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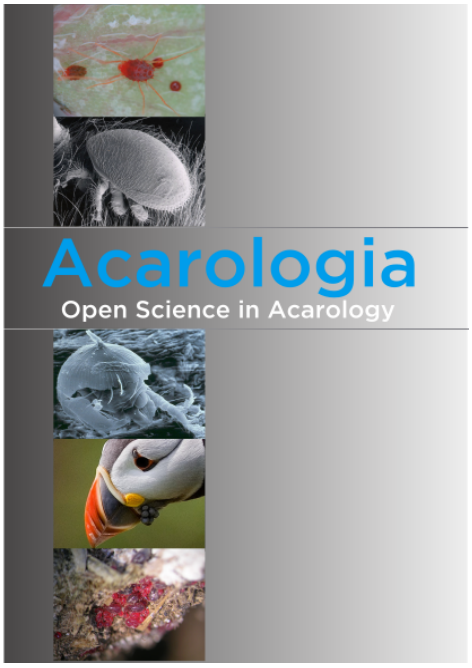

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Paraplothrombium maketawa n. sp. (Acariformes: Parasitengona), the first member of the Johnstonianidae recorded in New Zealand

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Original research

ABSTRACT

Paraplothrombium maketawa **n. sp.** is described from a female taken from native forest litter in a roadside ditch at the Maketawa river near Inglewood, Taranaki, New Zealand. This represents the first record of the Johnstonianidae in New Zealand.

Keywords *Paraplothrombium maketawa* n. sp.; Parasitengona; Johnstonianidae; Trombidioidea; new record; New Zealand
Zoobank http://zoobank.org/08B28650-2DB9-4F46-864F-FDA3A94C80F4

Introduction

The cosmopolitan family Johnstonianidae comprised 46 species in nine genera, with nine species recorded as *nomina dubia* in Mąkol & Wohltmann (2012, 2013).

Newell's (1957) monograph provides an introduction to the family and outlines why he thought their study was rewarding, "… this is perhaps the most primitive existing family, terrestrial or otherwise, within the Parasitengona". The family sits ecologically between the terrestrial trombidia and the water mites. Johnstonianids have always been found in moist habitats (Wohltmann 2001; Wohltmann *et al.* 2004). Newell (1957) was also attracted to their study because of the "very loose" nature of their parasitism as larvae. They do not attach firmly to their host as do the vast majority of the Parasitengona. The third fact of interest to Newell was the "generalized morphology" of these mites. They retain simple normal setae on the idiosoma and legs, while most Parasitengona frequently bear ornate setae.

However, Wohltmann *et al.* (2004) in their revision of the European Johnstonianinae point out that the assumed basal phylogenetic status claimed for the family is not supported by recent investigations.

This paper describes a new species of *Paraplothrombium* from New Zealand based on one female. Until now, the Johnstonianidae has not been recorded in New Zealand (Sirvid *et al.* 2009). *Paraplothrombium* is previously known from one species, *P. problematicum* Robaux, 1968 from Chile (Robaux 1968).

Materials and Methods

A Tullgren funnel extract was obtained from decaying mesic forest floor vegetation from under tawa/towai (*Beilschmedia tawa*/*Weinmannia racemosa*) forest from a roadside (SH 3A) storm-water ditch draining into the Maketawa river near Inglewood, Taranaki, S39.10°, E174.12°. The mite was initially stored uncleared in Hoyer's medium for 10 years. Then it was re-hydrated and cleared with acetic chloral hydrate. For microscopic examination, it

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was remounted in Hoyer's gum chloral for study with polarized light. Illustrations were aided with a camera lucida. Scanned drawings were labelled with GIMP software. An eyepiece graticule allowed measurements in micrometres (µm). Morphological nomenclature largely follows Newell (1957) and Wohltmann *et al*. (2004). Measurements taken from Robaux's (1968) illustrations of *P. problematicum* are indicated where used. Podomere length criteria are included as a note to Table 1. The system defining the place of insertion of specialized setae (relative to segment length) used by Newell (1957) is used here. e.g. ζ 0.6d means the seta ζ is inserted dorsally at 60% of the length of the segment from the proximal end. While usually possible to distinguish specialized setae from normal (n) seta, this author could not always distinguish different specialized setal types as did Newell (1957). Therefore his notation of labeling solenidia $s_{(1\text{-}4)}$ based on setal size and shape, is not used. Naming setae as n or specialized was informed from the setal position e.g., specialized leg setae are often dorsal, or at a particular location on the segment as well as birefringence qualities. Other characters used to assign setal type included the alveolus foramen size and shape and internal setal structure. Specialized setae were recognized from their larger tapered foramen through the exoskeleton (indicated in figures), than n setae foramen (open circles) as well as protoplasmic cores; distinctive curvature, blunt tips or their shape e.g., rod-shaped or spiniform.

