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Acarologia is under free license and distributed under the terms of the Creative Commons-BY-NC-ND which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are credited.
WATERMITES (ACARI: HYDRACHNIDIA) FROM NEW GUINEA: DESCRIPTIONS OF NINE NEW SPECIES OF AUSTRALIOBATES LUNDBLAD AND FIRST RECORDS OF DROPURSA COOK AND COAUSTRALIOBATES LUNDBLAD

BY P. R. WILES*

SUMMARY: Nine new Australiobates species from New Guinea are described and first records are reported for Dropursa babinda Cook, 1986, Coaustraliobates minor (Lundblad, 1947) and Coaustraliobates longipalpis (Lundblad, 1947). The importance of secondary sclerotization and plate development are discussed.


INTRODUCTION

Watermites are a common component of aquatic ecosystems (Ten Winkel & Davids, 1987). Adults and nymphs are predators of, and larvae parasites of, aquatic invertebrates (including the economically important blackflies and mosquitoes) (Smith, 1983). There are approximately 4000 species worldwide. Watermites of the Australasian region are apparently as diverse and numerous as those of Europe, N. America, Asia and Africa (Cook, 1983, 1986). Only recently has the watermite fauna of New Guinea been examined (Imamura, 1983; Wiles, 1990, 1991, 1994). In collections from streams and rivers Australiobates Lundblad, 1941 was the most common genus encountered.

Watermites of the genus Australiobates are confined to the southern land masses; Australia, S. Africa and southern S. America where they can be a major component of the fauna (Cook, 1986). Clearly they evolved prior to the break-up of Gondwanaland. There are 24 reported species in two subgenera, 12 Australian, 4 from New Zealand, 7 from Chile (Cook, 1988) and one from S. Africa (Viets, 1987) with nine additional species described below. Cook (1974) placed two species in a third subgenus Coaustraliobates, but raised this to full generic rank in 1986 with additional Australian species. The two existing subgenera are: Australiobates Cook, 1974, 22 spp. and Lundbladobates Besch, 1964, 2 spp. from S. America. Coaustraliobates Cook, 1986 and Dropursa Cook, 1986 are endemic to Australia and New Gui-
Fig. 1: *Dropures babinda* Cook. 1986.
nea, which suggests they evolved after the break-up of Gondwanaland.

*Australianobates, Dropursa* and *Coaustraliobates* have the characters of the Hygrobatinae (Cook, 1974): variable body sclerotisation which can be extended during growth (secondary sclerotisation) and glandularia (E4) present on the forth epimera (EpIV). They share the plesiomorphic morphological character state of an infracapitulum with long posterior process sometimes fused to the first epimera (Epi).

*Australianobates* have the combination of: well developed apodemes on EpIV which extend anteriorly to E4 and posteriorly beyond the margin of EpIV, a plesiomorphic condition found in *Dropursa*; an infracapitulum with a long, narrow posterior process sometimes fused to the first epimera (Epi), a plesiomorphic character shared with *Dropursa*; and two stout and one curved setae on the ventrodistal margin of the tibia of the first leg (I-Leg-5), a plesiomorphic condition found in *Coaustraliobates* and other hygrobatid genera, (e.g. *Hydrobatella, Atractides*).

*Coaustraliobates* have apomorphic character states of a long broad posterior process to the infracapitulum; a long, slender palp tibia (PIV) and short, indistinct EpIV apodemes.

*Dropursa* have apomorphic characters of a modified tibia and tarsus of the first leg (Fig. 1).

In collections from Thailand, Peninsular Malaysia, Sulawesi (as part of the Project Wallace Expedition, 1985), Brunei (as part of the Raleigh International Expedition 1992), Irian Jaya (as part of Royal Botanic Gardens, Edinburgh Expedition, 1992) and Papua New Guinea, nine *Australianobates*, one *Dropursa* and two *Coaustraliobates* species were found only in New Guinea. These are described below with notes on their morphology and distribution.

The holotype specimens will be deposited in the Natural History Museum, London. The methods of collection and preservation are given in Wiles (1992).

