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The Hydroporini (Coleoptera : Dytiscidae : Hydroporinae) of New Guinea: Systematics, Distribution and Origin of the Fauna

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Abstract

Only one species of Hydroporini, *Megaporus piceatus* (Régimbart, 1892), has been known from New Guinea. *M. piceatus* is very similar to the Australian *M. ruficeps* (Sharp, 1882) and study of additional material is neccessary to determine its status. *Chostonectes maai*, sp. nov., is described from Papua New Guinea. Its sister-species is the Australian *C. gigas* (Boheman, 1858). The classification of the genera *Megaporus* Brinck, 1943, and *Chostonectes* Sharp, 1882, is discussed, and autapomorphies for both groups are suggested. The following species of Hydroporini are reported from New Guinea for the first time: *Megaporus* sp., *Antiporus* sp., and *Sternopriscus hansardi* (Clark, 1862). A total of five Hydroporini species is now known from New Guinea. All are Australian, or of Australian origin. The New Guinean Hydroporini are not a monophyletic group. The factors delimiting the distribution of Hydroporini in New Guinea are climate and perhaps also vegetation. Australian Hydroporini are adapted to a seasonal climate and most of them also to open forests/woodland.

Introduction

Hydroporini are rather small Dytiscidae, ranging in size from about 1 to 7 mm, and occupy a great variety of habitats, and occur in almost every kind of shaller non-marine waterbody. The altitudinal range of the tribe extends from sea level up to 4000 m above sea level. The tribe is most diverse in the Holarctic region, with several hundred known species. Diversity decreases towards lower latitudes, and relatively few species are known from the Southern Hemisphere. Australia forms a striking exception, with 59 endemic Hydroporini species (Watts 1978, 1985) in eight genera, all of which are known only from the Australian faunal region. Only three species from these genera have been reported (Balfour-Browne 1945; Guignot 1956) as occurring outside Australia itself, namely: *Necterosma novaecaledoniae*, Balfour-Browne 1939 (New Caledonia, endemic), *Megaporus tristis* (Zimmermann, 1926, endemic to Fiji), and *M. piceatus* (Régimbart 1892, south-east New Guinea). The last is the only Hydroporini known from New Guinea.

Several additional species of New Guinean Hydroporini have been found recently among unsorted museum specimens, raising the number of New Guinean species to five. The aims of this paper are thus:

(i) to update the New Guinea Hydroporini fauna;

(ii) to describe a new species and provide notes on the others;

(iii) to discuss briefly the phylogeny of some species; and

(iv) to make some suggestions on the evolution of the New Guinean fauna.

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Materials and Methods

The material upon which this study is based is located in the following institutions.

ANIC	Australian National Insect Collection, Canberra, Australia
AMNH	American Museum of Natural History, New York, USA
BPBM	Bernice P. Bishop Museum, Honolulu, USA
BMNH	The Natural History Museum, London, UK
CMB	Author's collection
CPZ	Collection of Dr P. Zwick, Schlitz, Germany
MCSN	Museo Civico di Storia Naturale 'G. Doria', Genoa, Italy
NHMG	Naturhistorisches Museum Genf, Switzerland
NHMW	Naturhistorisches Museum, Vienna, Austria
NNML	Nationaal Naturhistorisch Museum, Leiden, The Netherlands
ZMB	Zoologisches Museum der Humboldt-Universität, Berlin, Germany

