A REVIEW OF THE SUBGENUS *BREVICAUDATURUS* (ACARI: HYDRACHNIDIA: ARRENURIDAE: *ARRENURUS*) FROM THE INDO-AUSTRALIAN AND PACIFIC REGION, WITH DESCRIPTION OF A NEW SPECIES

Harry Smit

Zoological Museum, University of Amsterdam, Plantage Middenlaan 64, 1018 DH Amsterdam, The Netherlands; smit.h@wolmail.nl

ABSTRACT - A review of the subgenus *Brevicaudaturus* from the Indo-Australian and Pacific Region is presented. One new species, *Arrenurus (Brevicaudaturus) postmai* is described from Australia. The following synonyms are established: *A. tricornutus* K.O. Viets as a junior synonym of *A. multicornutus* Walter, *A. quadricornutus* Piersig as a junior synonym of *A. laticodulus* Piersig, and both *A. matupitensis* Piersig and *A. toxopeusi* Viets as junior synonyms of *A. lohmanni* Piersig. New records are presented for *A. multicornutus* and *A. lohmanni* from Australia. Keys for males and females are included.
Key words - Water mites, Hydrachnidia, *Arrenurus*, *Brevicaudaturus*, Pacific, Indonesia, Australia.

INTRODUCTION

The recently proposed subgenus *Brevicaudaturus* (Smit, 1997) of the genus *Arrenurus* occurs worldwide, but has a mainly tropical and subtropical distribution. Numerous species are known from lentic habitats in the Indo-Australian and Pacific Region, and some of them are widespread. Knowledge of the distribution of species of the subgenus in this Region is limited due to their occurrence in areas little visited by acarologists. Moreover, as in all *Arrenurus* species groups there is a pronounced sexual dimorphism, and in some species only one of the sexes is known. Finally, identification of species of the subgenus is hampered by the often sketchy illustrations in the older literature. In this study, I examined some older museum material, most of which is slide-mounted so that only dorsal and ventral views were observable. Examination of the important lateral views of these specimens is not possible without remounting.

In the following review an attempt has been made to clarify the morphology and status of the species of the subgenus in the Indo-Pacific Region. Keys are presented for males and females and new records are given for Queensland, Australia and Fiji.

MATERIALS AND METHODS

Unless stated otherwise, all material was collected by the author. The holotype of *A. postmai* sp. nov. was deposited in the Western Australian Museum in Perth (WAM) and all non-type material in the Zoological Museum of the University of Amsterdam (ZMAN).

The following abbreviations are used: A1 and A2 for pre- and post-antennal glandularia, Cx2-4 for coxoglandularia 2-4, D1-4 for dorsoglandularia 1-4; L1-4 for lateroglandularia 1-4; V1-V3 for ventroglandularia 1-3; PI-PV for palp segments 1-5; and IV-leg-4-6 for fourth-sixth segments of fourth leg. Institutions where specimens are deposited are abbreviated as follows: HMB for Humboldt Museum Berlin; NMB for Naturhistorisches Museum Basel; and SMF for Forschungsinstitut und Naturmuseum Senckenberg in Frankfurt am Main. Numbering of the glandularia follows Jin & Wiles (1996) and Wiles (1997). All measurements are expressed in µm and measurements of leg and palp segments are of the dorsal margins.

Some of the illustrations are of teneral specimens in which the body was not fully sclerotized, giving them an asymmetrical appearance. In the older slides examined in this study a number of details can no longer be seen

clearly, especially the slender setae on the coxal and genital plates.

SYSTEMATICS

Arrenurus (*Brevicaudaturus*) Smit

Arrenurus (*Brevicaudaturus*) Smit, 1997: 252.

Diagnosis - Characters of Arrenuridae. Dorsal shield present, dorsal furrow complete or passing onto lateral surfaces. Cauda of male short and wide, posteriorly with or without a cleft which in some species may be very wide. D1 on very large humps.

Arrenurus (Brevicaudaturus) bicornutus Piersig

Arrenurus bicornutus Piersig, 1898: 570; Piersig & Lohmann, 1901: 110; Viets, 1923: 189.

Specimens examined - *Syntypes*: **Bismarck Archipelago**: 6 males and 9 females, pool near Matupi, 5 March1897, leg. Dahl (HMB). Other specimens - **Indonesia**: 1 male, Buru, 1921 (slide 3212, SMF).

Remarks - *Arrenurus bicornutus* is only known from the Bismarck Archipelago and Buru.

Arrenurus (Brevicaudaturus) laticodulus Piersig Figs. 1-3

Arrenurus laticodulus Piersig, 1898: 571; Piersig & Lohmann, 1901: 110; Piersig, 1903: 6; Walter, 1929: 271; Prasad, 1974: 26.
Arrenurus (Micruracarus) laticodulus Piersig: Viets, 1935: 26.
Arrenurus (Megaluracarus) laticodulus Piersig: Lundblad, 1946: 25; Cook, 1957: 76; Cook, 1967: 222; Lundblad, 1969: 398; Wiles, 1988: 495; Wiles, 1990: 281; Wiles, 1993: 138; Jin & Wiles, 1996: 338; Jin, 1997: 151.
Arrenurus (Brevicaudaturus) laticodulus Piersig: Smit, 1997: 253.
Arrenurus quadricornutus Piersig, 1903: 27. **New synonymy.**
Arrenurus quadricornutus Piersig : Walter, 1911: 214.
Arrenurus (Brevicaudaturus) quadricornutus Piersig: Smit, 1997: 253.

Specimens examined - Aru Islands: (as *Arrenurus quadricornutus*) female (palp only), 22 February 1908 (slide X/98, NMB). **Australia: Queensland**: 1 female, Hasties Swamp, Hasties Swamp National Park, 16 September 2000. **Fiji: Viti Levu**: 3 males, 28 females, pond near Lipanoni, approximately 35 km west of Suva, 6 October 2000.

Remarks - When Piersig (1903) described the male of *A. quadricornutus*, the female of *A. laticodulus* was not known to him. It was not until 1957 that the female was described by Cook (1957). In all aspects, females of *A. quadricornutus* and *A. laticodulus* are similar, and therefore I synonymize the two species. Unfortunately, in the original tube of *A. quadricornutus* in the Humboldt Museum (Berlin) only an unknown female was found. The holotype female of *A. quadricornutus* appears to be missing.

