International Journal of Acarology

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/taca20

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To cite this article: Tobias Pfingstl, Maria Minor, Sylvia Schäffer & Satoshi Shimano (2023) Coastal oribatid mites (Acari) from New Zealand: new morphological, ecological, and developmental data, International Journal of Acarology, 49:7-8, 422-439, DOI: 10.1080/01647954.2023.2284310

To link to this article: https://doi.org/10.1080/01647954.2023.2284310

INTERNATIONAL JOURNAL OF ACAROLOGY
2023, VOL. 49, NOS. 7–8, 422–439
https://doi.org/10.1080/01647954.2023.2284310

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Coastal oribatid mites (Acari) from New Zealand: new morphological, ecological, and developmental data

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ABSTRACT

Three species of oribatid mites associated with tidal rocks and mangroves were collected on Waiheke Island, Hauraki Gulf, New Zealand. One of the species was a yet undescribed member of the genus *Indopacifica*, collected in algae growing on roots of green button mangrove *Conocarpus erectus*. Here, we provide a description of *Indopacifica impedimenta* sp. n, including its juvenile stages, and discuss its distribution and differences from congenerics. The second species collected was *Fortuynia elamellata*, which was found in algae growing on intertidal rocks. Here, we provide supplementary morphological data on adult and juvenile stages and discuss their distribution and ecology. The third species found was *Sellnickia caudata*, collected from the same mangrove as *Indopacifica impedimenta* n. sp. However, *S. caudata* occurred only on leaves and twigs of the mangrove plants, which are not regularly flooded. We provide supplementary morphological data and SEM images of adults and a description of juvenile stages for this species. We also discuss the family placement of *Sellnickia* and provide barcode sequences for all species studied herein.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:8D74FD5A-27EE-48A9-8780-C1E6B1115629

ARTICLE HISTORY
Received 9 October 2023
Accepted 9 November 2023
Published online 24 November 2023

KEYWORDS
Auckland; mangrove; new species; *Sellnickia*; *Indopacifica*; *Fortuynia*

Introduction

The soil fauna of New Zealand is unusual, diverse, and characterized by high levels of species endemism (e.g. Hammer and Wallwork 1979; Sirvid et al. 2010). Oribatid mites represent an important group of the soil fauna because they play roles in decomposition, nutrient cycling, and soil formation (e.g. Behan-Pelletier and Lindo 2022). Several hundreds of Oribatida species have been described in New Zealand earlier in the 20th century (e.g. Hammer 1966, 1967, 1968; Luxton 1967). Since then, systematic work on Oribatida in New Zealand has continued with over 50 new species described in the recent decade (e.g. Olszanowski 1998; Liu and Zhang 2013; Colloff 2015; Ermilov et al. 2015, 2019; Norton and Fuangarworn 2015; Ermilov and Minor 2015, 2019; Niedbała and Ermilov 2016). Currently, 465 species of oribatid mites are known to occur in New Zealand (Subías 2022). Even so, the knowledge about their diversity is still largely incomplete.

Most oribatid mites are terrestrial species living in soil and leaf litter, but some groups have also managed to colonize coastal environments, where they have adapted to daily tidal inundation and intertidal food resources (e.g. Pfingstl 2017, 2023). Presently, members of two marine-associated oribatid mite families are known from the coasts of New Zealand, namely species of Podacaridae and Fortuyniidae. The Podacaridae prefer colder climates; therefore, they exclusively occur at the most southern shores of New Zealand, three species can be found on the South Island and seven other species are restricted to the subantarctic islands (Luxton 1990). The Fortuyniidae are adapted to warmer climates and only a single species, *Fortuynia elamellata*, could yet be found on coasts of Auckland (Luxton 1990). This species was described from New Zealand over fifty years ago (Luxton 1967) and apart from reports of two supposed subspecies, *F. elamellata shibai* (considered as *F. shibai* by Pfingstl et al. 2019) and *F. e. micromorpha*, from shores of Japan (Aoki 1974) and South Africa (Marshall and Pugh 2002), respectively, no further records have since been made of it.

During a short sampling trip to Waiheke Island in the Hauraki Gulf of New Zealand, which is 21.5 km off the east coast of Auckland, we collected three different oribatid mite species. One of the species is the above-mentioned *F. elamellata*, found in algae growing on intertidal rocks. The second species is a yet undescribed member of the genus *Indopacifica*, collected from algae growing on the roots of green button mangrove *Conocarpus erectus*. *Indopacifica* is a genus of typical intertidal oribatid mites and belongs to the family of Selenoribatidae. Members of this family occur on subtropical and tropical shores all over the world (e.g. Pfingstl 2017), but the record from Waiheke Island is the first record of this family from New Zealand. The other six species currently known in this genus are *Indopacifica iohanna* from the Philippines (Resch et al. 2019), *I. mauritiana* from Mauritius (Resch et al. 2019), *I. pantai* and *I. parva* from Thailand and Malaysia (Pfingstl et al. 2019), and *I. taiyo* and *I. tyida* from the southern Japanese Ryukyu islands (Pfingstl et al. 2021).

The third found species is *Sellnickia caudata* which was collected from the same mangrove as the new *Indopacifica* species. However, specimens of this species, which were making colonies, occurred only on higher parts of the mangrove plants, such as leaves and twigs, which are non-regularly flooded and thus do not represent a typical intertidal mite habitat. Michael (1908) described this species as *Notaspis caudata* from New Zealand. Later, Oudemans (1927) established the genus *Sellnickia*, by describing *Sellnickia heveae* from Sumatra, the second and still only other known species of this taxon. Grandjean (1958) transferred "*caudata*" to this genus and provided a complete description based on specimens from Australia. Finally, Hammer (1966) reported this species from New Zealand again and gave some additional depictions. *Sellnickia caudata* shows an interesting morphology, the

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rostrum shape is sexually dimorphic and both sexes possess an unusual porose pygidial tubercle. The function of these structures was discussed by some authors (Grandjean 1958; Norton and Alberti 1997), but without distinct conclusions. The ecology of this species is also interesting because specimens were all found above ground on leaves of plants (Grandjean 1958; Hammer 1966), indicating an arboreal lifestyle. In our observations, it appeared to to be feeding on plant tissue itself. To this day, however, nothing is confirmed about how these mites interact with the plant or if they can cause any damage to the plant.

The aims of the present paper are to describe the adults and immatures of the new species, provide additional morphological information on the already known species, give first descriptions of the juveniles of *S. caudata*, present first genetic data (barcodes), and update distribution data for all found species.

Material and methods

Samples of mangrove leaves were taken by hand and samples of littoral algae were scraped off rocks and mangrove roots with a knife or a small shovel. Afterwards, they were put in Berlese-Tullgren funnels for 12 to 24 hours to extract mites. Collected specimens were subsequently stored in ethanol (100%) for morphological and molecular genetic investigation.

Sample locations

1. New Zealand, Waiheke Island, Maitiatia Bay (NZ_03) – green and black algae on rocks and barnacles, median eulittoral; 06 December 2022; coordinates (latitude, longitude): −36.782325, 174.991766; *Fortuynia elamellata*.
2. New Zealand, Waiheke Island, Palm Beach (Mawhitipana) (NZ_04) – green algae on rock, median eulittoral; 06 December 2022; coordinates: −36.779038, 175.039289; *Fortuynia elamellata*.
3. New Zealand, Waiheke Island, Anzac Bay, Obrien Road (NZ_05) – green button mangrove (*Conocarpus erectus* L.); supralittoral; 06 December 2022; coordinates: −36.803552, 175.060864; *Sellnickia caudata* (on leaves and twigs), *Indopacifica impedimenta* n. sp. (in algae on roots).

Drawings and photographs

Preserved animals were embedded in Berlese mountant for microscopic investigation in transmitted light. Drawings were made with an Olympus BH-2 microscope equipped with a drawing attachment. These drawings were first scanned, then processed and digitized with the free open-source vector graphics editor Inkscape (https://inkscape.org).

For photographic documentation, specimens were air-dried and photographed with a Keyence VHX-7000 digital microscope using automated image stacking. For Scanning-Electron-Microscopic investigation, specimens were dehydrated and finally replaced in pentane, air dried, and then gold vapour-deposited. Scanning electron microscopic micrographs were taken by a JEOL JCM- 6000PLUS SEM microscope.

Morphological terminology used in this paper follows that of Norton and Behan-Pelletier (2009).

Barcoding

Extraction of total genomic DNA from single individuals followed the Chelex method provided in Schäffer et al. (2018). Standardized protocols were applied for PCR amplification, purification, and sequencing (Schäffer et al. 2010, 2018). The barcoding primers C_LepFolF and C_LepFolR (Hernández-Triana et al. 2014) were used to amplify the standard *COI* barcoding region (658 bp) and for the *D3* fragment of the *28S* rRNA we applied the primer pair D3A and D3B (Litvaitis et al. 1994). All sequences were uploaded to GenBank under the accession numbers OR756241–OR756245 (*COI*) and OR769687–OR769691 (*D3*).

Results

Description of new taxa

Family Selenoribatidae Schuster, 1963

Genus *Indopacifica* Pfingstl, Shimano & Lienhard

***Indopacifica impedimenta* n. sp.** Pfingstl, Minor & Shimano **sp. nov.**

LSID:urn:lsid:zoobank.org:act:A5170D5A-5D24-4E03-A744-C2AF02FD8815

Type material/locality

Holotype. Adult female (length 350 µm, width 234 µm); paratypes: 2 adult males (length 344/356 µm, width 228/231 µm)/ New Zealand, Auckland, Waiheke Island, Anzac Bay, next to Obrien Road; 6 December 2022; green muddy algae growing on mangrove roots (*Conocarpus erectus*). Preserved in ethanol and deposited at the New Zealand National Arthropod Collection in Auckland.

Etymology. The specific name “impedimenta” is given as noun in apposition. It is derived from the Latin meaning ’baggage’ or “impediment.” It first refers to the event of two of the authors having lost their baggage on their trip to New Zealand for the XVI International Congress of Acarology (ICA) 2022 and second, it is a tribute to this specific congress, which was successfully held despite the impediments at that time of existing worldwide COVID-19-crisis.

Diagnosis. Habitus and setal formulas typical for the genus (Pfingstl et al. 2019). Cerotegument conspicuous but fine granules over whole body. Prodorsal setae minute. Sensillum clavate, distally barbed. Slender triangular longitudinal elevation on prodorsum. Gastronotic region round in dorsal view, large but inconspicuous transversal depression on anterior part of notogaster. Median longitudinal depression on epimeron I, framed by a pair of parallel ridges. Two pairs of adanal setae. Claws long, thin, sickle-shaped with one proximoventral tooth.

Description of the adult

Measurements. Females ($N = 1$), length: 350 µm, width: 234 µm; males ($N = 2$), length: 344–356 µm (mean 350 µm), width: 228–231 µm (mean 230 µm).

Integument. Colour medium brown. Fine granular cerotegument covering whole body.

***Prodorsum* (Figure 1a).** Rostrum rounded in dorsal view, clearly demarcated from remainder of prodorsum by transverse ridge. Pair of anteriorly converging faint prodorsal ridges, difficult to observe. A broad but faint triangular median longitudinal elevation reaching from interbothridial area to demarcation of rostrum. Rostral (*ro*) and lamellar seta (*le*) minute, difficult to observe. Interlamellar seta (*in*) minute, exobothridial seta (*ex*) vestigial. Bothridium large cup with lateral incision. Bothridial seta (ca. 45 µm) slightly clavate, distally barbed, and laterally flattened.

Gnathosoma. Chelicera chelate, with two teeth on each digit. Setae *cha* and *chb* of approximately same length, both dorsally slightly pectinate. Palp setal formula 0-2-1-3-8 (+ solenidion ω). Distal part of rutellum developed as thin, triangular, slightly inwardly curved membrane with longitudinal incision. Setae *a* - and *m* long, smooth (ca. 17 µm). Mentum regular, finely granular, seta *h* simple, long (ca. 28 µm).

