190 species in 40 genera in Australia (Weir *et al.* 2019; Hutchinson & Allsopp 2021). The fauna has been revised three times in the last 65 years (Carne 1957; Endrödi 1985; Weir *et al.* 2019) and is, therefore, well known, at least at the generic level. Dynastinae may appear to be large and cumbersome and, therefore, unlikely dispersers, but they occur on remote oceanic islands, where there has evidently been autochthonous speciation (Endrödi 1985). Lord Howe Island, 600 km east of mainland Australia, is an example of such an island and has five recorded species of Dynastinae, one endemic (Reid *et al.* 2018; Reid & Hutton 2019; Reid *et al.* 2020).

Lord Howe Island is at the centre of a small oceanic archipelago, the Lord Howe Island Group, which is the eroded remnant of a shield volcano. The island began to form about 6.9 mya and quickly became a significant island, about 30 km in diameter and 1000 m elevation (Hutton 2008; Gilmore *et al.* 2020; Williams & Jones 2022). Eruptions ceased at about 6.3 mya (Williams & Jones 2022) and since then the island has been eroding. Currently, Lord Howe Island reaches 875 m elevation and is mostly densely forested with oceanic subtropical rainforest, but its offshore islets are small and almost treeless (Wilson 1994). The original island was old and large enough to have accumulated a large flora and fauna, which is evolving in situ, but also faces extinction as the island shrinks. Fifty to sixty per cent of the native flora and fauna is considered to be endemic (Wilson 1994; Cassis *et al.* 2003; Hutton *et al.* 2007; Hutton 2008). Lord Howe Island was discovered in 1788 but remained largely unexplored and unsettled by humans until the 1830s and is, therefore, relatively ecologically intact (United Nations Educational, Scientific and Cultural Organization 2022).

The coleopteran fauna of the island has been sampled and described since the early 1850s, and is now estimated to include 535 species, a small percentage of which are recent arrivals through human agency (Reid *et al.* 2020). The Australian Museum has been at the forefront of collecting the fauna of Lord Howe and the coleopteran collection from there includes 42 drawers of pinned specimens and thousands of specimens stored in ethanol. The material includes museum surveys from the 1880s, 1920s, 1970s, 1980, and several from 2000–2022. Some material from an earlier survey by George Masters in 1869 was examined by Australian Museum entomologist Sydney Olliff in the 1880s (Olliff 1889) and may be in the collection, but if so is unlabelled. Other important Coleoptera collections were made by MacGillivray (1853, in Natural History Museum, London), Arthur Lea (1916, in South Australian

Museum, Adelaide), Geoff Monteith (1979, in Queensland Museum, Brisbane), and several CSIRO entomologists from about 1965 to the present (Australian National Insect Collection, Canberra, Australia). The senior author has examined all of these collections.

In the 1860s, the house mouse, *Mus musculus* Linnaeus, 1758 (Rodentia: Muridae) was accidentally introduced to Lord Howe Island, followed by the ship rat, *Rattus rattus* (Linnaeus, 1758) (Rodentia: Muridae), in 1918 (Hutton *et al.* 2007). Feral pigs and cats were also present until eradication in the 1980s (Miller & Mullette 1985). These animals, particularly the rat, had a devastating effect on the fauna, driving five endemic passerine birds to extinction (McAllan *et al.* 2004), as well as some insects, of which only the weevil *Hybomorphus melanosomus* Saunders & Jekel, 1855 (Coleoptera: Curculionidae) is documented (Hutton *et al.* 2007; New South Wales Threatened Species Scientific Committee 2020). However, other insects such as a Phasmatodea, a Blattodea, and two Coleoptera, *Cormodes darwini* Pascoe, 1860 (Cleridae) and *Promethis sterrha* (Olliff, 1889) (Tenebrionidae), are considered extinct on the main island due to the rats, but persist on the tiny offshore islets that are rat free (Hutton *et al.* 2007; Reid *et al.* 2020). In 2019–2021 the Lord Howe Island Board oversaw the successful eradication of the two rodent species (New South Wales Department of Planning and Environment 2021) and a recent survey of the island shows that some large flightless Coleoptera are recovering (CAMR, unpublished observations, September 2022).