The female from Queensland differs from other known specimens in having very blunt humps (Fig. 2). However, from the literature it can be seen that there is some variation in the shape of these humps (compare Fig. 852 of Cook, 1967 with Fig. 1d of Wiles, 1993). This female is teneral and appears to represent an extreme condition in the range from pointed humps to very blunt humps in members of *A. laticodulus*. Because the specimen is not completely sclerotized, some of the humps are asymmetrical and some of the glandularia cannot be seen in dorsal view (D1, L1). V1, V2 and V3 are not illustrated in the ventral view.

Arrenurus laticodulus is one of the most widespread members of the genus, known from China to India, from the Indonesian Archipelago to the Pacific island of Yap, and west as far as Madagascar (Lundblad, 1946). Wiles (1988) erroneously reported it from Australia, referring to K.O. Viets (1975a). However, Viets (op. cit.) did not report the species from Australia. It is reported here for the first time from Australia and Fiji.

Arrenurus (Brevicaudaturus) lohmanni Piersig Figs. 4-5

Arrenurus lohmanni Piersig, 1898: 572; Piersig & Lohmann 1901: 111; Piersig, 1903: 21; Viets, 1923: 189.
Arrenurus (Megaluracarus) lohmanni Piersig: Cook & Bright, 1983: 198.
Arrenurus (Brevicaudaturus) lohmanni Piersig: Smit, 1997: 253; Harvey, 1998: 144.
Arrenurus matupitensis Piersig, 1903: 26. **New synonymy.**
Arrenurus (Brevicaudaturus) matupitensis Piersig: Smit, 1997: 253.
Arrenurus toxopeusi K. Viets, 1923: 189; Uchida, 1939: 213. **New synonymy.**
Arrenurus (Brevicaudaturus) toxopeusi K. Viets: Smit,

1997: 253.

Specimens examined - As *Arrenurus lohmanni* - *Syntypes* - **Bismarck Archipelago**: 2 males, pool near Matupi, 5 March 1897, leg Dahl (HMB). Other material - **Indonesia: Buru**: 1 male, 1921, leg. Toxopeus (slide 3214, incorrectly labelled "female", SMF); **Australia: Western Australia**: 1 male, McKenzie Spring, Millstream-Chichester National Park, (ZMAN); 3 females, pond, Knox Gorge, Hamersley Range National Park, 13 August 1994 (ZMAN). As *Arrenurus matupitensis* - *Holotype* - **Bismarck Archipelago**: 1 female, pool near Matupi, 5 March 1897, leg. Dahl (HMB). Other specimens - **Indonesia: Buru**: 1 female, 1921, leg. Toxopeus (slide 3216, SMF). As *Arrenurus toxopeusi* - *Holotype* - **Indonesia: Buru**: 1 female, 1921 (slide 3213, SMF).

Remarks - I believe that Cook & Bright (1983) were correct in suggesting that *A. matupitensis* is the female of *A. lohmanni*. Piersig (1903) found members of the two species in the same pond. In the specimens described by Piersig (1903), glandularia D3 and D4 of the dorsal shield are located closer to each other than to D2. In the three specimens from Australia, as well as in the specimen from Buru, glandularia D2, D3 and D4 are equidistant from one another. In an earlier paper (Smit, 1997), I described a female under the name of *A. lohmanni*. I now conclude that this female should be assigned to *A. tricornutus* Viets (see below under that species).

Viets (1923) described a similar species which he named *A. toxopeusi*. He based his diagnosis for this species on differences in body length/width (*toxopeusi* being more slender), the length/width ratio of the dorsal shield (more elongate in *A. toxopeusi*, see Fig. 4) and the shape of the anterodorsal humps (which do not extend beyond the lateral body margin in *A. toxopeusi*). In my three Australian females assigned to *A. lohmanni*, the body length/width ranges from 1.31 - 1.38 µm and the length/width ratio of the dorsal shield ranges from 1.03 - 1.15. For the type of *A. toxopeusi* these measurements are 1.42 and 1.32 respectively. The illustration of Piersig (1903) is not correct for the shape of the humps of D1as these do not extend beyond the body margin. In lateral view *A. toxopeusi* has the bilobed hump of D1 (Fig. 5) characteristic for *A. lohmanni*. The humps of the holotype do not appear to be completely sclerotized. Two palps were mounted on the type slide, one normally shaped and one mishappen. Unfortunately, the normal palp was lost during remounting. The only remaining difference between the two species is the more slender dorsal shield of *A. toxopeusi*, but this feature is highly variable and not reliable as a diagnostic character. Therefore, I consider *A. toxopeusi* to be a junior synonym of *A. lohmanni*.

A. lohmanni is widespread and known from the Bismarck Archipelago, Buru, Palau and Australia.

Arrenurus (Brevicaudaturus) multicornutus Walter
Figs. 6-12

Arrenurus multicornutus Walter, 1915: 118.
Arrenurus (Megaluracarus) multicornutus Walter: Cook, 1957: 76; Wiles, 1988: 499.
Arrenurus (Brevicaudaturus) multicornutus Walter: Smit, 1997: 253.
Arrenurus tricornutus K. Viets, 1955: 25. **New synonymy.**
Arrenurus (Megaluracarus) tricornutus K. Viets: K.O. Viets, 1975b: 93; Smit, 1992: 106.
Arrenurus (Brevicaudaturus) tricornutus K. Viets: Smit, 1997: 253; Harvey, 1998: 144.
Arrenurus (Brevicaudaturus) lohmanni (err., non Piersig, 1898): Smit, 1997: 253 [part., female].

Specimens examined - As *Arrenurus multicornutus* - *Lectotype* (new designation] - **New Caledonia**: 1 female, Kouinné, 20 October 1911, leg. Sarasin/Roux (slide IV/68, NMB); 1 female (palp only), 20 October 1911, leg Sarasin/Roux (palp of lectotype?, slide IV/69, NMB). *Paralectotype* - 1 female, same data as lectotype (also mounted on slide IV/68, NMB). As *Arrenurus tricornutus* - *Syntypes* - **Australia: Queensland**: 2 females, pool, Mossman, 6 June 1954, leg. Laird (slide 7758, SMF). Newly identified specimens - **Australia: Western Australia**: 8 females, McKenzie Spring, Millstream-Chichester National Park, 17 August 1994 (ZMAN); 1 female, Lily Creek Lagoon, Kununurra, 17 September 1998; 2 females, Fitzroy River, south of Fitzroy Crossing, 28 September 1998 (ZMAN); 2 males, 6 females, Taylor's Lagoon, east of Broome, 14 October 1998 (ZMAN); 2 males, 5 females, Lake Eda, east of Broome, 30 October 1998 (ZMAN); **Queensland**: 1 female, Saltlake (actually a freshwater pond, possibly temporary), 136 km north of Hughenden, on Hanna Highway, 23 June 1974, leg. B.V. Timms (slide 5632, SMF); 1 female, shallow pool on road to Hanush Waterhole, Lakefield National Park, 4 September 2000; **Northern Territory**: 1 female, Magela Creek flood plain, Ja Ja Billabong, 17 July 1979, leg. R. Tait (slide 7172, SMF). **Fiji: Viti Levu**: 3 females, pond near Lipanoni, approximately 35 km west of Suva, 6 October 2000.

