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Two new species of New Zealand *Anderus* Trewick *et al.* 2024 ground wētā (Orthoptera: Anostostomatidae)

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Abstract

Two new species of ground wētā endemic to Aotearoa New Zealand are described. *Anderus rakiura* **sp. nov.** is known only from Rakiura Stewart Island and is phylogenetically sister to *A. subantarcticus,* which is endemic to Tini Heke—The Snares, a smaller and more southern group of islands. *Anderus pipiwai* **sp. nov.** is found in wet forest of southwest South Island where it is sympatric with at least two other congeneric species. These additions bring the total number of *Anderus* species to eight.

Introduction

The Anostostomatidae endemic to Aotearoa New Zealand that are commonly referred to as Ground Wētā comprise two genera, each of which is sister to distinct taxa outside New Zealand (Trewick *et al.* 2024). The Ground Wētā share the feature of concealing themselves during the day in burrows that are typically capped with a soil door. This behaviour is not uncommon in Anostostomatidae worldwide but open or tree roosting (some *Deinacrida*) and tree-hole roosting (*Hemiandrus, Anisoura*) are more prominent in the New Zealand fauna.

Adults and juveniles of the two Ground Wētā genera, *Hemiandrus* Ander, 1938 and *Anderus* Trewick *et al.* 2024 are readily distinguished by the extent of pilosity on the maxillary palps. In *Anderus*, the 5th, 4th and 3rd segments of these palps are clothed in small hairs, in contrast *Hemiandrus* have hairs restricted to the 5th and part of 4th segment of their palps. Adult female *Anderus* all have rather long, thin and curved ovipositors, whereas this structure is highly variable among the twelve species of *Hemiandrus*. The paraprocts of adult male *Anderus* are stout, blunt, triangular or tapered but short, pigmented and typically project rearwards, whereas in *Hemiandrus* the paraprocts are long, thin, pale with darker tips that typically meet and project upwards, close to posterior of abdomen.

There are six described species of *Anderus* Trewick *et al.* 2024: *A. maculifrons* (Walker, 1869)*, A. fiordensis* (Salmon, 1950), *A. subantarticus* (Salmon, 1950)*, A. brucei* (Taylor-Smith *et al*. 2016)*, A. luna* (Taylor-Smith *et al*. 2016)*, A. nox* (Taylor-Smith *et al.* 2016). These species are all present in southern New Zealand and the ranges of *A. brucei, A. luna* and *A. nox* extend into North Island. *Anderus subantarcticus* is endemic to the subantarctic islands called The Snares (Tini Heke). Here we add two new species from southern New Zealand: *A. rakiura* **sp. nov.** from Rakiura-Stewart Island and *A. pipiwai* **sp. nov.** from southwest South Island.

Methods

Specimens collected by hand were stored in ethanol for morphological examination and DNA extraction and held in the Phoenix collection Massey University (MPN). Additional records from the Canterbury Museum (CMNZ). The following measurements were made in millimetres using Mitutoyu calipers (accurate to 0.05mm): HD dorsal-ventral length, BL body length (excluding ovipositor in females), HFL hind femur length, HFW hind femur width at widest point, HTL hind tibia, PL pronotum length at midline, PW pronotum width, OL linear ovipositor length from base to tip. Spine counts were made on leg elements.

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TABLE 1. *Anderus* ground wētā specimens sampled for DNA and sequenced for partial mtDNA cytochrome oxidase subunit 1.

