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New Records of Hyporheic Water Mites from Australia, with a Description of Two New Genera and Ten New Species (Acari: Hydrachnidia)

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ABSTRACT. Twenty-four species, representing 10 families, of hyporheic water mites were collected from Queensland and New South Wales, Australia. Two new genera, *Davidsia* n.gen. (Aturidae) and *Janszoonia* n.gen. (Athienemanniidae), and ten new species, *Anisitsiellides fuscatus* n.sp. (Anisitsiellidae), *Australiobates hyporheicus* n.sp. (Hygrobatidae), *Koenikea saponaria* n.sp. (Unionicolidae), *Austraturus crystalensis* n.sp., *Barwontius setipes* n.sp., *Davidsia aurita* n.sp. (Aturidae), *Hesperomomonia similis* n.sp., *Partidomomonia tertia* n.sp. (Momoniidae), *Janszoonia difficilis* n.sp. (Athienemanniidae) and *Arrenurus bunyaensis* n.sp. (Arrenuridae) are described. A list is given of all known hyporheic species of Australia. Finally, some considerations are given about the occurrence of hyporheic water mites in Australia.

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Australia is rich in hyporheic water mites. Weigman & Schminke (1970) described the first hyporheic species from Australia. Cook (1986) described thus far the majority of the Australian hyporheic water mites. However, due to his sampling method, most of his collections were a mixture of epigean and hypogean species. Since then, more species were described by Harvey (1988, 1989, 1990a, 1996, 1998a, 2003) and Smit (1998) and I recently collected the first known *Recifella* species from Australia (Smit, 2007). Table 1 gives an overview of the known hyporheic species from Australia. Additional information was taken from Harvey (1998b). Although several species from bottom deposits reported by Cook (1986) are very likely hyporheic, these have not been included. This applies especially to members of the genera *Anisitsiellides* Lundblad and *Frontipodopsis* Walter (Harvey, 1998b). Moreover, Boulton *et al*. (2004) found many undescribed species in the hyporheic of the Never Never Creek (New South Wales).

In this paper the results are given of the hyporheic samples made during collecting trips in 2003 and 2005 in New South Wales and Queensland. Two new genera and ten new species are described.

Material and methods

Unless stated otherwise, all material has been collected by the author. Several collecting trips were undertaken for hyporheic water mites. In the past the Karaman-Chappuis method was occasionally used by digging a hole in a gravel bank. Since 2003 a pump was used according to Boulton *et al*. (1992). This is an adapted Bou-Rouch pump, but much lighter, and therefore easier to use in the field. All species treated in this paper are collected with this method, and this is not repeated in the text.

Table 1.
Known hyporheic water mite species from Australia

Family	Subfamily	Species
Piersigiidae	Piersigiinae	*Austrapiersigia montana* Smit, 1998
	Stygolimnocharinae	*Stygolimnochares australica* Cook, 1986
Hydryphantidae	Wandesiinae	*Wandesia glareosa* Weigman & Schminke, 1970
		Wandesia troma Cook, 1986
	Euthyadinae	*Notopanisus vinnulus* Harvey, 1988
Zelandothyadidae		*Australiothyas swaini* Cook, 1986
Anisitsiellidae	Anisitsiellinae	*Anisitsiellides tolarda* (Cook, 1986)
		Rutacarus sasonus Cook, 1986
		Rutacarus stygius Harvey, 1990
Oxidae		*Frontipoda zadina* (Cook, 1986)
Pontarachnidae		*Litarachna amnicola* Cook, 1986
Limnesiidae	Limnesiinae	*Limnesia omneela* Cook, 1986
		Limnesia brinvoza Cook, 1986
Omartacaridae		*Omartacarus blythi* Cook, 1986
		Omartacarus bobidus Cook, 1986
Hygrobatidae		*Australorivacarus nudipes* Harvey, 1989
		Aspidiobatella smola Cook, 1986
		Gondwanabates bavinus Cook, 1986
		Gondwanabates dalvotus Cook, 1986
		Tasmanobates scutatus Cook, 1986
Aturidae	Axonopsinae	*Axonopsella interstitialis* Cook, 1986
	Notoaturinae	*Austraturus elongatus* Cook, 1986
		Spinaturus ctenophorus Cook, 1986
		Spinaturus bleptus Cook, 1986
		Melanaturus concavus Cook, 1986
		Thryptaturus boultoni Harvey, 1998
Momoniidae	Momoniinae	*Partidomomonia blythi* Harvey, 1990
		Partidomomonia cabanandra Harvey, 1990
		Hesperomomonia humphreysi Harvey, 1998
		Austromomonia grownsae Harvey, 1998
Mideopsidae	Mideopsinae	*Penemideopsis phreatica* Cook, 1986
	Guineaxonopsinae	*Guineaxonopsis australica* Cook, 1986
	Mideopsellinae	*Tiramideopsis lictus* Harvey, 1998
		Tillia davisae Harvey, 1990
Athienemanniidae	Notomundamellinae	*Notomundamella harveyi* Cook, 1986
		Mellamunda acares Harvey, 1988
		Davecookia peramica Harvey, 2003

Possible hyporheic species

Family	Subfamily	Species
Limnesiidae	Limnesiinae	*Limnesia ugava* Cook, 1986
Unionicolidae		*Koenikea rodosa* Cook, 1986
Mideopsidae	Mideopsinae	*Penemideopsis pusilla* Harvey, 1996
		Penemideopsis angovensis Harvey, 1996

This paper contains all collected species, including epigean species, which can be found occasionally in the groundwater. Only one *Monatractides* specimen and two *Oxus* specimens are not treated in this paper; they will be elaborated upon in future papers on these genera. Coordinates are measured with a GPS. Abbreviations used: PI–PV palp segments 1–5; IV-leg-4–6 fourth-sixth segments of fourth leg; AMS Australian Museum, Sydney; QM Queensland Museum, Brisbane. All non-type material has been deposited in the Zoological Museum of the University of Amsterdam (ZMAN).

Systematics

Family Anisitsiellidae Koenike

Panesar (2004) included the Anisitsiellidae as a subfamily of the Limnesiidae. However, this is not followed by Davids *et al*. (2006).

Genus *Anisitsiellides* Lundblad

Anisitsiellides circularis Cook, 1986

Anisitsiellides circularis Cook, 1986: 21; Harvey, 1990b: 641; Harvey, 1998b: 135.

Material examined. 1 male, 1 female, Saddle-tree Creek, Bunya Mountains National Park, Qld., Australia, 19 November 2003; 1 female, Dalrymple Creek, Goomburra Forest Reserve, Qld., Australia, 27°58.781'S 152°20.621'E, alt. 690 m, 5 November 2005.

Remarks. All previous records (all from new South Wales) were from surface waters.

Anisitsiellides fuscatus n.sp.

Figs. 1–6

Type material. HOLOTYPE female, Carters Creek, at crossing with Western Distributor Road, New South Wales, Australia, 35°30.914'S 150°03.546'E, alt. 187 m, 16 December 2003 (AMS).

Diagnosis. Venter with separate, complete anterior sclerite, ventroglandularia 5 not fused with ventral shield, swimming setae of IV-leg-5 more than twice as long as IV-leg-6.

Description. Female: Idiosoma pale brown, 713 long and 583 wide. Dorsum with a large dorsal plate with two pairs of glandularia and a pair of postocularia; dorsal plate 599 long and 446 wide. Dorsal furrow with six pairs of glandularia. Venter with a separate, complete anterior plate which bears a pair of small eyes. Lateroglandularia 1 in ventral shield near anterior sclerite. Ventroglandularia x (vgx, sensu Harvey, 1990b) in the middle of third coxae near suture line. Suture lines of coxae incomplete, especially between third and fourth coxae, posterior suture line of fourth coxae absent. Curved ridges extending anteriorly from the fourth coxal plates. Medial suture line of fourth coxae extending to genital field. Ventroglandularia 5 not incorporated in ventral shield. Genital field 148 long, with three pairs of acetabula. Anterior two pairs of acetabula elongated, both 38 long, posterior pair more rounded, 28 long. Lengths of PI–PV: 26, 70, 54, 100, 23. PII with an anteroventral seta, ventral margin of PIV straight, without setal tubercle. Lengths of I-leg-4–6: 91, 98, 92; segments stocky. Lengths of IV-leg-4–6: 122, 136, 122; terminal seta of IV-leg-6 49 long, the two swimming setae of IV-leg-5 271 long. Fourth leg without claws, legs I–III with a claw with clawlet and large claw blade.

Male: Unknown.

Etymology. Named for its brown colour.

Remarks. The new species is most close to *A. tabberabbera* Harvey, which shares the following characters: dorsal plate with two pairs of glandularia; separate, complete anterior platelet; vgx in the middle of third coxae. However, *A. tabberabbera* has a stocky palp, PII is without a ventral seta, a long terminal seta of IV-leg-6 and short swimming setae of IV-leg-5. *Anisitsiellides tolarda* Cook also has the ventroglandularia 5 not fused with the ventral shield. Harvey (1990b) thought that this reflected the teneral nature of the specimen. However, with one more species known with this character, it is clear that this is not dependent on the age of the specimen.

Family Limnesiidae Thor

Genus *Limnesia* Koch

Limnesia brinvoza Cook, 1986

Limnesia brinvoza Cook, 1986: 65; Harvey, 1998b: 136.

Material examined. New South Wales, Australia: 1 female, Cabbage Tree Creek, at crossing with Kings Highway, 35°34.367'S 150°02.537'E, 16 December 2003; 1 female, Hortons Creek, at crossing with Grafton-Armidale road, 30°00.006'S 152°40.952'E, alt. 17 m, 6 November 2005.

Remarks. Previously reported by Cook (1986) from three locations in New South Wales and Queensland. Cook (1986) considered this an interstitial species, but only one of the three locations where he found the species was a hyporheic sample.