Abbreviations: Standard abbreviations such as those in Wohltmann *et al*. (2004) are used.

Systematics

Johnstonianidae Newell, 1957: 411

Johnstonianinae Thor, 1935

Paraplothrombium Robaux, 1968: 463.

Type species: *P. problematicum* by original designation.

Diagnosis (amended from Robaux 1968) — Female. Crista metopica only with posterior sensilla, PSens; anterior sensilla replaced by n setae. Scutum prolonged into broad, blunt naso with anterior part separated from the posterior part by a constriction (possibly a preparation artifact). With coxal pars medialis; palp trochanter with oval fenestra. Palp tibia long, tapered, slender; basidont unidentate, inserted paraxially and ventrally, equal to odontus in length and stoutness; palp and leg tibiae and tarsi with raised fin-like spurs. Distribution: Chile, New Zealand. Male, larva and nymphs: unknown.

Remarks — Robaux's description of *P. problematicum* does not describe or illustrate fin-like cuticle spurs. However, they are present (Mark Judson pers. comm. July, 2019). *Diplothrombium* Berlese, 1910 (probably a sister genus) possesses these cuticle spurs on palp and TiI but in *D. longipalpe*, they are present on Ta I – IV (Wohltmann *et al*. 2004). Newell (1957) illustrates them clearly on the palp tibia of *D. micidium* in his Fig. 153. The new species has these structures (labelled fs in figures) on the PaTi and Ta and dorsodistally on TiI and TaII, III and IV. However there is a gradation in size and shape of the spurs from a cuticle swelling on distodorsal TaI to rather square shaped cuticle swellings (viewed laterally), especially around ω and ζ, on all leg tarsi. These two forms have not been called fin-like spurs in this paper.

Paraplothrombium maketawa n. sp.

Zoobank: 0A5B3E9C-7774-41CA-A9EE-E549F90AEE9C

Differential diagnosis

The new species differs from *P. problematicum* in its larger idiosomal length and width (1400 x 1000 compared to 960 x 720); a slightly more inflated TaI (TaI H : TaI L 175:350 = 0.50 versus 130:290 = 0.45). The separation of the naso into an anterior and posterior part is at the n setae (replacing the ASens) in the new species (labelled ns in Fig. 1D) but *c*. 50 anterior to

the n setae replacing the ASens in *P. problematicum*. Two pairs of straight acuminate setae, AL (anterolateral scutalae) and ML (middle scutalae), set adjacent and anterior to PSens are *c*. 50 long in *P. problematicum* (calculated from Robaux 1968, Fig. 6E) while in the new species they are 72 long. Dorsal setae up to 70 long in the new species, 50 in *P. problematicum.* In *P. problematicum* the ratio of TaI L : TiI L is 290:140 = 2.01; in the new species 350:200 = 1.75.

Description

Female holotype (Figs. 1A–D, 2A–D, 3A–D, 4A–F, Table 1) — Colour when fresh not recorded; slide mounted, red brown. Idiosoma with shoulders giving a square outline; idiosoma with short bent smooth setae, some faintly barbed distally, imbricate to adjacent posterior setae insertions (Figs. 1A, 1B). Idiosomal setae each on small convex platelet in smooth cuticle. Sub-cuticle with distinct reticulate pattern (nerve net of Thor 1904; Fig. 1C) formed from intersection of three sets of straight parallel striae *c*. 12 apart with each set at 60° angle to the adjacent, intersections often form star of David pattern. They do not extend under scutum.

Anterior dorsal idiosoma — Eyes on pedicel of ocular sclerite either side of crista metopica, about level with base of PSens; ocular sclerite 38 in diameter; pedicels 425 apart; anterior eye lens 30 in diameter, posterior 25. Crista metopica posterior end to anterior tip of naso 387 long (Fig. 1D) with unclear boundaries, extends anteriorly into broadly rounded naso that becomes narrower and pointed after clearing or as a result of flattening on slide (see discussion). At the time of remounting and clearing, one nude PSens measuring 70 long present, but may have been broken; both posterior sensilla now missing from specimen. Two n setae, 67 long, set in n alveoli in position of anterior trichobothria; distance between bases of these n setae and PSens 125. AL and ML 72 long, inserted on scutum edge just anterior to PSens (Fig. 1D), one of each pair is missing in the specimen. Seta PL off scutum and posterior to PSens. Anterior to the level of PSens and eyes on each side are 9 simple, curved setae set in round to oval convex platelets of 15 diameter.

