

A REVIEW OF THE PARATYDEIDAE (ACARI: PROSTIGMATA) WITH DESCRIPTIONS OF THE FIRST AUSTRALIAN REPRESENTATIVES, *TANYTYDEUS LAMINGTON* SP. NOV. AND *T. KAKADU* SP. NOV.

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ACARI
PARATYDEIDAE
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AUSTRALIA

SUMMARY: We briefly review and key the described species of Paratydeidae, provide a revised diagnosis for the family, re-establish *Neotydeus* as a valid genus, and describe the first Australian species, *Tanytydeus lamington* sp. nov. and *Tanytydeus kakadu* sp. nov., from Queensland and the Northern Territory, respectively.

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RÉSUMÉ : Nous donnons une brève révision et une clé des espèces décrites de Paratydeidae, et une diagnose révisée de la famille. Nous rétablissons comme valide le genre *Neotydeus*, et décrivons les premières espèces d'Australie, *Tanytydeus lamington* sp. nov. et *Tanytydeus kakadu* sp. nov., du Queensland et du Territoire du Nord, respectivement.

INTRODUCTION

The microarthropod faunas of dry soils are often dominated by minute, soft-bodied mites of the Prostigmata (including Endeostigmata) (THERON *et al.*, 1969, PRICE, 1973, KETHLEY 1990). Many of these mites have elongate bodies, and some are more or less worm-like, including the Paratydeidae—a problematical group. Although originally classified as members of the Tydeoidea (BAKER, 1949), subsequent study discovered characters such as separate cheliceral bases and small, strongly curved movable cheliceral digits (BAKER, 1950; THERON *et al.*, 1969) that suggest a closer relationship to the Anystoidea (KETHLEY, 1982). However, placement of the Paratydeidae in the Anystina is still tentative (EVANS, 1992). No strong apomorphies have been proposed to define

the family, and distinguishing characteristics are the elongate body form, separation of coxae I–II from III–IV, constrictions or “sutures” of the opisthosoma, the absence of characteristics of other families (e.g. rutella, leg trichobothria, and the palptibial claw and tarsal ‘thumb’), the presence of anystoid-like chelicerae, and reductions of the prodorsal setation to one pair of trichobothria and two pairs of setae, and the palps to four segments (KETHLEY 1982, 1990). The Paratydeidae is a morphologically homogeneous group: differences among genera are not impressive (KETHLEY 1982) and placement depends on the presence or absence of eyes, the number of transverse “sutures” dividing the opisthosoma, and the shape of the prodorsal plate. To date, ten species of paratydeid mites have been described, and six genera have been proposed to accommodate them: *Paratydeus alexan-*

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deri Baker, 1949, *Neotydeus ardisanneae* Baker, 1950, *Sacotydeus lootsi* Theron, Meyer and Ryke, 1969, *Tanytydeus cristatus* Theron, Meyer and Ryke, 1969, *Tanytydaeus neocristatus* Kandeel and Hoda, 1984, *Scolotydaeus bacillus* Berlese, 1910, *Scolotydeus simplex* Delfinado and Baker, 1974, *Scolotydaeus corticicola* Flechtmann, 1992, *Hexatydeus aegyptiacus* Solomon, 1974 and *Hexatydeus amabilis* Kandeel, 1992.

In Australia, KETHLEY (1990: 684) states that the Paratydeidae are one of the three dominant families of soil-inhabiting prostigmatans (along with Nanorchestidae and Pseudoscheyleidae). However, despite their reputed prominence, no Australian Paratydeidae have been described, and the only generic record is of a "*Paratydeus*" sp. taken from soil on One-Tree Island, a coral cay in the Great Barrier Reef off the coast of Queensland (HEATWOLE *et al.*, 1981). Herein, we provide a new diagnosis for the family, describe two new species of Paratydeidae from mainland Australia, and provide a key to all of the described species.

MATERIALS AND METHODS

Samples of sandy soil from under rocks (Kakadu National Park, Northern Territory) or rotting wood, bark and mosses (Lamington National Park, Queensland) were extracted into 80% ethanol in simple Berlese funnels using 40 watt light bulbs. Mites were cleared in Nesbitt's solution (KRANTZ, 1978) and mounted in Hoyer's or Heinze PVA medium (EVANS, 1992) on glass microscope slides. Measurements are in μm , follow structures in parentheses, and are based on specimens observed under differential-interference microscopy and measured using a calibrated ocular grid. Legs were measured from the coxal base to the tips of the claws, idiosomas from naso to tip of abdomen, and setae from their insertions to tips. Setal designations follow KETHLEY (1990); eugenital setae and papillae follow JUDSON (1995).