Family Omartacaridae Cook

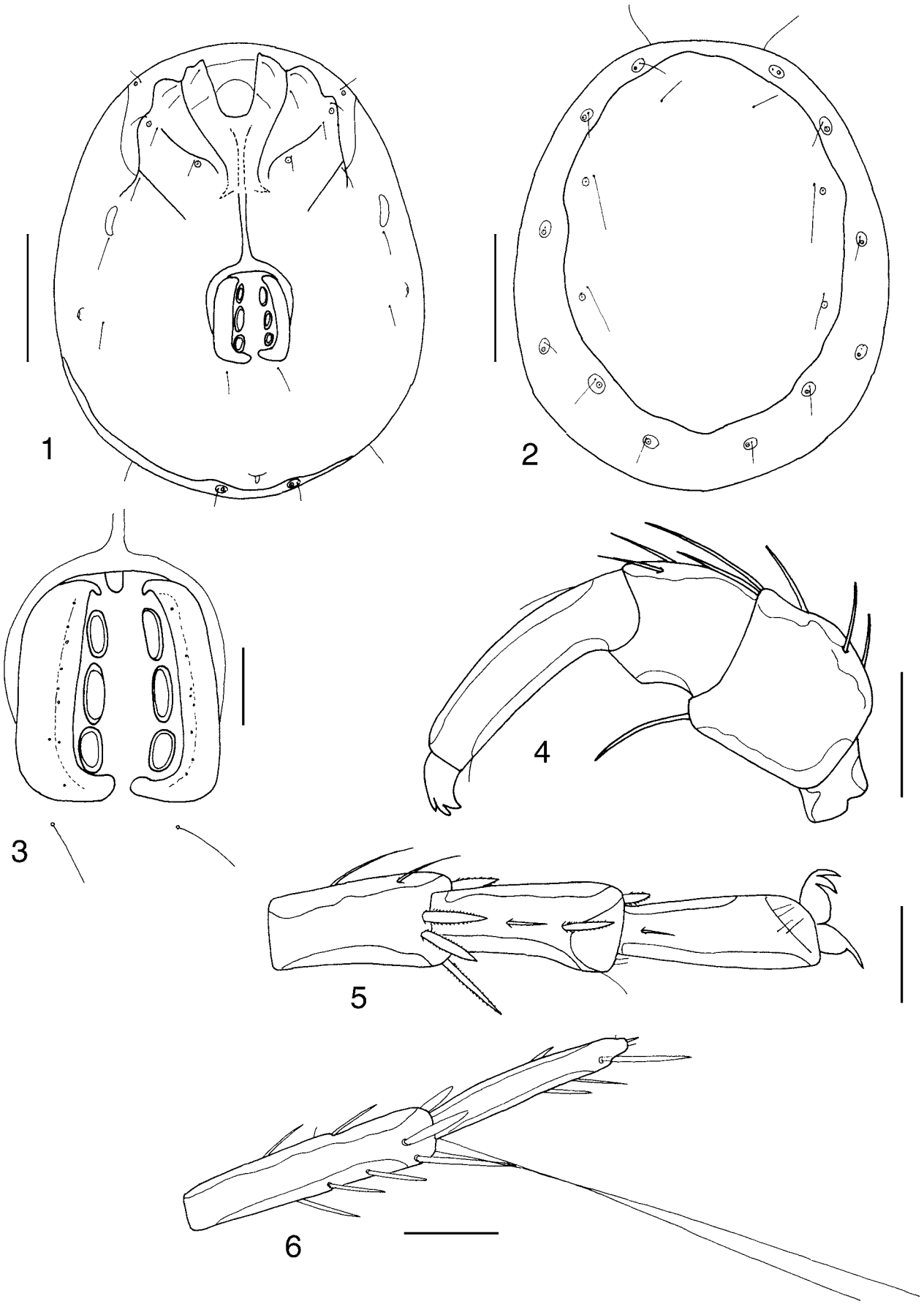
Genus *Omartacarus* Cook

Omartacarus lomedus Cook, 1986

Omartacarus lomedus Cook, 1986: 83; Harvey, 1998b:141.

Material examined. 1 female, Hortons Creek, at crossing with road Grafton-Armidale, 30°00.006'S 152°40.952'E, alt. 17 m, N.S.W., Australia, 6 November 2005.

Remarks. This is the second known specimen, the first was described from northern Queensland.



Figs 1–6. *Anisitsiellides fuscatus* n.sp., holotype female: (1) ventral view; (2) dorsal view; (3) genital field; (4) palp; (5) I-leg-4–6; (6) IV-leg-4–6. Scale bars 1–2 200 µm, 3–6 = 50 µm.

Family Hygrobatidae Koch

Genus *Australiobates* Lundblad

Australiobates (Australiobates) hyporheicus n.sp.

Figs. 7–11

Type material. HOLOTYPE female, West Canungra Creek at Blue Pool, Lamington National Park, Queensland, Australia, 15 November 2003 (QM).

Diagnosis. Glandularia of fourth coxal plates shifted onto third coxal plates; genital field triangular; IV-leg-5 with four swimming setae, IV-leg-6 with three swimming setae.

Description. Female: Idiosoma dorsally 672 long and 405 wide, ventrally 737 long. Fourth coxal plates extending onto dorsum, the dorsal parts scale-like. One pair of small eyes, which are hardly visible. Capitulum 244 long, including its a long anchoral process, which is approximately 114 long. First and second coxal plates ending posteriorly in a long, pointed extension. Posterior apodemes of fourth coxal plates short, 30 long. Posterior margin of fourth coxal plates sloping. Glandularia of fourth coxal plates shifted onto third coxal plates. Genital plates triangular, with three pairs of acetabula, 22 in diameter; acetabula occupying most of the space of genital plate. Genital plate 62 long and 37 wide, occupying only a small part of the genital field. Pregenital sclerite large, 92 wide. Lengths of PI–PV: 22, 58, 78, 86, 40. PII stocky; PIV ventrally straight, with well separated, thin setae; PV relatively long compared to other species. Lengths of I-leg-4–6: 128, 120, 108. Lengths of IV-leg-4–6: 206, 228, 204. IV-leg-5 with four long swimming setae, IV-leg-6 with three swimming setae. Legs I–III without swimming setae. All legs with claws, clawlet and small claw blade.
Male: Unknown.

Remarks. No other *Australiobates* species has the glandularia of the fourth coxae shifted onto the third coxae. Moreover, the long swimming setae are also unusual, as most species have only two swimming setae on IV-leg-5. In most hyporheic species swimming setae are reduced, so it is somewhat questionable if the new species is truly hyporheic. However, the small, reduced eyes are an indication of a subterranean way of life.

Genus *Aspidiobates* Lundblad

Aspidiobates geometricus Cook, 1986

Aspidiobates geometricus Cook, 1986: 106; Harvey & Cook, 1988: 57; Smit, 1992: 96; Harvey, 1998b: 139; Smit, 2001: 153.

Material examined. 1 male, Dalrymple Creek, Goomburra Forest Reserve, Qld., Australia, 27°58.781'S 152°20.621'E, alt. 690 m, 17 November 2003.

Remarks. Undoubtedly an epigean species, considering the numerous published records from surface waters.

Aspidiobates scutatus Lundblad, 1941

Aspidiobates scutatus Lundblad, 1941: 115; Cook, 1986: 104; Harvey & Cook, 1988: 57; Smit, 1992: 99; Harvey, 1998b: 139; Smit, 2001: 153.

Material examined. 1 female, Never Never Creek at crossing with Promised Land Road, N.S.W., Australia, 22 November 2003.

Remarks. Like the previous species, undoubtedly an epigean species.

Genus *Kallimobates* K.O. Viets

Kallimobates australicus K.O. Viets, 1978

Kallimobates australicus K.O. Viets, 1978: 81; Imamura, 1984: 66; Cook, 1986: 121; Harvey, 1998b: 140; Smit, 2001: 156.
Kallimobates cooki Smit, 1992: 99; Harvey, 1998b: 140.

Material examined. 1 female, West Canungra Creek at Blue Pool, Lamington National Park, Qld., Australia, 15 November 2003.

Remarks. Many records from surface waters indicate that this is an epigean species.

Family Unionicolidae Oudemans

Genus *Koenikea* Wolcott

Koenikea (Notomideopsis) crinita Cook, 1986

Koenikea crinita Cook, 1986:, 197; Harvey, 1998b: 142; Smit, 2004: 169.
Koenikea purpurea Smit, 1992: 105; Harvey, 1998b: 142; Smit, 2004: 169.

Material examined. 1 female, Barkers Creek at Little Falls, Bunya Mountains National Park, Qld., Australia, 19 November 2003.

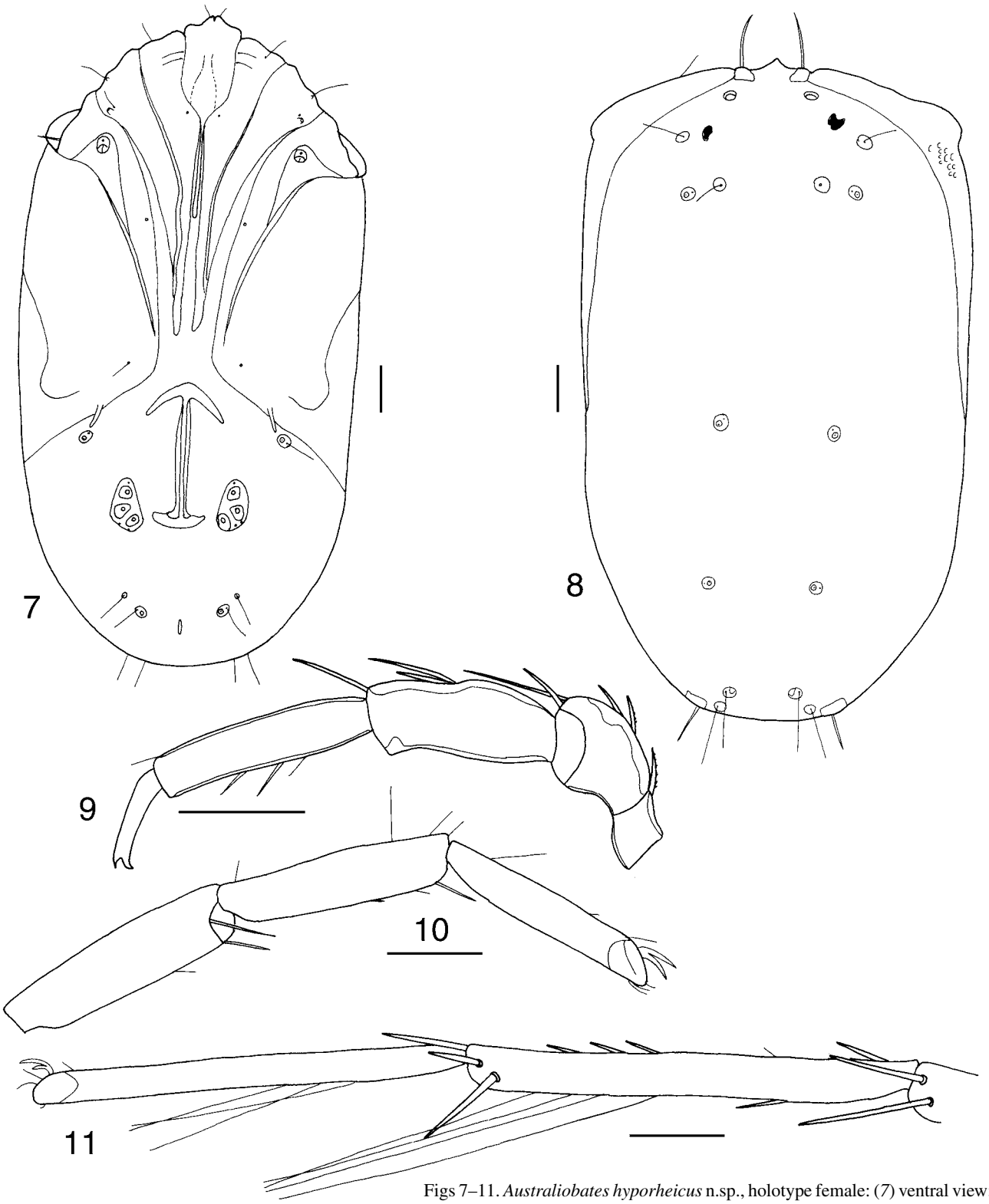
Remarks. An epigean species, all previous records were from surface waters.