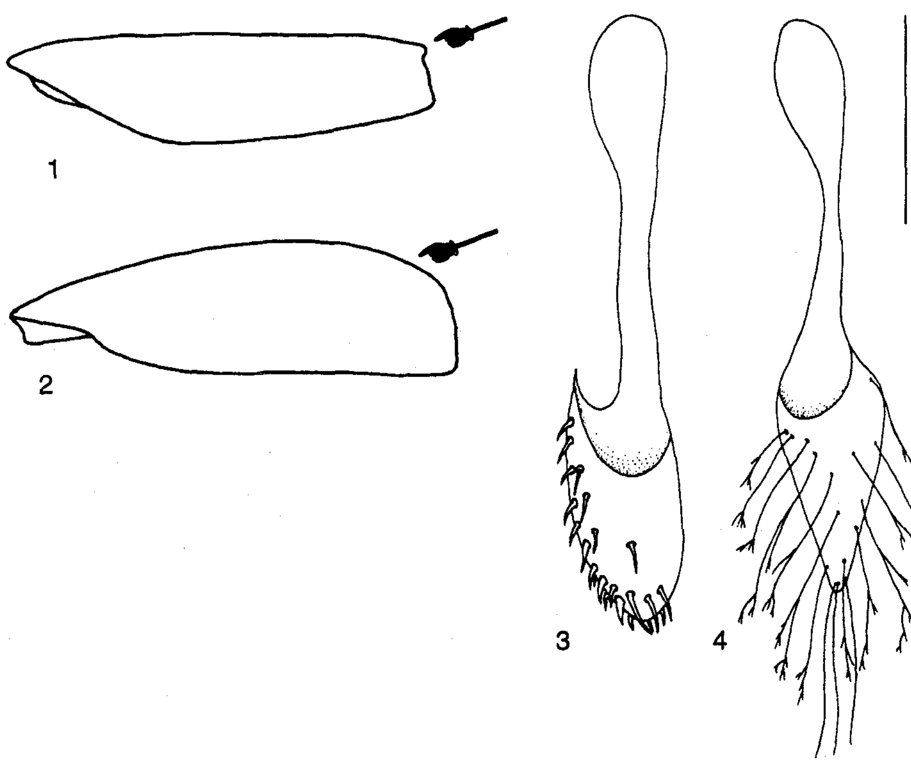
Measurements taken with the beetle in a horizontal position are TL (total length), TL-h (total length minus head), TW (total width), Lp (length of pronotum), Wpb (width of pronotum at base).

Results

Genera Megaporus *Brinck and* Chostonectes *Sharp*

These genera were separated by Watts (1978) mainly on the basis of one feature, the metafemoral structure: species of *Megaporus* were characterised by having stout metafemora, with the distoposterior angle acute, whereas in *Chostonectes* the metafemora are long and slender, with the distoposterior angle rounded (Watts 1978).

Generic identification based on this feature is problematic, however. Figs 1 and 2 illustrate the metafemora of *Chostonectes gigas* (Boheman) and *Megaporus howitti* (Clark),



Figs 1–4. *1–2,* Metafemora in ventral view: *1, Chostonectes gigas*; *2, Megaporus howitti*. Fingers point to distoanterior angles. *3–4,* Gonocoxa: *3, Chostonectes maai*; *4, Megaporus ruficeps*.

species of similar body size. The metafemora of *Chostonectes* are indeed more slender than those of *Megaporus*, but the distoposterior angles are very similar. However, the distoanterior angles are distinctly different: acute in *Chostonectes*, rounded in *Megaporus* (Figs 1 and 2, arrows). This difference also separates *M. ruficeps* (Sharp), *M. hamatus* (Clark) and *C. maai*, sp. nov. However, further species need to be studied to determine the value of this feature.

In addition, certain features of the genitalia of females are peculiar to the species of each genus.

(i) The gonocoxae of *Megaporus* species are bead-like. The gonocoxae and nine gonocoxosternae bear long setae, which have multiple branches distally (Fig. 4). [Species examined: *M. ruficeps* (Sharp), *M. hamatus* (Clark), *M. howitti* (Clark), *M. solidus* (Sharp) (in NHMW and CPZ).]

(ii) The gonocoxae of *Chostonectes* species are hook-shaped (Fig. 3). The setae are stout and simple, as are those on the gonocoxosterna. [Species examined: *C. maai*, sp. nov., *C. gigas* (Boheman), *C. johnsoni* (Clark).]

The bead-like shape of the gonocoxae is probably plesiomorphic, while multiple-branched setae appear to be apomorphic for *Megaporus*. Hook-shaped gonocoxae are here interpreted as apomorphic for *Chostonectes*, whereas stout and simple setae are plesiomorphic.