FAMILY PARATYDEIDAE

DIAGNOSIS. Elongate, soft-bodied acariform mites with plicate cuticle; pale white to orange or violet in colour. Prodorsum of adult with shield reduced or

absent, one pair of trichobothria (*sci*), 2 pairs of setae (*ve*, *sce*), 0–2 pairs of eyes, and dorsolateral peritremes with tracheae opening between bases of chelicerae. Rutella absent; palps linear, 4-segmented (femora fused to genua), without thumb-claw complex; cheliceral bases free; movable digit hook-like; fixed digit reduced to short lobe. Dorsal-sejugal suture well developed; coxal fields III–IV displaced well posteriorly I–II; segment *C* of opisthosoma delimited posteriorly by a dorsal, suture-like constriction at the level of coxae III; segment *D* often similarly delimited by a constriction posteriorly coxae IV. Genital and anal openings distant to approximate; anal opening terminal; 2–3 pairs of genital papillae. Legs without trichobothria; femora I and IV divided; dorsal peg-like setae present on palpcoxa and/or coxae I; all tarsi with two claws and a small claw-like empodium. Male with an internal spermatophoric complex presumably used to produce stalked spermatophores.

REMARKS. Paratydeids probably represent an early derivative group of Anystina that have adapted to a euedaphic life-style through elongation of the body and the loss or reduction of various sensory structures (e.g. eyes, leg trichobothria) of little use in the narrow channels of soil pore space. They appear to be most closely related to the Pseudoscheyleidae, and especially to the enigmatic genus *Stigmocheylus* (see LINDQUIST, 1977). Little is known about the biology of paratydeid mites, other than the tendency for them to be abundant in the soils of grasslands and dry forests and to possess a larval and three nymphal stages (KETHLEY, 1982, 1990). Their stout, hook-like movable digits suggest a predatory life-style, but these mites have never been successfully cultured and only rare feeding on the fluids of nematodes and of fungal hyphae has been observed in the laboratory (WALTER, 1988).

Two main divisions of the family Paratydeidae are apparent. Those similar to *Paratydeus* Baker share a number of primitive character states such as eyes (seemingly absent in *S. simplex*), separate anal and genital openings, and the lack of constrictions or "sutures" of the opisthosoma beyond segment *C*. Those similar to *Neotydeus* Baker share three apparently derived character states: the loss of eyes, the conjunction of the anal and genital regions, and a

constriction of the opisthosoma behind segment *D*. KETHLEY (1982) suggested that only two or three valid genera of Paratydeidae had been described. Although this may be true, too little is known of the ontogeny of these mites to propose synonymies at this time. The only previous generic synonymy in the family was of *Neotydeus* with *Scolotydeus* (DELFINADO & BAKER, 1974); however, this was apparently made without reference to THERON *et al.*'s (1969) description of *S. bacillus*, and we consider it to be an error. Therefore, we revive *Neotydeus*. Below we key out the genera and species of Paratydeidae and describe two new Australian species.