Remarks - Walter (1915) did not designate a holotype. Two specimens were found on the type slide of *A.*

multicornutus, a large female, 2150 µm long and 1688 µm wide, (Figs. 6-7) on which Walter (1915) based his description (designated here as the lectotype), and a smaller female, 1688 µm long and 1327 µm wide (Fig. 8) (designated here as the paralectotype). The lectotype and paralectotype are designated in order to ensure the name's proper and consistent application.

My specimens from The Kimberley, Australia also show a considerable variation in size, ranging from 1588-2110 µm in length and 1226-1718 µm in width. The specimens reported by Cook (1957) from Yap were smaller, the females ranging from 1390-1770 µm in length and 1170-1570 µm in width.

K.H. Viets (1955) described *A. tricornutus* from Australia, separating it from *A. multicornutus* by the larger size, shape of the anterior and dorsal body margin and the structure of palp. It now appears that specimens of *Arrenurus tricornutus* exhibit variability within the range of those of *A. multicornutus*, and that size is not a reliable character for separating the two species. I remounted the two specimens from the type series of *A. multicornutus* and therefore had the opportunity to examine the specimens from various aspects. I conclude that reported distinctions in body shape between members of the two species result from observations of variously oriented specimens rather than real species differences. Some of the humps on the lectotype of *A. multicornutus* are not fully sclerotized (Figs. 6-7) and appear rounded. The palps of members of the two species are also similar in shape. The palp of the holotype is in poor condition and only one long seta is visible, although Walter (1915) mentioned four setae. K.H. Viets (1955) mentioned two setae on PII for *A. tricornutus*, but my Australian specimens have up to five setae on this segment. The shape of the body and size of the palp appear to show continuous variation among specimens of *A. multicornutus* and *A. tricornutus*, and I therefore consider them to be conspecific.

The shape of the posterior body margin in females is also variable, with some specimens having a wide indentation (Fig. 9) but others having only a narrow one (Figs. 10-11). The females previously assigned by me to *A. lohmanni* Piersig (Smit, 1997) do not belong to that species and must now be assigned to *A. multicornutus*. I based my earlier identification on co-occurrence of my females with a male of *A. lohmanni* and on the slightly widened genital plate. However, the latter character can also be found in some members of *A. multicornutus*. Other differences mentioned by me, i.e. the smaller size, the more concave anterior body margin and the smaller humps of A1, all fall within the range of variation noted for *A. multicornutus*. A female specimen from Lakefield National Park has only very small, probably not fully sclerotized, humps on the dorsal shield (Fig. 12), but is otherwise similar and is also assigned to this species.

Arrenurus multicornutus is widespread and reported from Fiji, New Caledonia, Yap, Australia and the Malay Peninsula. Within Australia, the species was known previously from Queensland and the Northern Territory. It is reported here for the first time from Western Australia and Fiji.

Arrenurus (Brevicaudaturus) postmai sp. nov.
Figs. 13-17

Specimens examined - *Holotype*: Male, pools upstream from Bell Gorge Falls, The Kimberley, Western Australia, Australia, 11 September 1998 (WAM).

Diagnosis - Male with body round in shape and with cauda short and broad, D1 on large humps, posterior part of cauda medially with one large hump.

Description -Male - Body 1257 long and 1126 wide, body colour yellowish. Body shape rounded. Dorsal furrow incomplete, extending onto lateral surfaces of body. Cauda short and broad, 721 long. D1 on large humps. Posterior part of cauda with a large hump medially (Fig. 13). Posterior margin of cauda concave. Cauda with a prominent ridge laterally. D4 shifted posteriorly, not visible in dorsal view. L4 on short humps (Fig. 16). Gonopore 113 long. Genital plates long, extending to lateral body margin (Figs. 14-15). Posterior margin of genital plates with numerous long setae. Lengths of PI-PV: 55, 120, 76, 132, 54. PII with five setae on anterior margin, PV blunt, but this might be an aberration (Fig. 17). Lengths of I-leg-4-6: 239, 243, 324. Lengths of IV-leg-4-6: 324, 243, 194; IV-leg-4 without a spur.

Female. Unknown.

Etymology - Named after Johannes Postma (Ann Arbor).

Remarks - The new species has a body shape similar to that of *A. laticodulus* Piersig. However, the body of the latter species is more elongate, the cauda extends further beyond the posterior body margin, the cauda lacks a medial hump and the posterior margin of the cauda is more or less straight.

Arrenurus (Brevicaudaturus) roobeeki Smit

Arrenurus (Megaluracarus) roobeeki Smit, 1992: 108; Harvey, 1998: 144.
Arrenurus (Brevicaudaturus) roobeeki Smit, 1997: 253.

Specimens examined - Australia: Queensland: 1

female, Red Lily Lagoon, Lakefield National Park, 4 September 2000.