Posterior dorsal idiosoma — Posterior to crista and extending to emergence of first pair of legs is a transverse strip of cuticle without setae or platelets (better seen ventrally). Posterior to it, mid-dorsal setae spine-tipped, diameter 4, 50–60 long, while posterior dorsal setae 60–70 long, diameter 5, set on convex, round or oval, platelets 25 in diameter; platelet edges 20 apart, setae set in middle or offset to the edge.

Idiosoma venter — Ventral habitus (Fig. 2A). Coxal fields (Figs. 1A, Table 1): I, punctate *c*. 35 straight n setae; pars medialis (pm) 125 x 25, with 9 straight setae; lateral half with *c*. 40 macro-pores (Fig. 1B); II, *c*. 35 straight n setae, apodeme incomplete postlaterally; III, 28 straight n setae; IV, 38 straight n setae, 40–50 long.

Genital opening 250 x 250, and ventral setae (Fig. 2C) 50 long, diameter 2.5, on platelets 17 in diameter. Cuticle striae faint, visible under oil immersion. Genital and epigenital valves each 30 at widest point, punctate. Genital valves each with 15 setae 45–55 long. Epigenital valves each with 16 setae. Setae longer than valve maximum widths. Three pairs genital papillae 50–60 diameter, anterior largest. Anal opening: 150 long, 85 wide, with one pair valves each with 7 straight setiform setae, 40 long.

Gnathosoma (Fig. 2D) — Ventral: anterior edge, with villi. Two flagellate medial oral *or* setae posterior to villi. Posterior to *or*, n setae 45–72 long set in punctate infracapitulum. Chelicerae 275 long (incl. movable digit). Chitinized pair of peritreme tracheal ducts 125 long. PaTr (Fig. 2D) with oval fenestra; PaTi basidont 50 long, almost as stout as odontus, 50 long (Fig. 3A).

Dorsal: PaTi surface with row of four fin-like spurs (Figs. 3A,B); more such spurs on PaTa face which opposes PaTi. Ventral PaTa with at least one n seta with long barbs. PaTa in posterior view with blunt ω 22 long set 0.9pl. PaTa *c*. 34 n setae and *c*. nine sinusoidal ζ with large diameter insertions. PaTi from proximal to distal with rows of 10, 4, 4, 2 setiform setae up to 70 long, the proximal row with distinct long barbs. PaFe with 19 setiform setae some lightly barbed. PaGe with 15 setiform setae some lightly barbed.