Specimen	GenBank	Species	Location	Latitude	Longitude	iNaturalist	Date	Collector
MPN_GW109	EU676799	*brucei*	Opepe, Lake Taupo	-38.759706	176.217339		28.XII.2005	S. Trewick
MPN_GW126	EU676793	*brucei*	Pureora Forest	-38.47361	175.56782		15.XI.2005	P. Johns
MPN_GW49A	EU676765	*brucei*	Puketi Forest	-35.18728	173.76288		10.XII.1990	M. Morgan-Richards
MPN_GW68	EU676767	*brucei*	Lake Waikaremoana	-38.800821	177.120621		28.III.2004	S. Trewick
MPN_GW1481	PV678944	*fiordensis*	Stuart Mounts	-45.1261216	167.760986	107595184	25.II.2022	D. Hegg
MPN_GW1521	PV678946	*fiordensis*	Mt Grono, Secretary Island	-45.26565	166.95185		25.I.2022	T. Scott-Fyfe
MPN_GW70	PV678931	*fiordensis*	Lake Roe, Fiordland	-45.703842	167.146702		15.III.2004	G. Gibbs
MPN_FD1	PV678928	*fiordensis* (=*nitaweta*)	Sinbad Valley, Fiordland	-44.633055	167.812659		23.II.2013	E. Edwards
MPN_FD15	PV678929	*fiordensis* (=*nitaweta*)	Sinbad Valley, Fiordland	-44.633055	167.812659		26.II.2011	E. Edwards
MPN_GW1401	PV678941	*fiordensis* (=*nitaweta*)	Lake Roe, Fiordland	-45.703842	167.146702	9362047	01.I.2018	D. Hegg
MPN_GW1516	PV678945	*fiordensis* (=*nitaweta*)	Shy Lake, Fiordland	-45.596384	166.880971		16.III.2022	T. Scott-Fyfe
MPN_GW104	EU676742	*luna*	Sky Farm, Takaka	-40.926518	172.857594		29.I.2006	M. Morgan-Richards
MPN_GW1385	PV678937	*luna*	Tongariro	-39.206495	175.6794533	72430150	26.II.2021	D. Hegg
MPN_GW143	EU676784	*luna*	Lewis Pass	-42.361271	172.252423		19.XII.2006	J. Goldberg
MPN_GW916B	PV678948	*luna*	Waikamaka St., Ruahine Ra.	-39.81114	176.13543		13.III.013	M. Lusk
MPN_GW119	EU676770	*maculifrons*	Catlins Coast, Southland	-46.618316	169.012578		6.I.2006	PME/PS
MPN_GW130	EU676745	*maculifrons*	Craigieburn Range	-43.145462	171.746805		19.III.2006	R. Pratt
MPN_GW150	EU676786	*maculifrons*	Franz Josef, Westland	-43.387855	170.185483		10.I.2006	J. Goldberg
MPN_GW201	EU676772	*maculifrons*	Princhester Stm, Takitimu Ra.	-45.606832	167.955319		2.XII.2006	P. Johns

.....continued on the next page

TABLE 1. (Continued)

Specimen	GenBank	Species	Location	Latitude	Longitude	iNaturalist	Date	Collector
MPN_GW1542	PV678947	*nox*	Lakehead, St Arnaud	-41.876144	172.825345		14.XII.2005	M. Griffin
MPN_GW212	EU676746	*nox*	Mt Haidinger, Kahurangi	-40.68333	172.56667		4.IV.2007	I. Millar
MPN_GW76	EU676766	*nox*	Charleston, Buller	-41.906589	171.442561		15.III1997	A. Tennyson
MPN_GW896A	PV678933	*nox*	Denniston Plateau	-41.739361	171.794436		26.I.2013	E. Trewick
MPN_GW1066	PV678936	*pipiwai* **sp. nov**.	Cleddau Valley, Fiordland	-44.72038	167.94607		-.I.2014	T. Jewell
MPN_GW1402	PV678942	*pipiwai* **sp. nov.**	Brewster Hut track, Haast Pass	-44.08194	169.391388	8937575	24.IX.2017	D. Hegg
MPN_GW1403	PV678943	*pipiwai* **sp. nov.**	Brewster Hut track, Haast Pass	-44.08194	169.391388	8937575	24.IX.2017	D. Hegg
MPN_GW36a	PV678930	*pipiwai* **sp. nov.**	Haast Summit	-44.077036	169.385497		13.I.1998	S. Trewick
MPN_GW561	PV678932	*pipiwai* **sp. nov.**	Knobs Flat, Eglinton Valley	-44.973815	168.024044		28.XII.09	S. Trewick
MPN_GW1390	PV678938	*rakiura* **sp. nov.**	Port Pegasus, Stewart Island	-47.199964	167.638315	9592902	17.I.2018	D. Hegg
MPN_GW1391	PV678939	*rakiura* **sp. nov.**	Tin Range, Stewart Island	-47.087686	167.795648	9593056	11.I.2018	D. Hegg
MPN_GW1392	PV678940	*rakiura* **sp. nov.**	Tin Range, Stewart Island	-47.087686	167.795648	9593056	11.I.2018	D. Hegg
MPN_GW792	PV678949	*subantarcticus*	Hoho Bay, The Snares	-48.025392	166.608639		10.X.2010	J. Hiscock
MPN_GW988	PV678934	*subantarcticus*	Station point, The Snares	-48.022481	166.609861		11.IV.2010	NIWA
MPN_GW989	PV678935	*subantarcticus*	Station point, The Snares	-48.022481	166.609861		11.IV.2010	NIWA