Koenikea (Notomideopsis) saponaria n.sp.

Figs. 12–18

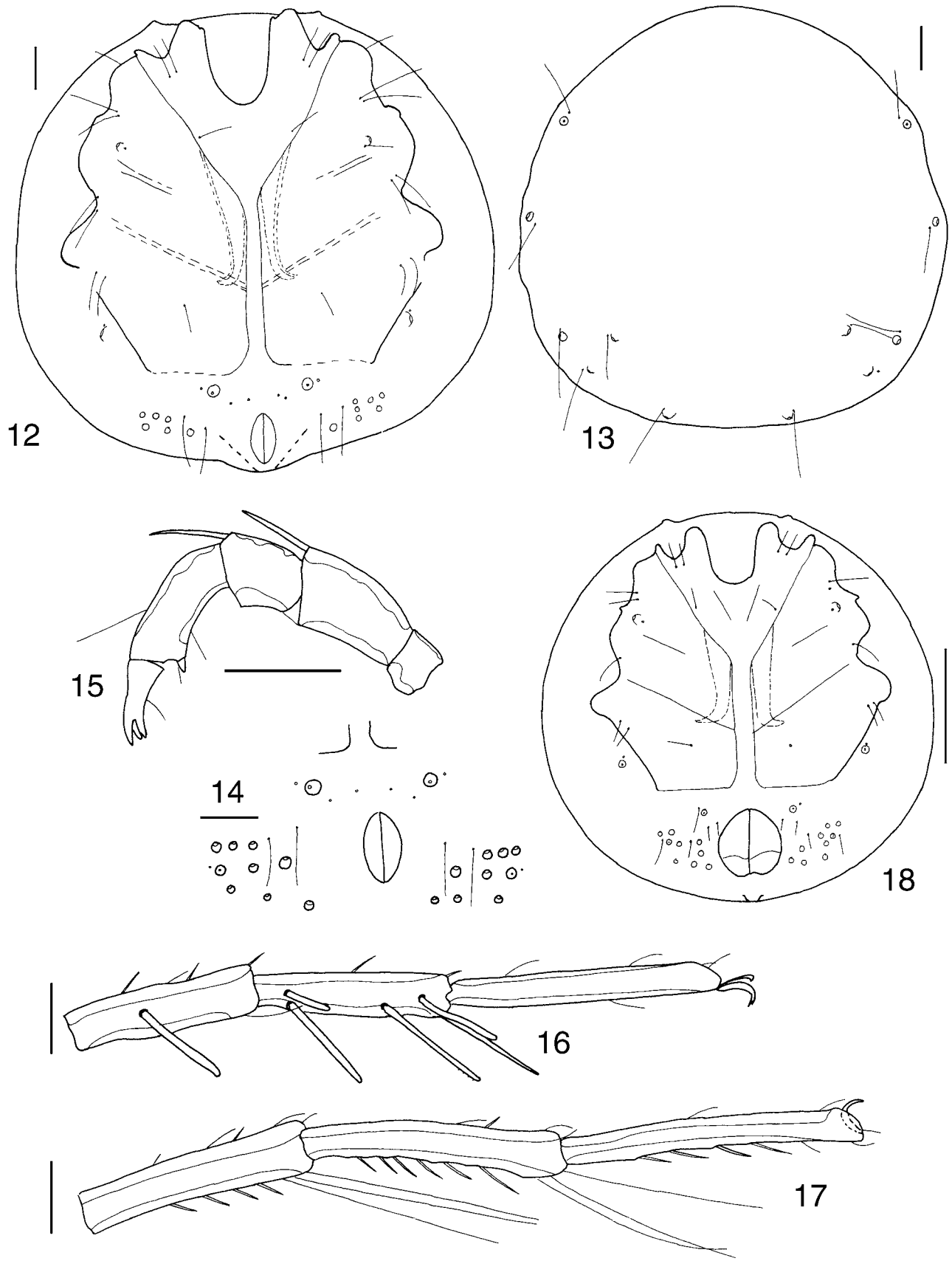
Type material. HOLOTYPE male, Carters Creek at crossing with Western Distributor Road, New South Wales, Australia, 35°30.914'S 150°03.546'E, alt. 187 m, 16 December 2003 (AMS). PARATYPES: 2 females (AMS, ZMAN), same data as holotype; 1 male, 1 female, West Canungra Creek at Blue Pool, Lamington National Park, Queensland, Australia, 15 November 2003 (ZMAN).

Diagnosis. Genital field with 6–8 pairs of acetabula, glandularia 3, 4 and 5 of dorsal shield at equal distance of each other; male genital field bulging.



Figs 7–11. *Australiobates hyporheicus* n.sp., holotype female: (*7*) ventral view; (*8*) dorsal view; (*9*) palp; (*10*) I-leg-4–6; (*11*) IV-leg-5-6. Scale bars = 50 µm.

Description. Male: Dorsal and ventral shields present, dorsal shield strongly convex and without apophyses. Idiosoma dorsally 535 (510) long (including bulging genital field) and 510 (486) wide. Dorsal shield with six pairs of glandularia, none of which are on tubercles. Dorsal furrow complete, dorsal shield 446 long and 462 wide. Glandularia 3, 4 and 5 (see Smit, 2004) lying in a triangle, at equal distance of each other. One pair of eyes present lying below integument. First coxal plates extending to or just beyond anterior idiosoma margin. Tips of first coxal plates blunt. Suture lines of second and third coxal plates incomplete. Apodemes of first coxal plates extending onto anterior part of fourth coxal plates. Coxoglandularia 2 located more or less halfway posterior margin of fourth coxal plates and genital field. Genital field with eight pairs of acetabula, a pair of glandularia situated laterally in genital field. Genital field bulging, gonopore 64



Figs 12–18. (*12–17*) *Koenikea saponaria* n.sp., holotype male: (*12*) ventral view; (*13*) dorsal shield; (*14*) genital field; (*15*) palp; (*16*) I-leg-4–6; (*17*) IV-leg-4–6; scale bars 12–17 = 50 µm. (*18*) *Koenikea saponaria* n.sp., paratype female, ventral view, scale bar = 200 µm.

long. Excretory pore terminal. Lengths of PI–PV: 16, 58, 36, 63, 36. Ventral margin of PII straight. PIV stocky, peg-like seta on a short tubercle, located near distal end of segment. Lengths of I-leg-4–6: 130, 131, 164. Lengths of IV-leg-4–6: 156, 174, 184. IV-leg-4 with four ventral setae and a distal pectinate seta, IV-leg-5 with six ventral setae and a distal pectinate seta and IV-leg-6 with four ventral setae and a distal pectinate seta. III-leg-4 and -5 and IV-leg-4 and -5 with three swimming setae, IV-leg-3 with one swimming seta. Claws of legs without clawlet and claw blade.

Female: Dorsal and ventral shields present, dorsal shield strongly convex. Idiosoma nearly circular, 672 (583–648) long and 658 (575–624) wide. Dorsal furrow complete, dorsal shield 624 long and 591 wide, with six pairs of glandularia, none of which are on tubercles. Configuration of dorsal glandularia as in male. Tips of first coxal plates blunt, extending almost to anterior idiosoma margin. Apodemes of first coxal plates extending onto anterior part of fourth coxal plates. Genital field with eight (six) pairs of glandularia. Gonopore 114 long and 106 wide. Lengths of PI–PV: 22, 69, 50, 72, 40; palp as in male. Lengths of I-leg-4–6: 157, 132, 156. Lengths of IV-leg-4–6: 170, 182, 162. IV-leg-4 ventrally with (2)3–4 setae and one pectinate distal seta, IV-leg-5 ventrally with (4) 5 setae and one distal pectinate seta and IV-leg-6 with 4 (5) ventral setae. Swimming setae as in male. Claws of legs without clawlet and claw blade.

Etymology. The convex shape of the idiosoma is reminiscent of a piece of soap.

Remarks. Two other Australian *Koenikea* species have less than ten acetabula: *K. pauciacetabula* Smit and *K. rubipes* Smit. The first species has a differently shaped IV-leg-6 with a large claw, while the genital field is not bulging. Moreover, within the genital field an enlarged glandularium is found, which is absent in the new species. *Koenikea rubipes* also has an enlarged glandularium within the genital field, and the genital field is not bulging. Additionally, IV-leg-5 has 11 ventral setae and a pectinate distal seta. This is very likely the second interstitial Australian species of the genus. Based on the very different morphology, Cook (1986) considered *K. rodosa* Cook as an interstitial species. With two records from hyporheic collections from widely separated locations, *K. saponaria* n.sp. very likely is an obligate hyporheic species.

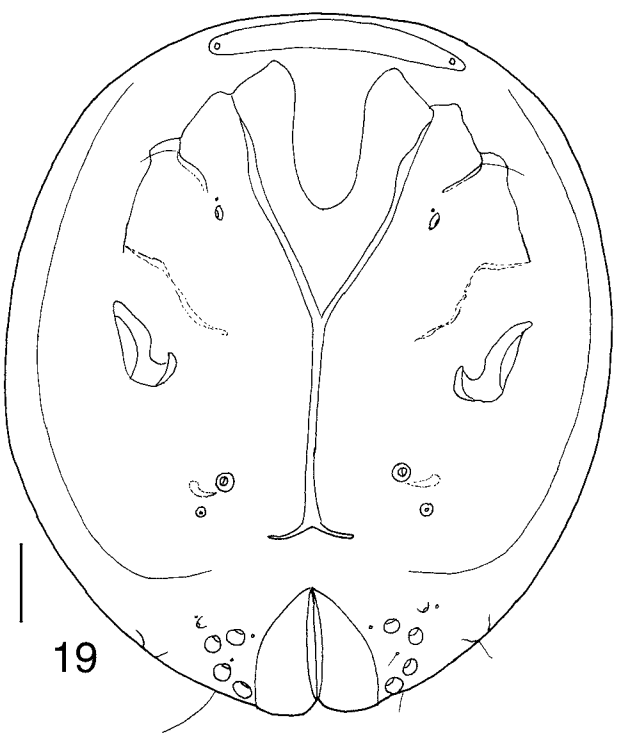


Fig. 19. *Axonopsella fragala* Cook, ventral view female. Scale bar = 50 µm.