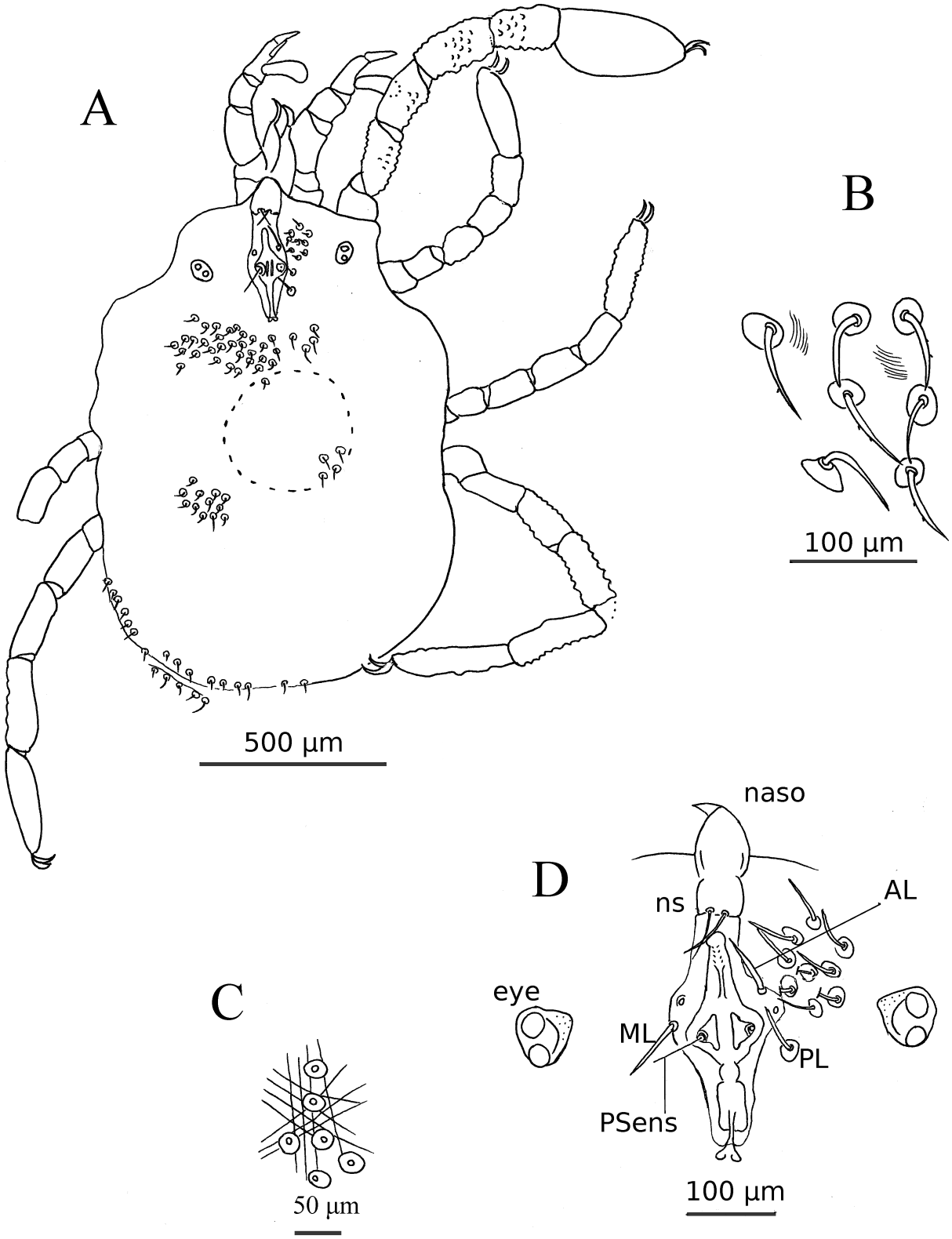

Figure 1 *Paraplothrombium maketawa* **n. sp.**: A – dorsal habitus; dashed circle – egg; B – dorsal setae; C – sub-cuticle pattern (nerve net of Thor 1904); D – anterior dorsal idiosoma.