KEY TO ADULT FEMALE PARATYDEIDAE

1. Genital and anal openings separate; opisthosoma not strongly constricted behind setal row *d*; 1–2 pairs of eyes or eye-like bodies usually present on lateral prodorsum 2
- Genital and anal openings proximate; opisthosoma strongly constricted behind setal row *d*; eyes always absent 6
- 2(1) Adult female with 6 pairs of aggenital setae 3
- Adult female with 2 pairs of aggenital setae ... 5
- 3(2) Eyes present; adult female with 9–10 pairs of genital setae 4
- Eyes absent; adult female with 4 pairs of genital setae; New York
..... *Scolotydaeus simplex* Delfinado & Baker
- 4(3) Adult female with 10 pairs of genital setae; one pair of ill-defined eyes; trichobothria *sci* about 50% longer than *sce*; setae *f2* and *h2* less than twice length of *f1* or *h1*; Italy, Norway
..... *Scolotydaeus bacillus* Baker
- Adult female with 9 pairs of genital setae; two pair of eyes; trichobothria *sci* 3–4 times length of *sce*; setae *f2* and *h2* 3–4 times length of *f1* or *h1*; Brazil .. *Scolotydaeus corticicola* Flechtmann
- 5(2) Prodorsum with subtriangular shield between bases of *sci*; mid-dorsal opisthosomal setae relatively short, not passing insertion of next seta in series; *c2* twice length of *c1*; *sci* twice length of both *sce* and *c1*; South Africa. . *Sacotydeus lootsi* Theron *et al.*
- Prodorsum without shield; mid-dorsal opisthosomal setae relatively long, most passing insertion of next seta in series; *c2* subequal to *c1*; *sci* subequal to *sce*, slightly longer than *c1*; Mexico
..... *Paratydeus alexanderi* Baker
- 6(1) With 2 pairs of genital setae and 3 pairs of aggenital setae; Egypt. 7
- With 4 or more pairs of genital and aggenital setae; various countries 9
- 7(6) Three pairs of genital papillae
..... *Hexatydeus amabilis* Kandeel
- Two pairs of genital papillae 8
- 8(7) Prodorsal shield subtriangular
..... *Tanytydeus neocristatus* Kandeel & Hoda
- Prodorsal shield linear
..... *Hexatydeus aegypticus* Soliman
- 9(6) Prodorsal shield absent; 4 pairs of aggenital setae; North America *Neotydeus ardisanneae* Baker
- Prodorsal shield linear; 5 or 6 pairs of aggenital setae 10
- 10(9) With 2 pairs of genital papillae and 4 pairs of genital setae; distal segments of legs I–II without elongate pits; South Africa
..... *Tanytydeus cristatus* Theron *et al.*
- With 3 pairs of genital papillae and 5–6 pairs of genital setae; distal segments of legs I–II with elongate pits; Australia 11
- 11(10) With 5 pairs of genital and aggenital (3 + 2) setae; seta *ve* anterolateral to *sci*, short, about 1/3 length of *sce*; seta *h2* at least twice the length of *h1*; Queensland *Tanytydeus lamington* sp. nov.
- With 6–7 pairs of genital and 6 pairs of aggenital (4 + 2) setae; seta *ve* anterior to *sci*, relatively long, approaching length of *sce*; seta *h2* less than 1/3 longer than *h1*; Northern Territory
..... *Tanytydeus kakadu* sp. nov.

Tanytydeus

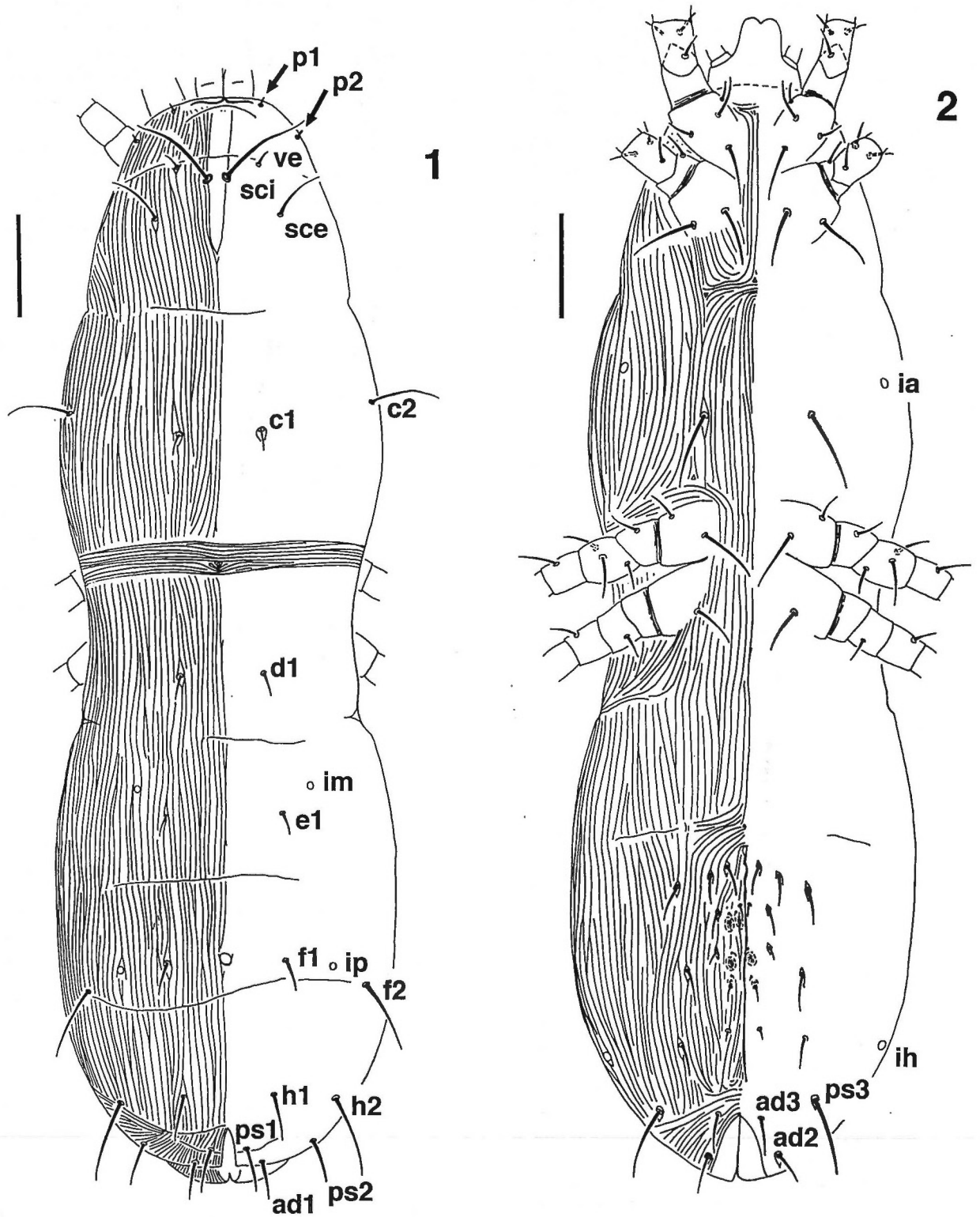
TYPE SPECIES: *Tanytydeus cristatus* Theron, Meyer & Ryke, 1969: 703.