Family Frontipodopsidae K. Viets

Genus *Frontipodopsis* Walter

Frontipodopsis (Frontipodopsis) obscura Cook, 1986

Frontipodopsis obscura Cook, 1986: 205; Harvey, 1998b: 139.

Material examined. 1 female, West Canungra Creek at Blue Pool, Lamington National Park, Qld., 15 November 2003.

Remarks. All previous records of the species were from New South Wales, and none was of certain hyporheic origin (Cook, 1986).

Family Aturidae Thor

Subfamily Axonopsinae K. Viets

Genus *Axonopsella* Lundblad

Axonopsella fragala Cook, 1986

Fig. 19

Axonopsella fragala Cook, 1986: 226; Harvey, 1998: 138.

Material examined. 1 male, 2 females, Dalrymple Creek, Goomburra State Forest, Qld., Australia, alt. 690 m, 27°58.781'S 152°20.621'E, 17 November 2003; 1 female, same location, 5 November 2005.

Description. Female: Dorsal and ventral shields present; dorsal furrow complete. Idiosoma dorsally 421 (417) long and 365 (365) wide. Ventrally with a separate anterior platelet bearing the antenniform setae. Medial coxal suture line distinct. Fourth coxal plates with two pairs of glandularia and between these glandularia a pair of apophyses. Width of gonopore 70. Genital field with four pairs of acetabula. Posterior three pairs in a line with each other. Lengths of PI–PV: 19, 46, 27, 54, 30. PIV ventrally with a long seta on a small tubercle, located in the middle of segment. Lengths of I-leg-4–6: 44, 55, 35. Lengths of IV-leg-4–6: 66, 70, 50. IV-leg-5 with two swimming setae, other legs without swimming setae. Claws with clawlet, without claw blade.

Remarks. Cook (1986) collected the species from northern New South Wales. He also collected *Twarntaturus alphus* Cook on the same site, which was collected by me from hyporheic habitats as well. Cook (1986) did not describe the female of *A. fragala*. He pointed out the difficulty of assigning females to described males. Cook could only identify females with specific characters. I assume that the male and females collected by me from the hyporheic sample belong to the same species. The configuration of apophyses of the genital field and the glandularia and of the fourth coxae might be of diagnostic value. However, this needs to be ascertained by more descriptions of females.

Subfamily Notoaturinae Besch

Genus *Austraturus* K.O. Viets

Austraturus crystalensis n.sp.

Figs. 20–24

Type material. HOLOTYPE male, Big Crystal Creek, Paluma Range National Park, Queensland, Australia, 18°58.754'S 146°15.231'E, 21 October 2005. PARATYPES: 2 females (QM), 1 female (ZMAN), same data as holotype.

Diagnosis. Fourth leg and posteromedial dorsal plate of male unmodified, gonopore of male short, PII high and ventrally with two teeth.

Description. Male: Dorsal and ventral shields present, dorsal furrow complete. Idiosoma ventrally 365 long and 263 wide, dorsally 308 long. Idiosoma colour pale, eyes absent. Dorsum with three pairs of plates and a large posteromedial plate, the latter 196 long and 162 wide, with two shallow concavities. Anterior pair of plates bearing the postocularia. Anterolateral plates each with two pairs of glandularia, posterolateral plates each with one pair of glandularia. Posteromedial plate unmodified, with three pairs of glandularia. Setae of dorsal plates not thickened. First coxal plates extending beyond anterior body margin. Glandularia of fourth coxal plates small, located halfway anterior and posterior margin of fourth coxal plates. Gonopore short and narrow, 27 long. Only a few (approximately six) acetabula visible. Excretory pore terminal. Lengths of PI–PV: 19, 58, 30, 84, 29. PII high with two large teeth ventrally, ventral margin of PIV slightly convex. Lengths of first leg segments not measurable. Lengths of IV-leg-4–6: 74, 79, 76. Fourth leg unmodified. Swimming setae absent. Claws of legs with clawlet, without claw blade.

Female: Dorsal and ventral shields present, dorsal furrow complete. Idiosoma ventrally 373 (340–373) long and 271 (243–267) wide, dorsally 304 (275–308) long. Dorsum as in male, large posteromedial plate 176 long and 154 wide. First coxal plates extending beyond anterior body margin. Glandularia of fourth coxal plates located near anterior margin of fourth coxal plates. Gonopore 45 long. Anterior two pairs of acetabula noticeably larger than others. Most acetabula not visible. Lengths of PI–PV: 18, 60, 33, 84, 28; palp as in male, but PII ventrally with a small third tooth. Lengths of I-leg-4–6: 52, 54, 68. Lengths of IV-leg-4–6: 70, 78, 68. Legs without swimming setae. Claws of legs with clawlet, without claw blade.

Etymology. Named after the type locality.

Remarks. Cook (1986) considered *A. concavus* Cook an interstitial species, based on its peculiar morphological characters. If correct, the new species described here is the second interstitial species of the genus. It is the least modified species of the genus, without modifications of the posteromedial dorsal plate or the fourth leg of the male. The female can be identified with the shape of the palp. *Austraturus projectus* Cook also has PII with two teeth, but this species has a much longer PIV.

Genus *Cabellaturus* Cook

Cabellaturus triangularis Cook, 1986

Cabellaturus triangularis Cook, 1986: 262; Harvey, 1998b: 139.

Material examined. 1 male, 1 female, Saddle-tree Creek, Bunya Mountains National Park, Qld., 19 November 2003.

Remarks. Reported previously from a few locations from New South Wales and Queensland, but not from hyporheic habitats.

Genus *Twarntaturus* Cook, 1986

Twarntaturus alphus Cook, 1986

Twarntaturus alphus Cook, 1986: 268; Harvey, 1998b: 139.

Material examined. 3 males, 1 female, Saddle-tree Creek, Bunya Mountains National Park, Qld., Australia, 19 November 2003; 1 female, Big Crystal Creek, Paluma Range National Park, Qld., 18°58.754'S 146°15.231'E, 21 October 2005; 1 male, Dalrymple Creek, Goomburra Forest Reserve, Queensland, Australia, 27°58.781'S 152°20.621 E, 5 November 2005.

Remarks. Previously reported from northern New South Wales. Cook (1986) didn't report this species from locations of certain hyporheic origin.