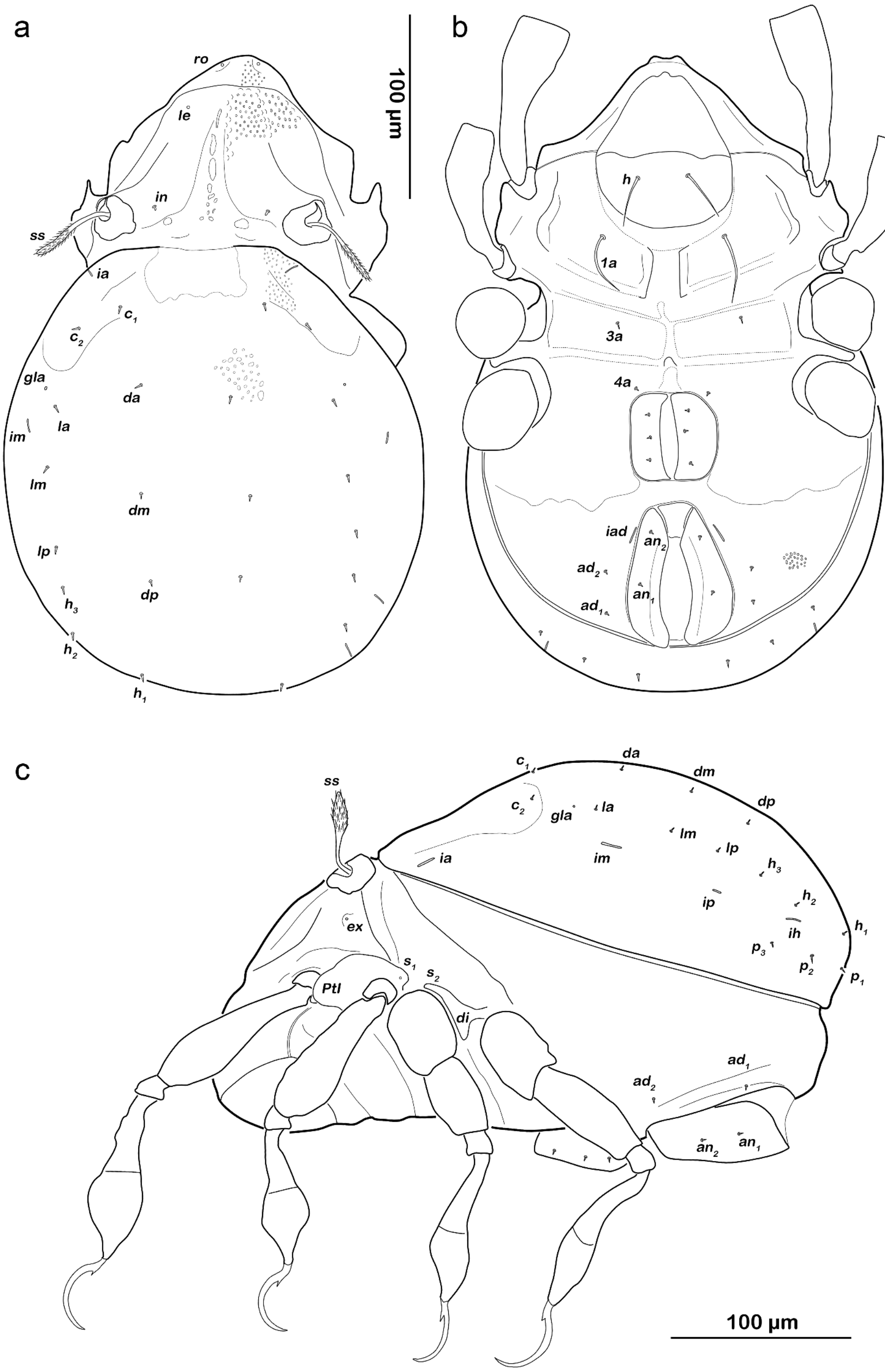

Figure 1. *Indopacifica impedimenta* n. sp. adult. (a) Dorsal view, legs omitted. (b) Ventral view, leg segments partially omitted. (c) Lateral view.

***Notogastral region* (Figure 1a).** Notogaster rounded, nearly circular in dorsal view. Dorsosejugal articulation incomplete. A semicircular transverse cuticular depression adjacent to anterior border of notogaster. A median lighter rectangular area with irregular contours adjacent to anterior border of notogaster. Fourteen pairs of thin, short setiform notogastral setae (length 5–10 µm), c_1, c_2, *da*, *dm*, *dp*, *la*, *lm*, *lp*, $h_{1–3}$, $p_{1–3}$; c_3 absent. Orifice of opisthonotal gland *gla* anterior to seta *la*. Lyrifissure *im* laterally between setae *la* and *lm*.

***Podosoma and venter* (Figure 1b).** Median longitudinal, rectangular-shaped depression reaching from epimeres I to epimeres III, on epimeres I this depression is laterally delimited by a pair of distinct cuticular ridges. Indistinct circular depression on posterior border of epimeres III, anterior of genital orifice. Epimeral setation 1-0-1-1, setae *1a* long (ca. 35 µm), fine, setae *3a* and *4a* very short (5–8 µm). Three pairs of short (ca. 5 µm), fine genital setae present. Preanal organ triangular in ventral view, interior part anchor-shaped. Two pairs of minute (1–3 µm) adanal setae $ad_{1–2}$ and two pairs of minute (1–3 µm) anal setae $an_{1–2}$ present. Lyrifissure *iad* oblique, framing anterior border of anal opening.

***Lateral aspect* (Figure 1c).** A broad lateral furrow reaching from dorsal to ventral sejugal scissure. Pedotectum I *Ptl* present, round, small, pedotectum II absent. Lateral enantiophysis consisting of two opposite projections (s_1, s_2); the anterior rounded, the posterior pointed and elongated. Discidium *di* developed as prominent conical bulge.

***Legs* (Figure 2).** Monodactylous, long hook-like slender claw with one acute distinct proximoventral tooth and slight serration on proximal dorsal edge. Cerotegument granular. No porose areas detectable. Indistinct ventral carina on femur I and II. Lateral setae *l* of all genua scale-like, broadened, short, and blunt. Setation (first set of numbers, given in the order trochanter-femur-genu-tibia-tarsus) and solenidia (second set of numbers, given in the order genu-tibia-tarsus): Leg I (0-3-2-3-18) (1-2-2), leg II (0-3-2-3-15) (1-1-1), leg III (1-2-1-2-13) (1-1-0), leg IV (1-2-1-3-12) (0-1-0).

Remarks

The new species can be distinguished from congeneric species by its minute notogastral setae (5–10 µm), all other species show distinctly longer setae (10–16 µm). There is also a slender triangular median longitudinal elevation on the prodorsum of the new species, such an elevation is lacking in *Indopacifica iohanna* and *I. pantai* and is conspicuously less developed in *I. parva*, *I. mauritiana*, *I. taiyo* and *I. tyida*. An obvious depression on epimeres I is present in all *Indopacifica* species but in none is it framed by distinct straight parallel ridges as shown in the new species.

Distribution. This species has yet only been found in a single location on Waiheke Island, New Zealand. A wider distribution along the warmer northern shorelines of the North Island should be considered. This is also the first record of a member of the family Selenoribatidae from New Zealand and represents the southernmost occurrence of this group.

Ecology. Specimens occurred in algae patches growing on mangrove roots; therefore, we can assume that this species prefers to dwell in mangrove habitats. Moreover, the claws of this species are slender and weakly curved, which is indicative for typical mangrove-dwelling oribatid mites (Pfingstl et al. 2020).

Description of juveniles

Common features of juvenile stages. Colour brown. Integument plicate and soft, except for centrodorsal plate. Whole cerotegument showing dense granulation. Prodorsum triangular, rostrum rounded.

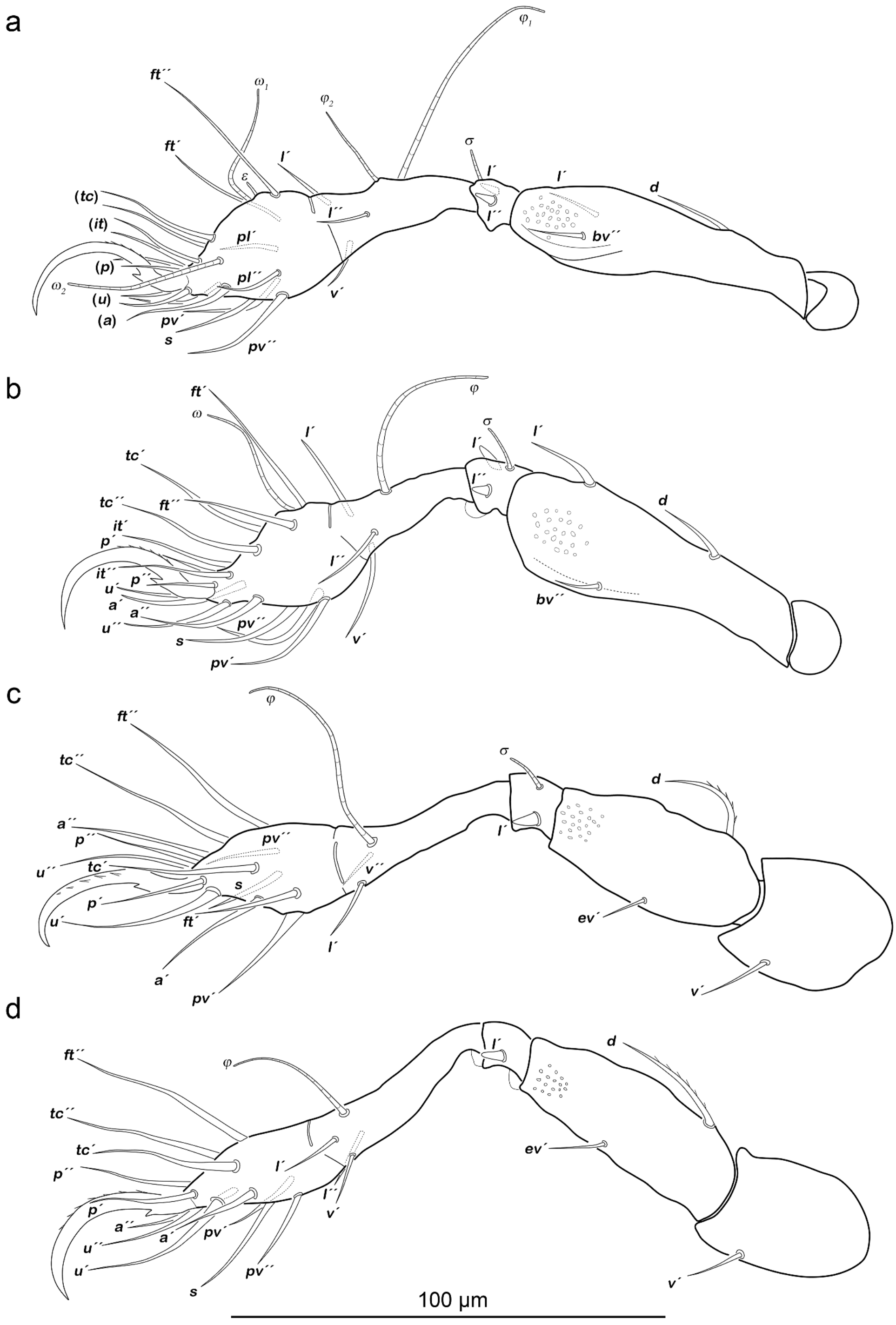

Figure 2. *Indopacifica impedimenta* n. sp. adult legs antiaxial view. (a) Left leg I. (b) Left leg II. (c) Right leg III. (d) Right leg IV.

Rostral, lamellar and interlamellar setae minute, exobothridial seta shaped like minute lamella. Sensillum clavate, distally spinose. Bothridium cup-like. Large centrodorsal plate bearing centrodorsal setae. Centrodorsal plate slightly convex, plateau-like; lateral and posterior inner borders of plate deepened like broad furrow. Large folds completely framing centrodorsal plate. Ventral furrows typical for selenoribatid juveniles. Legs, tarsus I with short knob-like famulus, no porose areas on femora detectable, genua with broadened scale-like lateral setae, claws with one sharp proximoventral tooth.

Larva. ($N = 3$) length: 203 (all showed the same length).

Prodorsum: All prodorsal setae minute, lamellar (*le*) and rostral (*ro*) setae very difficult to observe.

Gastronotic region (Figure 3a). Eleven pairs of short (ca. 8 µm), spiniform and smooth notogastral setae; $c_{1–3}$, *da*, *dm*, *dp*, *la*, *lm*, *lp*, $h_{1–2}$; h_3 absent; h_2 slightly longer than others (ca. 10 µm).

Podosoma and venter. Epimeral setation 1-0-1, epimeral seta *1a* conspicuously longer (15 µm) than *3a* (ca. 6 µm). Claparède's organ *clp* globular.

Legs. Setation and solenidia: leg I (0-2-2-3-16) (1-1-1), leg II (0-2-2-2-13) (1-1-1), leg III (0-2-1-1-13) (1-1-0).