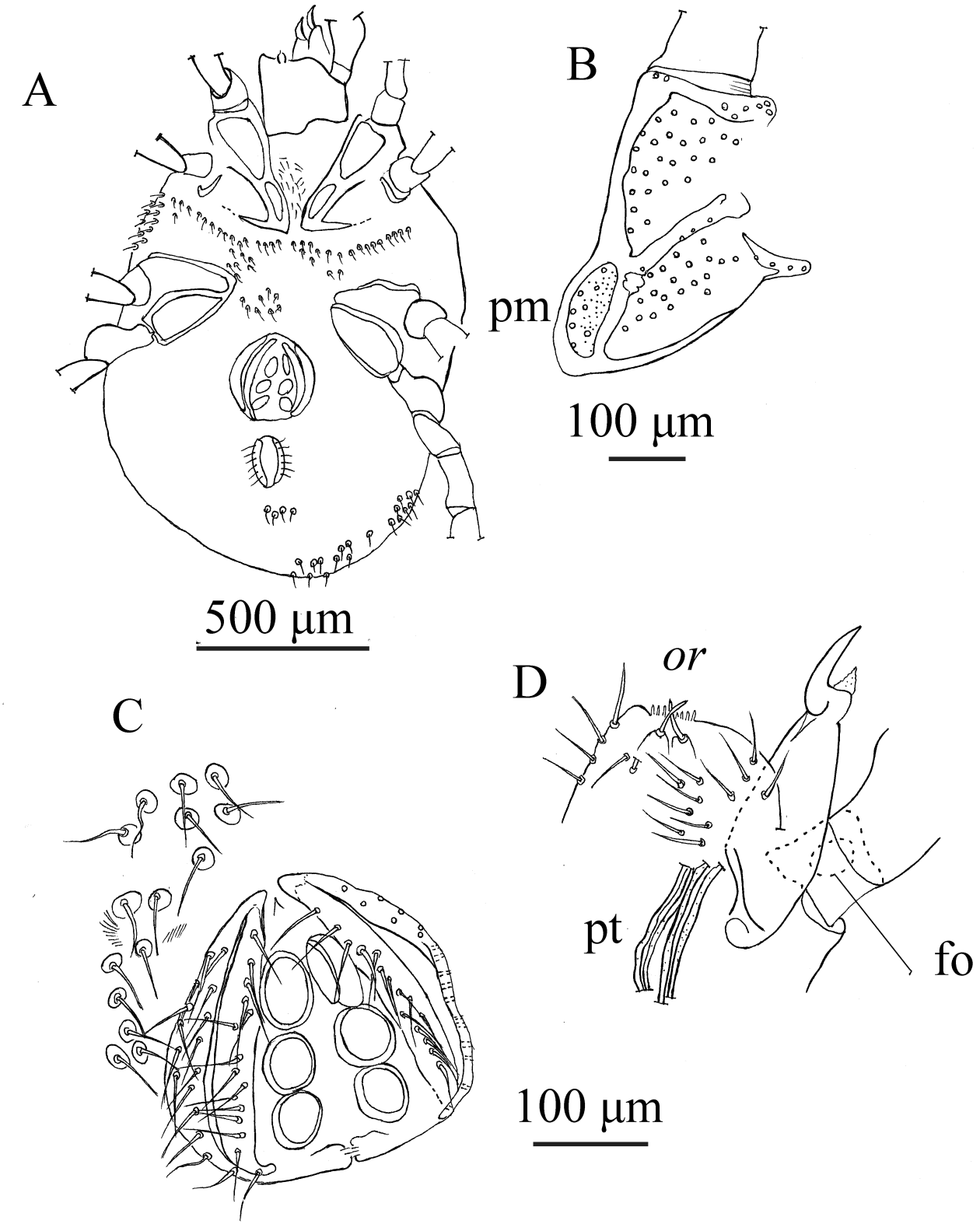

Figure 2 *Paraplothrombium maketawa* **n. sp.**: A – ventral idiosoma; B – coxal fields I and II; pm – pars medialis; open circles – n setae alveoli; solid dots – macropore openings; C – female genital opening and the adjacent ventral idiosomal setae; D – anterior gnathosoma in transparency; fo – foramen ovale of PaTr; *or* – oral setae; pt – terminal section of peritremes.