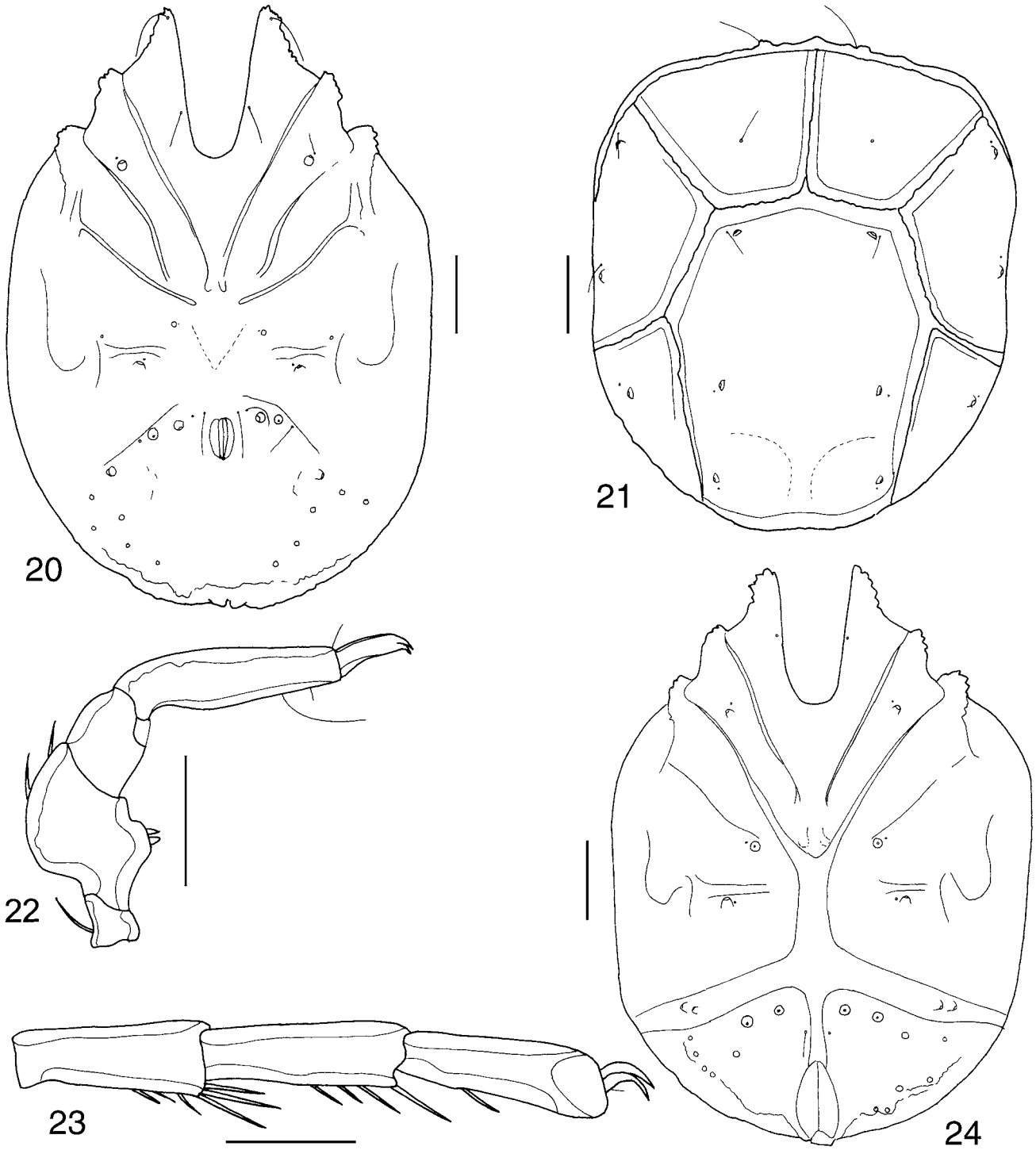
Genus *Barwontius* K.O. Viets

Barwontius lunoka Cook, 1986

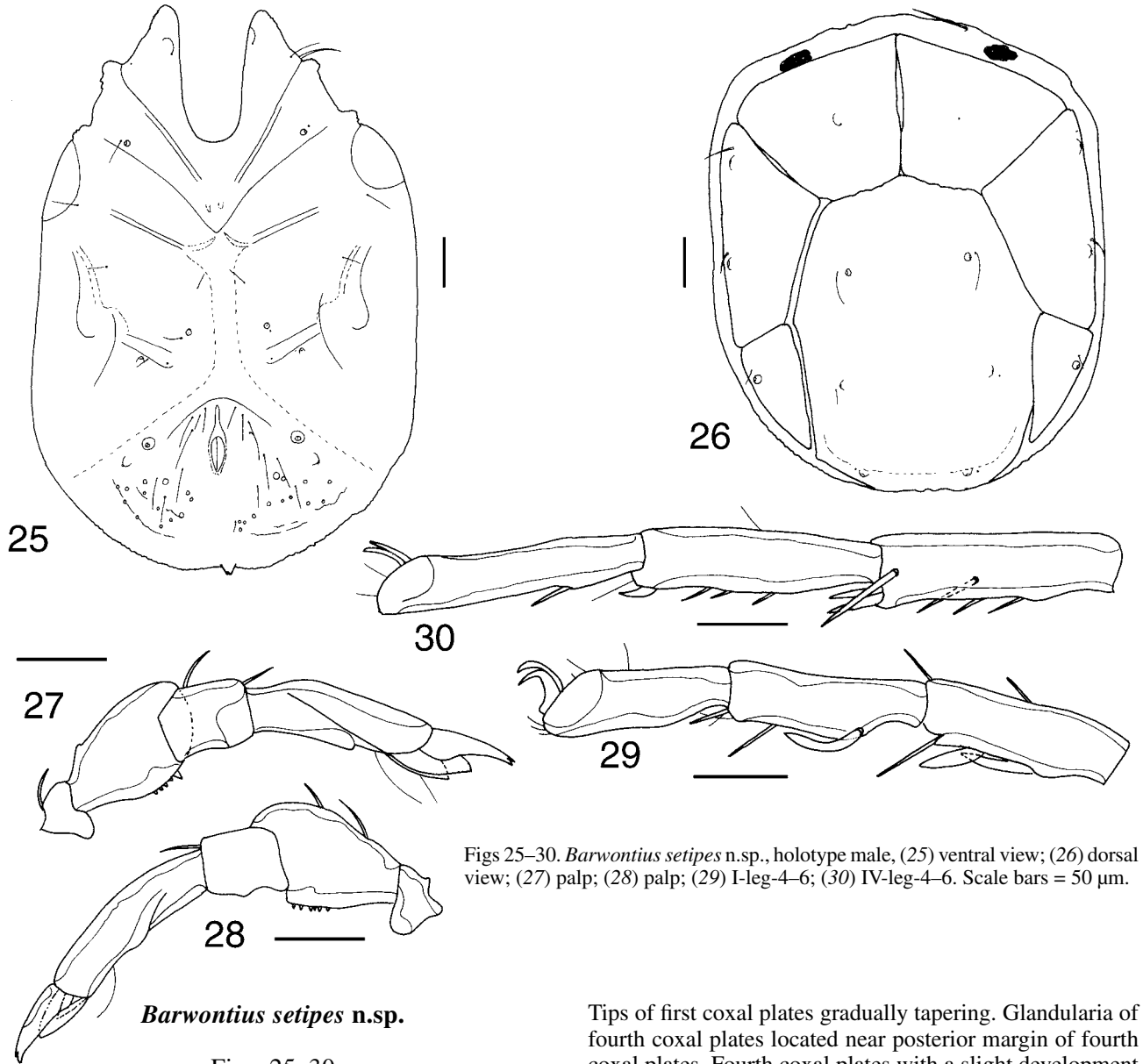
Barwontius lunoka Cook, 1986: 282; Harvey, 1998b: 138.

Material examined. Male, Barkers Creek at Little Falls, Bunya Mountains National Park, Qld., Australia, 19 November 2003.

Remarks. Known previously from two males from New South Wales. More records are needed to judge whether this is an epigean or a hyporheic species.



Figs 20–24. *Austraturus crystalensis* n.sp., (*20–23*) holotype male: (*20*) ventral view; (*21*) dorsal view; (*22*) palp; (*23*) IV-leg-4–6, scale bars 20–23 = 50 µm. (*24*) *Austraturus crystalensis* n.sp., paratype female, ventral view, scale bar = 50 µm.



Figs 25–30. *Barwontius setipes* n.sp., holotype male, (*25*) ventral view; (*26*) dorsal view; (*27*) palp; (*28*) palp; (*29*) I-leg-4–6; (*30*) IV-leg-4–6. Scale bars = 50 μm.

Barwontius setipes n.sp.

Figs. 25–30

Type material. HOLOTYPE: male, Carters Creek at crossing with Western Distributor Road, New South Wales, Australia, 35°30.914'S 150°03.546'E, alt. 187 m, 16 December 2003 (AMS).

Diagnosis. I-leg-5 with a large, curved seta, I-leg-4 with two large, straight setae. Ventral margin of PII with large denticles.

Description. Male: Dorsal and ventral shields present, dorsal furrow complete. Idiosoma ventrally 567 long and 397 wide, dorsally 486 long. Dorsum with three paired plates and a large posteromedial plate. Anteromedial plates with postocularia, anterolateral plates with two pairs of glandularia, posterolateral plates with one pair of glandularia. Large posteromedial plate with three pairs of glandularia. None of the associated seta of the dorsal glandularia enlarged. One pair of eyes present. Dorsal shield 470 long and 373 wide, posteromedial plate 324 long and 243 wide. First coxal plates extending beyond anterior idiosoma margin. Tips of first coxal plates gradually tapering. Glandularia of fourth coxal plates located near posterior margin of fourth coxal plates. Fourth coxal plates with a slight development of parallel ridges, mainly near lateral margin. Two pairs of glandularia located lateral of genital field. Genital field with relatively few acetabula, approximately 12, but exact number difficult to ascertain. Lengths of PI–PV: 34, 82, 42, 106, 48; PIV with large flap-like extensions, extending well beyond anterior margin of segment. Ventral margin of PII with 5–6 denticles. Lengths of I-leg-4–6: 110, 108, 74. I-leg-5 with a large, curved heavy seta, I-leg-4 with two large, straight heavy setae; 1–2 smaller setae present as well on these leg segments. Lengths of IV-leg-4–6: 134, 132, 126. IV-leg-5 with four ventral seta, the posterior seta enlarged; IV-leg-6 with one ventral seta. Legs without swimming setae. Claws of legs with clawlet and small claw blade.

Female: Unknown.

Etymology. Named for the peculiar stout setae of the first leg.

Remarks. No other Australian *Barwontius* species has the first leg modified as in the new species. Moreover, in most other species PII is smooth or with very small denticles.

Davidsia n.gen.

Diagnosis. Characters of the Aturidae and the subfamily Notoaturinae. Dorsum with one large plate and three pairs of smaller plates. Configuration of the dorsal plates follows the general pattern of the Notoaturinae. One pair of anteromedial plates with the postocularia, anterolateral plates each with two pairs of glandularia, posterolateral plates with one pair of glandularia and the large posteromedial plate with three pairs of glandularia. First coxae long and pointed extending well beyond anterior body margin. Suture lines of coxae incomplete. Posterior margin of fourth coxal plates indistinct; near posterior margin a pair of glandularia. Another pair of glandularia on second coxal plates. On fourth coxal plates a pair of pointed humps. Five pairs of acetabula lying in the integument. Palp very long, especially PIV. PII elongated, ventral margin of segment with spine-like projections. First legs of male modified, I-leg-6 forming a sheath with a long claw with a long and slender clawlet. Claw with two short, hyaline claw blades. I-leg-5 slightly enlarged. Fourth legs of male relatively unmodified.

Type species. *Davidsia aurita* n.sp.

Etymology. Named after the Dutch acarologist Kees Davids (1931–2004). The gender is feminine.

Remarks. The modified first legs are unique among the Notoaturinae; in the other six genera any leg modification has occurred on legs IV. Together with its unusual palp and the long projecting and pointed first coxal plates, the new genus differs well enough to warrant a separate status. The new genus has some superficial resemblance to the New Zealand genus *Uralbia* Hopkins, especially the palps of the two genera are similar. However, *Uralbia* differs in many other characters, noticeably the male genital field and the dorsal plates, with the anteromedial plate undivided and the loss of glandularia on other dorsal plates. Therefore, it is unlikely that the two genera are closely related, and there similarity is more the result of there hyporheic way of living.

Davidsia aurita n.sp.

Figs. 31–36

Type material. HOLOTYPE male, Dalrymple creek, Goomburra Forest Reserve, Queensland, Australia, 27°58.781'S 152°20.621 E; 5 November 2005 (QM). PARATYPE male, same data as holotype (ZMAN).

Diagnosis. As for genus.

Description. Male: As for genus. Idiosoma ventrally 563 (551) long and 365 (364) wide. Large posteromedial plate 300 (251) long and 243 (232) wide. One pair of small eyes present. Gonopore 70 long. Lengths of PI–PV: 32, 142, 43, 235, 33. PII ventrally with about 9 small spine-like setae; palp with a reticulate pattern. Lengths of I-leg-4–6 110, 142, 154. Lengths of IV-leg-4–6: 140, 150, 128; fourth leg with numerous long, stiff setae.

Female: Unknown.

Etymology. Named for its ear-shaped sixth segment of first leg.

Family Momoniidae Viets

Genus *Hesperomomonia* Harvey

This is the second species of the genus, necessitating a small change of the diagnosis of the genus: Posterior dorsal plate with two or three pairs of associated setae. Lateral of large dorsal plates 1–4 platelets with lack glandularia, these platelets may be very small.

Hesperomomonia similis n.sp.