Remarks - Thus far, this species has been reported only from the type locality in Queensland, Australia. The specimen reported here agrees well with the type material, but differs in having a distinct medial margin on the fourth coxal plates and a less concave posterior body margin

Keys to Species of *Brevicaudaturus* from Indo-Australian Pacific Region

Females -

1. Dorsal shield relatively small, rounded or somewhat ellipsoidal, without humps 2
- Dorsal shield not rounded or ellipsoidal, or with humps (which may be large or small) 3
2. Large hump of D1 in lateral view pointed dorsad and with anterior margin having two lobes; humps of L4 in lateral view located 2/3 of distance between apex of D1 and posterior body margin . . . . . *A. lohmanni*
- Large hump of D1 in lateral view pointed posteriad, and with anterior margin with one lobe; hump of L4 in lateral view located near posterior body margin . . . . . *A. bicornutus*
3. Large hump present between humps of D1 . . . . . *A. multicornutus*
– No large hump present between humps of D1 . . . 4
4. Dorsal shield more or less pear-shaped, humps bifid in lateral view . . . . . *A. roobeeki*
– Dorsal shield more or less round, humps simple in lateral view . . . . . *A. laticodulus*

Males -

1. No large hump present between humps of D1 . . . 2
– Large hump present between humps of D1 . . . . . *A. multicornutus*
2. Posterior body margin medially convex 3
– Posterior body margin medially concave 4
3. Cauda medially with a hump . . . . . *A. postmai*
– Cauda medially without hump . . . . . *A. laticodulus*
4. Humps of D1 bifid in lateral view . . . . *A. roobeeki*
Humps of D1 simple in lateral view 5
5. Large humps of D1 relatively broad in lateral view and directed anteriad; D3 lying lateral to D2 . . . . *A. lohmanni*
- Large hump of D1 relatively slender in lateral view and directed posteriad; D3 lying medial to D2 . . . . *A. bicornutus*

ACKNOWLEDGEMENTS

I am indebted to Ulrike Schreiber and Dr. M. Grasshoff (SMF) and Dr. A. Hänggi (NMB) for the loan of specimens from the Viets and Walter Collections, respectively, to Dr J. Dunlop (HMB) for his help during my visit to the Humboldt Museum and to the Queensland Parks and Wildlife Service for their permission to collect in the national parks of Queensland. Dr. Wilco Liebrechts (Suva, Fiji) and the National Trust for Fiji gave valuable assistance during my visit to Fiji. G.M. van der Pal assisted me on my collecting trips. Dr B.V. Timms gave me information on the localities where he collected water mites which are now in the Viets Collection. Terry Gledhill commented on a first draft of this paper and he and Johannes Postma (Ann Arbor) corrected the English.

REFERENCES

Cook, D. R. 1957. Arrenuri from the island of Yap (Acarina: Arrenuridae). The Pan-Pacific Entomologist 33: 75-78.

Cook, D. R. and G. R. Bright 1983. Water mites of the Palau Islands. Acarologia 24: 187-201.

Cook, D. R. 1967. Water mites from India. Mem. Amer. Entom. Inst. 9: 1-411.

Harvey, M. S. 1998. The Australian water mites. A guide to Families and Genera. Monographs on Invertebrate Taxonomy 4. CSIRO Publishing, Collingwood, 150 p.

Jin, Daochao and P. R. Wiles. 1996. New species of *Arrenurus* Dugès (Acari: Hydrachnidia: Arrenuridae) from China and first records of watermites from Laos. Acarologia 37: 317-344.

Jin, Daochao 1997. Hydrachnellae - Morphology, Systematics. A primary study of Chinese fauna. Guizou Science and Technology Publishing House, Guiyang, 356 pp.

Lundblad, O. 1946. Madagassische Süsswassermilben. Ark. Zool. 38A: 1-40.

Lundblad, O. 1969. Indische wassermilben, hauptsächlich von Hinterindien. Ark. Zool. 22: 289-443.

Piersig, R. 1898. In- und ausländische Hydrachniden. (Vorläufige Mittheilung). Zool. Anz. 21: 568-575.

Piersig, R. and H. Lohmann 1901. Acarina. Hydrachnidae and Halacaridae. Das Tierreich 13: 1-336. Friedländer und Sohn, Berlin.

Piersig, R. 1903. Beiträge zur Kenntnis der Hydrachniden-Fauna des Bismarck-Archipels. Arch. Naturg. 70: 1-34.

Prasad, V. 1974. A catalogue of mites of India. Indira Acarol. Publ. House, Ludhiana, 320 pp.

Smit, H. 1992. Water mites from New South Wales and Queensland, Australia (Acari, Hydrachnellae). Tijdschrift voor Entomologie 135: 91-112.

Smit, H. 1997. Australian water mites of the genus *Arrenurus*, with the description of 12 new species, from northern and western Australia (Acari: Hydrachnellae: Arrenuridae). Records of the Western Australian Museum 18: 233-261.

Uchida, T. 1939. *Arrhenurus toxopeusi* from the Palau Islands. Annot. Zool. Japon. 18: 213.

Viets, K. H. 1923. Über einige Hydracarinen von den Molukken. Zool. Anz. 57: 188-191.

Viets, K. H. 1935. Die Wassermilben von Sumatra, Java und Bali nach den Ergebnissen der Deutschen Limnologischen Sunda-Expedition. Arch. Hydrobiol., Suppl. 14: 1-113.

Viets, K. . 1955. Kleine Sammlungen europäischer und außereuropäischer Wassermilben (Hydrachnellae, Acari). Abh. naturw. Ver. Bremen 34: 1-26.

Viets, K. O. 1975a. Wassermilben (Hydrachnellae, Acari) aus Stillgewässern in Guatemala. Studies Neotrop. Fauna 10: 57-76.

Viets, K. O. 1975b. Neue Wassermilben (Acari, Hydrachnellae) aus Australien. Zoologica Scripta 4: 93-100.

Walter, C. 1911. Hydracarina der Aru-Inseln. Abh. Senckenberg. naturf. Ges. 34: 209-222.

Walter, C. 1915. Les Hydracariens de la Nouvelle-Calédonie. In: F. Sarasin & J. Roux (eds.), Nova Caledonia. Forschungen in Neu-Caledonien und auf den Loyalty-Inseln. Zool. 2: 95-122. C.W. Kreidel, Wiesbaden.