Protonymph. ($N = 4$) length: 231–246 µm (mean 242).

Gastronotic region (Figure 3b). Fifteen pairs of notogastral setae; $c_{1–3}$, *da*, *dm*, *dp*, *la*, *lm*, *lp*, $h_{1–3}$ and $p_{1–3}$, all short, spiniform, approximately the same length (8–10 µm).

Podosoma and venter. Epimeral setation 1-0-1-1. Seta *4a* medially on epimeron IV. One pair of short genital setae. Aggenital setae absent.

Legs. Setation and solenidia: leg I (0-3-2-3-16) (1-1-2), leg II (0-3-2-2-13) (1-1-1), leg III (0-2-1-1-13) (1-1-0), leg IV (0-0-0-0-7) (0-0-0).

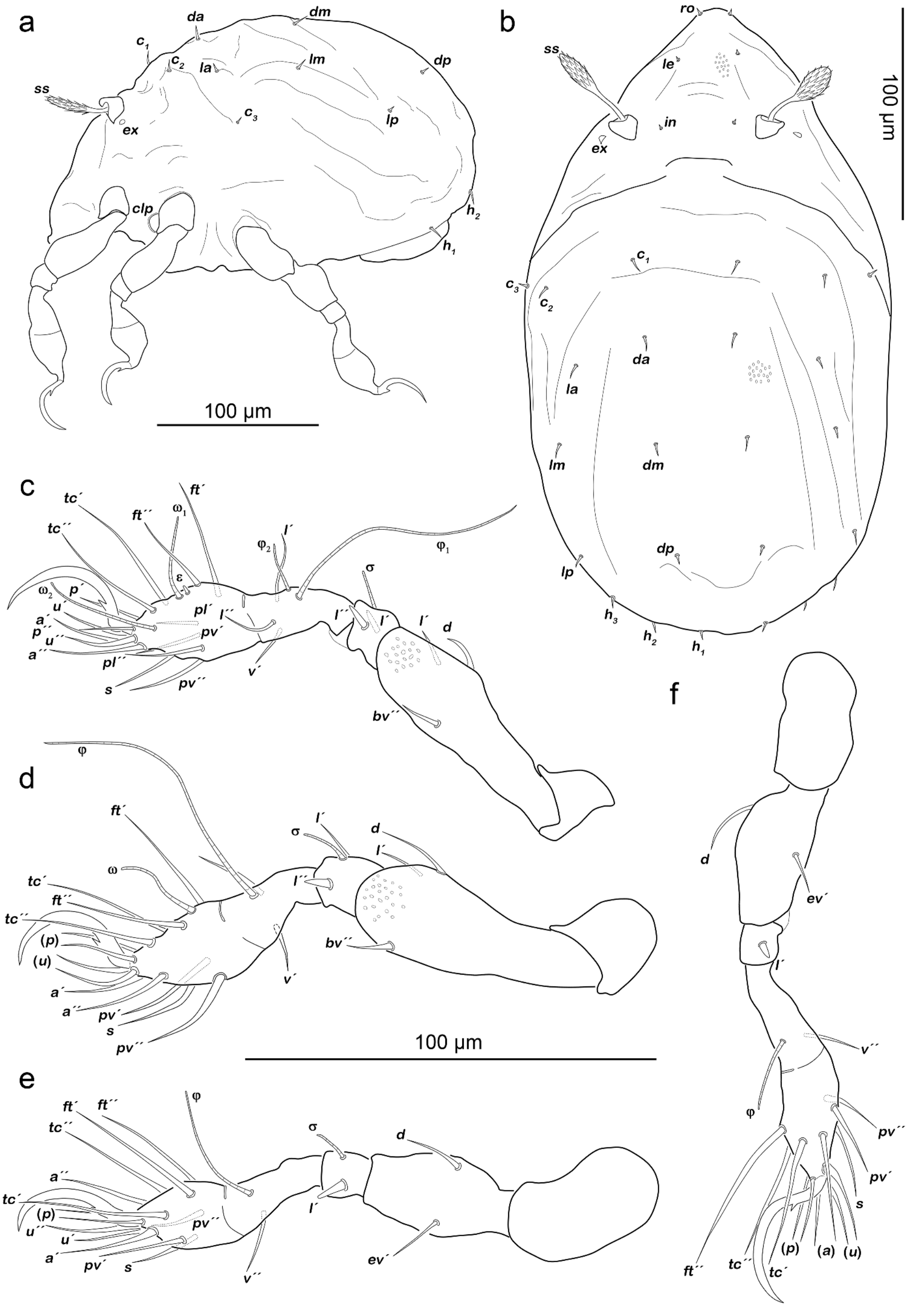

Figure 3. *Indopacifica impedimenta* n. sp. immatures. (a) Larva lateral view. (b) Protonymph dorsal view, legs omitted. (c) Deutonymph left leg I, antiaxial view. (d) Deutonymph left leg II, antiaxial view. (e) Deutonymph right leg III, antiaxial view. (f) Deutonymph right leg IV, antiaxial view.

Deutonymph. ($N = 1$) length: 305 µm.

Gastronotic region. Fifteen pairs of notogastral setae, same positions and shapes as in protonymph, all of approximately the same length (10 µm).

Podosoma and venter. Epimeral setation 1-0-1-1. Two pairs of short genital setae (approx. 4 µm) arranged in a longitudinal row. Two pairs of adanal setae $ad_{1–2}$ (6–8 µm) flanking anal valves.

Legs Figure 3c–f. Setation and solenidia: leg I (0-3-2-3-16) (1-2-2), leg II (0-3-2-2-13) (1-1-1), leg III (0-2-1-1-13) (1-1-0), leg IV (0-2-1-1-12) (0-1-0).

Tritonymph. ($N = 1$) length: 381 µm.

Gastronotic region. No difference to deutonymph.

Podosoma and venter. Epimeral setation 1-0-1-1.

Three pairs of short genital setae in longitudinal row. Two pairs of adanal setae $ad_{1–2}$ and two pairs of minute anal setae $an_{1–2}$.

Legs. Setation and solenidia: leg I (0-3-2-3-18) (1-2-2), leg II (0-3-2-3-15) (1-1-1), leg III (0-2-1-1-13) (1-1-0), leg IV (0-2-1-2-12) (0-1-0).

Remarks

Presently, only juveniles of *Indopacifica iohanna*, *I. taiyo* and *I. tyida* are known (Resch et al. 2019; Pfingstl et al. 2021) and the immatures of the new species show an identical habitus, notogastral and ventral setation. Juvenile stages of *I. iohanna* lack a proximoventral tooth on their claws and thus can be easily distinguished from immatures of the new species. This proximoventral tooth, however, is present in nymphs of *I. taiyo* and *I. tyida*, but these show only two setae on tibia I whereas immatures of the new species show already three setae on this segment from the larva. Apart from these characters, there is no way to distinguish the juveniles of *Indopacifica* species.

Supplementary morphological data for Fortuynia elamellata

Family Fortuyniidae Hammen, 1963

Genus *Fortuynia* Hammen, 1960

Fortuynia elamellata Luxton, 1967

Luxton (1967) gave a very good and detailed description of the adult and juvenile stages of this species. Therefore, we only repeat the most important features and add very few morphological details that were not given in the original description.

Adult

Diagnosis. Dark brown to almost black mites. Body length ranges 438–488 µm and body width 270–290 µm (females slightly larger than males). Integument finely punctate. Prodorsum triangular in dorsal view, rostrum demarcated by faint transversal ridge passing in front of lamellar setae (Figure 4d). Rostral (*ro*) and lamellar seta (*le*) smooth, spiniform, the latter slightly shorter (ca. 20 µm vs. 15 µm). No lamellar ridges (Figure 4a,b,d). Interlamellar (*in*) and exobothridial seta (*ex*) vestigial. Sensillum (ss) smooth, medially incurving, with clavate head. Van der Hammen´s organ typical for the genus (Figure 4c); canal *ce* present, short, reaching bothridium, canal *ci* absent. Gnathosoma typical for the genus. Notogaster with anterior rectangular light spot with irregular border. Fourteen pairs of long, smooth spiniform notogastral setae (length 15–40 µm), seta *da* faintly serrated (difficult to observe), c_3 absent (Figure 4a,b). Lyrifissures and opisthonotal gland opening typical for the genus. Pedotectum I small, scale-like; pedotectum II absent. Epimeral formula 3-1-3-2, setae smooth, length ranging 15–45 µm, *1b* longest, *3a* shortest. Five pairs of genital setae, one pair of aggenital setae. Two pairs of anal and three pairs of thin and smooth adanal setae. Legs monodactylous, long hook-like claws with two dorsal rows of minute serration (difficult to observe) (Figure 4e,f). Porose areas present on all femora and on trochanter III and IV. Trochanter III and IV with distinct dorsal spur. Leg setation and solenidia: I (1-4-2-3-18) (1-2-2), II (1-4-2-3-15) (1-1-1), III (2-3-1-3-15) (1-1-0), IV (1-2-2-3-12) (0-1-0).

Remarks

The specimens investigated herein match exactly the morphological description of *Fortuynia elamellata* specimens in Luxton (1967) and there is no doubt that we are dealing with the same species. The supposed subspecies *F. elamellata shibai* was described from Japan and shows differences in the length of notogastral seta *da*, in the position of the aggenital setae, the development of pedotectum I and the spur on trochanter III (Aoki 1974). A recent study (Pfingstl et al. 2019) concluded that these differences are of interspecific nature and that *F. e. shibai* represents a distinct species. We confirm the differences and agree that *F. shibai* should not be longer regarded as subspecies. Another suggested subspecies, namely *F. elamellata micromorpha*, was described from South African coasts (Marshall and Pugh 2002), and also diverges from the nominate species in the length of seta *da*, position of aggenital seta and size of pedotectum I, but additionally shows a striking difference in body size (380–404 µm in *F. micromorpha* versus 438–488 µm in *F. elamellata*). Altogether, this subspecies shows more differences to *F. elamellata* than *F. shibai* and thus its status as subspecies may also no longer be justified. A recent phylogeny of marine associated mites using morphological and molecular genetic data (Pfingstl et al. 2023) indicated a close relation of the above-mentioned taxa but did not render them as direct sister species or groups of a single clade. Moreover, the three "*elamellata*" species differ in the length of the *28S* gene fragment and show different substitutions in at least one base pair, which strongly supports the distinctness of each species.

Ecology

Fortuynia elamellata specimens were all collected from intertidal rock habitats (Luxton 1967, present study) which indicates a preference for this type of environment. Furthermore, their claws are strongly curved and high (from dorsal to ventral edge), which indicates an adaptation to rocky tidal coastal environments (Pfingstl et al. 2020).

Distribution. *Fortuynia elamellata* has been reported from four different locations in New Zealand: (I) from the Three Kings Islands north of Auckland, (II) from the Bay of Islands in the northern part of Auckland region, (III) from the Takatu Peninsula in North Auckland (Luxton 1967, 1990), and (IV) from Waiheke Island close to the eastern shore of Auckland City (present study). All these occurrences are restricted to the northern parts of the North Island where warmer seawater temperatures prevail. Fortuyniid mites are known to be adapted to warmer climates (e.g. Pfingstl et al. 2021); therefore, it makes sense that *F. elamellata* may be restricted to the warm temperate regions of New Zealand. Although supposed subspecies of *F. elamellata* were found on shores of South Africa and Japan (Aoki 1974; Marshall and Pugh 2002; Pfingstl et al. 2021), the nominate species has not been found yet outside of New Zealand and thus may represent a strictly endemic species.

Juvenile stages. Apheredermous, dark brown in colour (similar to adults). Integument plicate and soft except more sclerotized centrodorsal plate. Pattern of plication and system of tracheal pores in folds typical for the genus. Prodorsum triangular, hysterosoma oval in dorsal view. Bothridium small cup, sensillum with short stalk and smooth clavate head. Interlamellar (*in*) and exobothridial (*ex*) seta already vestigial. In larva, all notogastral setae faintly serrated, in following stages only setae c_1, c_2 and *da* with faint serration. Bases of notogastral setae surrounded by small pores.

Larva ($N = 2$). Length 225–246 µm (mean 236 µm).