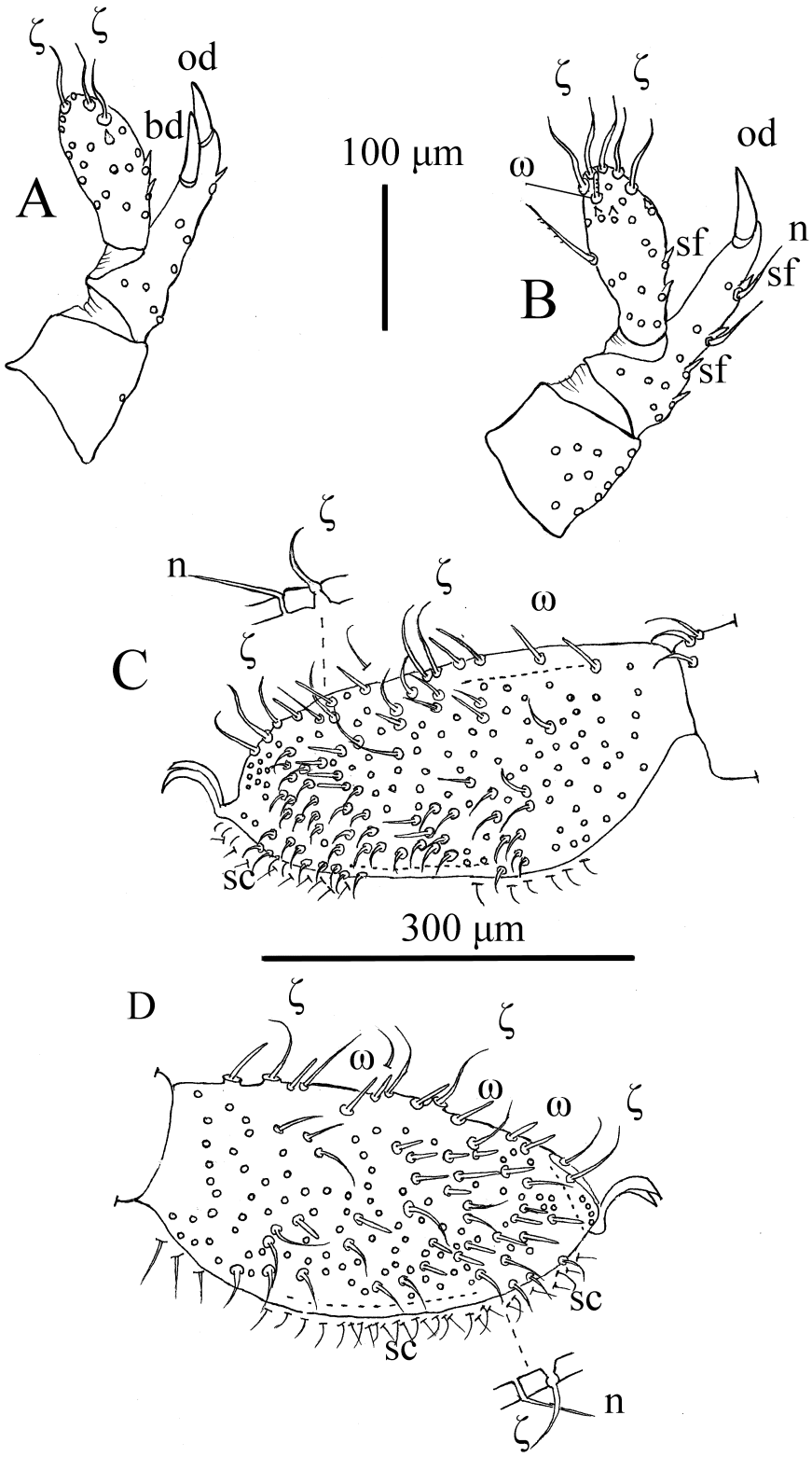

Figure 3 *Paraplothrombium maketawa* **n. sp.**: A – internal (anterior) view of terminal segments of Pa; bd – basidont; od – odontus; fs – fin-like spurs; ζ – eupathidium; B – posterior (external) view of distal segments of palp; circles mark alveoli of n setae; fs – fin-like spurs on PaTi and PaTa; od – odontus; ω – short solenidion; C – TaI posterior, sc – scopula; D – TaI anterior; scopula components n and ζ and relative thickness of cuticle under scopula and on segment dorsum as insets including foramen shapes.

Legs (Table 1, Figs. 3C - D, 4A - F) — Specialized setae present on all podomeres except Cx, Tr and bFe. Legs with exoskeleton mostly rugose, cuticle up to 20 thick. Legs terminate in pair of claws on I and II, 62–87 from tip to base measured across the span; on III and IV, that span is 100. Tarsal claw-retraction fossae poorly developed on all legs.

Leg I: Ta (Figs. 3C, D) with *c*. 500 setae on segment. Specialized setal numbers (ω + ζ) *c*. equal to number of n setae marked as open circles in figures; fin-like spurs absent. Ventral scopula (brush) of *c*. 15 rows of 5 columns (75 vζ) set in similar number straight n setae as close as 5 apart. Anteroventral surface adjacent to scopula with another 60 vlζ'. Lateral region of anterior face *c*. 70 n setae. Postventral *c*. 60 vlζ''. Posterior face: 70 n setae and similar number of ω + ζ". Numerous ζ" longer, thicker, more re-curved, but fewer in number than anterior face. Proxidorsal face10 ζ up to 50 long set in equally long straight n setae. Distodorsally >20 ω variously shaped, straight, curved and re-flexed and from 20–35 long but none clavate. Famulus ε not designated. Anterior face: distodorsal 10 ω *c*. 30 long, rod like, blunt tipped. Ti: unable to separate any specialized solenidia φ from ζ. Ge: 10 distodorsal ζ as curtain over Ge-Ti joint (Fig. 4B). tFe: stout, straight, n ventral setae, some distinctly barbed, grade into stouter curved shorter barbed setae on dorsum of segment. Single θ set dorso-distally, recurved. 15 ζ on segment dorsum and post lateral face. bFe: *c*. 30 curved distinctly barbed n setae. Tr: 5 n setae.

Leg II: Ta (Figs. 4A, C) venter clothed in straight n setae *c*. 50 long; ventral, lateral and medial faces devoid of ζ. ε, 0.56d, 5 long on short pedestal; ω 0.60d, semi-recumbent, 23 long, bluntly lanceolate, thickest at 10% of its length (Fig. 4C); other ω set at 0.25d , 0.30d and 0.45d as tapered blunt rods 40 long. Single dorsal strongly recurved ζ set at level of ω (0.60d) and ε (0.56d). Largest fin-like spur 20 long, base 12 deep set at top of claw-retraction fossa (marked fs in Fig. 4A) Anterior and posterior fossae rims each with two smaller fin-like spurs. Venter of this segment with stout spinous setae. Ti: ventral surface with n setae up to 75 long; dorsum with *c*.15 thin recurved ζ 40 long and two vertical straight ζ 50 long. Ge: ventral, medial and lateral faces with *c*. 36 n setae. Dorsum with *c*. 12 finely tapered, curved ζ, four straight ζ 50 long, one retrosely curved ζ 50 long. tFe: with 24 straight n setae; four dorsal curved ζ. bFe: 12 n setae. Tr: 2 n setae. Leg III: Ta (Figs. 4D, E), post-ventral with *c*. 20 straight stiff spines, 50 long. Dorsal fin-like spurs 0.8d ; ω at 0.30d, 0.31d, 0.45d, 0.50d, 0.65d, and 0.80d all straight *c*. 45 long; retrose ζ 0.60d. Lateral segment faces with n setae. Ti: venter with spines 75 long, medial and lateral faces with *c*. 32 straight n setae. Dorsum six straight n setae 50 long with *c*. 25 thin curved ζ *c*. 35 long. Retrose ζ 45 long at 0.80d. Ge: ventral and lateral surface n setae *c*. 65 long. Dorsal surface with thin curved ζ 20 long, single strongly retrose ζ at 0.75d. tFe: venter and lateral faces each with *c*. 15 n setae. Dorsal detail obscured; 2 slightly sigmoid ζ and 6 fine ζ 30 long. bFe: 10 n setae. Tr: 5 n setae.