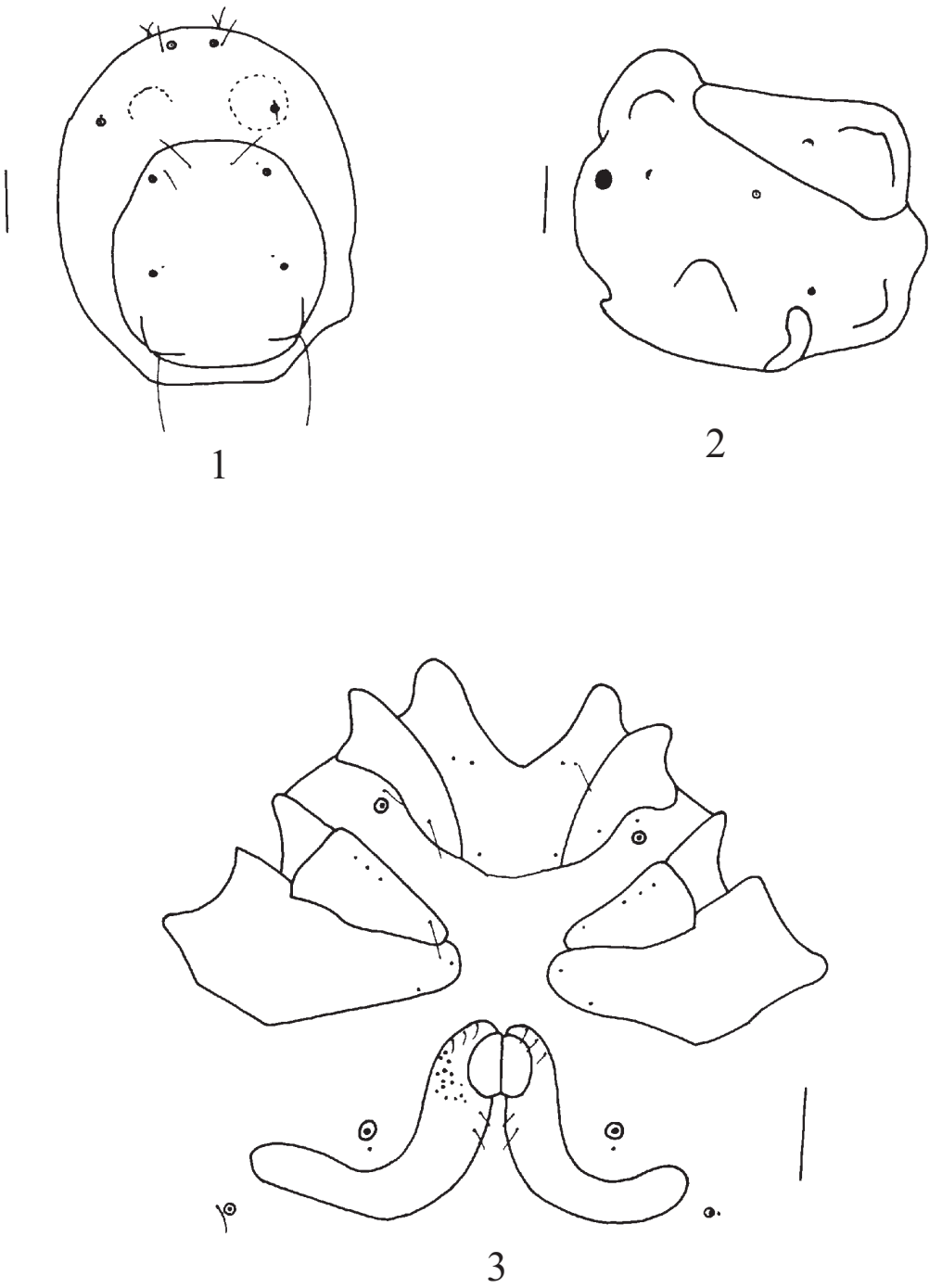
Walter, C. 1929. Hydracarinen aus Java. Treubia 11: 211-273.

Wiles, P. R. 1988. Watermites of the Genus *Arrenurus* Dugès 1834 (Hydrachnidia) from Peninsular Malaysia. Malay. Nat. J. 41: 479-504.

Wiles, P. R. 1990. The watermites (Acari: Hydrachnidia) of North Sulawesi. In: Knight, W.J.& Holloway, J.D. (Eds.), Insects and the Rain Forest of South East Asia (Wallacea): 279-295. The Royal Entomological Society of London, London.

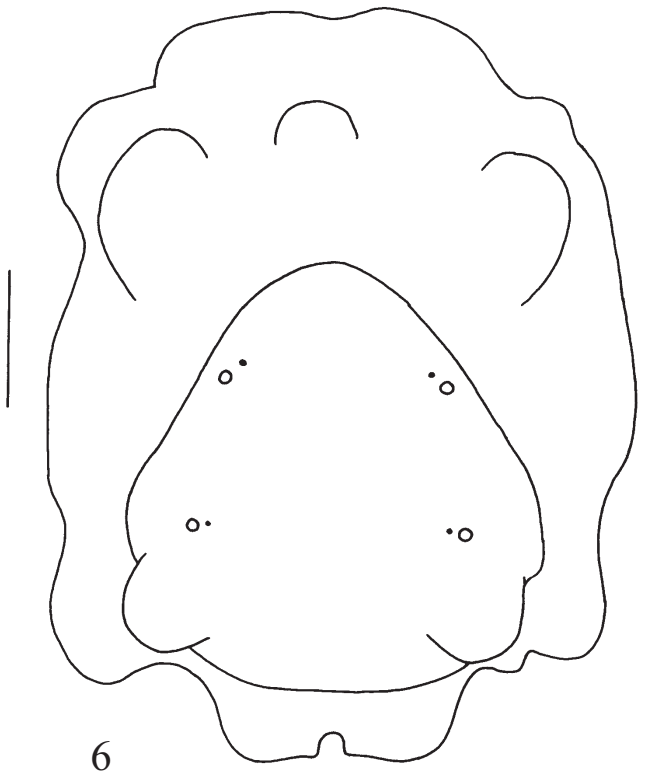
Wiles, P. R. 1993. New species of tropical watermites (Acari: Hydrachnidia: Arrenuridae) from Asia. Quek. J. Micr. 37: 135-145.

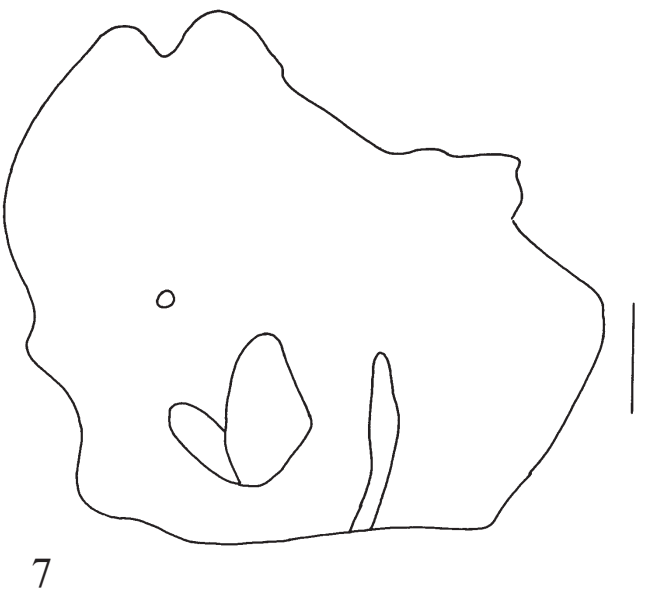
Wiles, P. R. 1997. The homology of glands and glandularia in the water mites (Acari: Hydrachnidia). J. Nat. Hist. 31: 1237-1251.