During 2017–2022, the senior author has been involved in surveying the Coleoptera of Lord Howe Island, particularly targeting the larger species, arbitrarily designated 1 cm or more in length (Reid *et al.* 2018; Reid & Hutton 2019; Reid *et al.* 2020). At least 86 such species have been found on Lord Howe Island, including five Dynastinae. The dynastines probably only include two native species, *Pimelopus fischeri* (Montrouzier, 1860) and *P. noctis* (Olliff, 1889) (Carne 1957; Reid *et al.* 2020). *Metanastes vulgivagus* (Olliff, 1889) was originally described from Lord Howe and Sydney but is a widespread eastern Australian species, which is a pest of grasses (Cumpston 1940; Carne 1957) and, therefore, likely to have been accidentally introduced to Lord Howe Island with imported turf and garden materials. Similarly, *Heteronychus arator* (Fabricius, 1775) is a widespread pest of grasses in eastern Australia, but is an African species introduced to the Sydney or Newcastle area about 1920 (Allsopp & Hutchinson 2019) and first recorded in 1930 (Cumpston 1940). It is also likely to have been introduced to Lord Howe through human activity. The fifth, *Cryptodus tasmanianus* Westwood, 1841, is another widespread eastern Australian species, first recorded from Lord Howe by Carne (1957). This may also be a species introduced accidentally through human activity, although it is not known to be a pest. Since this species is now absent from the main island but still present on offshore islets, it may have been present on all islands before the arrival of *R. rattus* on the main island in 1918, an event that may have extinguished *C. tasmanianus* there (Reid *et al.* 2020).

However, there is a sixth distinctive and flightless species in the Australian Museum collection, represented by a single female specimen collected in the 1970s. Despite the intensity of collecting on this island, no other specimens of this species are known and, since it is flightless, it may be extinct. In the absence of further specimens, this article provides a name for this new but possibly extinct species, to generate interest in its possible rediscovery and conservation.

Methods

All photographs except the antenna were taken on a Canon EOS 5DS with EF 100 mm and MP-E65 mm Macro lenses, using a StackShot Macro Rail. The antenna was photographed on a Leica stereo microscope M205 A. All image stacks were composited using Zerene Stacker version 1.04, processed in Adobe Photoshop version 22.3.1 and sharpened in Topaz Labs Sharpen AI version 3.3.1. Label data of the type is given in full with a ‘/’ separating each line and a semicolon separating each label.

Description

Semanopterus kingstoni Reid & Tees, new species

(Figs 1–10)

Type. Holotype female. AUSTRALIA, LORD HOWE ISLAND: Mt Gower LHI, / 700m pitfall, / 30.1.1979 [handwritten label by T. Kingston]; Lord Howe I., N.S.W. / leaf litter / Mt Gower / T. Kingston / Date 30-1-79

[printed label, except date handwritten by unknown person]; K188798 [printed]; HOLOTYPE / *Semanopterus* ♀ / *kingstoni* Reid & Tees ['Holotype' printed]. The holotype is deposited in the entomology collection of the Australian Museum (Sydney, Australia).



FIGURES 1–6. *Semanopterus kingstoni* new species, holotype. 1, dorsal habitus; 2, lateral habitus; 3, dorsal of head; 4, anterior of head; 5, antenna; 6, labels.

Description. The holotype is slightly damaged: right apical maxillary and labial palpomeres, left protarsomeres 2–5, right protarsus, left mesotarsomeres 3–5, right mesotarsomeres 4–5, metatarsomeres 4–5 missing; right antenna removed and mounted on a point.