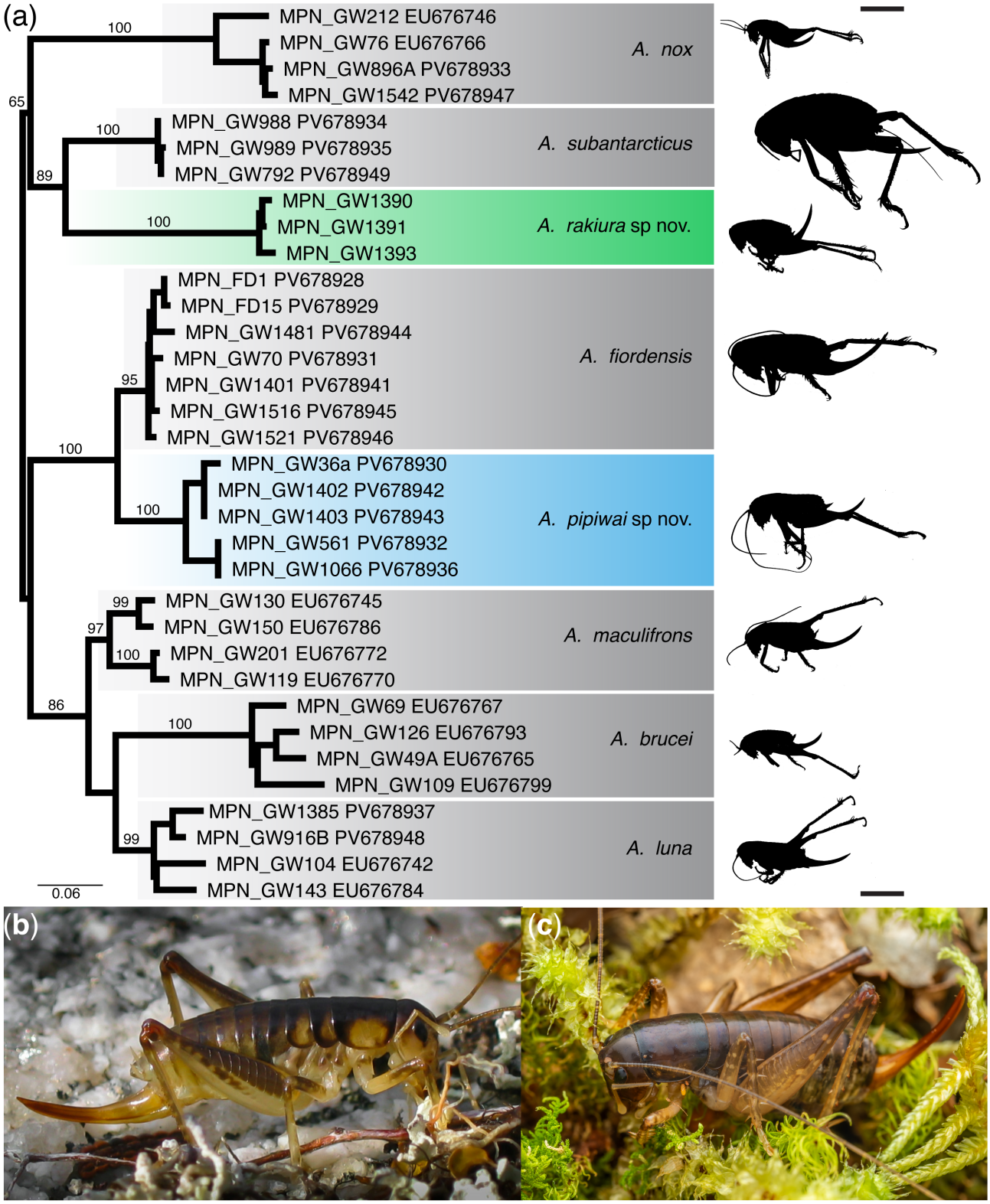

FIGURE 1. (a) Maximum Likelihood phylogeny of mtDNA COI sequence alignment (722bp) with optimal rate model GTR+F+I+G4 for representatives of the New Zealand genus *Anderus*, showing the placement of two new species: (b) *Anderus rakiura* **sp. nov.** and (c) *A. pipiwai* **sp. nov.** Values at nodes are the result of 1000 ML bootstrap generations. GenBank accession numbers are shown in the tip labels. Silhouettes of adult females of each species show their relative size and shape and proportional size of ovipositor (scale bars = 1 cm). In habitus images of adult females courtesy of (b) Tony Jewell and (c) Danilo Hegg.

Mitochondrial DNA cytochrome oxidase subunit I (COI) sequences were generated using standard methods (Trewick & Morgan-Richards 2005) with PCR primers C1-J-2195 and L2-N-3014 (Simon *et al.* 1994) from DNA extracted from muscle tissue. Suitable homologous mitochondrial DNA sequences were obtained from GenBank (NCBI) for comparison. Nucleotide sequences were aligned using the Geneious alignment tool in Geneious Prime 2020.2.2 (https://www.geneious.com; Kearse *et al.* 2012). Phylogenetic analysis used the Neighbor-Joining algorithm of Geneious and Maximum Likelihood implemented in IQtree2 through IQ-Tree tools (Trifinopoulos *et al.* 2016; Minh *et al.* 2020) using model selection (Kalyaanamoorthy *et al.* 2017) and ultrafast bootstrapping of 1000 (Hoang *et al.* 2018). Novel DNA sequences were deposited in GenBank (Table 1).

Sample locations were mapped in R using the Maps (Becker *et al.* 2022a) and Mapdata (Becker *et al.* 2022b) packages calling the 'nzHires' map with projection="sp_mercator" to align with the NZ entomological areas map outline https://lris.scinfo.org.nz/layer/48165-nz-area-codes-for-recording-specimen-localities/.