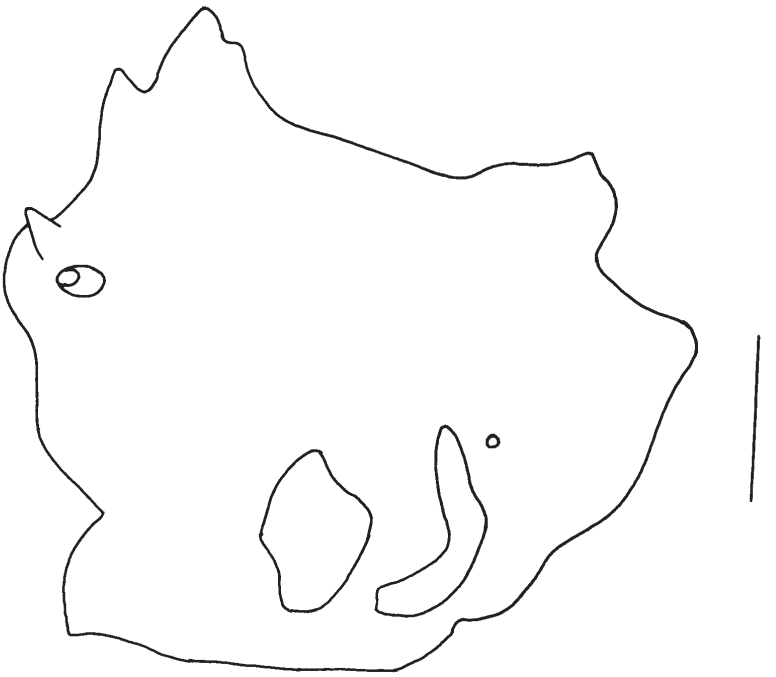
Figs. 1-3. *Arrenurus laticodulus* Piersig - female from Hasties Swamp, Queensland. 1.dorsal view; 2. lateral view; 3. ventral view. Scale bars = 400 µm (Figs. 1-2) and 200 µm (Fig. 3).

Figs. 4-5. *Arrenurus toxopeusi* K.H. Viets (= *A. lohmanni* Piersig) - holotype female. 4. dorsal view; 5. lateral view. Scale bar = 400 µm.

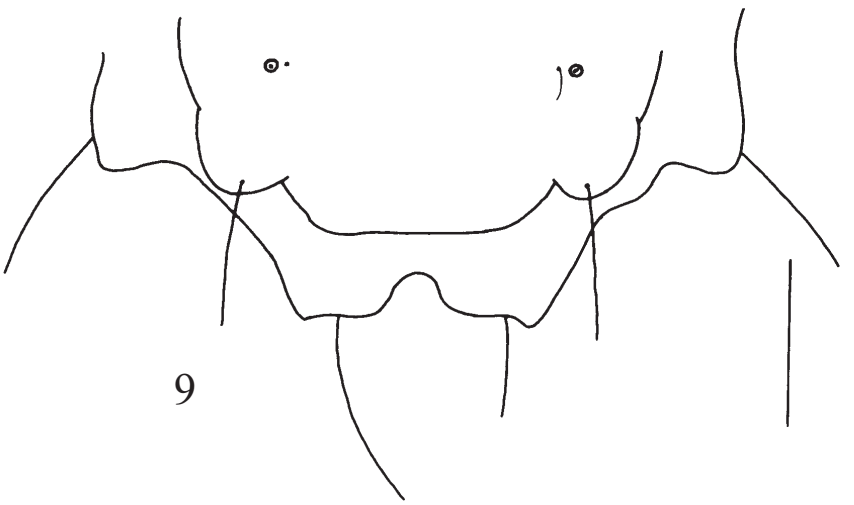




Figs. 6-7. *Arrenurus multicornutus* Walter - lectotype female. 6. dorsal view; 7. lateral view. Scale bar = 400 µm.