Body convex (Figs 1–2), robust; dark reddish brown, anterior and basal margins of pronotum, scutellum, elytral suture, pygidium and apical abdominal ventrite almost black, venter, femora and antennae paler reddish brown, membrane between abdominal ventrites 5 and 6 orange; dorsal surface shiny; length 27 mm, pronotal width 10.5 mm, elytral width 13.5 mm.



FIGURES 7–10. *Semanopterus kingstoni* new species, holotype. 7, ventral habitus; 8, prothoracic leg; 9, metathoracic leg; 10, posterior.

Head (Figs 3–5). Frons rugulose, sculpture shallower and sparser than clypeus; ocular canthi rugulose and laterally setose, slightly bulging anterior to eyes; Clypeus transverse, trapezoidal, apical width less than half basal width, anterior edge truncate and medially reflexed, surface transversely rugulose; frontoclypeal suture distinct, transverse, with small symmetrical median tubercle; eye reniform, dorsal part slightly smaller than ventral part; antenna with 9 antennomeres, 1 scyphiform, 2–6 transverse, 5–6 triangular, 7–9 forming a tight transversely oval club with 7 widest; width of club slightly greater than length of antennomeres 2–6; antennomeres 1–2 punctured with long setae, 3–6 glabrous, 7–9 with scattered punctures and short recumbent setae; mandible laterally rounded, projecting laterally and apically beyond clypeal margin, densely laterally punctured and setose; maxilla laterally exposed, including base of palp; apical maxillary palpomere elongate cylindrical, length about 3x width and about 1.5x length of preapical palpomere, which is slightly shorter than preceding palpomere; galea with large elongate

triangular apical tooth, visible below mandibular apex; base of labial palpi hidden by side of mentum; mentum laterally expanded and longitudinally arched at middle, narrowing to bifurcate apex, surface closely rugosely punctured and setose.

Thorax (Figs 1–3, 7–10). Pronotum transverse, width 1.5x length, and greatest width about 1/3 from base, with almost straight basal margin, evenly rounded lateral margins, rounded posterior angles, rounded but slightly produced anterior angles, and truncate anterior margin; margins strongly raised laterally, anteriorly shallow raised with inner margin narrowly triangular at midline, basal margin not raised except at sides; anterior edge membranous; pronotal disc convex, with narrow elongate depression in basal half of midline and a few scattered small dimples laterally; disc sparsely and finely punctate, except elongate depression with larger, denser, C-shaped punctures, anterior and basal margins finely and densely punctured; prothoracic hypomerion densely rugosely punctured and setose; prosternum smooth and almost impunctate anterior to coxae, at middle convexly produced and strongly elevated with dense punctures and setae; postcoxal lobe truncate in ventral view, elongate triangular in posterior view, strongly punctured and setose; scutellum transversely semi-oval, sparsely micropunctured; elytra apparently fused but with distinct suture, slightly abbreviated with rounded apices, reaching basal margin of propygidium; elytral disc almost non-striate, four irregular lines of punctures present but obscured by similarly sized and spaced interstitial punctures; sutural margin slightly elevated and impunctate, and two similar low ridges on disc; epipleuron setose at base only, apical half undefined; mesoventrite densely punctured and setose; mesocoxae adjacent; wing reduced to a short broad lobe, less than 0.2x elytral length (not visible under elytra in posterior view); metaventrite finely and sparsely punctured, laterally setose, medially glabrous, abbreviated, shorter than mesoventrite on midline and about equal to length of metacoxa laterally; protibial anterior surface with row of large punctures and setae, outer margin tridentate, denticles equidistant, distal strongly curved, proximal small and obtuse; protibial spur long and flat; mesotibiae and metatibiae with a single lateral oblique ridge of short spines and setae and dorsal margin with irregularly serrate ridge; metafemur oval, longer than wide, stout, laterally with rows of setose punctures on dorsal edge and near ventral margin; metatibia abruptly expanded in apical third to truncate apex, latter with dense row of acute setae (mostly broken); length of metatibial inner spur about 1.5x outer spur, both broad and almost straight; metatarsomere 1 asymmetrically triangular, width almost equal to length, without lateral carina.