DIAGNOSIS. Eyes absent; prodorsal shield linear, crista-like; naso weakly expressed; segments *C* and *D* delimited by suture-like constrictions; genital and anal openings proximate; 3 pairs of *ad* setae; 2–3 pairs of genital papillae. Adult female with 4–6 pairs of genital and 5 pairs of aggenital setae.

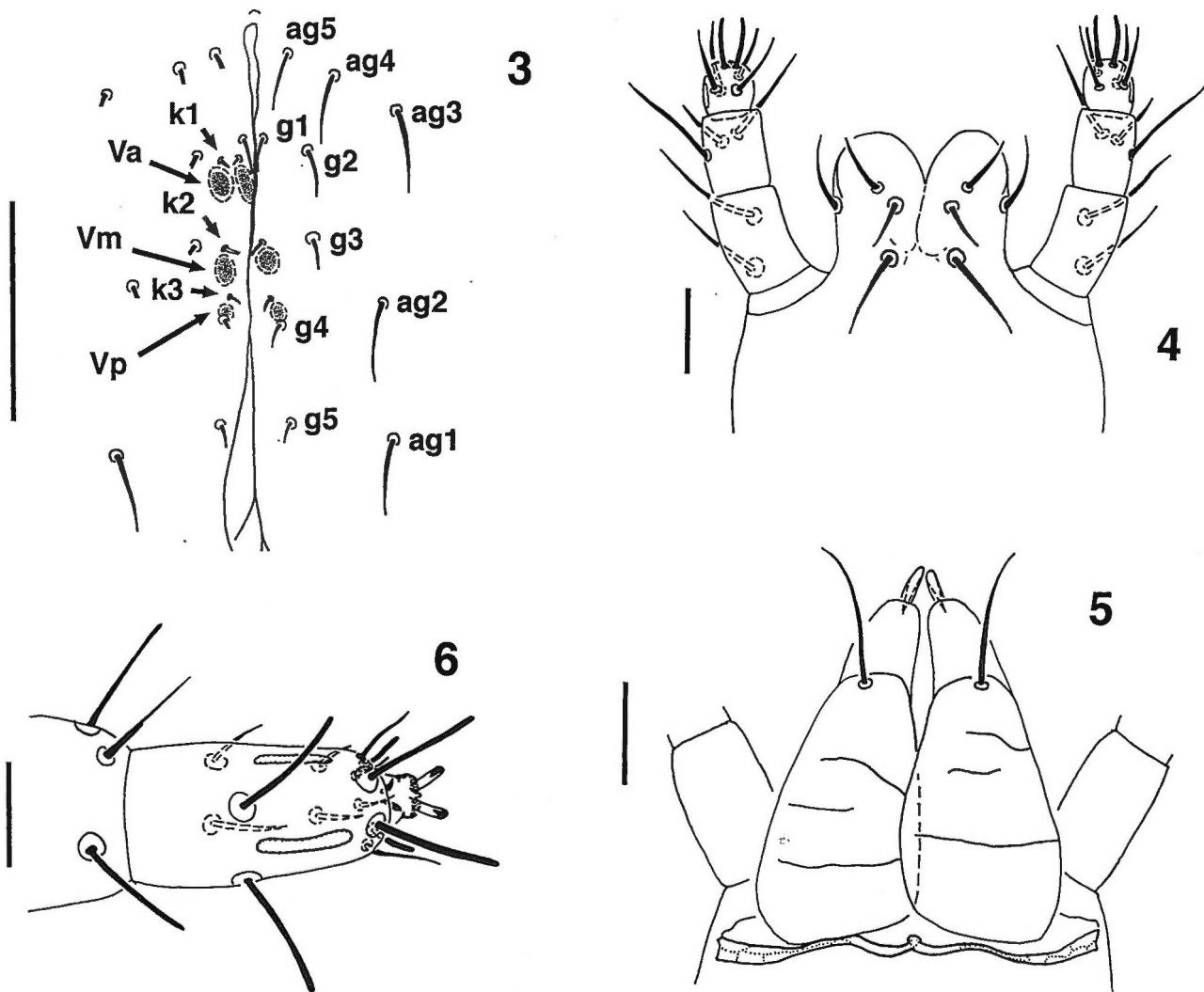
Tanytydeus lamington n. sp.