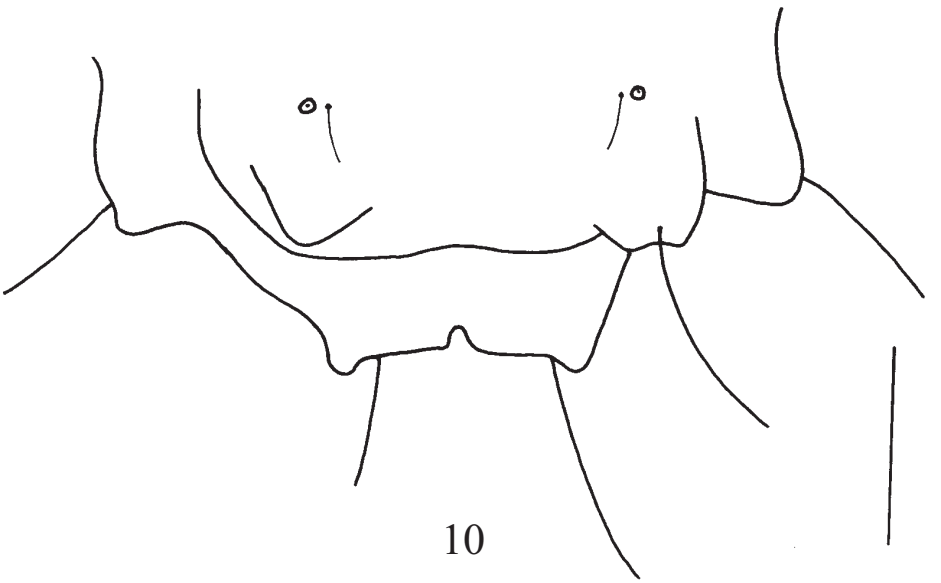


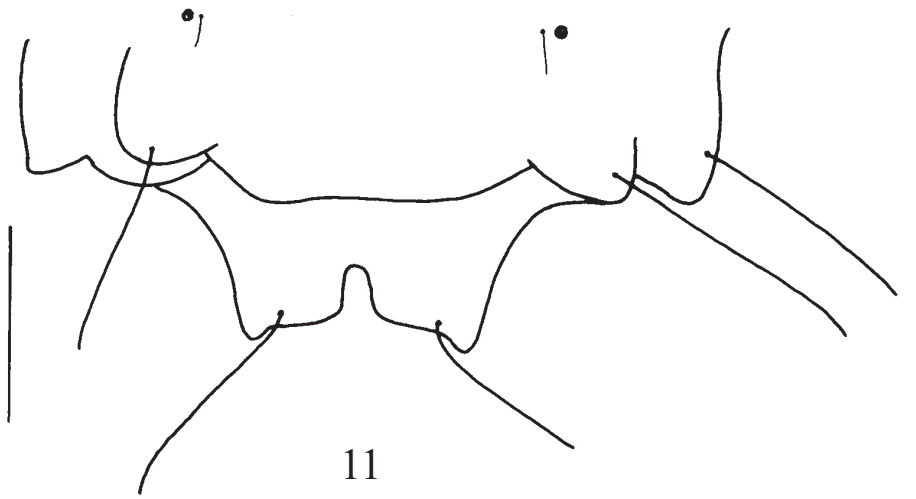
8



9

Figs. 8-9. *Arrenurus multicornutus* Walter - 8. paralectotype female, lateral view; 9. female from Taylor's Lagoon, Western Australia, dorsal view of posterior region of body. Scale bar = 400 μm.





Figs. 10-11. *Arrenurus multicornutus* Walter - 10. female from Taylor's Lagoon, Western Australia, dorsal view of posterior region of body; 11. female from Lily Creek Lagoon, Western Australia, dorsal view of posterior region of body. Scale bar = 400 μm.

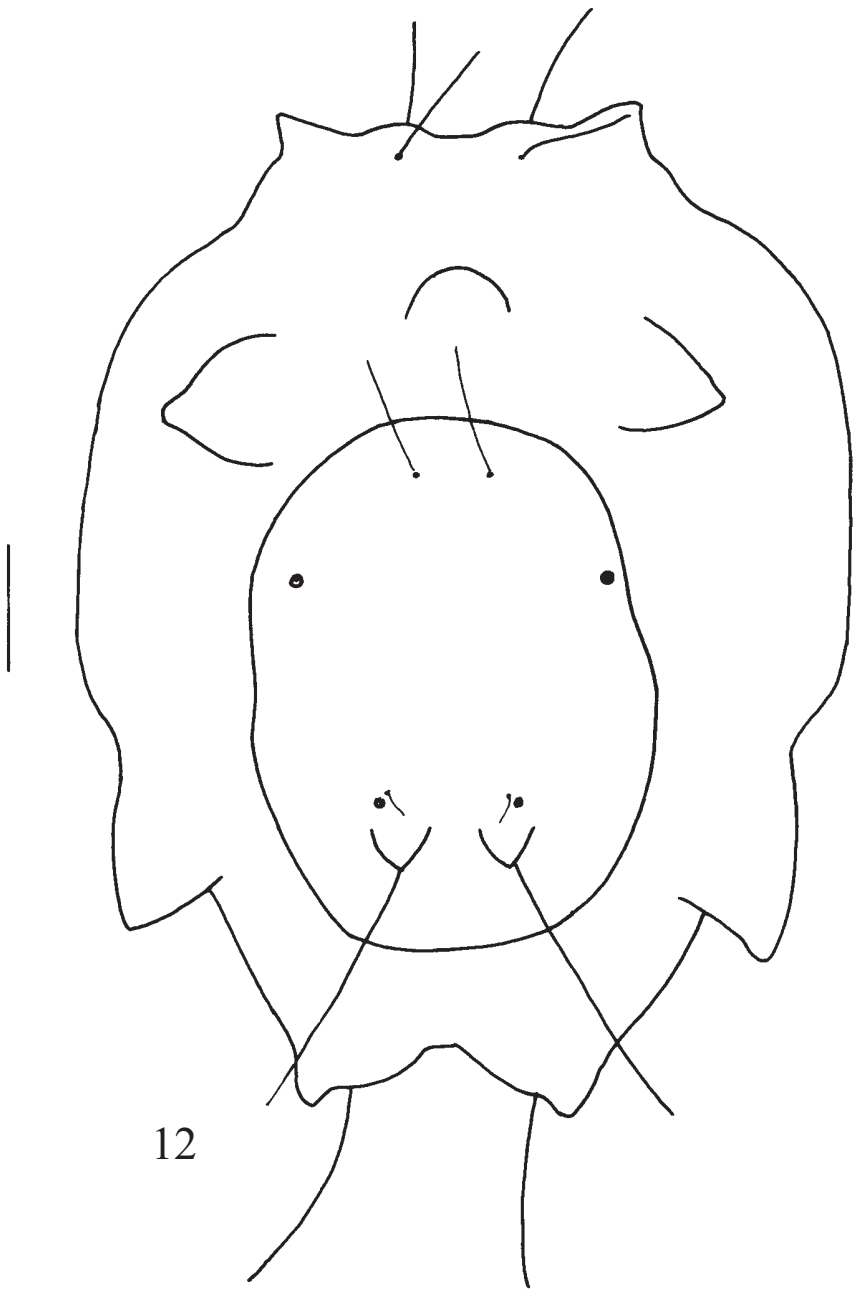
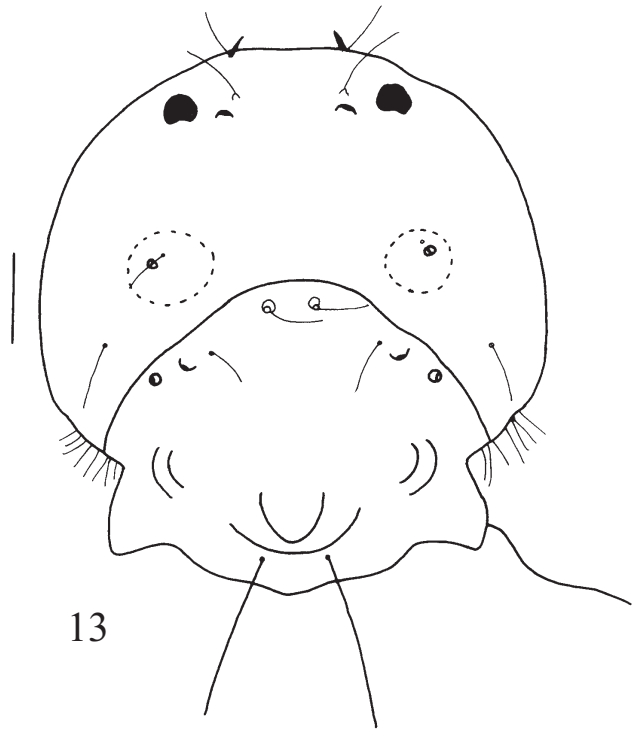
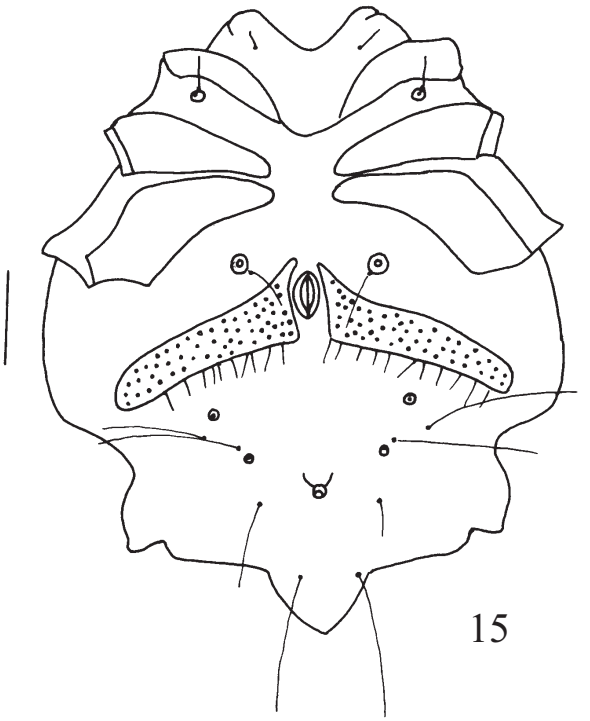
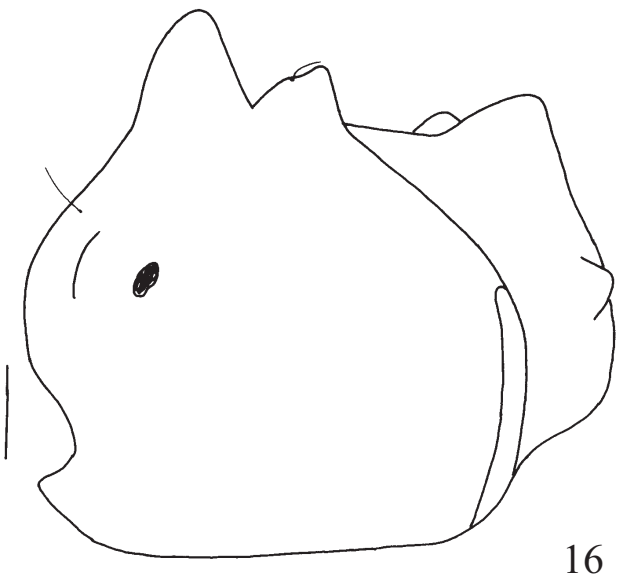