Abdomen (Figs 2, 7, 10). Propygidium slightly convex in lateral view, as long as pygidium, without stridulatory files, disc evenly sculptured with mixture of large setose punctures, dense micropunctures and microreticulation; pygidium evenly shallowly convex, glabrous, disc sparsely micropunctate, dense at base and lateral margins, thick apical ridge with a few setae (most broken off); ventrite 1 punctured and setose throughout, ventrites 2–4 with dense large and small punctures and setae at sides and base, almost impunctate and glabrous at middle, ventrite 5 similar but also transverse row of large punctures and setae near posterior margin; membrane between ventrites 5 and 6 expanded, about half length of ventrite 5; ventrite 6 anteriorly densely micropunctate and punctate, with scattered setae, posterior margin with weakly defined raised edge. Genitalia not examined.

Etymology. Named for Tim Kingston, the collector of this species.

Notes. The new species is placed in *Semanopterus* because it best fits most of the diagnostic features of this genus, as described by Carne (1957), Endrödi (1985), and Weir *et al.* (2019): body reddish brown to black; frontoclypeal suture armed with low tubercle; clypeus broadly triangular or trapezoidal, with sides straight and anterior edge upturned; head without vertically flattened area; mandibles strongly exposed beside and beyond clypeus; apical maxillary palpomere not enlarged; maxillae with galeae strongly developed, conspicuously toothed; apical labial palp cylindrical; mentum not dilated, not covering bases of maxillary palpi; elytra with odd numbered intervals costate; elytra without tubercle near scutellum; protibia tridentate; apex of metatibia truncate, with many spiniform setae; metatarsomere 1 without distinct longitudinal external carina; propygidium not enlarged, without stridulatory ridges; last ventrite of female with transverse sulcus.

Semanopterus kingstoni differs from all other species of this genus by: convex body; distinct frontoclypeal suture; antennae with 9 antennomeres; pronotal disc with single fovea, in basal half; pronotal basal angles rounded and basal border absent medially; epipleura indistinct apically and with setae confined to base; protibiae bluntly tridentate; metatibia with a single oblique setose ridge. This combination of characters easily distinguishes *S. kingstoni* from all other species in the genus. It might, therefore, be argued that *S. kingstoni* should be placed in a new genus. However, the convexity, loss of anterior pronotal fovea and loss or reduction of borders and margins on pronotum and elytra, may all be linked to loss of flight. Furthermore, variation in the number of antennomeres is not regarded as significant at generic rank in the Dynastinae and is widespread in dynastine genera as currently understood (Carne 1957).

Discussion

Brachyptery in Dynastinae. Flightlessness in Dynastinae appears to be rare, but possibly overlooked. It is not mentioned in surveys of the Australian fauna (Carne 1957; Weir *et al.* 2019), nor in the Endrödi (1985) monograph on Dynastinae. Scholtz (2000) reviewed brachyptery in the Scarabaeoidea but excluded the Dynastinae, except for mention of one South African species, but it is unclear whether this is brachypterous. Searching the Zoological Catalogue website with ‘Dynastinae’ and ‘brachypter’ (or ‘flightless’) fails to find references. *Semanopterus kingstoni* is the only oceanic species of *Semanopterus* and the only species that is brachypterous, which supports Darwin’s theory of loss of flight in island insects (Darwin 1859; Scholtz 2000).