This interpretation is based on the study of numerous Palaearctic species of Hydroporini as well as of Australian *Antiporus* sp., *Sternopriscus* sp., and *Sternopriscus hansardi* (Clark), which all belong to the Hydroporini as well. A more complete review of genital structures of the female, particularly of the Australian Hydroporini genera, is still needed before a fully satisfactory character interpretation can be offered.

Megaporus piceatus (Régimbart)

(Figs 5–7, 19)

Macroporus piceatus Régimbart, 1892: 984. — Zimmermann, 1920: 79.
Megaporus piceatus. — Guignot, 1956: 55.

Material Examined

Holotype. ♀, New Guinea, Rigo, June 1889, L. Loria, MCSN.

Other material. **Papua New Guinea: Western Province**: 1 ♂, Morehead, light trap, 18 m, 6.vii.1964, H. Clissold, BPBM. **Morobe Province**: 1 ♂, 1 ♀, Markham Valley, Gusap, 90 m W of Lae, 330 m, 27–30.i.1965, M. E. Bacchus, BMNH. **Eastern Highland Province**: 1 ♂, 2 ♀, Kainantu area, Onerunka, 4.ii., 14.viii. and 13.x.1979, W. Ulrich, CMB and NHMG.

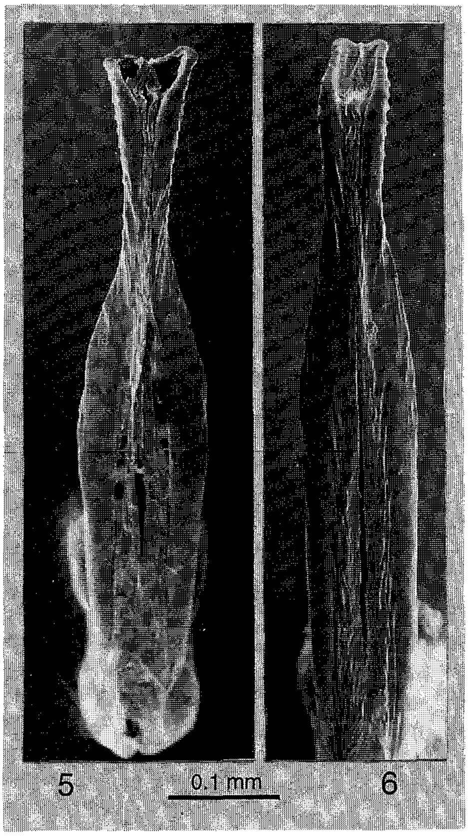
Comments

Only the female holotype has so far been known of *M. piceatus*. It was collected at Rigo which is close to Port Moresby. *M. piceatus* is now recorded from three additional Papua New Guinean localities.

This species is very similar to the widespread (Fig. 19) Australian *M. ruficeps* (Sharp) which was redescribed by Watts (1978).

The holotype of *M. piceatus* is dark brown and cannot be separated from *M. ruficeps*. The male from Morehead is teneral and the median lobe is slightly deformed. The dorsal surface is brown. I cannot separate this specimen from *M. ruficeps* either. The five specimens from Gusap (upper Markham valley) and Onerunka (upper Ramu valley) differ from *M. ruficeps* studied in having (i) a blackish dorsal surface (Fig. 7), whereas it is brownish to dark reddish brown in *M. ruficeps*, (ii) slighty less-dense punctation of the pronotum, and (iii) a slightly different shape of the median lobe (Figs 5, 6).

The tip of the median lobe is distinctly 'V'-shaped in the Onerunka male, whereas it is



Figs 5–6. Median lobe in dorsal view: *5, Megaporus piceatus*, Onerunka; *6, M. ruficeps*, Queensland.

almost straight-sided and distinctly longer in the *M. ruficeps* specimens studied. However, the median lobe of the Gusap individuals is intermediate.

Figs 11 and 12 show the median lobe in lateral view and the paramere, respectively, of *M. ruficeps*. Size and shape of these structures are similar in the Morehead *M. piceatus*, while the median lobe and parameres are slightly larger but still of similar structure in the Onerunka *M. piceatus*.

The status of *M. piceatus* is thus problematic. The holotype and the Morehead specimen cannot be separated from *M. ruficeps*, while Markham Valley specimens are slightly different and the Gusap Valley specimens are intermediate. Study of additional New Guinean material is needed to settle this problem.