(Figs. 1–9)

MATERIAL EXAMINED. — Holotype ♀: Queensland, Lamington National Park, Mt Bithongabel, 28° 16' S, 153° 10' E, 15 Dec. 1998, ex rotting wood, bark



FIGS. 1-2: *Tanytydeus lamington* sp. nov. (adult female), dorsal (1) and ventral (2) views of idiosoma. Scale bars = 50 µm.



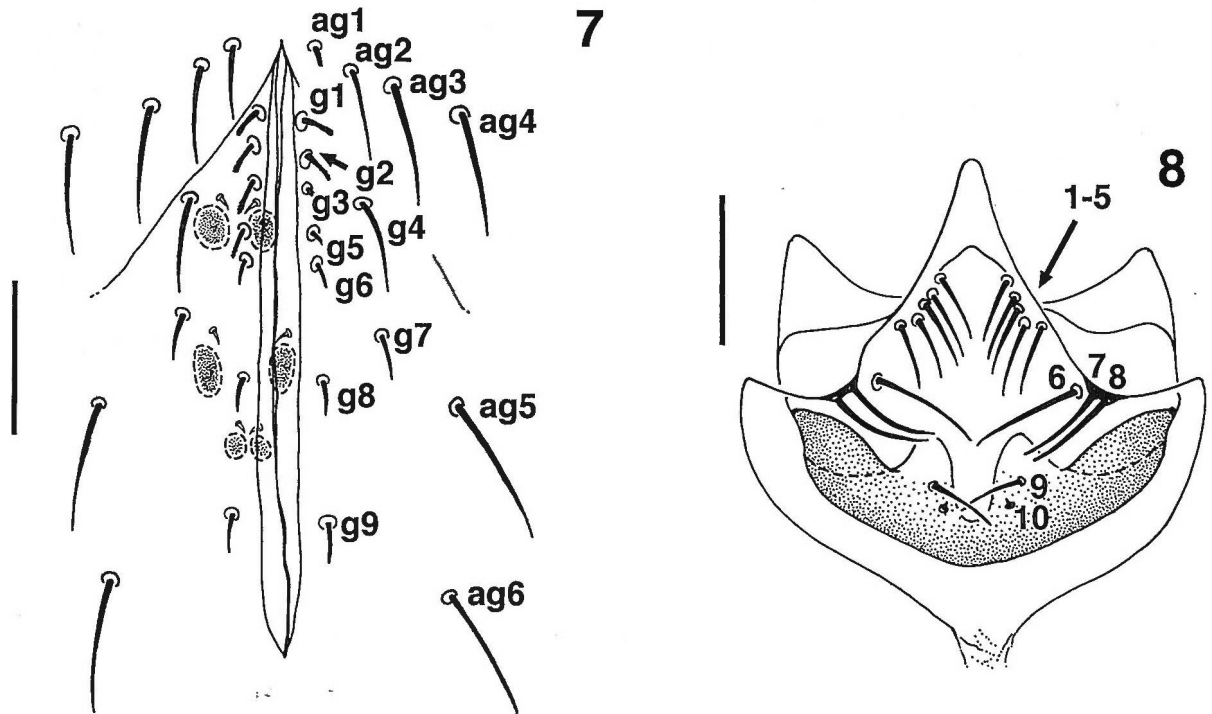
FIGS. 3-6: *Tanytydeus lamington* sp. nov., adult female.