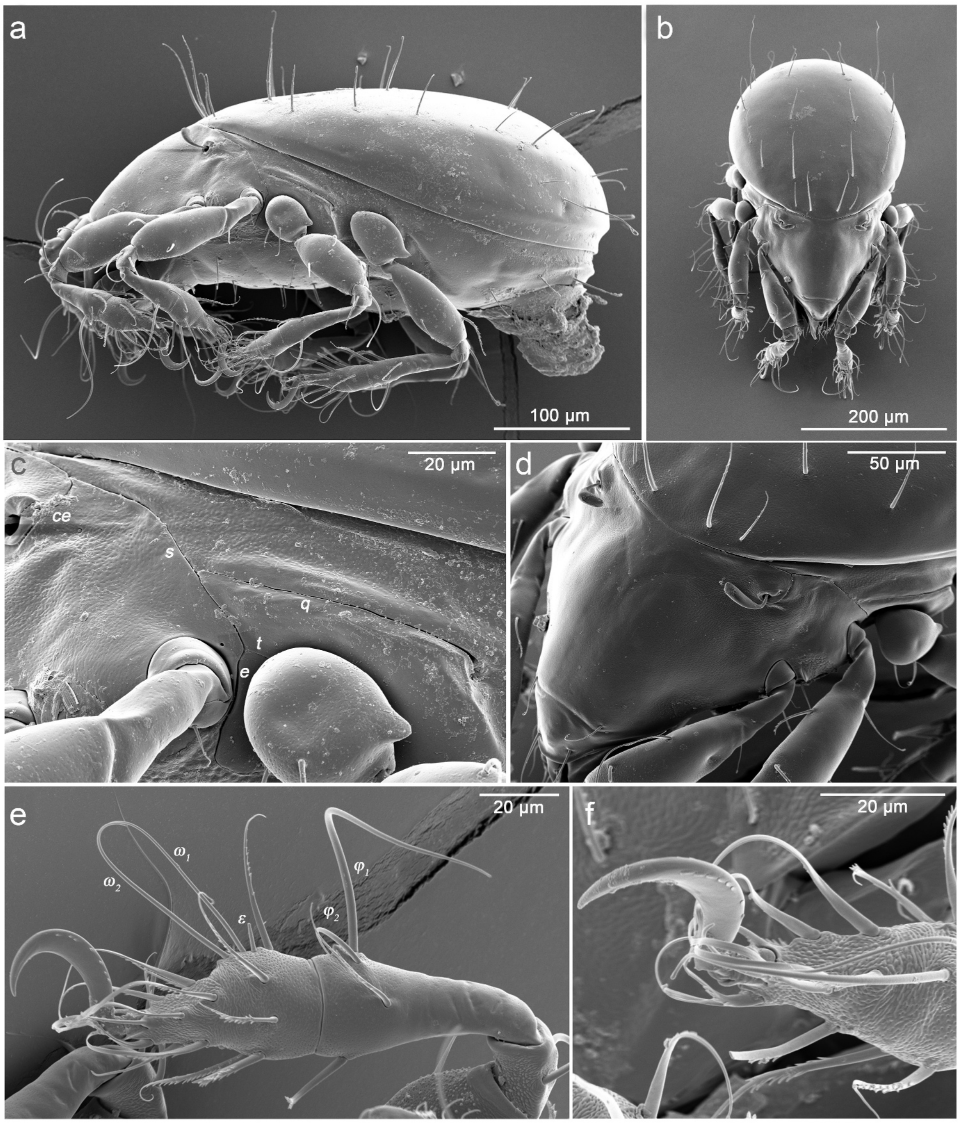

Figure 4. *Fortuynia elamellata* SEM-images of adult female. (a) Lateral view. (b) Dorso-frontal view. (c) System of lateral cuticular channels in detail. (d) Prodorsum in dorso-lateral view. (e) Tarsus and tibia I, paraxial view. (f) Claw of leg I showing minute dorsal spines.

Eleven pairs of notogastral setae. Epimeral setation 2-1-2. Leg setation and solenidia: I (0-2-2-3-16) (1-1-1), II (0-2-2-2-13) (1-1-1), III (0-2-1-1-13) (1-1-0).

Protonymph ($N = 2$) (Figure 5a,b). Length 299–310 µm (mean 305 µm).

Fifteen pairs of notogastral setae. Epimeral setation 3-1-2-1. One pair of genital setae. Leg setation and solenidia: I (0-2-2-3-16) (1-1-2), II (0-2-2-2-13) (1-1-1), III (0-2-1-1-13) (1-1-0), IV (0-0-0-0-7) (0-0-0).

Deutonymph ($N = 4$). Length 350–369 µm (mean 363 µm).

Fifteen pairs of notogastral setae. Epimeral setation 3-1-2-2. Two pairs of genital (*g*), one pair of aggenital and three pairs of adanal setae (ad_{1-3}). Leg setation and solenidia (Figure 6): I (0-3-2-3-16) (1-2-2), II (0-3-2-2-13) (1-1-1), III (1-2-1-1-13) (1-1-0), IV (0-2-2-1-12) (0-1-0).

Tritonymph ($N = 8$) (Figure 5c). Length 436–481 µm (mean 460 µm).

Fifteen pairs of notogastral setae. Epimeral setation 3-1-3-2. Four pairs of genital, one pair of aggenital, three pairs of adanal, and two pairs of anal setae (an_{1-2}). Leg setation and solenidia: I (0-4-2-3-18) (1-2-2), II (0-4-2-2-15) (1-1-1), III (1-3-1-2-15) (1-1-0), IV (1-2-2-2-12) (0-1-0).

Remarks

Our specimens of *F. elamellata* juveniles conform with the characteristics given by Luxton (1967). When comparing the juveniles of *F. elamellata* to immatures of the former supposed subspecies *F. shibai* (Pfingstl et al. 2021), they look very similar at first glance. The habitus, developmental setal formulas and the size range of each stage are identical. But the sizes and shape of nearly all notogastral setae are significantly different. In juveniles of *F. shibai* most notogastral setae (c_{1-3}, *da*, *dm*, *la*, *lm*, h_2) are spinose and long, whereas in *F. elamellata* immatures all notogastral setae are relatively short (only a third of the length of the setae in *F. shibai*) and only the setae c_{1-2}, *da*, *dm* are spinose; the rest are setiform. Juveniles of *F. elamellata* differ in the same way from immatures of the supposed subspecies *F. e. micromorpha* (Hugo-Coetzee et al. 2022) but the latter are ca. 50 µm smaller in each stage and thus easily distinguishable.

Supplementary morphological data for *Sellnickia caudata*

Family *Sellnickiidae* Balogh and Balogh, 1984

Genus *Sellnickia* Oudemans, 1927

Sellnickia caudata (Michael, 1809) (*Notaspis*)

Grandjean (1958) provided a very detailed and comprehensive re-description of the adults of this species. Herein, we only repeat and complement the most important features

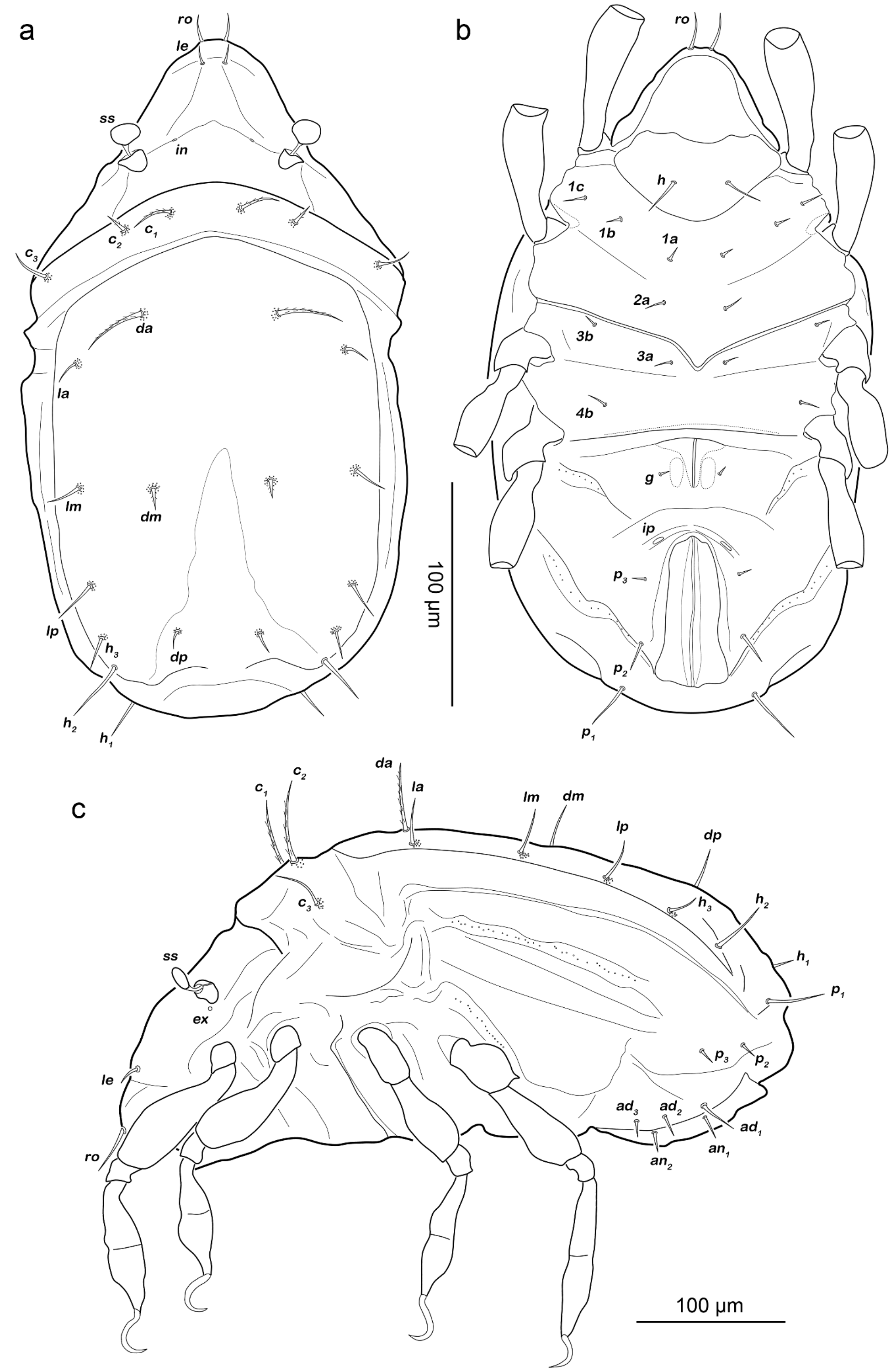

Figure 5. *Fortuynia elamellata* nymphs. (a) Protonymph dorsal view, legs omitted. (b) Protonymph ventral view, leg segments partially omitted. (c) Tritonymph lateral view.

and provide the first SEM images of this species as well as the first description of juveniles.

Adult

Diagnosis. Dark brown, large sized (656–734 µm) oribatid mites. Sexually dimorphic rostral lobe. Sensillum short globular. Prodorsal setae long, robust and ciliate. Lamellar ridge present. Dorsosejugal scissure incomplete. Octotaxic system present, large porose areas. Ten pairs of almost completely reduced notogastral setae. Large pygidial protuberance present. Legs heterotridactylous, with tarsal, tibial and femoral porose areas and remarkably pectinate unguinal tarsal setae.

Characters of the adult

Measurements. Females ($N = 4$), length: 656–734 µm (mean 684 µm), width: 425–456 µm (mean 442 µm); males ($N = 2$), length: 656–719 µm (mean 688 µm), width: 419–431 µm (mean 425 µm).

Integument. Colour dark brown. Cuticle smooth, except for gastronotic area showing faint foveate pattern (Figure 7a,e). Cerotegument absent, except for thin finely granular layer covering lateral area between bothridium and leg acetabula (Figure 7b,c).