However, for the moment it seems most practicable to interpret *M. piceatus* as a separate species being very similar to *M. ruficeps*.

Megaporus sp.

(Figs 8, 13, 19)

Material Examined

Papua New Guinea: Western Province: 1 ♂, Lake Daviumbu, Fly River, 1–10.ix.1936, Archbold Expedition, AMNH.

Comments

In the single teneral male studied (Fig. 8), the median lobe (Fig. 13) is similar to that of the Australian *M. solidus* (Sharp) and *M. nativigi* Mouchamps (compared with the drawings in Watts 1978); however, as the specimen was very soft, the drawing may not be fully accurate. However, the New Guinean specimen is most probably a different species that will have to be sought in the course of future fieldwork.

Chostonectes maai, sp. nov.

(Figs 3, 9, 14–17, 19)

Type locality: Papua New Guinea, Eastern Highland Province, Tapo near Kainantu.

Material Examined

Holotype. ♂, Tapo [= Tapu], 1650 m, 3 km NW of Kainantu, 22.x.1959, T. C. Maa, BPBM.

Paratypes. 6 individuals with same label data as holotype, BPBM; 4 individuals, Aiyura, 1800–1900 m, 6.i.1965, J. Sedlacek, BPBM; 2 individuals, Onerunka near Kainantu, 7.iv.1979 and v.1979, W. Ulrich, leg, NHMG.

Diagnosis

A rather distinct species of *Chostonectes*, *C. maai* is readily separated from the other species of the genus by its large size, sculpture and colour (see Description below). It is morphologically closest to *C. gigas* (Boheman, 1858) with which it shares (i) metacoxal lines diverging anteriorly and posteriorly and (ii) a median lobe with a spine near the tip (Fig. 14).

Chostonectes maai, sp. nov., can most easily be separated from *C. gigas* by its surface colour: distinct vittae are present in *C. maai* (Fig. 9) but absent in *C. gigas* (Fig. 10). I have modified Watts' (1978: 59) key to Australian species to include *C. maai*, sp. nov., and an Australian species described by Wewalka (1994) in a key for the World species of *Chostonectes*, as follows.