Figs. 37–41

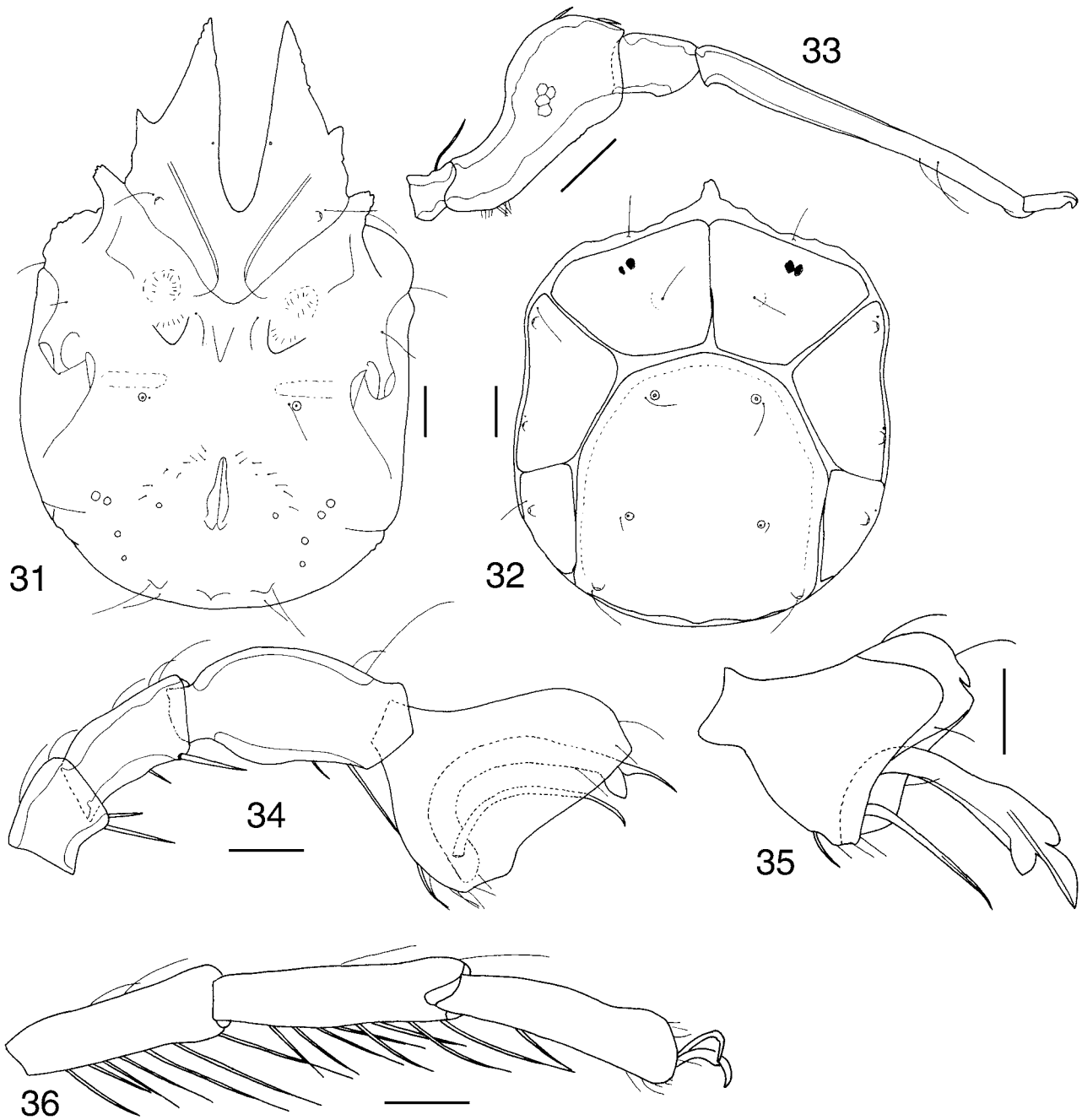
Type material. HOLOTYPE female, Hortons Creek, hyporheic, at crossing with road Grafton-Armidale, 30°00.006'S 152°40.952'E, alt. 17 m, New South Wales, Australia, 6 November 2005 (AMS).

Diagnosis. Large anterior dorsal plate with almost all dorsoglandularia in anterior half; large posterior dorsal plate with two dorsoglandularia; lateral of anterior large dorsal platelet only one minute platelet.

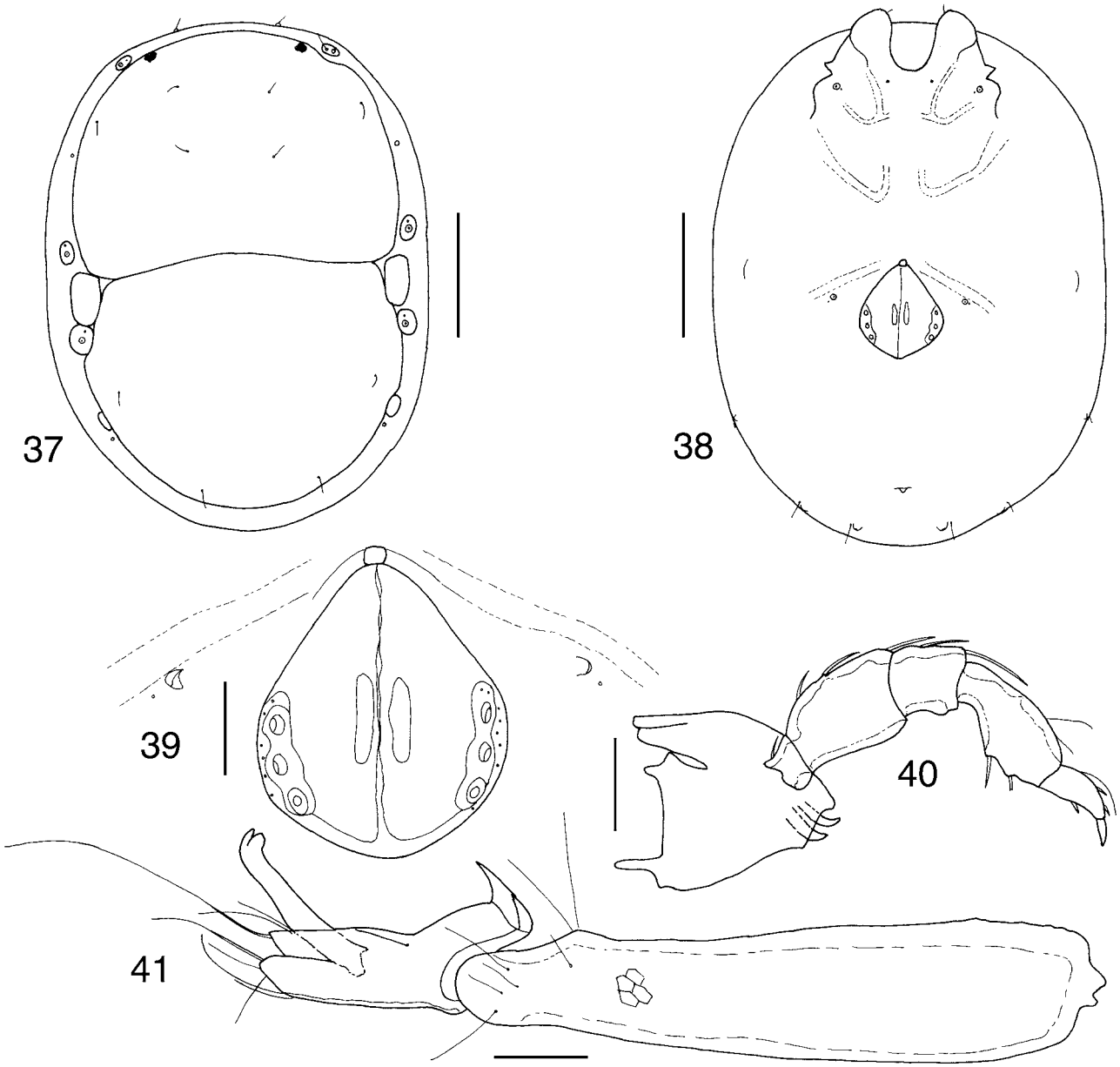
Description. Female: Colour pale. Idiosoma dorsally 818 long and 608 wide, ventrally 842 long. Dorsum with two large plates, the anterior plate 356 long and 535 wide, posterior plate 421 long and 510 wide. Dorsoglandularia on these plates lacking, only associated setae present. Anterior plate with postocularia and two pairs of associated setae, the posterior pair much closer to each other than the anterior pair; all pairs of associated setae almost in anterior half of plate. Posterior plate with two pairs of associated setae. Lateral of these large plates two platelets with glandularia, and two platelets without glandularia or associated setae. Moreover, two pairs of minute platelets lateral of large platelets. Eyes present but small. Ventral shield undivided. Capitular bay moderately deep and basally rounded. Suture lines of coxae incomplete and obliterated. Genital field pear-shaped, with three pairs of acetabula in gonopore, each pair of three acetabula on a small platelet. Genital field 153 long and 134 wide. Excretory pore closer to posterior idiosoma margin than to genital field. Chelicera two-segmented, 119 long. Lengths of PI–PV: 21, 70, 38, 74, 38 (excluding heavy seta). PIV enlarged, with two ventral heavy, pointed setae (one is probably broken); PV with a heavy terminal seta. Lengths of I-leg-4–6: 124, 330, 144; I-leg-6 typical for the family Momoniidae, with anteriorly a blunt, heavy seta, ending posteriorly pointed; I-leg-5 elongated. Claws of legs II-IV with large clawlet and small claw blade.

Etymology. Named for its similarity with the previous described species of the genus—*Hesperomomonia humphreysi* Harvey.

Remarks. The new species is close to *H. humphreysi* from Western Australia. It differs in the position of the setae on the anterior dorsal plate, in having two pairs of setae instead of three on the posterior dorsal plate and in the different number of platelets without glandularia lateral of the dorsal plates. The palp of the two species is very similar. Other differences are found in the large, heavy seta of I-leg-5: pointed in *H. humphreysi* and blunt in *H. similis*, while the posterior part of this segment is more slender in *H. similis*. Finally, I-leg-5 is much longer in the new species.



Figs 31–36. *Davidsia aurita* n.sp., holotype male, (*31*) ventral view; (*32*) dorsal view; (*33*) palp; (*34*) I-leg-3–6; (*35*) I-leg-6; (*36*) IV-leg-4–6. Scale bars = 50 µm.



Figs 37–41. *Hesperomomonia similis* n.sp., holotype female, (*37*) dorsal view; (*38*) ventral view; (*39*) genital field; (*40*) palp + capitulum; (*41*) I-leg-5–6. Scale bars 37–38 200 µm, 39–41 = 50 µm.

Genus *Austromomonia* Harvey

Austromomonia grownsae Harvey, 1998

Austromomonia grownsae Harvey, 1998a: 102; Harvey, 1998b: 145.

Material examined. 1 female, Dalrymple Creek, hyporheic, Goomburra Forest Reserve, Qld., Australia, 27°58.781'S 152°20.621'E, alt. 690 m, 5 November 2005.