***Prodorsum* (Figures 7c and 8a,c).** Rounded in dorsal view; striking sexual dimorphism present, females with median rectangular

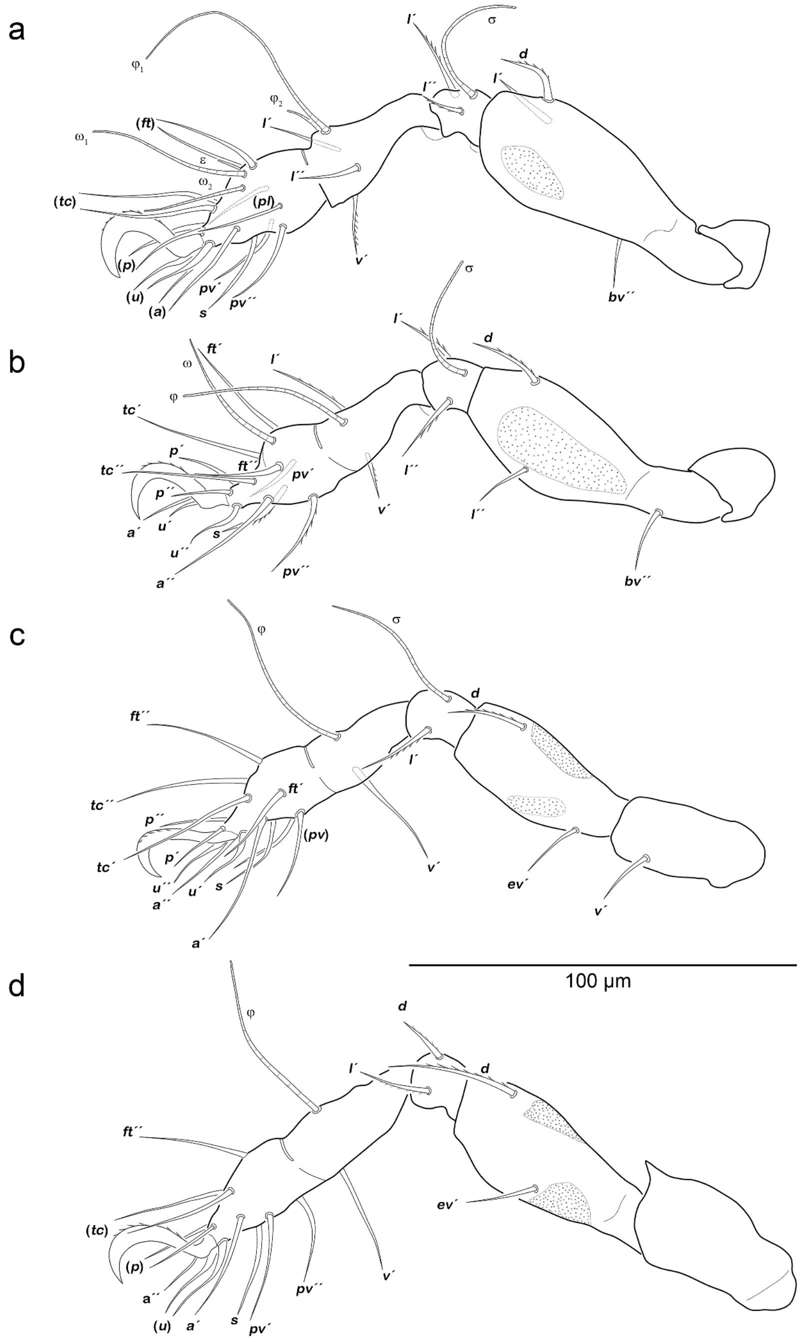

Figure 6. *Fortuynia elamellata* legs deutonymph, antiaxial view. (a) Left leg I. (b) Left leg II. (c) Right leg III. (d) Right leg IV.

rostral lobe, not seen in dorsal view, males also with median rectangular rostral lobe but lateral parts of this structure are strongly notched resulting in a frontal orientation of the lobe, which is then very well visible in dorsal view (Figure 8c). Rostral seta (*ro*) long (ca. 80 μm), setiform and slightly ciliate, lamellar (*le*) and interlamellar seta (*in*) very long (150–165 μm), robust setiform and strongly ciliate. Exobothridial seta (*ex*) shorter (ca. 75 μm) but also robust and strongly ciliate. Prominent lamellar ridge running from bothridium to the base of lamellar seta, nearly straight in dorsal view, curved in lateral view (Figure 7c). Tutorium (*tu*) developed as cuticular enfolding with sharp edge reaching from anterior of bothridium to insertion of rostral seta (Figure 7c). Sensillum short with slender stalk and large globular head covered by minute barbs.

Notogastral region. Circular in dorsal view, with conspicuous large caudal protuberance (ca. 50 μm) at the posterior end (Figures 7a and 8). Protuberance with median porose area at its terminal part; no difference in this structure between male and female. Dorsosejugal scissure medially interrupted. Two pairs of small inconspicuous ridges in humeral area. Ten pairs of minute notogastral setae (c_2, *la*, *lm*, *lp*, h_{1-3}, p_{1-3}), seta p_1 located on caudal protuberance (Figures 7d and 8a,c), seta p_{2-3} only visible in lateral view. Octotaxic system consisting of large elliptical or round porose areas. Porose area *Aa* largest near vestige *la*, *A1*, *A2* and *A3* slightly smaller, all located on posterior half of notogaster (Figures 7e,f and 8a,c). Orifice of opisthonotal gland *gla* circular and laterad of seta *lp*.

Lateral aspect. Pedotectum I *PtI* large shield-like, pedotectum II *PtII* smaller, but still well-developed (Figure 7c). Discidium absent.

Podosoma and venter. Epimeral setation 3-1-3-3, all setae smooth and spiniform (19–30 μm). Six pairs of genital setae, genital orifice slightly larger in females. One pair of aggenital setae (*ag*). Two pairs of anal setae (an_{1-2}) and three pairs of adanal setae (ad_{1-3}), ad_1 and ad_2 located posterior of anal valves. Lyrifissure *iad* small in anterior paranal position.

Gnathosoma. Chelicera chelate with strong interlocking teeth on digits (Figure 9a). Seta *cha* and *chb* long spiniform and

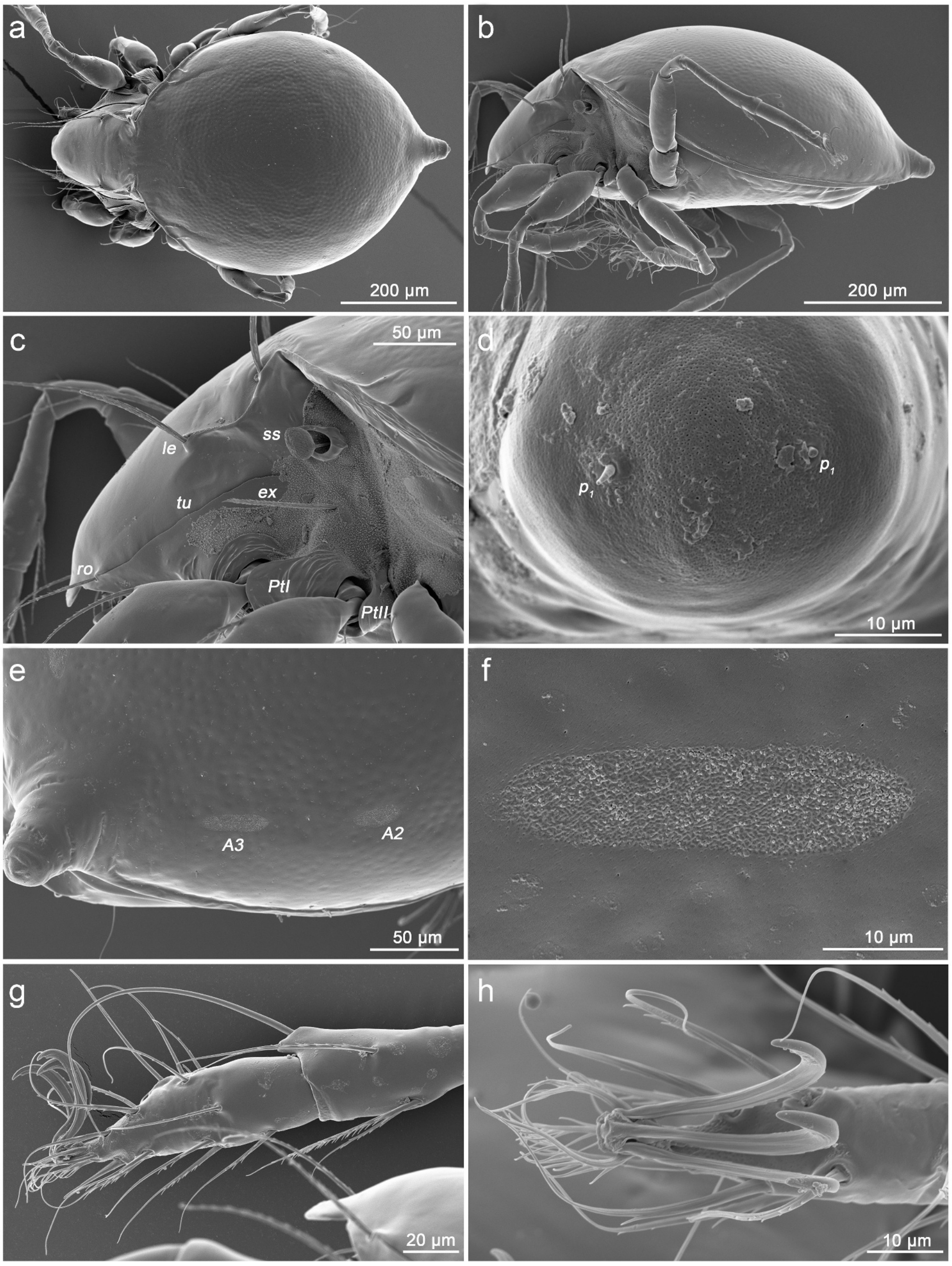

Figure 7. SEM-micrographs of adult *Sellnickia caudata*. (a) Female in dorsal view. (b) Male lateral view. (c) Male prodorsum in lateral view. (d) Posterior gastronotic protrusion in caudal view. (e) Protrusion and gastronotic porose areas. (f) Gastronotic area porosa *A2* in detailed view. (g). Distal segments of right leg I in paraxial view. (h). Tridactylous ambulacrum with claws in ventral view.

unilaterally barbed. Trägårdh's organ *Tg* a blunt thin triangular lamellar blade in paraxial position. Palp setal formula 0-2-1-3-8 (+ solenidion ω), tarsal eupathidium *acm* and solenidium ω associated forming a "corne double" (Figure 9b). Mentum diarthric, seta *h* spiniform smooth (ca. 30 µm). Rutellum with three distal teeth, the most lateral largest and blunt, two inner teeth slightly smaller but acute, all almost fully covered by thin lamella in ventral view (Figure 9c). Setae *a* and *m* spiniform and unilaterally barbed (15–20 µm).

***Legs* (Figure 10).** Heterotridactylous, median claw strongest, lateral claws slightly weaker and with distal ventral indentation. All claws borne on an elongated slender pretarsal stalk, whereas stalk of tarsus I is slightly shorter than that of other legs. Cerotegument finely granular. Large porose areas on paraxial aspect of all femora and elongated porose areas on ventral side of each tarsus and tibia. A small dorsal porose area on tarsus I and II surrounding the base of solenidia. Tibia and tarsi elongated whereas in posterior legs they are relatively longer. Solenidia φ_{1-2} of tibia I borne on small apophysis. Setae (*u*) on tarsus I remarkably pectinate ventrally, the same applies to setae (*p*) and (*u*) on all other tarsi (Figure 7g,h). Leg setation and solenidia: I (1-5-2-4-18) (1-2-2), II (1-5-2-4-15) (1-1-1), III (2-3-1-3-15) (1-1-0); IV (1-2-2-3-12) (0-1-0).