Leg IV: Ta (Fig. 4F), venter with 40 straight spines as on the medial and lateral faces. Dorsal ω tapered blunt semi-recumbent rods at 0.06d, 0.25d and 0.30d, 30 long on slightly

Table 1 *Paraplothrombium maketawa* **n. sp.** Podomere and palp lengths, L (µm) for holotype female.

	Cx	Tr	bFe	tFe	Ge	Ti	Ta	Total*	Total**
I	215	50	225	200	225	200	350	1465	1250
II	250	50	150	110	140	145	240	1085	835
III	225	50	170	135	150	175	250	1155	930
IV	260	130	190	175	225	275	315	1570	1310
Pa	120	60	180		110	200	120	670	550

Note: L measured between the dorsal condyles except for Tr and bFe where the distance is between the podomere's major proximal and distal condyles. CxIL excludes pars medialis. TaL excl. claws. *includes CxL; ** excludes CxL. The length of the pars medialis (paracoxal) field is 150 long; the TaI H (height) is 175. PaTi length includes odontus.

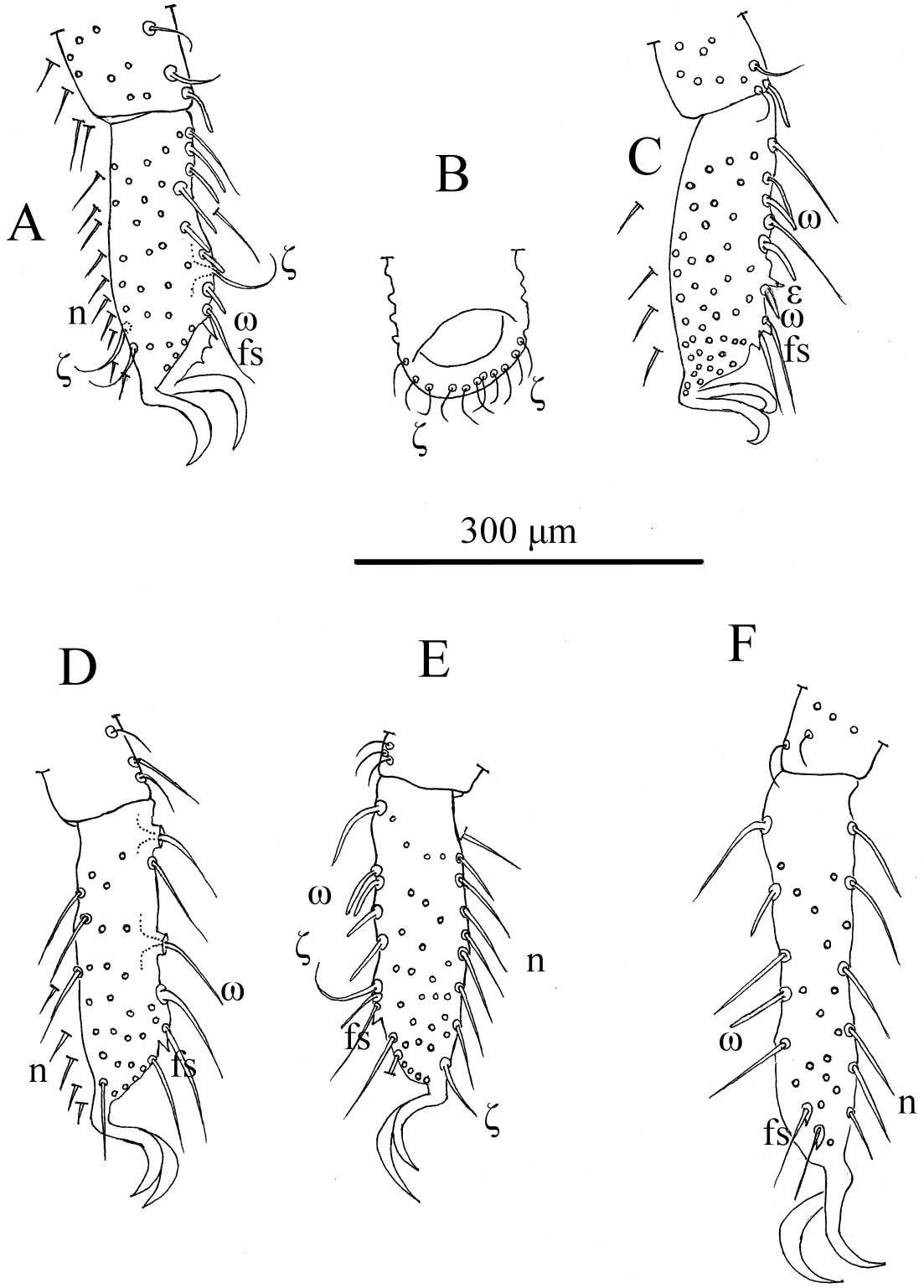

Figure 4 *Paraplothrombium maketawa* **n. sp.**: A – TaII anterior, n ventral spines;B – GeI distodorsal rim with fringe of ζ at Ge-Ti joint; C – TaII posterior, ω 0.6d semi-recumbent, non-clavate and ε; D – TaIII anterior; E – TaIII posterior; F – TaIV posterior.

raised pedicels; straight and curved ζ 75 long. Ti: with n straight setae, dorsum with four φ set at 0.20d, 0.65d, 0.70d and 0.90d with the three proximal raised and pointed 67 long and the distal one recumbent 25 long. Also dorsal surface bears > 15 ζ with fine tapered curved tips. Ge: venter unseen. Dorsum with seven stout erect ζ 65 long and *c*. 15 finely tapered ζ 50 long. tFe: venter with 2 stout n setae, laterodorsally 3 stout ζ 65 long and *c*. 12 finely tipped ζ. bFe: *c*. 10 n setae. Tr: *c*. 5 n setae.

Egg — Finely punctate shell (now broken) within holotype; 300 diameter (Fig. 1A).

Material examined — Holotype female with egg. Collected South of Inglewood, Taranaki, New Zealand, S39.10, E174.12., Alt. *c*. 210m, western side of State Highway 3A under tawa/kamahi native trees from roadside seepage/storm-water drain on the banks of the Maketawa River; J. M. Clark, 6th June 1997. Locality now removed by road realignment. Holotype on slide to be deposited in the Canterbury Museum, Rolleston Ave., Christchurch 8013, New Zealand.