Key for the World Species of *Chostonectes*

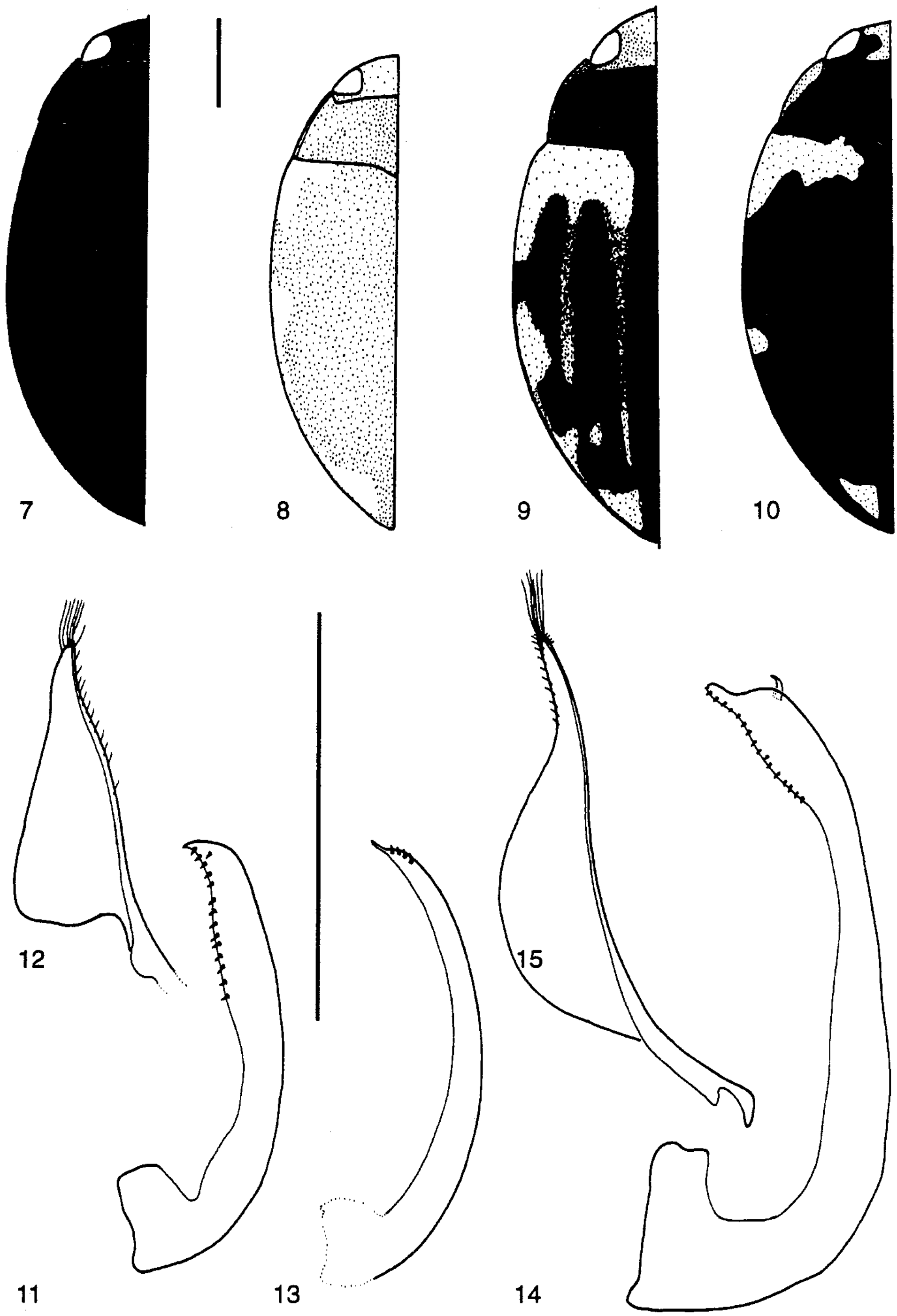
1. Metacoxal lines diverging anteriorly and posteriorly, epipleura without border to basal pit 5
   Metacoxal lines subparallel anteriorly and posteriorly, border to the basal epipleural pit visible .. 2
2. Small species, TL 4 mm, punctures on head joined by network of deep grooves 3
   Larger species, TL 5 mm, punctures on head not joined by grooves .... *C. johnsoni* (Clark)
3. Pronotum unsually shiny between the puncturation, pronotum at least basomedially black 4
   Pronotum usually strongly reticulate between the puncturation, pronotum almost entirely red-yellow .... *C. nebulosus* (MacLeay)
4. Head red-yellow, pronotum basomedially black .... *C. sharpi* Sharp
   Head and pronotum black .... *C. wattsi* Wewalka
5. Head at least discally without microreticulation, elytra vittate (Fig. 9), Australia .... *C. gigas* (Boheman)
   Head with distinct microreticulation, elytra not vittate (Fig. 10), Papua New Guinea .... *C. maai*, sp. nov.

Description

Measurements are shown in Table 1.

Colour and habitus (Fig. 9). Head dark brown to blackish, with reddish pattern. Pronotum black to dark brown, paler laterally, somewhat reddish. Elytra blackish, with distinct reddish vittate pattern of variable extent. Ventral surface reddish to dark brown. Epipleura black. Legs reddish to yellowish.

Surface sculpture. Head: large punctures coarse and evenly distributed, absent only from extreme anterior and posterior portions; a few small punctures present posteriorly;



Figs 7–15. *7–10,* Habitus: *7, Megaporus piceatus,* Onerunka; *8, Megaporus* sp., Fly River; *9, Chostonectes maai*; *10, Chostonectes gigas. 11, 13–14,* Median lobes in lateral view: *11, Megaporus ruficeps*; *13, Megaporus* sp.; *14, Chostonectes maai. 12, 15,* Parameres: *12, Megaporus ruficeps*; *15, Chostonectes maai.*

distinct microreticulation visible. Pronotum: large punctures coarse, most numerous along anterior and posterior margins, less dense medially and least dense anterolaterally. Diameter of punctures slightly increasing towards anterior and posterior margins. Distinct microreticulation visible, most distinct laterally. Diameter of punctures is 2–3 × diameter of meshes. Elytra: large punctures coarse and almost evenly distributed. Size of punctures 2–3× diameter of meshes. Smaller punctures at apical angle and along suture. Microreticulation distinct, most clearly visible on antero-discal 2/3. Ventral surface: microreticulation present. Epipleura, metasternum, metacoxal plates, and abdominal segments with large punctures of different diameters.