Assessment of habitat and conservation status of *Semanopterus kingstoni*. Lord Howe Island, approximately 14 km² in area, has been extensively surveyed for macro-invertebrates, including Coleoptera, for the last 50 years. Tim Kingston undertook the first of these surveys. He was employed by the Australian Museum to study the density and diversity of leaf litter invertebrates on Lord Howe as part of a project to rehabilitate the flightless endemic woodhen, *Hypotaenidia sylvestris* (Sclater, 1869) (Gruiformes: Rallidae). In the 1970s the bird was confined to the southern mountains; rehabilitation was based on removing introduced predators and finding areas with greatest density of suitable prey in leaf litter. Kingston focussed on the slopes of Mount Gower. At each of 10 prospective sites, 48 leaf litter samples were taken (Miller & Kingston 1980). The most significant sites for re-introduction of the bird were identified as Little Slope and Erskine Valley (Fullagar 1985). The results of this survey were never published and the specimens collected were never properly labelled. The material was deposited in the Australian Museum and coleopteran exemplars from each sample were mounted, but the bulk has remained unsorted in ethanol.

The specimen labels (Fig. 4) merely indicate that it was collected on Mount Gower, at 700 m elevation, in a pitfall trap, a method of collecting not mentioned by Miller & Kingston (1980). The surface of Mount Gower is mostly vertical at this elevation, but the track to the summit along the northern ridgeline decreases in slope at this point (just above the ‘Get Up Place’) and this is, therefore, most likely to be the collection locality. The vegetation at 700 m changes to montane palm and cloud forest (Sheringham *et al.* 2016). Since there have never been any records of *Semanopterus kingstoni* from the lowlands, including post-rat-eradication night surveys (Reid *et al.* 2020, CAMR personal observations), it seems likely that it is endemic to the high-rainfall cloud forest summit of Mount Gower, at 700–875 m. However, ‘was’ may be the more accurate verb, as this species has not been seen since 1979.

The single specimen of *Semanopterus kingstoni* has resided unnamed in the Australian Museum mounted collection for 40 years. All ethanol-stored material collected by Kingston and later collectors has been searched and no further specimens found. This species has not been collected in any other surveys of Lord Howe, including the intensive survey of 64 sites undertaken in 2000–2001 (Cassis *et al.* 2003), a one-week survey of the Mount Gower summit plateau by the senior author and colleague (2002), and an unpublished altitudinal transect survey of the insects of Mount Gower in 2003. No specimens were collected in earlier surveys by the Australian Museum (1880s), Lea (two months in 1916), Monteith (three weeks in 1979), or other coleopterists. The senior author has spent nine nights looking for Coleoptera on the summit and lower slopes of Mount Gower and failed to find this species. We suspect that *Semanopterus kingstoni* may be extinct.

Key to the species of Dynastinae from Lord Howe Island

1. Propygidial disc densely sculptured with transverse ridges 2
- Propygidium smooth surfaced and evenly punctate, without stridulatory ridges 5
- 2(1) Propygidial disc with scattered unaligned and equal sized short transverse ridges, not forming a pair of stridulatory files; anterior margin of head rounded 3
- Propygidial disc with paired stridulatory files, formed by longitudinally aligned dense transverse ridges, decreasing in size from base to apex; anterior margin of head excavate either side of midline. *Heteronychus arator* (Fabricius, 1775)
- 3(2) Mandibles bidentate; frontoclypeus with single median tubercle; 5–7 shallow elytral striae 4
- Mandibles tridentate; frontoclypeus with either 2 tubercles or none; 9 deep elytral striae *Metanastes vulgivagus* (Olliff, 1889)
- 4(3) Base of pygidium setose; elytral punctures ocellate, with a fine ridge around each puncture. . . *Pimelopus noctis* (Olliff, 1889)
- Base of pygidium glabrous; elytral punctures simple, unridged *Pimelopus fischeri* (Montrouzier, 1860)
- 5(1) Body flat; mentum expanded concealing bases of palpi; elytra densely punctured, relatively dull *Cryptodus tasmanicus* Westwood, 1841
- Body convex; mentum not laterally expanded; elytra not densely punctured, relatively shiny. *Semanopterus kingstoni* Reid & Tees, **new species**

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