3. — Genital region (scale bar = 50 μ m). 4. — Venter of gnathosoma (scale bar = 10 μ m). 5. — Dorsal view of chelicerae (scale bar = 10 μ m). 6. — Tarsus I (scale bar = 10 μ m).

and moss, *Nothofagus moorei* forest, D. E. WALTER (deposited in Queensland Museum, Brisbane). Paratypes: 4 ♀, 5 ♂, 5 tritonymphs, 2 deutonymphs, same data as holotype (deposited in University of Queensland Insect Collection).

FEMALE (Figs. 1-6). — Idiosoma 520-540 μ m long, with longitudinal striae except for a region of transverse striae level with leg III; dorsosejugal and segment C sutures well developed, less clearly constrict-

ted posteriad segment D. Prodorsum with linear, crista-like shield and 3 pairs of setae: a pair of simple trichobothria, *sci* (53), on the shield margin and 2 pairs of simple setae, *ve* (12) and *sce* (35), in the plicate cuticle; peg-like setae, *p1* (4) and *p2* (4) on dorsal palpcoxae and coxae I, respectively. Peritremes open at the base of the cheliceral digits and extend laterally along the cheliceral bases and longitudinally into the opisthosoma. Anteriorly, an integumental fold delineates a weak naso.



FIGS. 7-8: *Tanytydeus lamington* sp. nov., adult male. 7. — Genital region. 8. — Internal genital structure. Scale bars = 20 μ m.

Opisthosoma with 12 pairs of setae in addition to anal, aggenital and genital setae. Segment *C* with setal pairs *c1* (14) rod-like, *c2* (58); pore *ia* and seta *c3* (56) located ventrally. Setae *d1* (13), *e1* (13), *f1* (17), *h1* (24), *ps1* (23) and *ps2* (20) short and rod-like. Setae *f2* (45), *h2* (46), and *ps3* (40), elongate, acuminate. Pore *im* anterolaterad seta *e1*; large median pore and pore *ip* between *f1-2*; *f2* (40-45), pore *ih* lateral of *h2* (46). Anus flanked by three pairs of rod-like setae *ad* 1-3 (19-22). Genital opening with 5 pairs of genital setae (*g*), an interior row of 3 setae and an outer row of 2 setae; 5 pairs of aggenital setae (*ag*); 3 pairs of genital papillae (*Va*, *Vm*, *Vp*), *Vp* about half the size of *Va* and *Vm*; a minute seta is positioned anteriorly of each papilla (*k1-3*).

Setation of coxal fields I-IV 4-3-2-2, respectively; trochanters 0-1-1-0; (basi)femora (1)7-3-3-(1)2; genua 6-3-3-1; tibiae [rod-like setae] 6[2]-2-3-3; tarsi [rod-like setae] 8[6]-6-6-5. Solenidion of tibiae I short (6), anterolateral, and protected by a guard seta sharing the same alveolus; tarsus II with a short (6) median solenidion. Tibiae I with elongate (8 \times 1)

sensory pit, tibiae II-III with shorter (5-6), narrower (0.5) pits. All tarsi with a pair of claws and a small, claw-like empodium; tarsus I with 2 elongate (10 \times 2) sensory pits; tarsus II with a single sensory pit (9 \times 1). Leg I longest (185-190), leg II-III (140), leg IV (154-160).