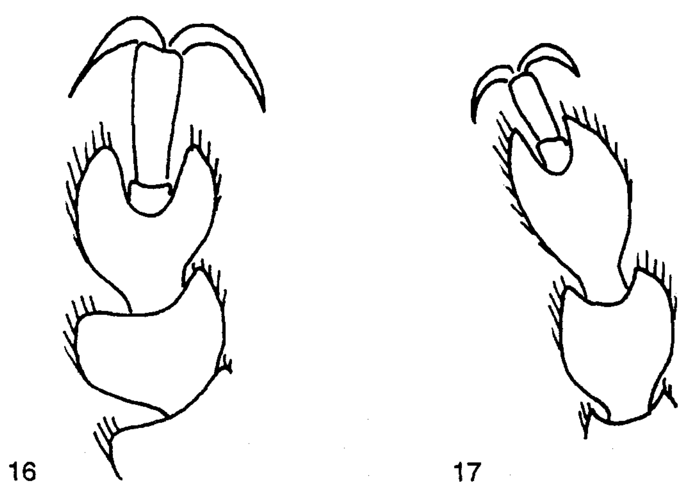
Table 1. Measurements (in mm) of some New Guinean Hydroporini

	n	TL	TL-h	TW	Lp	Wpb
M. piceatus (Holotype)	1	5·6	5·0	3·0	0·85	2·8
M. piceatus (Onerunka)	2	5·4–5·7	4·9–5·2	3·0	0·9	2·9–3·0
C. maai: Onerunka	2	5·4	4·8–4·9	3·0	0·9	2·3
C. maai: Aiyura	4	4·8–5·2	4·6–4·9	2·8–3·0	0·8–0·9	2·1–2·3
C. maai: Tapo	7	5·0–5·4	4·7–5·0	3·0–3·1	0·9–1·0	2·3–2·5

Structures. Pronotum with a distinct lateral border along its entire length. Metacoxal lines diverging anteriorly and posteriorly.

Male. Pro- and mesotarsomeres 1–3 strongly expanded laterally, tarsomere 5 and claws longer than in female (Figs 16 and 17). These tarsomeres bear numerous adhesive setae ventrally which are also present in the female. Median lobe (Fig. 14) with a small dorsal spine near tip, paramere (Fig. 15) elongate and slender with few long setae distally and few short setae distoexternally.

Female. Pro- and mesotarsomeres 1–3 strongly expanded laterally but still somewhat more slender than in male (Fig. 17). Gonocoxae (Fig. 3) hook-shaped in distal 1/3 and with short, stout setae there. Gonocoxosterna with few short, stout and numerous thin, long setae.



Figs 16–17. Protarsus of *Chostoncetes maai*: *16*, ♂; *17*, ♀.

Systematic Position

Chostonectes maai is the sister-species of *C. gigas*. The apical spine on the median lobe (Fig. 14) is a synapomorphy, because such a spine is absent in the other *Chostonectes* spp. and all other Hydroporinae known to me. Furthermore, the metacoxal lines diverging anteriorly and posteriorly, as well as epipleura without border to basal pit, are features present in *C. gigas* and *C. maai* but not in other *Chostonectes* species. The polarity of these characters cannot be determined here, however.

Species Representing Other Genera

Antiporus sp.
(Fig. 19)

Material Examined

Papua New Guinea: Western Province: 1 ♂, 1 mi S. of Morehead, 8.44°S, 141.38°E, 29.viii.1970, Key and Balderson, ANIC.

Comments

The specimen is teneral and cannot be identified.