Remarks

Grandjean (1958) provided the most detailed description for *Sellnickia caudata* and although his specimens originated from Queensland, Australia, the specimens from New Zealand investigated herein exactly match their morphology. We could not find any deviating characters. The second known species of this genus, *Sellnickia heveae* (Oudemans 1927), was synonymized with *S. caudata* by Subías (2022) based on their almost identical appearance. However, Oudemans (1927) noted that his species shows a thick, lanceolate and unilaterally ciliate palptibial seta unlike that of *S. caudata* which is typically setiform. This difference was confirmed by Grandjean (1958) and thus the supposed synonymy should be discarded (Behan-Pelletier 2015). *Sellnickia heveae* also possesses the characteristic pygidial protuberance and Oudemans

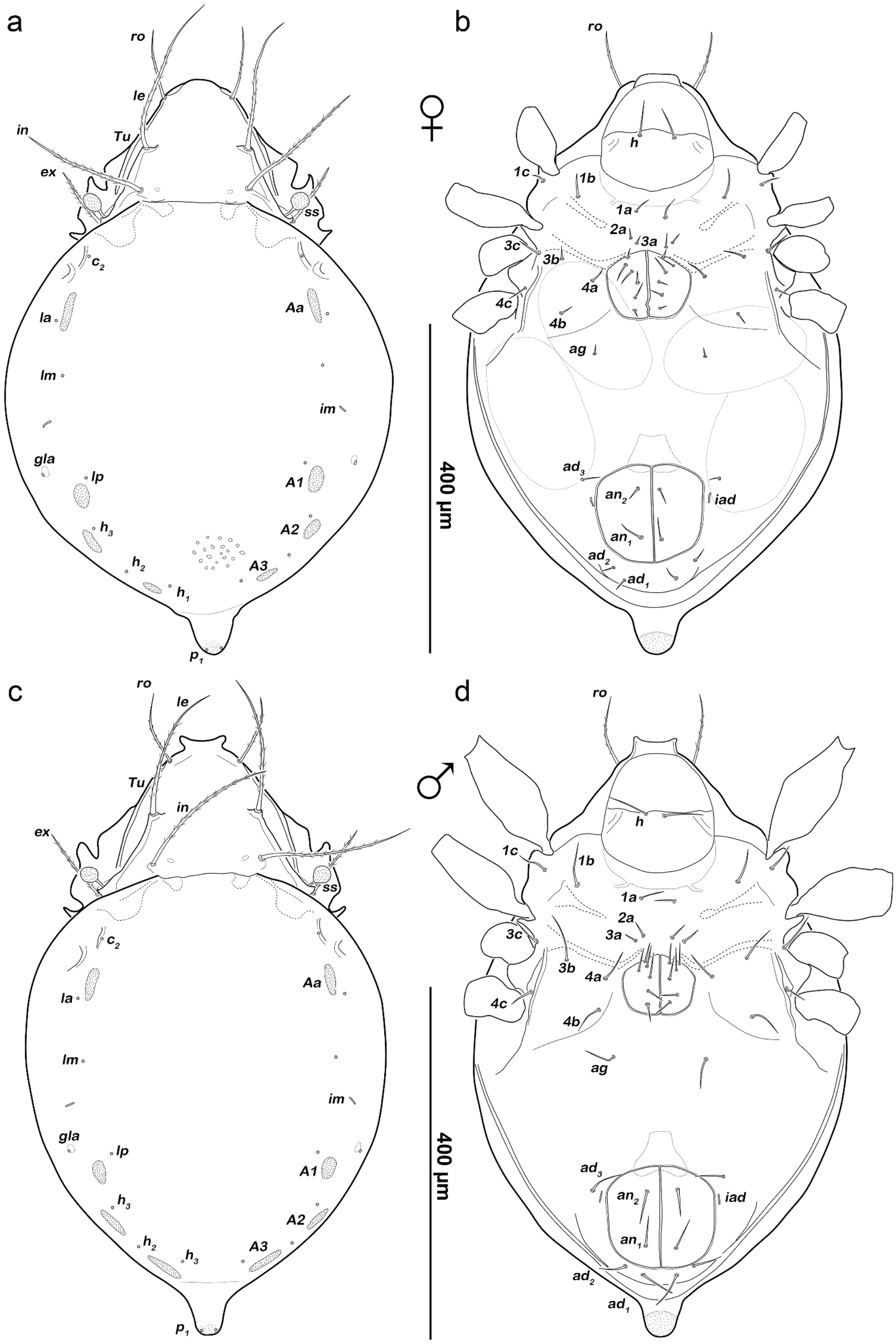

Figure 8. *Sellnickia caudata* adult. (a) Female dorsal view, legs omitted. (b) Female ventral view, leg segments partially omitted. (c) Male dorsal view, legs omitted. (d) Male ventral view, leg segments partially omitted.

(1927) hypothesized that it consists of a sticky material that allows the mites to glue themselves to the leaves when strong winds blow. Grandjean (1958) clearly contradicts that, stating that the pygidial tubercle rather secretes a typical cerotegument layer instead of a sticky substance. Observations in the field are clearly needed to answer if the protuberance is involved in attachment or in some kind of pheromonal communication, or in something else.

The sexual dimorphism of rostral lobes found in *Sellnickia caudata* is unusual and the function is yet unknown. Norton and Alberti (1997) stated that the male lobe has got the right size and shape to fit over the pygidial tubercle of the female, and thus males could possibly "nuzzle" this protuberance. In that case, the question remains why males show the exact same pygidial tubercle with a probable secretory function. Sexually dimorphic rostral structures are known to occur in several other oribatid taxa, as for example in the genus *Symbioribates* where rostral setae are modified or in *Nasozetes* where there is a spatulate protuberance in the males (e.g. Behan-Pelletier 2015). These dimorphic structures in oripodoid and other mites may all be somehow involved in some kind of mating behaviour (e.g. Bayartogtokh et al. 2017, 2022).

The higher-level taxonomy of *Sellnickia* species shows some inconsistencies and needs clarification. The family Sellnickiidae, consisting of *S. caudata* and *S. hevea*, is accepted by Norton and Behan-Pelletier (2009) and Schatz et al. (2011), but Subías (2022) includes these two species in the family Oribatulidae. Grandjean (1958) was the first to discuss the family placement of *Sellnickia* and he argued that the genus shares many characters with Oribatulidae, as for example the elongated pretarsi, the notched lateral claws, or the tarsal porose area which is also present in *Phauloppia* and *Lucoppia*. At the same time, he admitted that

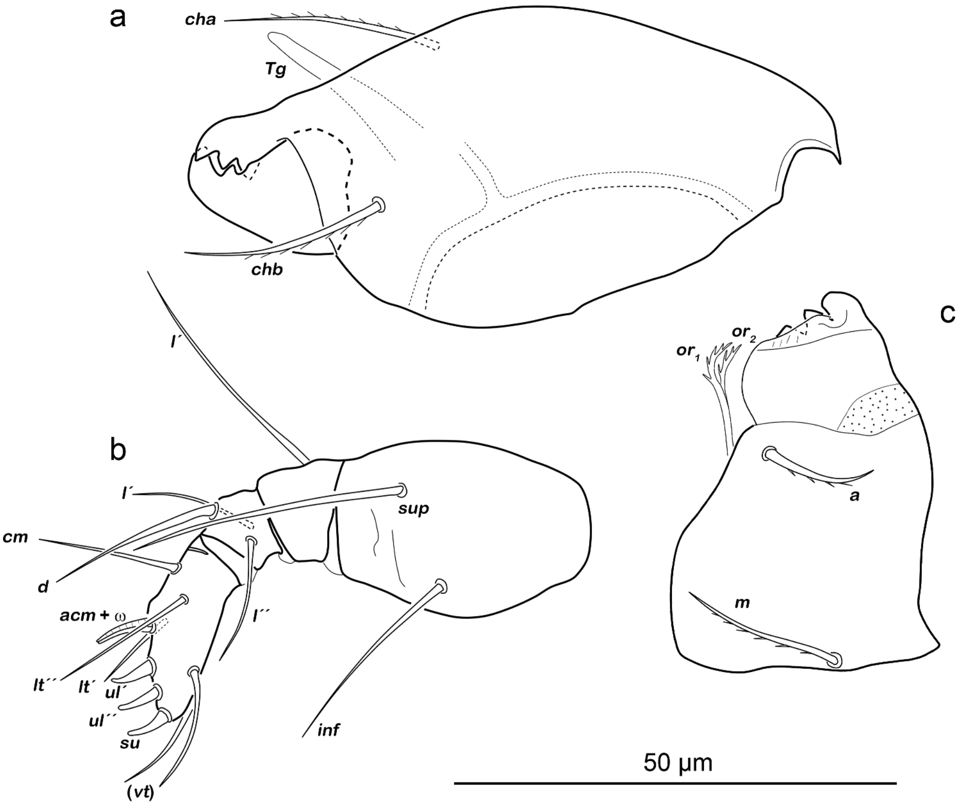

Figure 9. *Sellnickia caudata* deutonymph mouthparts (valid for all stages, adult included). (a) Left chelicera, antiaxial view. (b) Left pedipalp, antiaxial view. (c) Left rutellum, ventral view. Scale bar applies to all.

there are certain characters in *Sellnickia* that are not present in Oribatulidae, e.g. the lack of centrodorsal setae, a sclerotized spermatopositor and a specifically shaped preanal organ, which could justify the erection of a separate family. However, Grandjean (1958) refrained from doing the latter and stated that a final decision should only be made when the juvenile morphology of *Sellnickia* is known in detail. Balogh and Balogh (1984) established the subfamily Sellnickiinae in Oribatulidae and listed the reduction of notogastral setae, the absence of the dorsosejugal suture, 5 to 6 pairs of genital setae and the adanal position of lyrifissure *iad* as diagnostic characters for this group. They also included the monotypic genus *Grandjeania* into this subfamily. Later, Norton and Behan-Pelletier (2009) were the first to mention the family name "Sellnickiidae" and they listed femur II with 5 setae, the caudal protuberance bearing porose area and seta p_1, a complete circumpedal carina posterior to acetabulum IV and the possession of one solenidion on tarsus II as diagnostic traits for the family. The legs of *Grandjeania* are not known in detail but its notogaster exhibits two caudal protuberances that do not bear seta p_1 and the circumpedal carina is absent, at least according to the figures (Balogh 1963, p. 42); as a consequence, it was excluded from Sellnickiidae. Schatz et al. (2011) outlined the higher-lever classification of Oribatida and listed the Sellnickiidae as monogeneric family with two species, *S. caudata* and *S. heveae* and they mentioned Balogh and Balogh 1984 as family authors. Shortly after, Behan-Pelletier (2015) published a review on sexual dimorphism in oribatid mites which included details of *Sellnickia caudata*, but it was listed as a member of the family Oribatulidae in all associated tables. The recent world catalogue of oribatid mites (Subías 2022) conforms to that and includes *Sellnickia* in Oribatulidae, and accordingly the placement of this group of mites remains unclear. Based on the present data on adult and juvenile morphology (which follows in the next section), we think that *Sellnickia* should be placed in the separate family Sellnickiidae and not in Oribatulidae, although they are closely related to the latter group. The diagnostic familial characters given by Norton and Behan-Pelletier (2009) should be accepted whereas the presence of tarsal pulvilli in the immatures should be added to the diagnosis. The Sellnickiidae should only include the two *Sellnickia* species for now, but when more morphological details on *Grandjeania* and their juvenile morphology are reported in the future, the family might be adjusted in the sense of Balogh and Balogh (1984).

Ecology

Members of the genus *Sellnickia* have been exclusively found on leaves of trees and thus they are apparently arboreal. Specimens of *S. heveae* were collected from *Hevea* sp. tree leaves (Oudemans 1927), while individuals of *S. caudata* were collected from leaves of lemon trees (Grandjean 1958), from green leaves of an undetermined plant (Hammer 1966) and from twigs and leaves of green button mangrove *C. erectus* (present study). The occurrence on different species of plants indicates that the mites are not adapted to a specific type of plant. In the present study, we found high numbers of *S. caudata* specimens on nearly every investigated leaf, and they were observed to feed on the plant tissue and to form moulting aggregations on the underside of the leaves. Whether such strong infestations can cause harm to the plant is yet unknown, at least such cases have not been reported yet.

Distribution

Sellnickia caudata was originally described from Auckland, New Zealand (Michael 1908), but details about the exact collection site were not provided in the respective publication. This species was also collected in the Rotoehu State Forest in the Bay of Plenty (Hammer 1966) and now it was found on Waiheke Island in the Hauraki Gulf, New Zealand. Consequently, *S. caudata* may show a common distribution on the landmasses of north-eastern North Island. Outside New Zealand, there is a single report from Maryborough in Queensland (Grandjean 1958) pointing to a wider distribution in Australia as well. The second species, *S. heveae* was reported from Medan in Sumatra (Oudemans 1927). Presently, all members of the genus are only known from the Australasian region.