**Abbreviations and terms used in text**

The following abbreviations are used in the text (see Fig. 1):

- A1, A2: pre- and post-antennal glandularia
- Anus: (= excretory pore sensu Prasad & Cook, 1972)
- B1–B4: laterocentral platelets 1–4
- C1–C4: dorsocentral platelets 1–4
- D1–D4: dorsoglandularia 1–4
- E1–E4: epimeroglandularia 1–4
- Ep: epimeron, the plate to which legs are attached (= coxa sensu Cook (1974))
- EpIII/IV: suture line between EpIII and EpIV
- F1, F2: pre- & post-frontal platelets.
- g1–g5: lyrifissures 1–5
- Genital plate: plate, with acetabula.
- H1–H4: ventral platelets 1–4
- L1–L4: lateroglandularia 1–4
- ML: median length of epimera
- Ms: median seta on EpiV
- P1–PV: palp segments 1–5 (trochanter to tarsus)
- R1, R2: pre- and post-ocularia
- V1–V4: ventroglandularia 1–4
- Ventral process: posterior extension of ventral infracapitulum
- I-Leg-3: first leg segments 3–6 (genu–tarsus)
- IV-Leg-6: fourth leg segment 6 (tarsus)
- Legs-2–4: segments 2–4 of each leg.

All lengths are in μm. Lengths of palp and leg segments are dorsal lengths.

**Glands, glandularia and platelets (Fig. 1)**

There are fundamentally 18 pairs of glandularia and two pairs of ocular setae on an adult watermite. In *Australianobates, Dropursa* and *Coaustraliobates* E1 and E3 are absent. E4 are located at the anterior margin of EpIV where, in some species, they may ‘migrate’ into EpIII behind the suture line EpIII/IV (Fig. 8). V1 has no associated gland and is located close to V2 and lateral to the anus. The seta and gland of V2 may be separate. V3 and V4 are anteriorly displaced relative to the genital and anal fields and are located posterior to EpIV. Typically, glandularia and lyrifissures lie free in the integument and there is no development of platelets. However, in a number of species the integument around the glandularia, lyrifissures and points of muscle attachment to the cuticle are thickened to form platelets which are thought to develop, during the adult phase (especially in males), through secondary sclerotisation. Platelets combine in various configurations which may be asymmetrical. This is particularly the case for the New Guinea species *A. longiseta, A. reticulata* and *A. reticuloides*. Most species do not exhibit strong secondary sclerotization but *A. vimorus* Cook, 1986 (pos-
sibly a “plated” form of *A. linderi*), *A. ventriscutatus* Cook, 1986 (which has a single ventral shield) and *A. vantermus* Cook, 1988 show plate development.

The development of plates during life presents a particular taxonomic problem as mites with plates appear to be very different to plate-free specimens. Species are often defined on the pattern of plates. However, the pattern and size of plates in *Australiobates* (*A. longiseta* sp. n.) indicates that some specimens of a single species may develop plates whilst another might not. It is possible that this is the product of a simple mechanism which fails to “switch off” secondary sclerotization in plated forms. I have therefore, included plated and non-plated forms together if there are no other differences in morphology. Breeding experiments are necessary to confirm or reject this hypothesis.

**KEY TO THE NEW GUINEA *Australiobates* species**

(for key to Australian species see Cook, 1988).

1) 2 long swimming setae present on IV-Leg-5, ventral PIII and PIV strongly convex. ........ *A. convexipalpis* sp. n.
Swimming setae short, < length IV-Leg-5, or absent, ventral PIII and PIV not strongly convex ........ 2)

2) Legs-2–4 with long plumose dorsal setae, PV broad with dorsal claw widely separated from ventral claws. .......................... *A. plumosa* sp. n.
Legs without long plumose setae, PV not broad with dorsal claw close to ventral claws. ........ 3)

3) E4 located well into EpIII taking anterior suture line of EpIV almost to anterior margin of EpIII. ........ .......................... *A. varirataensis* sp. n.
E4 located behind or on EpIII. ........ 4)

4) Epicuticle with reticulate pattern, variable but always present on the dorsum. .......................... 5)
Epicuticle without reticulate pattern. .......... 6)

5) PIV ventral setae long; in plated form: central plate between D3 absent. ........ *A. reticulata* sp. n.
PIV ventral setae short; in plated form: central plate between D3 present. ........ *A. reticuloides* sp. n.