Etymology — *maketawa* - Polynesian name probably referring to the tawa tree /ˈtaʊə/ /ˈtɑːwə/ once abundant in the area in pre-European times; '*make*' also pronounced with long vowels. The mite was collected close to the Maketawa River.

Discussion

The author examined the three specimens identified as *Paraplothrombium* from Tasmania (Seeman in Driessen 2016). These specimens have richly branched dorsal setae: not the stiff rod-like setae of Johnstonianidae. They also lacked a projecting naso, fenestrated palp trochanter and pars medialis. They are excluded from *Paraplothrombium*.

The fin-like spurs, at least on the PaTa, are postulated here, to function as a support for the setae bases where those setae are used to apply a force such as holding prey. The PaTi dorsodistal fin-like spurs may also support the setal bases when they are used to push mesic substrate. The original generic diagnosis of *Paraplothrombium* (Robaux 1968: 463) mentions "La partie antérieure de la crête séparée de la postérieure par un étranglement, …" (The anterior part of the crista is separated from the posterior part by a constriction - author's translation). The constriction may be an artifact, i.e., the bending of the crista in the slide preparation makes the separation appear.

In the new species, there appeared to be a break or constriction in the crista separating the naso from the "2 poils simple non sensoriels". But by adding water to the mounting medium and releasing the coverslip pressure on the specimen, the apparent break became less obvious, presumably as the crista regained its more original shape. Newell (1957: 426) wrote: "The structure of the adult scutum as delineated by Berlese and reproduced by various authors is incorrect because of the very sharp downward flexure of the scutum between the posterior and anterior sensilla, …". Newell (1957) also pointed out that the naso anterior spine of *Centrotrombidium* is vertical so it cannot be seen in specimens unless laterally viewed.

This specimen is the only member of the family Johnstonianidae that the author has collected in more than 20 years of collecting forest floor mites in NZ. The species is most likely endemic to NZ and less likely to be recently transferred by humans, given the poor traveling record of the Johnstonianidae (Newell 1957: 441).

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