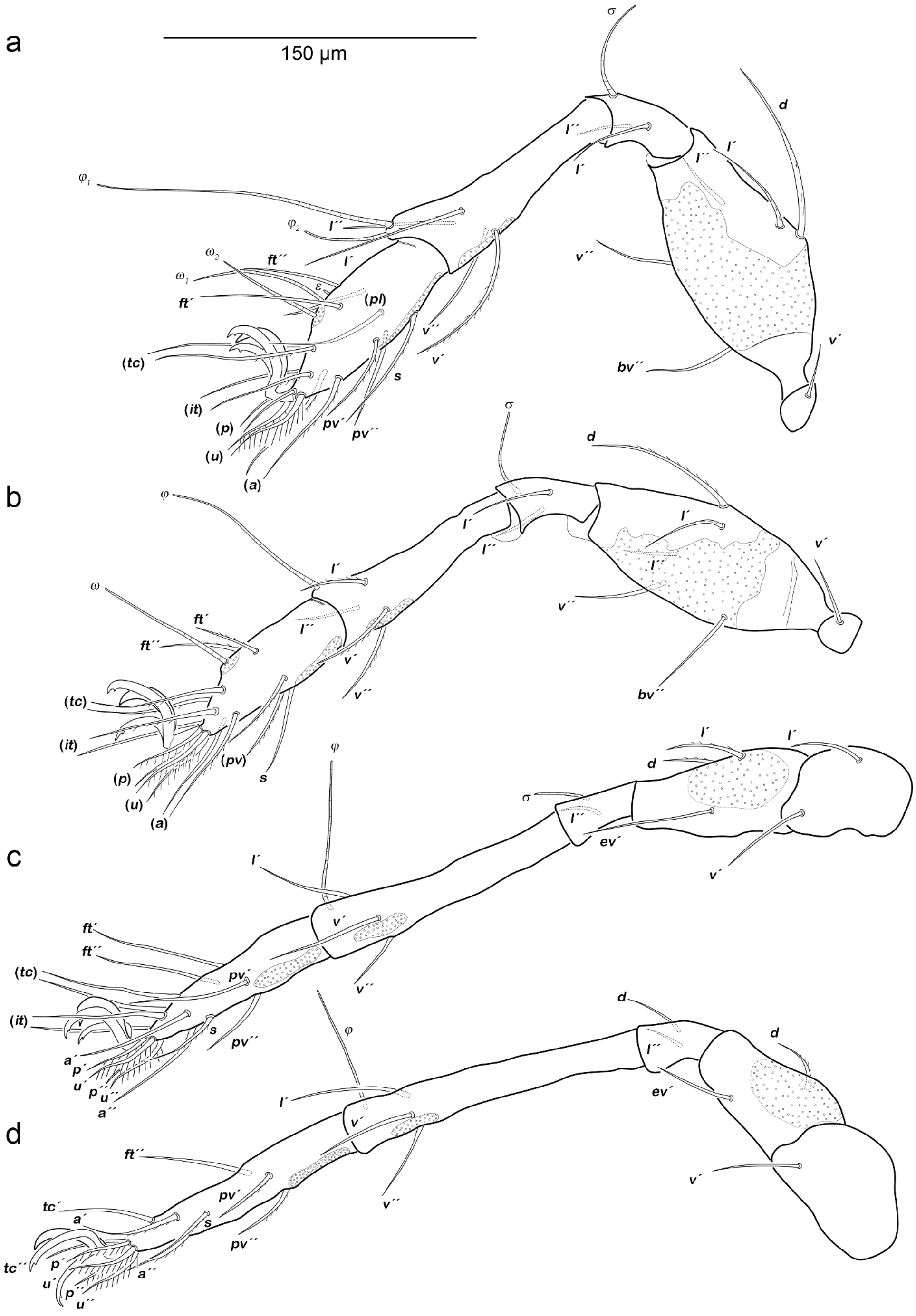

Figure 10. *Sellnickia caudata* adult legs. (a) Right leg I, paraxial view. (b) Right leg II, paraxial view. (c) Left leg III, antiaxial view. (d) Left leg IV, antiaxial view.

Description of juveniles

Common features of juvenile stages. Apheredermous. Bideficient; all opisthonotal setae associated with small porose excentrosclerites Figure 11a–c. Colour of prodorsum light brown, gastronotic region pale yellow. Integument soft, slightly plicate, except for stronger sclerotized prodorsum. Posterior edge of the prodorsum with a pair of lighter spots. All prodorsal setae long and barbed (Figure 11a). Bothridium small, cup-like. Sensillum short globose, surface of distal globe rough, covered with minute spines. A pair of small light spots adjacent to dorsosejugal scissure. Gastronotum oval in dorsal view, slightly convex in lateral view. Legs monodactylous with large lobe-like subunguinal pulvillus (Figure 11d). Porose areas present on femora, tibiae, and tarsi (difficult to observe). Seta *d* absent from genua and tibiae although respective solenidion is present.

Larva. ($N = 1$): length 262 µm.

Prodorsum (Figure 12a). Interlamellar (*in*) and lamellar seta (*le*) long, robust, and ciliate (ca. 50 µm), the former slightly thicker. Exobothridial seta (*ex*) long, spiniform, weakly ciliate (ca. 30 µm). Rostral seta (*ro*) long, thin, weakly ciliate (ca. 34 µm).

Gastronotic region (Figure 12a). Ten pairs of notogastral setae, $c_{1\text{–}2}$, *da*, *dm*, *dp*, *la*, *lm*, *lp*, $h_{1\text{–}2}$. Setae $c_{1\text{–}2}$, *da*, *dm*, *la* and *lm* long (length 15–25 µm), robust and ciliate; other setae short (8–11 µm), spiniform and smooth. At the base of each seta there is a small porose sclerite, slightly invaginated, difficult to observe. Orifice of opisthonotal gland (*gla*) circular, ring-like; gland small elliptical sac.

Podosoma and venter (Figure 12b). Epimeral setation 2-1-2, all setae short (approx. 8 µm) and spiniform. Claparède's organ (*clp*) globular. Aggenital, genital, adanal and anal setae not developed. Cupule of lyrifissure *ih* anterior of anal opening.

Legs. Setation and solenidia: leg I (0-2-2-2-16) (1-1-1), leg II (0-2-2-2-13) (1-1-1), leg III (0-2-1-1-13) (1-1-0).

Protonymph. ($N = 1$): length 286 µm.

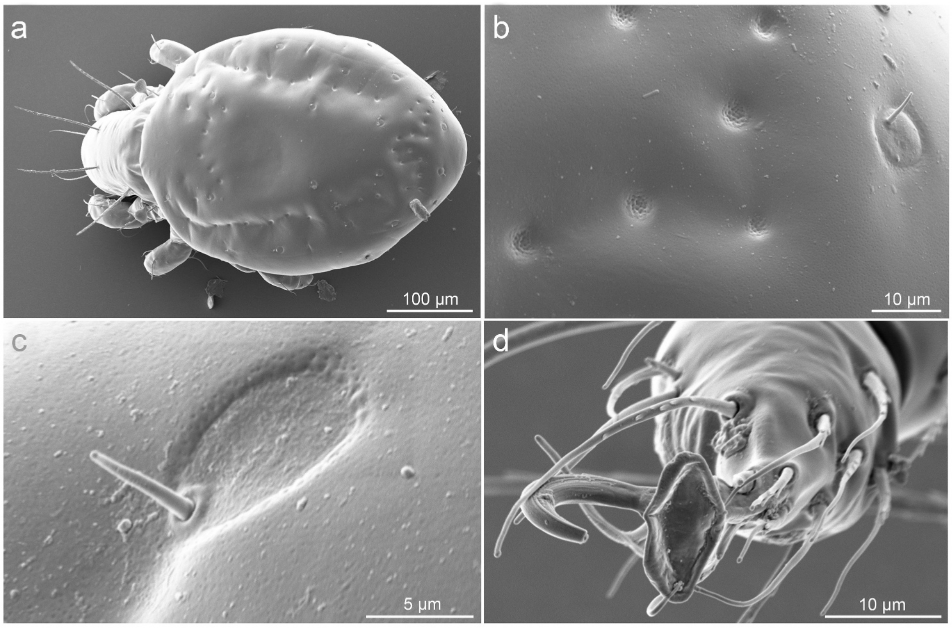

Figure 11. SEM micrographs of *Sellnickia caudata* nymphs. (a) Deutonymph dorsal view. (b) Gastronotic porose areas and excentrosclerites. (c) Excentrosclerite in detail. (d) Monodactylous tarsus with subunguinal pulvillus (adhesion pad).

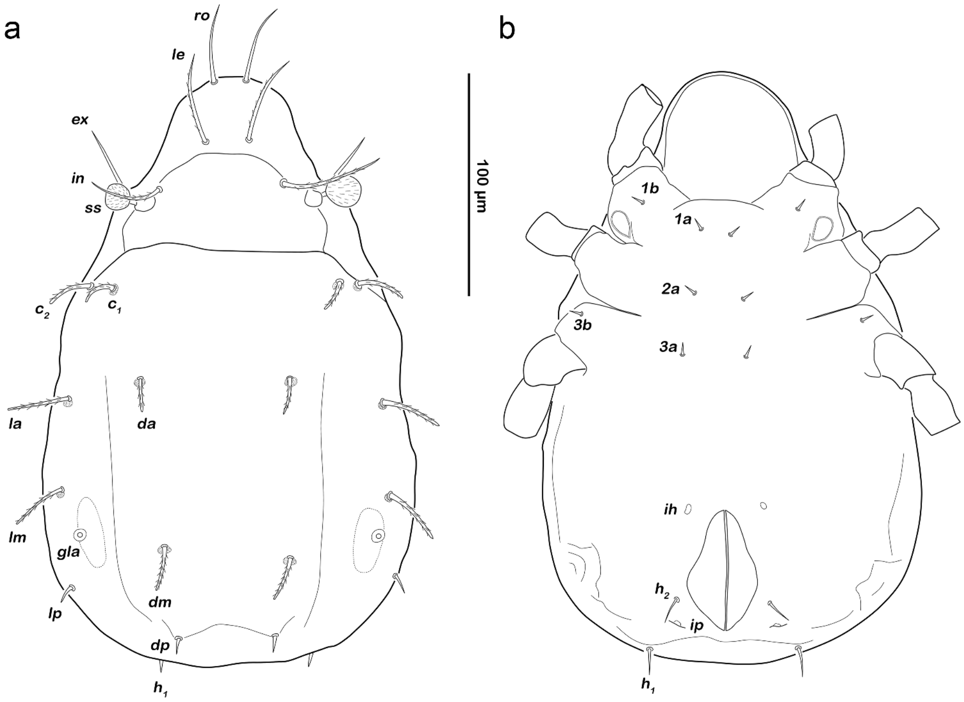

Figure 12. *Sellnickia caudata* larva. (a) Dorsal view, legs omitted. (b) Ventral view, leg segments partially omitted.

Prodorsum. Interlamellar (*in*) and lamellar seta (*le*) long, robust, and ciliate (52–56 µm), the former slightly thicker. Exobothridial seta (*ex*) long, spiniform, weakly ciliate (ca. 40 µm). Rostral seta (*ro*) long, thin, weakly ciliate (ca. 47 µm).

Gastronotic region. Fourteen pairs of notogastral setae; $c_{1\text{-}2}$, *da*, *dm*, *dp*, *la*, *lm*, *lp*, h_{1-3}, p_{1-3}. All short (ca. 5 µm), spiniform, smooth with small porose sclerites (excentrosclerite) at base. More than 40 additional small, slightly invaginated porose sclerites, distributed over gastronotic region.

Podosoma and venter. Epimeral setation 3-1-2-1, all setae spiniform and approx. same length (8 µm). Setae *1c* and *4b* added in this stage. One pair of short (ca. 5 µm) genital setae. Adanal and anal setae not developed. Cupule of lyrifissure *ip* anterior of anal opening.

Legs. Porose areas paraxially on femora I-III and ventrodistally on tarsi and tibiae I-III; difficult to observe. Setation and solenidia: leg I (0-2-2-3-16) (1-1-2), leg II (0-2-2-2-13) (1-1-1), leg III (0-2-1-1-13) (1-1-0), leg IV (0-0-0-0-7) (0-0-0).

Deutonymph. (*N* = 3): length 331–388 µm (mean 365 µm).

Prodorsum (Figure 13a). Interlamellar (*in*) seta very long, robust and ciliate (ca. 90 µm), lamellar seta (*le*) shorter and thinner (ca. 63 µm). Exobothridial seta (*ex*) long, spiniform, weakly ciliate (ca. 40 µm). Rostral seta (*ro*) long, thin, weakly ciliate (ca. 53 µm).

Gastronotic region (Figure 13a). Fourteen pairs of notogastral setae, same positions, shapes and lengths in protonymph. Microsclerites and porose areas same as in protonymph.