6) PIII dorsodistal seta as long as PIV, integument thick. .......................... *A. longiseta* sp. n.
PIII dorsodistal seta shorter than PIV, integument typical. .......... 7)

7) Palps slender, ventral PIII strongly concave. ........ *A. concavipalpis* sp. n.
Palps typical, ventral PIII not strongly concave. .......... 8)

8) Male genital plate setae located between anterior acetabula; female genital plates broad and triangular. ........ *A. archboldi* sp. n.
Male genital plate setae in a fringe anterior to anterior acetabula, female genital plates narrow and straight. ........ *A. bruijnii* sp. n.

*Australiobates plumosa* sp. n.

(Fig 2)

Female: Colour yellow-brown, length 591–670, width 470–557. Idiosoma with no signs of secondary

![Fig. 2: Australiobates plumosa sp. n.](image_url)
sclerotisation or plate development; cuticle smooth. Epi not fused with infracapitulum. Posterior pair of acetabula lying behind the postgenital sclerite; length of genital plate 167–180. PII terminal setae short; ventral margin of PII and PIII almost straight; two short, pointed setae ventrally on PIV variable in position; PV broad with dorsal claw widely separated from ventral claws. Length PI–V 30, 78, 98–113, 104–113, 33–39. Legs 2–4 with long plumose dorsal setae. Swimming setae absent.


Etymology. Name alludes to the plumose setae on the legs.

Diagnosis and discussion. The plumose setae on the legs are apomorphic. Specimens were found in small streams at high altitudes >1800 m, from locations more than 2° latitude apart.

**Australiobates concavipalpis** sp. n. (Fig 3)


**FIG. 3: Australiobates concavipalpis** sp. n.


Etymology. — Name refers to the shape of the palp.

Diagnosis and discussion. — This species is widely distributed in PNG. It has no swimming setae and is similar to A. rudagus Cook, 1986 from Queensland, but with longer spatulate setae ventrally on PIV, setae present on ventrodistal PIII and a spatulate ventrodistal seta on I-Leg-5.

Australiobates convexipalpis sp. n. (Fig. 4)


Female: Similar to male, length 670, width 478. V4 posterior to genital plates. Posterior acetabula anterior or adjacent to the post-genital sclerite. Genital plate length 104. Length PI–V 28, 69, 80, 106, 32.

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**Fig. 4:** Australiobates convexipalpis sp. n.


Etymology. — Name refers to the convex shape of ventral Pili.

Diagnosis and discussion. — This species is widely distributed in coastal streams of New Guinea. It is the only New Guinea species with swimming setae on all legs. It is similar to A. violaceus Lundblad, 1941 from Australia, but the ventral Pili is convex and V2 setae are separate from the gland. (The Australian species A. queenslandicus also has swimming setae.)

Australiobates longiseta sp. n.

(Fig. 5)

Male: Body length 376, width 254. Integument thick with variable secondary sclerotisation and plate development. R2 and A2 may be located together on a plate or free in the integument. Similarly, D2, D3, D4 and L3 may be located on a single asymmetrical dorsal plate or free in the cuticle. V1 and V2 may be located together on plates lateral to the anus. Epimera porose. Epi not fused to ventral extension of infracapitulum. Apodemes of EpiV may be hidden by secondary sclerotisation. Ventroglandularia with various degrees of secondary sclerotisation but not fused to epimera. Genital plate variable in shape, with over 12 small setae between anterior acetabula, length 65, width 80. PIII distoventral setae variable in location and dorso-distal seta long, as long as PIV; PIV with two spatulate ventral setae. Length PI–V 20, 37, 47, 48, 21. Ventrodistant I-Leg-5 with one pointed and one spatulate seta. Length I-Leg-3–6 57, 80, 83, 83. Swimming setae absent.