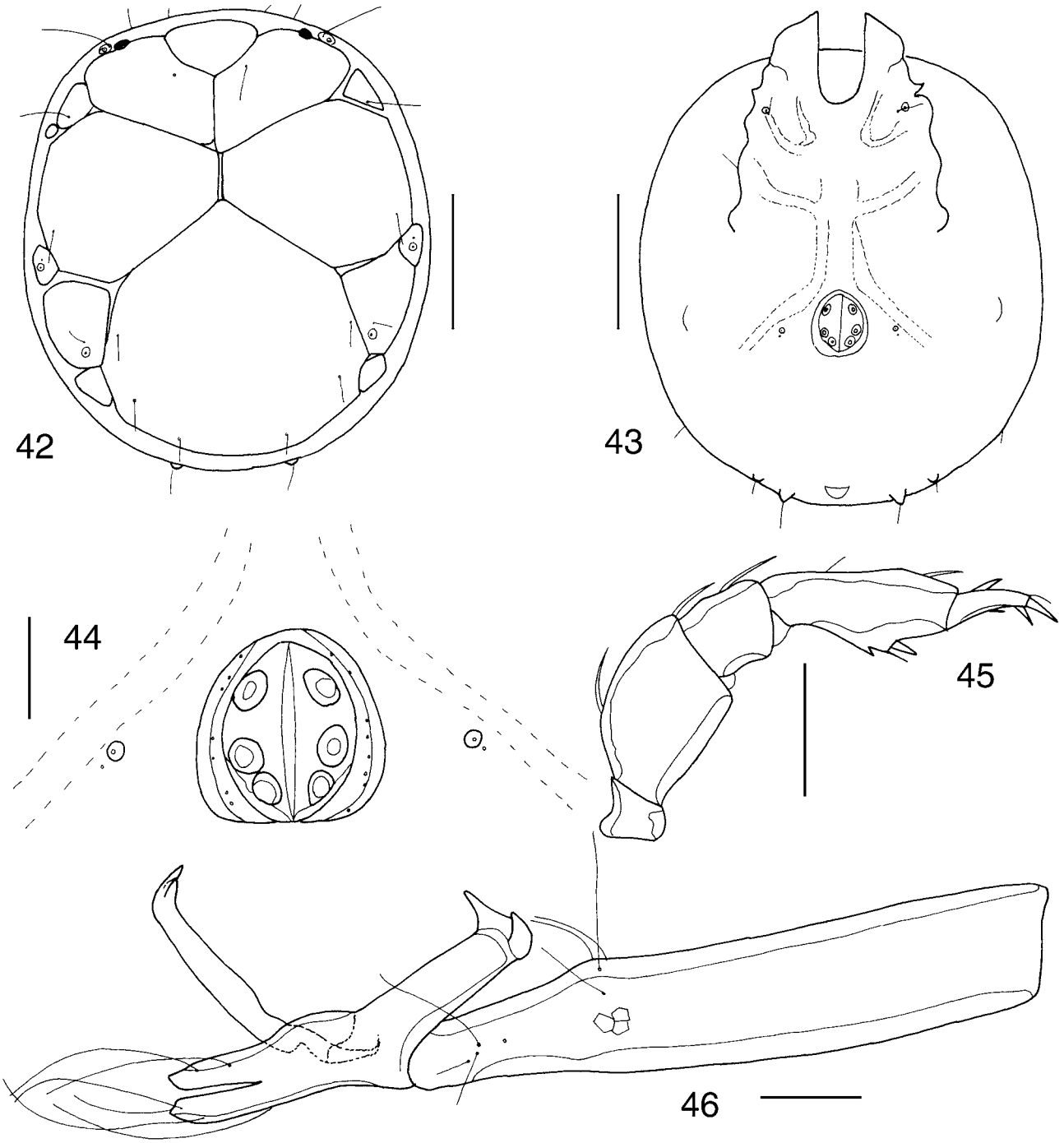
Remarks. This is the third known specimen; the previous two specimens came from the Never Never Creek in New South Wales (Harvey, 1998a). The species is only known from the female sex. In addition to the description of Harvey (1998a), the following characters can be added: platelet with lateroglandularia 2 dived in two platelets on one side and complete on the other side; IV-leg-5 truncated in a different view than illustrated by Harvey (1998a).

Genus *Partidomomonia* Cook

Partidomomonia tertia n.sp.

Figs. 42–46

Type material. HOLOTYPE male, Dalrymple Creek, Goomburra Forest Reserve, Queensland, Australia, 27°58.781'S 152°20.621 E; alt. 690 m, 17 November 2003 (QM). PARATYPES: 1 male (QM), 1 male (ZMAN), same data as holotype; 1 male (ZMAN), same location as holotype, 5 November 2005.



Figs 42–46. *Partidomomonia tertia* n.sp., holotype male, (*42*) dorsal view; (*43*) ventral view; (*44*) genital field; (*45*) palp; (*46*) I-leg-5–6. Scale bars 42–43 = 200 µm, 44–46 = 50 µm.

Diagnosis. Lateroglandularia 5 fused with large posterior dorsal plate.

Description. Male: Colour pale. Dorsal and ventral shields present. Idiosoma ventrally 725 (697–770) long and 591 (591–648) wide, dorsally 648 (616–697) long. Dorsum with one posterior large plate with three pairs of setae lacking the associated glandularia. Anteriorly two pairs of large plates, the most anterior plate with the postocularia, the posterior of these two plates with a pair of setae without the associated glandularia. Laterally of these large plates three pairs of glandularia on smaller plates (dg2, lg3 and lg4 sensu Harvey, 1990a). Ventral shield entire; capitular bay deep and rounded basally. Suture lines of coxae incomplete and obliterated. First coxae extending beyond anterior body margin. Gonopore with three pairs of acetabula lying within the gonopore, acetabula not on platelets. Posterior two acetabula closer to each other than anterior acetabula. Gonopore 88 long, anteriorly rounded. Excretory pore close to posterior idiosoma margin. Lengths of PI–PV: 23, 62, 33, 71, 26 (without large terminal seta). Palp typical, PIV ventrally with one large and one small pointed seta both on a

small tubercle; PV with a large terminal pointed seta. Lengths of I-leg-4–6: 94, 308, 198. I-leg-6 typical for the family Momoniidae, with I-leg-5 elongated and I-leg-6 bifurcate distally with a slender and downwards pointed claw. Lengths of IV-leg-4–6: 157, 214, 157. Claws of legs II-IV with large clawlet and small claw blade.

Female: Unknown.

Etymology. This is the third species of the genus from Australia.

Remarks. The new species differs from the two known Australian species and the one known species from New Zealand in the lateroglandularia 5 which are fused with the large posterior dorsal plate. In all three other species the lateroglandularia are lying on separate platelets. Moreover, *P. blythi* Harvey and *P. polyplacophora* Cook have a much more elongated idiosoma shape. The two known Australian species have been found in Victoria. Cook (1986) found a deutonymph in Queensland, but left it unnamed. I-leg-6 of this nymph is much shorter than in the new species, so very likely it cannot be assigned to the new species.

Genus *Momoniella* Viets

Momoniella parva Cook, 1986

Momoniella parva Cook, 1986: 286; Harvey, 1998b: 145.

Material examined. 4 males, 6 females, 5 nymphs, Barkers Creek at Little Falls, Bunya Mountains National Park, Qld., Australia, 19 November 2003; 11 males, 9 females, Saddle-tree Creek, Bunya Mountains National Park, Qld., 19 November 2003; 1 male, 1 female, Dalrymple Creek, Goomburra Forest Reserve, Qld., Australia, 27°58.781'S 152°20.621 E; alt. 690 m, 17 November 2003; 1 male, same location, 5 November 2005.

Remarks. Cook (1986) did not report this species from hyporheic habitats. As all my findings of *M. parva* are from hyporheic habitats, so this species is very likely is a true hyporheic species. In the surface sample of Barkers Creek only a female of *M. australica* Cook was found, while in the hyporheic sample only *M. parva* was found. Cook (1986) stated that *M. parva* should have a dorsal shield which is longer than wide, while *M. australica* has a dorsal shield which is wider than long. However, occasionally specimens of *M. parva* have been found with a dorsal shield equally long and wide or slightly more wide than long. *Momoniella parva* is smaller than *M. australica*, while there are differences in the genital field between the two species (see Cook, 1986).

Family Athienemanniidae K. Viets

Subfamily Notomundamellinae Cook

Janszoonia n.gen.

Diagnosis. Characters of the family Athienemanniidae and the subfamily Notomundamellinae. Dorsal and ventral shields present, dorsal furrow complete. Dorsal shield large, with three pairs of glandularia and a pair of postocularia. Dorsal shield without apophyses. Eyes absent. Eight pairs of acetabula on small platelets within the gonopore, four pairs on the posterior platelets, one pair on the middle platelets and three pairs on the anterior platelets. Laterally of gonopore, four small acetabula irregularly placed on a ridge-like structure. Palp rotated.

Type species: *Janszoonia difficilis* n.sp.

Etymology. Named after the Dutch sailor Willem Janszoon, possibly the first European to reach Australia in 1606. The gender is feminine.

Remarks. From Australia three genera are known: *Notomundamella* Cook, *Mellamunda* Harvey and *Davecookia* Harvey, all belonging to the endemic subfamily Notomundamellinae. The latter genus is described from the same locality as the new genus described here. None of the known members of the Notomundamellinae has a similar configuration of the acetabula. *Notomundamella* has a dorsal shield with apophyses (absent in the new genus), while the gonopore has three lobes with numerous acetabula. *Mellamunda* has eight acetabula within the gonopore, but not on platelets, and 5–7 pairs in the ventral shield. *Davecookia* has five pairs of acetabula within the gonopore (three large pairs and two small ones), no acetabula in the ventral shield and the female has a very broad gonopore. The new genus is most closely related to *Mellamunda*, as both females have acetabula within the gonopore and acetabula incorporated into the ventral shield. However, the genital field of *Mellamunda* differ completely from those of the new genus. The acetabula of *Mellamunda* are partly covered by the idiosoma and not on platelets. The acetabula of the new genus within the integument are lying on platelets, while those outside the integument are located on a ridge-like structure. These differences warrant a separate status of the new genus.