Fig. 12. *Arrenurus multicornutus* Walter, female from Lakefield National Park, Queensland, dorsal view. Scale bar = 200 µm.



Figs. 13-14. *Arrenurus postmai* sp. nov. - holotype male. 13. dorsal view; 14. ventral view. Scale bar = 200 μm.





Figs. 15-16. *Arrenurus postmai* sp. nov. - holotype male. 15. ventral view, cauda slightly upturned; 16. lateral view. Scale bar = 200 µm.

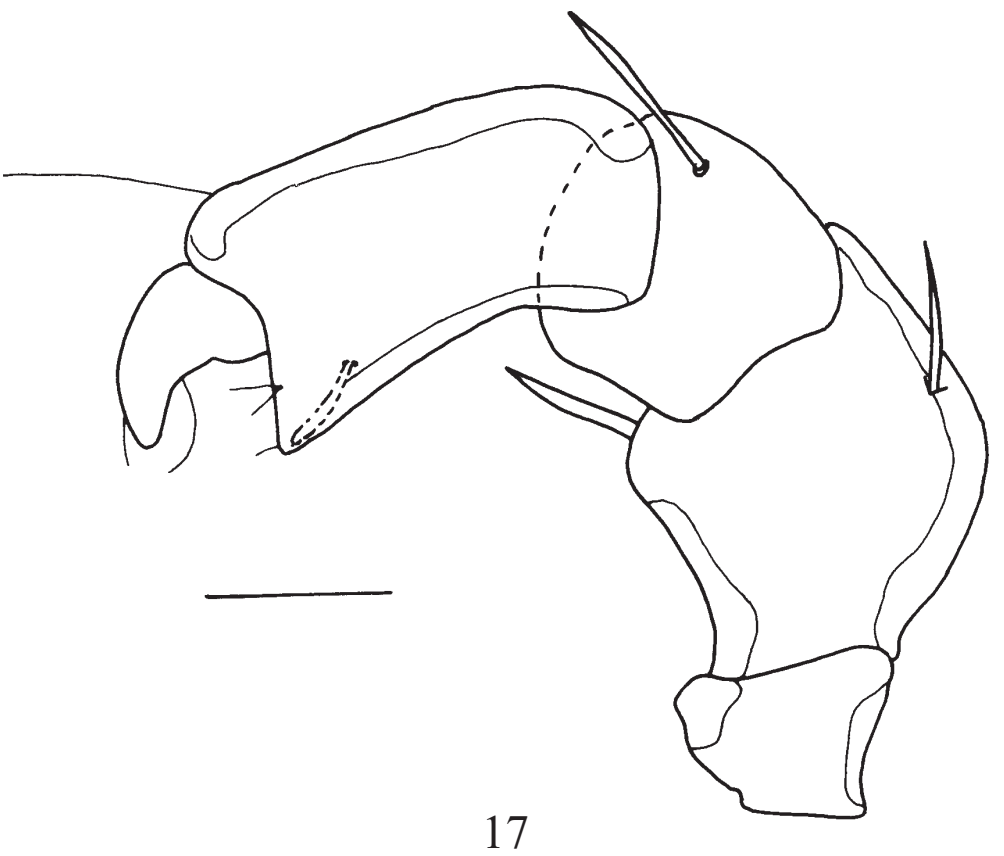


Fig. 17. *Arrenurus postmai* sp. nov. - holotype male, palp. Scale bar = 50 µm.