Etymology. — Name refers to the long dorso-distal seta of PIII.

Diagnosis and discussion. Males and females exhibit variable degrees of secondary sclerotisation, which are more extreme in males. The thick integument, porose epimera and long palp seta on PIII are diagnostic. The species is widely distributed from sea level to 2000 m altitude, in somewhat polluted streams (Higaturu Oil Palm plantation), slow flowing brooks and turbulent stony streams.

It is similar to the non-plated Australian species, A. queenslandicus Cook, 1986 and A. perplexus Cook, 1986 (for which only the male has been described, also from Queensland) which have long dorso-distal setae on PIII. A. longiseta can be separated from A. queenslandicus by the absence of swimming setae and presence of broader spatulate PII ventral setae and from A. perplexus by the presence of spatulate distal setae on I-Leg-5.

Australiobates reticulata sp. n.

(Fig. 6)

Male. Length 591–626, width 460. Idiosoma with or without dorsal plates. Dorsal plate development variable, sometimes asymmetrical: R1 may be incorporated into an anterior plate with A1 or free in integument, D4 may be fused to V2, V1 and the anus on a large common plate or free in the integument and L4 may be fused to V4. Epicuticle with reticulate
FIG. 5: *Australiobates longiseta* sp. n.
FIG. 6: Australiobates reticulata sp. n. ♂


Etymology. — Name refers to the reticulate nature of the cuticle.

Diagnosis and discussion. This species is identified by the reticulate pattern on the integument and the typical palp with long PIV ventral setae and, in the plated form, by the absence of a central plate between D3. It is similar to *A. reticuloides* and is found in mountain streams at altitudes above 1500 m.

**Australiobates reticuloides** sp. n.
(Fig. 7)


Etymology. — Similar to *A. reticulata*.

Diagnosis and discussion. Species with a reticulate cuticle and slender palp with short PIV ventral setae; found at altitudes above 1500 m. (See discussion under *A. reticulata*.)

**Australiobates varirataensis** sp. n.
(Fig. 8)

Male: length 817, width 573. Venter typical of genus, no secondary plate development and infracapitulum free in integument. E4 located well into EpiII, taking anterior suture line of EpIV almost to anterior margin of EpIII. Genital plate with three pairs of acetabula. Palp with two stout blunt setae located close together on ventral PIV. No ventral setae on PIII. Legs without swimming setae.

Female (damaged specimen): location of E4 similar to male. V4 located posterior to genital plate. Posterior pair of genital acetabula located posterior to the middle acetabula. Palp similar to male. Length PI–V 28, 58, 83, 85, 27. Distal I-Leg-5 with
FIG. 7: *Australobates retuloides* sp. n.


well developed ventral seta, one blunt; a very well developed recurved seta present.

Material examined. — Holotype ♂, PAPUA NEW GUINEA: R. Variata, National Park entrance, Port Moresby, 23 Nov. 1988, slide A105♂; paratype 1 A14♀.

Diagnosis and discussion. This species is similar to *A. mutatus* Cook, 1986. The apomorphic diagnostic character is the striking anterior location of E4. (Specimens were damaged during dissection.)

*Australiobates archboldi* sp. n.  
(Fig. 9)


Etymology. Named after Richard ARCHBOLD who explored the area around L. Habbema (1938–1939), Irian Jaya (see ARCHBOLD, RAND & BRASS 1942).