Chelicerae with bases free, each with a simple seta and a strongly curved movable digit. Venter of gnathosoma with 4 pairs of simple setae, lateral and posterior pairs longest (14-16). Palp trochanters, femora-genua, tibiae and tarsi with 0-2-3-4[2], setae [rod-like setae], respectively.

MALE (Figs. 7-8). — Similar to female except in genital region. Genital opening flanked by 9 pairs of *g* setae and 6 pairs of *ag* setae. Anterior 3 pairs of genital setae (*g1-3*) thickened, toothed; genital setae *g4-5* with small, inconspicuous barbs. Seta *g1* unpaired in one specimen. Leg and palpal chaetotaxy, genital papillae and *k* setae as in female. Internal genital complex 65 μ m long \times 63 μ m wide, with broad, granulate base. Ten pairs of setae within the structure, as figured.

TRITONYMPH (Fig. 9) — Similar to adult female except smaller (470–490) and with 3 pairs of genital and 3 pairs of aggenital setae.

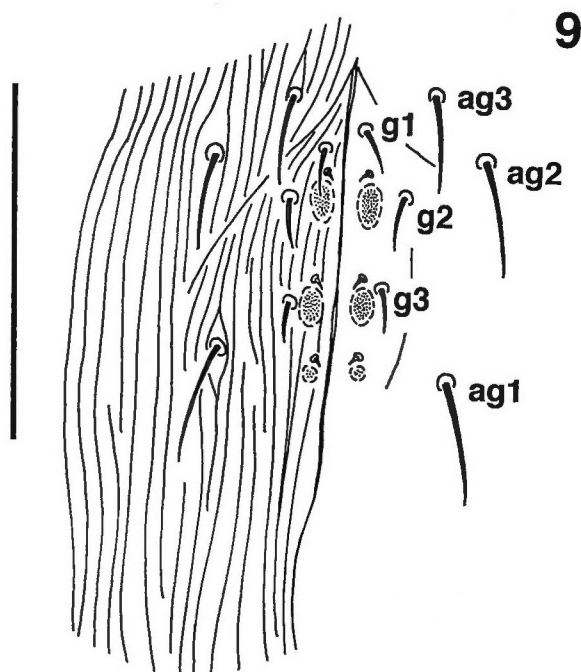


FIG. 9: *Tanytydeus lamington* sp. nov. (tritonymph), genital region. Scale bar = 50 μ m.

DEUTONYMPH — Similar to tritonymph except smaller (440) and with 2 pairs of genital papillae, one seta in coxal field IV, telofemora I with 6 setae; femora IV not subdivided, with 3 setae.

REMARKS: The habitat of *T. lamington*, montane subtropical rainforest dominated by southern beech, is unusually mesic for a paratydeid; however, these specimens were collected from the relatively xeric microhabitat of moss and bark on logs and tree trunks. The elongate pits on the distal leg segments are reminiscent of those containing the rhagidial organs in the Rhagidiidae; however, no solenidia are present. We assume that they have a chemosensory function, and that the rod-like setae of tarsi and tibiae I (each with a narrow papilla on its tip) also are chemosensory. The species described below, *T. kakadu*, can be distinguished from *T. lamington* by having the pits filled with a smooth,

raised area, and by the length and placement of setae *ve*, by having 3 rather than 2 rod-like setae on the palp tarsus, and by having 8, rather than 7, setae on telofemora I.