This is the first record of this genus from New Guinea (Fig. 19). *Antiporus* contains six described Australian (Watts 1978) and two New Zealand (Ordish 1966) species.

Sternopriscus hansardi (Clark)
(Fig. 19)

Hydroporus hansardi Clark, 1862.
Sternopriscus hansardi. — Watts, 1978: 77.

Material Examined

Indonesia: Irian Jaya: 1 ♂, Paniai lake near Bobairo, 25.viii.1939, NNML. **Australia: Victoria:** Halls Weir, CPZ.

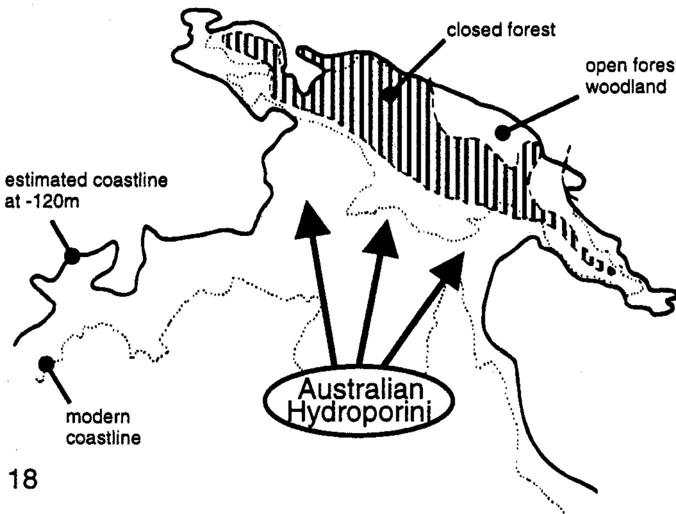
Comments

This is the first record of this genus from New Guinea. *S. hansardi* is widespread along the east coast of Australia (Adelaide to Cairns, Queensland, inland to Swan Hill, Victoria, and Canberra, Watts 1978).

I have identified the locality given on the label as an area near Enarotali, Paniai Lake. This lake is situated on the western edge of New Guinea's central cordillera, at an altitude of about 1900 m above sea level (Fig. 19). This came somewhat as a surprise, as I did not collect *Sternopriscus* on a field trip to that area in 1991. According to this, the species may also occur in the south-west New Guinean lowlands.

Discussion

Up to 4000 m above sea level New Guinea is covered mostly with tropical rainforests (including mossy forests, or 'Nebelwald'). The climate is aseasonal. There are, however, some exceptions. The extreme south and south-east (Port Moresby area) of New Guinea has a dry and strongly seasonal climate, comparable with that of northern Australia. The Ramu-Markham River and the Sepik River areas in the north, as well as some places in the north-east, are comparably dry and seasonal (Whitmore 1981: 38). The Ramu-Markham areas are covered with open forest, whereas the Sepik areas are mainly covered with tropical rainforests.



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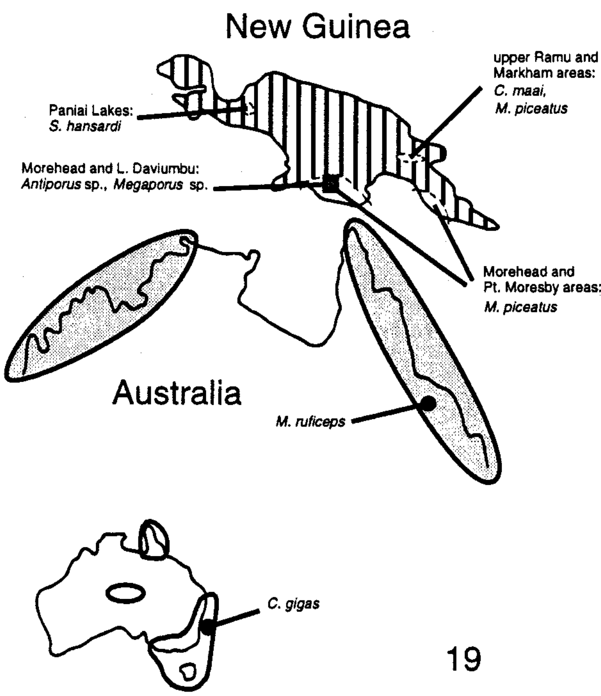