July 1988, A100♀; R. Sura, Pomaga, 8 July 1988, A18♂, A171♀, A172♀; R. Cum, Mt. Hagen, 4 July 1988, A170♀; IRIAN JAYA: Outflowing river, D. Habbema, alt. 3400 m, 19 Oct. 1992. A293 (♂♀♂), A239♀, A292♀; R. Wekikama, Wamena, 21 Oct. 1992, A323 ♂♀♂. Diagnosis and discussion. Collected from a wide range of altitudes from sea level to 3000 m. This species is similar to *A. linderi* Lundblad, 1941, but has stockier tarsi on I-Leg and no swimming setae on IV-Leg-5; males have setae between the anterior genital acetabula (not in a line located anteriorly) and the female genital plates are broad and triangular (not narrow and straight). Specimens from lake Habbema are included here, but there are minor differences in the distribution of male genital plate setae and small differences in palp shape.

*Australiobates bruijni* sp. n. (Fig. 10)


Etymology. Named after Dr J. V. de Bruin, who as district officer for Central Netherlands New Guinea (1939–1944), first explored the central highlands of Irian Jaya (RHYS, 1947).
Material examined. — Holotype $\delta$: PAPUA NEW GUINEA, Angorum Road, Stream, Wewak, PNG, 25 July 1988, slide A103 holotype $\delta$, paratype 1 A107 (8$\delta$, 8$\varphi$). Additional material: R. Hohoman, Wewak, PNG. 26 July 1988 A162 $\delta$, A167 $\delta$ (2$\delta$); Angorum Road, R. Kambagora, PNG, 27 July 1988. A158 $\delta$ (1$\delta$); Refugee camp stream, Vanimo, PNG, 21 July 1988; A150 $\delta$ (1$\delta$). Usipi creek, Vanimo, PNG, 18 July 1988, A154 $\delta$, A152 $\varphi$, (3$\delta$ 2$\varphi$); Waterfall stream, Vanimo, PNG, 18 July 1988; A86 $\delta$, A85 $\varphi$ (1$\delta$ 2$\varphi$); R. Sura, Ba-amo, PNG, 7 July 1988, A23 $\delta$, A19 $\varphi$ (1$\delta$ 1$\varphi$); R. Sura, Pomaga, PNG, 8 July 1988, A69, A70 (2$\delta$); Golf club stream, Mt. Hagen, PNG. 2 July 1988, A72, A73 (2$\delta$).

Diagnosis and discussion. Widespread in New Guinea. Similar to A. linderi Cook, 1986, but without swimming setae on IV-Leg-5; slender I-Leg-5 with more posteriorly located ventral setae and PII not markedly convex.

NEW RECORDS FOR NEW GUINEA

Coaustrialobates longipalpis (Lundblad, 1941)

Coaustrialobates longipalpis (Lundblad), Cook 1986: Australia.

PAPUA NEW GUINEA, R. Sura, Da-amo, S. Highlands; 7 July 1988, A27 $\varphi$ (1$\varphi$).

Coaustrialobates minor (Lundblad, 1947)


Coaustrialobates minor (Lundblad), COOK 1986: Australia.

PAPUA NEW GUINEA, Lake Kutubu, S. Highlands; 10 July 1988 & 9 July 1988, A214 $\delta$, A186 $\delta$, A187 $\delta$, A190 $\delta$, A210 $\delta$, A272 $\varphi$, A210 $\varphi$, A216 $\varphi$, A272 $\varphi$. Remarks: This is a common species in Lake Kutubu although only previously reported from streams.
Dropursa babinda Cook, 1986

Dropursa babinda Cook, 1986: Australia.


DISCUSSION

The Australiobates from New Guinea have a difficult taxonomy particularly because of secondary sclerotisation. Variable plate development occurs in A. longiseta, a species with the apomorphic characters of a leathery, thick integument; heavily porose epimera and long PIII dorso-distal seta. In other species the position is not so clear cut. A closer examination of the phenomenon might have wider implications for watermite taxonomy. Secondary sclerotisation also occurs in other genera e.g. Neumania which may have variable plated forms (Neumania multiscutata Piersig, 1906), although there are generally other correlated morphological differences.

The taxonomy of Australiobates requires more detailed examination to assess the morphological criteria used to identify species. This first collection of watermites from New Guinea indicates that they are a common and diverse group of watermites which may be as important in Australasian waters as Hygrobates species are in Europe.

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