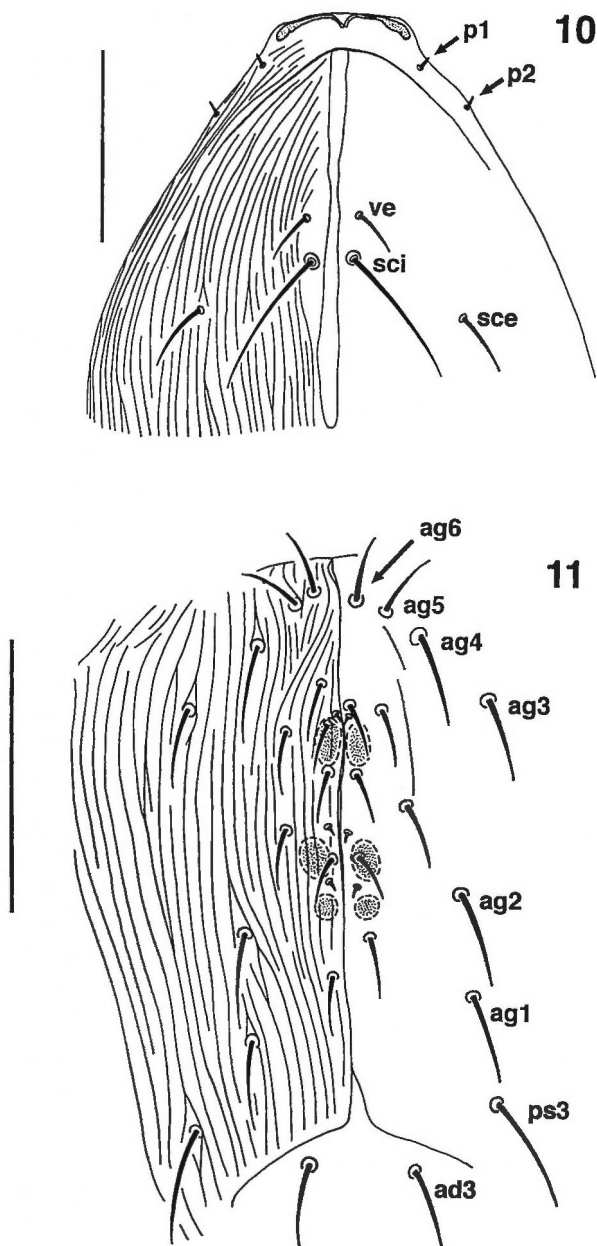
Tanytydeus kakadu n. sp.

(Figs. 10–11)

MATERIAL EXAMINED — Holotype ♀: Northern Territory, Kakadu National Park, Baroalba Gorge, Gubara Walk, 12° 50' S 132° 52' E, ex soil under rocks, D. E. WALTER and H. C. PROCTOR (deposited in Queensland Museum, Brisbane). 1 ♀, same data as holotype.

FEMALE (Figs. 10–11).—Idiosoma similar to that of *T. lamington*, 455 μ m long. Seta *ve* (16) anterior of trichobothria *sci* (45) and adjoining the linear, cristalike prodorsal shield; *sce* 22 μ m long. Lateral opisthotal setae generally shorter than in *T. lamington*: segment C with three pairs of setae, *c1* (15), *c2* (24), *c3* (23–25); seta *c1* is unpaired on one specimen. Setae *d1* (14), *e1* (15), *f1* (15), *f2* (19), *h1* (15–18), and *ps1* (20) short and rod-like. Setae *h2* (26), *ps2* (26), *ps3* (25), slightly longer, acuminate. Large median pore between setae *f1* absent. Genital opening with a variable number of genital setae (*g*): one specimen with 13 *g* setae, seta *g1* unpaired; the other specimen with 11 *g* setae, seta *g6* unpaired. Both specimens with an outer row of 2 pairs of *g* setae. Six pairs of *ag* setae. Three pairs of genital papillae (*Va*, *Vm*, *Vp*), *Vp* about half the size of *Va* and *Vm*; a minute seta is positioned anteriorly of each papilla (*kl1*–3).

Setation of coxal fields I–IV 4-3-2-2; trochanters 0-1-1-0; (basi)femora (1)8-3-3-(1)2; genua 7-4-2-3; tibiae [rod-like setae] 5[3]-4-3-3; tarsi [rod-like setae] 8[6]-5[1]-6-5. Solenidion of tibiae I short (4) and protected by a guard seta sharing the same alveolus; tibia I with an elongate (7 \times 1), raised sensory bump, tibiae II–IV with shorter (5–6) raised bumps. Genu I–II with elongate raised sensory bumps (7, 5 long, respectively). All tarsi with a pair of claws and a small, claw-like empodium; tarsus I with elongate (9 \times 2), raised sensory area; tarsus II with a short (3) median solenidion and elongate (7 \times 1), raised sensory area. Leg I longest (200), leg II–III (152), leg IV (180).



FIGS. 10-11: *Tanytydeus kakadu* sp. nov., adult female. 10. — Pro-dorsum. 11. — Genital region. Scale bars = 50 μ m.

Chelicerae with bases free, each with a simple seta and a strongly curved movable digit. Venter of gnathosoma with 4 pairs of simple setae, lateral and posterior pairs longest (18). Palp trochanters, femora-genua, tibiae and tarsi with 0-2-3-4[3], setae [rod-like setae], respectively.

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