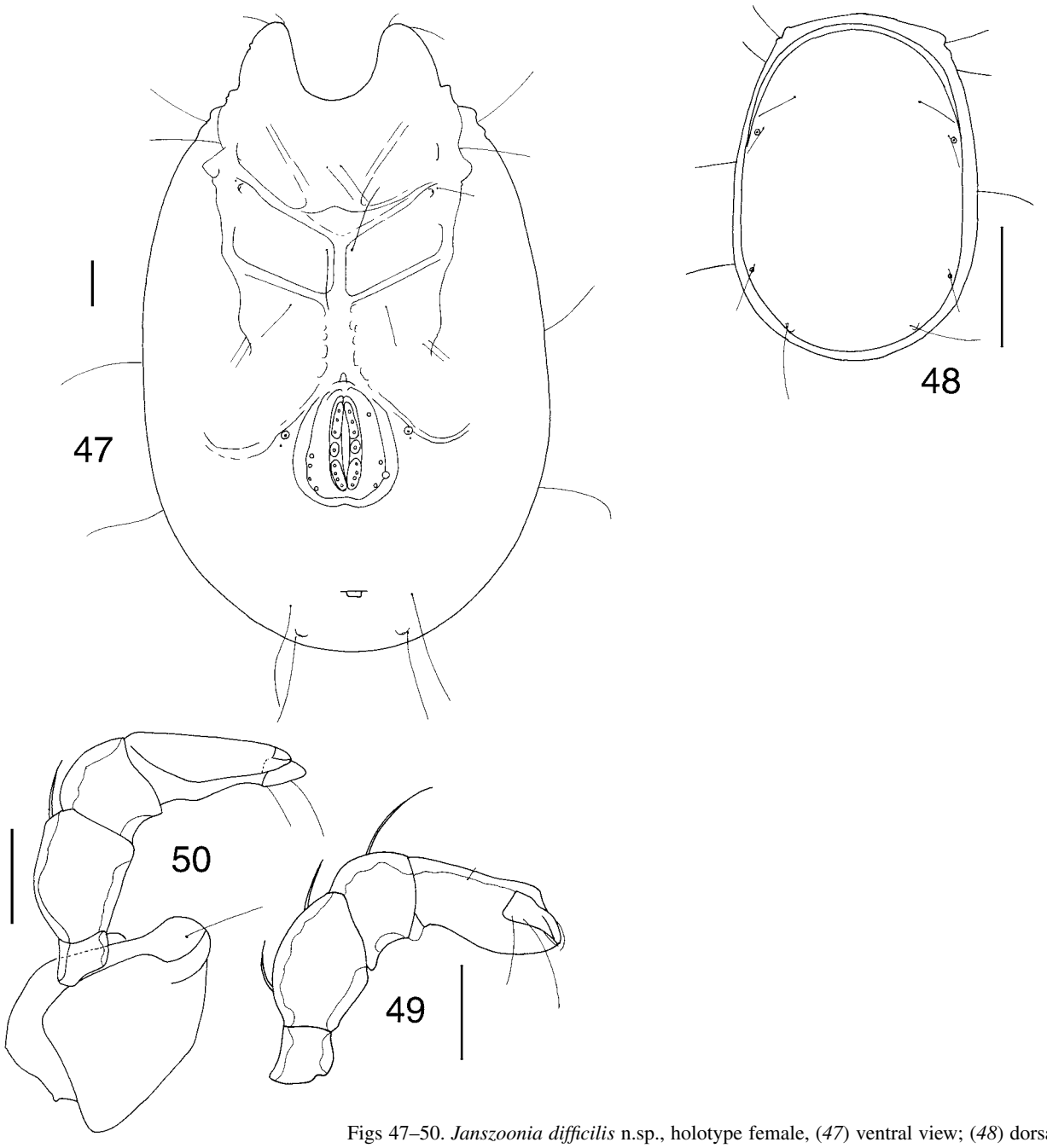
Janszoonia difficilis n.sp.

Figs. 47–50

Type material. HOLOTYPE female, Never Never Creek, Tallywood Point, New South Wales, Australia, 30°21.624'S 152°54.269'E, 7 November 2005 (AMS).

Diagnosis. As for genus.

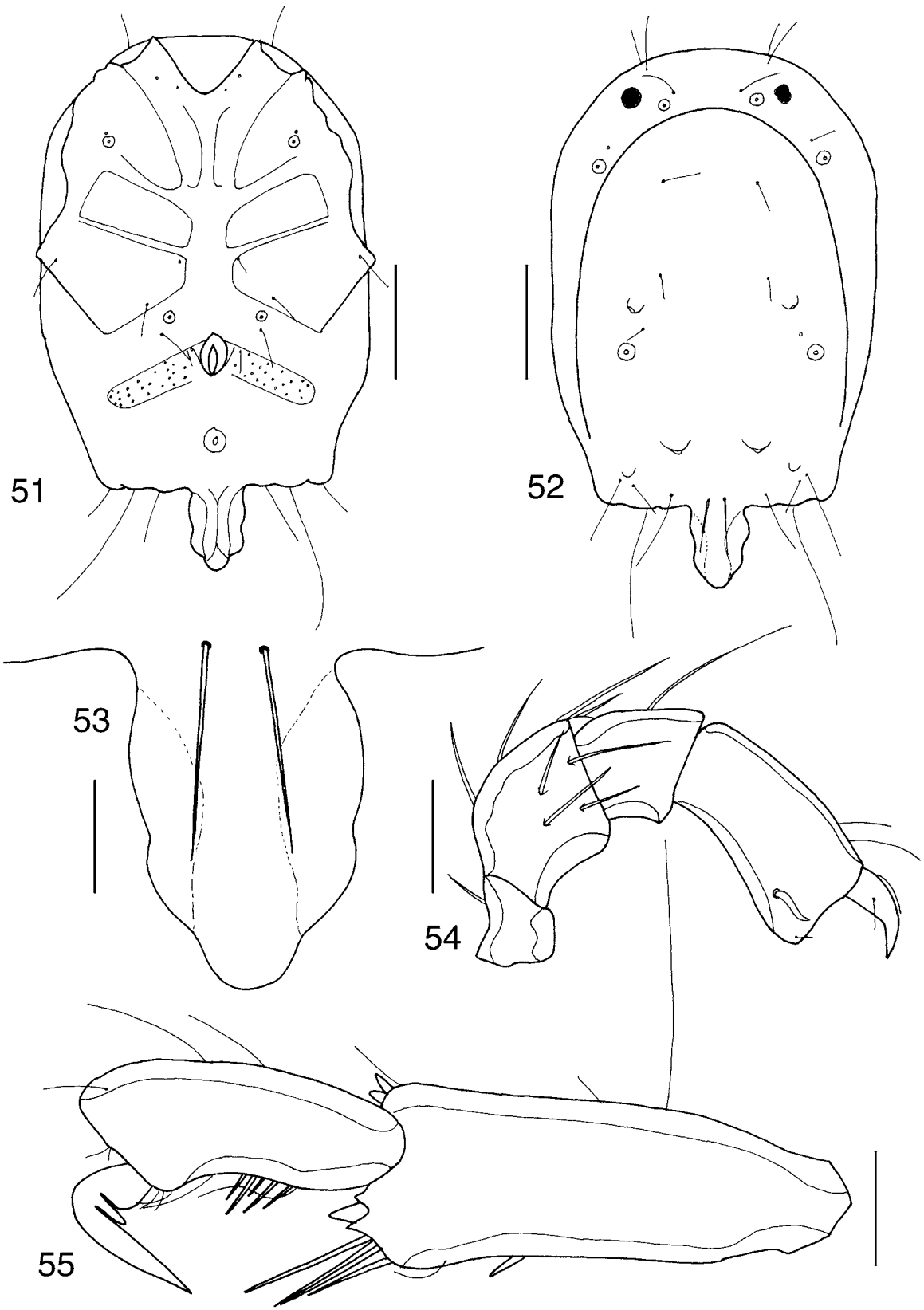
Description. Female: As for genus. Idiosoma 583 long and 415 wide dorsally, and 640 long ventrally. Dorsal shield large, separated from ventral shield by a narrow strip of



Figs 47–50. *Janszoonia difficilis* n.sp., holotype female, (*47*) ventral view; (*48*) dorsal view; (*49*) palp; (*50*) palp + capitulum. Scale bars Fig. 48 = 200 µm, Figs 47,49,50 = 50 µm.

soft integument. Dorsal shield 543 long and 381 wide, with three pairs of glandularia and a pair of postocularia. Distance between anterior two pairs of glandularia larger than distance between posterior two pairs. First coxae rounded and extending beyond anterior idiosoma margin. Suture lines between first and second coxae indistinct. A pair of glandularia near anterior margin of third coxae. Genital field 124 long. Lateral of the genital field a pair of glandularia. Excretory pore closer to posterior idiosoma margin than to genital field. Lengths of PI–PV: 30, 67, 47, 74, 32. PV enlarged, wider than illustrated in Fig. 49 (because of its oblique position in the slide), with two long medial setae. Lengths of I-leg-4–5: 72, 100, 88; I-leg-3 with two long, ventral setae. Lengths of IV-leg-4–6: 102, 134, 120. Legs without swimming setae, only some small rudimentary setae present. Claws without clawlets.
Male: Unknown.

Etymology. Named for difficulties encountered when collecting this species. Although the Never Never Creek is known as a good collecting site for hyporheic water mites (Boulton & Harvey, 2003; Boulton *et al*., 2004), none could be found in 2003, despite intensive collecting efforts over a period of two days. On the second occasion in 2005, again after intensive efforts to collect, only two water mites were collected, the new species described here and one *Oxus*.



Figs 51–55. *Arrenurus bunyaensis* n.sp., holotype male, (*51*) ventral view; (*52*) dorsal view; (*53*) detail of petiole, dorsal view; (*54*) palp; (*55*) III-leg-5–6. Scale bars 51–52 = 200 µm, 53–55 = 50 µm.

Family Arrenuridae Thor

Genus *Arrenurus* Dugès

Arrenurus (Arrenurus) bunyaensis n.sp.

Figs. 51–55

Type material. HOLOTYPE male, Barkers Creek at Little Falls, Bunya Mountains National Park, Queensland, Australia, 19 November 2003 (QM).

Diagnosis. Third leg of male modified, with a large claw. Petiole with undulating lateral margins and a rounded posterior margin.

Description. Male: Idiosoma pale orange, 931 long (including petiole) and 551 wide. Anterior idiosoma margin convex. Dorsal shield incomplete, 470 wide. Dorsoglandularia 1 and 2 lying close to each other. Capitular bay V-shaped, rounded basally. Pygal lobes and cauda absent. Medial margin of third and fourth coxal plates more or less of same length, posterior margin of fourth coxal plates sloping. Third and fourth coxal plates well distanced medially. Petiole with undulating lateral margins, rounded posteriorly. Near base of petiole dorsally two long setae. Gonopore 60 long. Genital plates lying oblique, genital plates about three times as long as wide, not reaching lateral idiosoma margin. Lengths of PI–PV: 35, 82, 62, 90, 40. PII with four setae on medial side. Lengths of I-leg-4–6: 128, 146, 134. III-leg modified: III-leg-5 enlarged, III-leg-6 ventrally with a row of six short setae and with a large claw; lengths of III-leg-4–6: 1674, 200, 140. Lengths of IV-leg-4–6: 184, 172, 126; IV-leg-4 without spur. Third and fourth legs with numerous swimming setae.

Female: Unknown.

Etymology. Named after the Bunya Mountains.

Remarks. The modified third leg is unique for the genus *Arrenurus*. It is always the fourth leg which is modified in the males, with IV-leg-4 in many cases with a spur. Besides the modified third leg, the petiole is also diagnostic for the new species.

Discussion

During this study hyporheic water mites were collected in relatively few locations. Despite many collection efforts, success was usually low. In the Northern Territory no hyporheic water mites could be collected. Most mountain ranges in the Northern Territory consist of sandstone and rivers are therefore without suitable gravel banks. However, the few locations where hyporheic water mites were collected yielded many new taxa, indicating that a diverse hyporheic water mite fauna is present. Repeated collecting efforts at some sites resulted either in new taxa that had not been collected before, or were met with little success. This phenomenon has also been noted in other parts of the world, e.g., Germany (Gerecke, 2002). Apparently the density of hyporheic mites is low, which makes it difficult to re-collect species. Hyporheic mites are sensitive to changes in the environment, e.g., land use (logging, agriculture), pollution and changes in water table (Boulton, 2001; Boulton *et al*., 2003 and references therein). This could explain the difficulty in finding locations where hyporheic water mites were present.

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