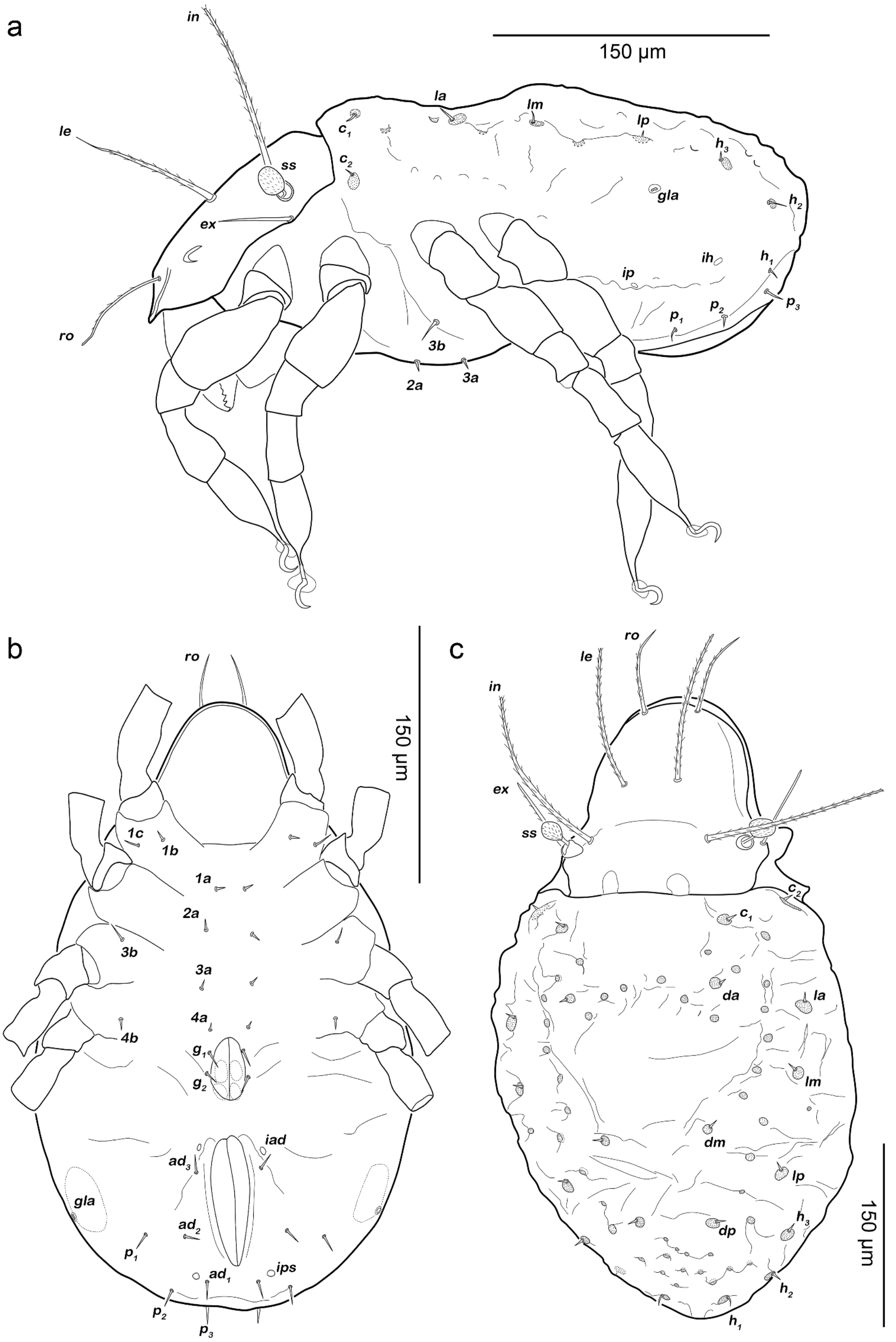

Figure 13. *Sellnickia caudata* nymphs. (a) Deutonymph lateral view. (b) Deutonymph ventral view, leg segments partially omitted. (c) Tritonymph dorsal view, legs omitted.

Podosoma and venter (Figure 13b). Epimeral setation 3-1-2-2, seta *4a* added in this stage (ca. 9 µm). Two pairs of short (ca. 6 µm) genital setae g_{1-2}. Three pairs of adanal setae (ca. 11 µm) flanking anal orifice. Cupule of lyrifissure *iad* anterior of anal opening.

Legs (Figure 14). Porous areas same as in protonymph, but in this stage also on leg IV. Setation and solenidia: leg I (0-3-2-3-16) (1-2-2), leg II (0-3-2-2-13) (1-1-1), leg III (1-2-1-1-13) (1-1-0), leg IV (0-2-1-1-12) (0-1-0).

Tritonymph. ($N = 1$): length 494 µm.

Prodorsum (Figure 13c). Interlamellar (*in*) seta very long, robust and ciliate (139 µm), lamellar seta (*le*) shorter and thinner (120 µm). Exobothridial seta (*ex*) long, spiniform, weakly ciliate (62 µm). Rostral seta (*ro*) long, thin, weakly ciliate (65 µm).

Gastronotic region (Figure 13c). Fourteen pairs of notogastral setae, no difference to deutonymph (microsclerites included). Additional microsclerites same, positions and shapes as in deutonymph.

Podosoma and venter. Epimeral setation 3-1-2-3, seta *4c* added in this stage, close to trochanter IV, length of all epimeral seta ca. 9 µm. Four pairs of genital setae g_{1-4} (6 µm). Three pairs of adanal setae, same positions, shapes, and sizes as in deutonymph. Two pairs of short anal setae (6–8 µm), fully developed in this stage.

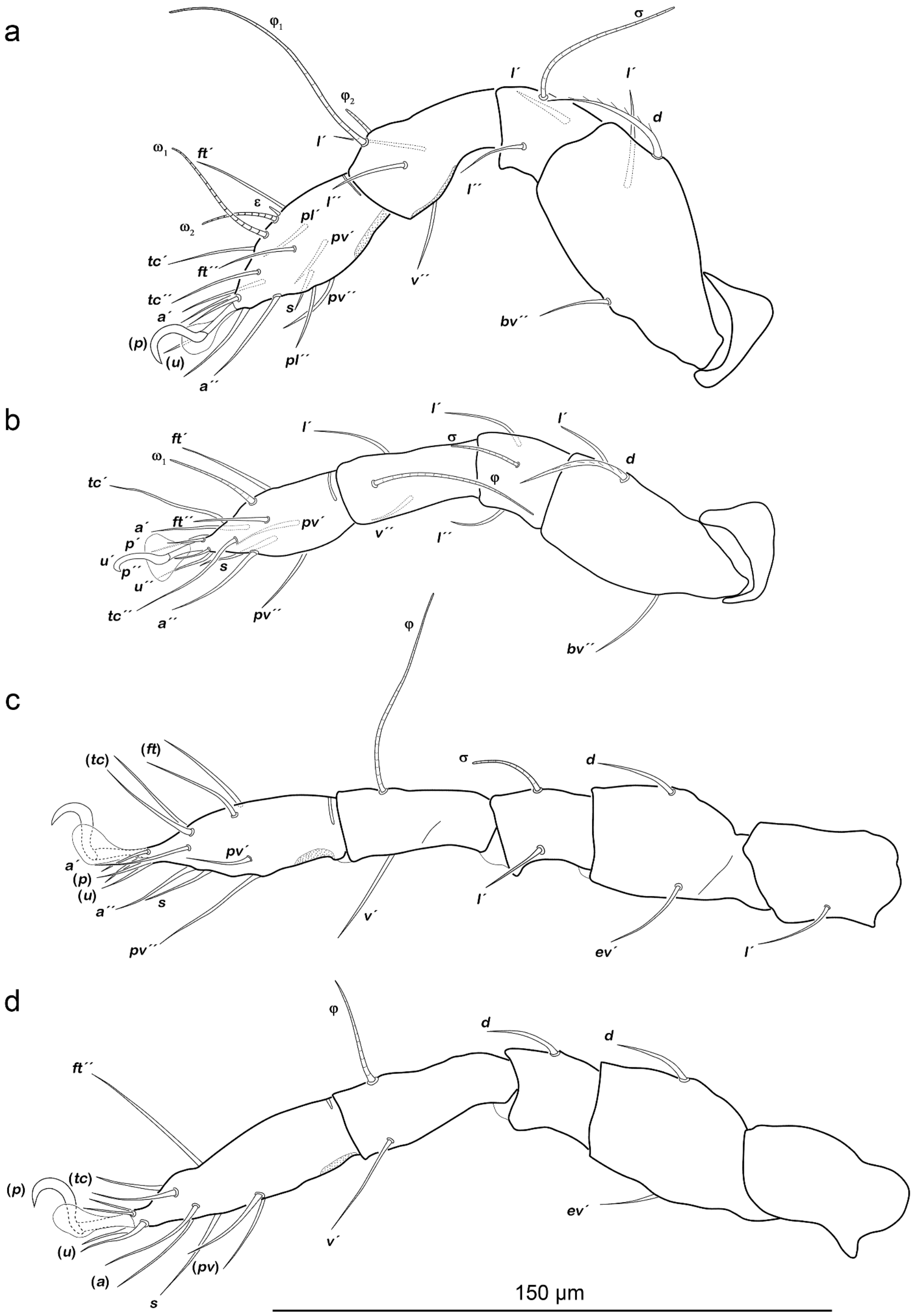

Figure 14. *Sellnickia caudata* deutonymph legs. (a) Left leg I, antiaxial view. (b) Left leg II, dorsal view. (c) Right leg III, antiaxial view. (d) Right leg IV, antiaxial view.

Legs. Porose areas same as in deutonymph. Setation and solenidia: leg I (0-3-2-3-18) (1-2-2), leg II (0-3-2-3-15) (1-1-1), leg III (1-2-1-1-15) (1-1-0), leg IV (1-2-2-1-12) (0-1-0).

Conspicuous changes during ontogeny. The larva shows small porose excentrosclerites associated only with the notogastral setae. From the protonymph, numerous additional small, slightly invaginated porose sclerites appear on the gastronotum and these are not associated with other structures. The anterior notogastral setae $c_{1–2}$, *da*, *dm*, *la* and *lm* are remarkably long, robust and ciliate in the larva, but in the protonymph they become small spiniform and smooth, and they keep this appearance throughout the subsequent ontogenetic development.

Remarks

Oudemans (1927) also found a tritonymph but gave very limited information on it in his work about *S. heveae*. He mainly mentions the ambulacrum which consists of a pretarsus equipped with a single claw and a conspicuous pulvillus ("carunkel"). Immatures of *S. caudata* show the exact same feature on their legs. Tarsal pulvilli, only present in the juvenile stages, can also be found in *Ametroproctus*, *Cymbaeremaeus* (Behan-Pelletier 1987, 1988), *Dendroeremaeus* (Behan-Pelletier et al. 2005) and *Megeremaeus* (Behan-Pelletier 1990). Apart from the latter, all taxa are exclusively arboreal species; therefore, this morphological feature is clearly an adaption to this lifestyle. Most of these groups, including *Sellnickia*, are not related to each other, consequently juvenile adhesive pulvilli have evolved independently in these lineages (e.g. Pfingstl 2023).

Herein, we report the presence of opisthonotal excentrosclerites for the first time in the juveniles of *Sellnickia*, a feature that is characteristic for immatures of Oripodoidea (e.g. Norton and Behan-Pelletier 2009).

Barcodes for species

Indopacifica impedimenta n. sp. (1 specimen) *COI* gene fragment (658 bp): OR756243; *D3* fragment of *28S* rRNA (320 bp): OR769691.

Fortuynia elamellata (2 specimens) *COI* gene fragment (658 bp): OR756241, OR756242; *D3* fragment of *28S* rRNA (319 bp): OR769687, OR769688.

Sellnickia caudata (2 specimens) *COI* gene fragment (658 bp): OR756244, OR756245; *D3* fragment of *28S* rRNA (315 bp): OR769689, OR769690.

Acknowledgments

We would like to thank Prof. Yukie Sato for assisting us in the field collection on Waiheke Island. The sampling did not require a permit from the NZ Department of Conservation.

The new mite species '*Indopacifica impedimenta*' was collected by authors while attending the XVI International Congress of Acarology 2022 (ICA2022) at the University of Auckland, New Zealand (NZ). Previously, in 2020, a COVID-19 pandemic broke out worldwide, causing significant economic and logistical disruption and, unfortunately, many victims. Our condolences go out to all those affected, including, most regrettably, many Acarology colleagues. Amid this chaos, the ICA2022 conference was organized in a way that overcame these problems and became the first international conference in the history of ICA to be held in a hybrid mode, both onsite and online. Many participants were able to listen to the presentations online. The participants at the venue, though small in numbers, were united and cooperated to make the conference a good one. We would like to pay tribute to the hard work of the organizers, the International Executive Committee of ICA (Secretary: Kimiko Okabe) and the Local Organizing Committee with President Zhi-Qiang Zhang and Secretary Maria Minor, one of the co-authors of this paper. However, due to logistics stoppages and disruptions in resuming operations, Pfingstl and Shimano, two of the co-authors, had lost baggage on their flights to New Zealand. In particular, Shimano's luggage was found one month after the end of ICA2022. We named the new species 'impedimenta' as a word to commemorate the tragedy of COVID-19, lost luggage, and the great success of ICA2022 in NZ.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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