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Figs 18–19. *18,* Coastline and vegetation of Northern Australia and New Guinea during the peak of the last glaciation, some 20 000 years before present (Nix and Kalma 1974). Australia and New Guinea were connected by a broad land-bridge in the present-day Torres Strait area. Possible migration routes of Australian Hydroporini into New Guinea are indicated by arrows. *19,* Known distribution of New Guinean Hydropini and of known Australian sister-taxa. New Guinean regions presently covered with rainforest are striped.

Seasonal climate and open forests/grassland may be found in the Baliem River valley and around the Paniai Lakes of West New Guinea (Irian Jaya) (personal observations).

The New Guinean insect fauna is chiefly of Oriental origin (Taylor 1974). Insects are most diverse in the tropical lowland rainforests. The major biogeographical discontinuity probably lies across southern New Guinea and northern Australia, and this may be explained by climatic and vegetation factors: the Australian and southern New Guinean fauna is adapted to a dry climate and to savannahs, whereas most of the remaining New Guinean fauna is adapted to very humid rainforests. Both regions are therefore considered to form distinct evolutionary centres (Taylor 1974).

Australian Hydroporini are generally adapted to seasonal climates. The known distribution of the New Guinean species is in agreement with this, as all known localities are situated in areas with a seasonal to strongly seasonal climate.

No significant geographical barrier exists between Australia and New Guinea. The gap between the Cape York peninsula and south New Guinea is rather narrow: Torres Strait is less than 120 miles wide at present. Insects may also utilise the numerous islands of the Torres Strait as stepping stones for dispersal. This is especially true for those being capable of flight, such as the Hydroporini under study. Moreover, a broad land-bridge probably connected New Guinea and Australia from at least 20 000 years before present to as recently as 8000 years before present, the result of the most recent glaciation events at higher latitudes (Nix and Kalma 1974) that gave rise to lower sea levels. During most of this time, this land-bridge as well as the south and north-east coast of New Guinea were covered with open forest or woodland.

The possibilities for dispersal of the Australian Hydroporini were especially good during this period (Fig. 18). The broad band of open forest along the south and north-east coast of New Guinea probably served as a pathway for at least some Hydroporini, which must have had a wider distribution in New Guinea than they have today. The present localities in the Paniai area (*S. hansardi*) and in the Markham River area (*C. maai*, *M. piceatus*) may well be explained in this way. Further fieldwork will very probably reveal the occurrence of additional Hydroporini species in southern New Guinea, as already suggested by the presence of *Antiporus* sp. and *Megaporus* sp.

The known distribution of New Guinean Hydroporini is summarised in Fig. 19.

Megaporus ruficeps is widespread in north-eastern and north-western Australia. The similar New Guinean *M. piceatus* occurs in areas with a seasonal climate (i.e. in the south and around Port Moresby). A morphologically slightly different population is known from the upper Ramu and Markham areas. This is probably a population that was geographically separated rather recently as the rainforests expanded during the past 10 000 years.

Chostonectes maai is known only from the upper Ramu area. Its sister-species, *C. gigas*, is widespread in Australia (Watts 1978; Larson 1994).

Sternopriscus hansardi is widely distributed along the east coast of Australia. The central New Guinean locality was perhaps reached after the last glaciation, when a broad dispersal route must have been available. The single specimen from New Guinea cannot be distinguished morphologically from Australian specimens.

The southern New Guinean *Antiporus* sp. and *Megaporus* sp. need further study for a better understanding of their identity. They either represent Australian species, or have closely related species in Australia. The occurrence of *Megaporus* sp. at Lake Daviumbu is interesting because this area lies directly along the northernmost border of the southern New Guinean savannahs (Rand and Brass 1940).

Southern New Guinea in particular has strong affinities with the Australian flora and fauna (Walker 1974), and this is also true of the Hydroporini. Five taxa have contributed to the known New Guinean Hydroporini fauna, and the New Guinean Hydroporini do not constitute a monophyletic group.

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