Type material is in the Museum of New Zealand Te Papa Tongarewa (NMNZ).

Results

Morphological examination and comparison of short DNA sequences representing partial mtDNA COI revealed clusters of variation consistent with two new species within the ground wētā genus *Anderus*. Genetic divergence among clusters was larger than observed within genetic clusters (Table 2) and concordant with morphological traits such as distinctive arrangement of spines on fore and mid tibia, and male genitalia.

Both new *Anderus* species are more delicate than *A. subantarcticus*, similar to members of the *A. maculifrons* complex in overall proportions (Figure 1). *Anderus rakiura* **sp. nov.** was collected only on Rakiura-Stewart Island and is sister to *A. subantarcticus* found about 100 km southwest on the Snares islands (3.4 km^2) (Figure 1, 3). Though sister lineages they have sequence divergence of about 17.5% at mtdDNA COI. *Anderus pipiwai* **sp. nov.** is phylogenetically sister to *A. fiordensis* (Figure 1), with mtDNA sequence divergence between these two species of about 9.4% (Table 2).

TABLE 2. Mean pairwise HKY (Hasegawa *et al.* 1985) genetic distances among mtDNA COI sequences for eight species of *Anderus* ground wētā.

Species	Intraspecific	Comparison	Intraspecific
luna	0.060	*maculifrons*	0.120
maculifrons	0.052	*luna*	0.120
brucei	0.072	*maculifrons*	0.160
subantarcticus	0.003	*maculifrons*	0.147
rakiura **sp. nov.**	0.014	*subantarcticus*	0.175
nox	0.045	*fiordensis*	0.181
pipiwai **sp. nov.**	0.026	*fiordensis*	0.094
fiordensis	0.016	*pipiwai* **sp. nov.**	0.094

Class: Insecta

Order: Orthoptera

Suborder: Ensifera

Superfamily: Stenopelmatoidea Burmeister, 1838

Family: Anostostomatidae Saussure, 1859

Genus: *Anderus* Trewick, 2024

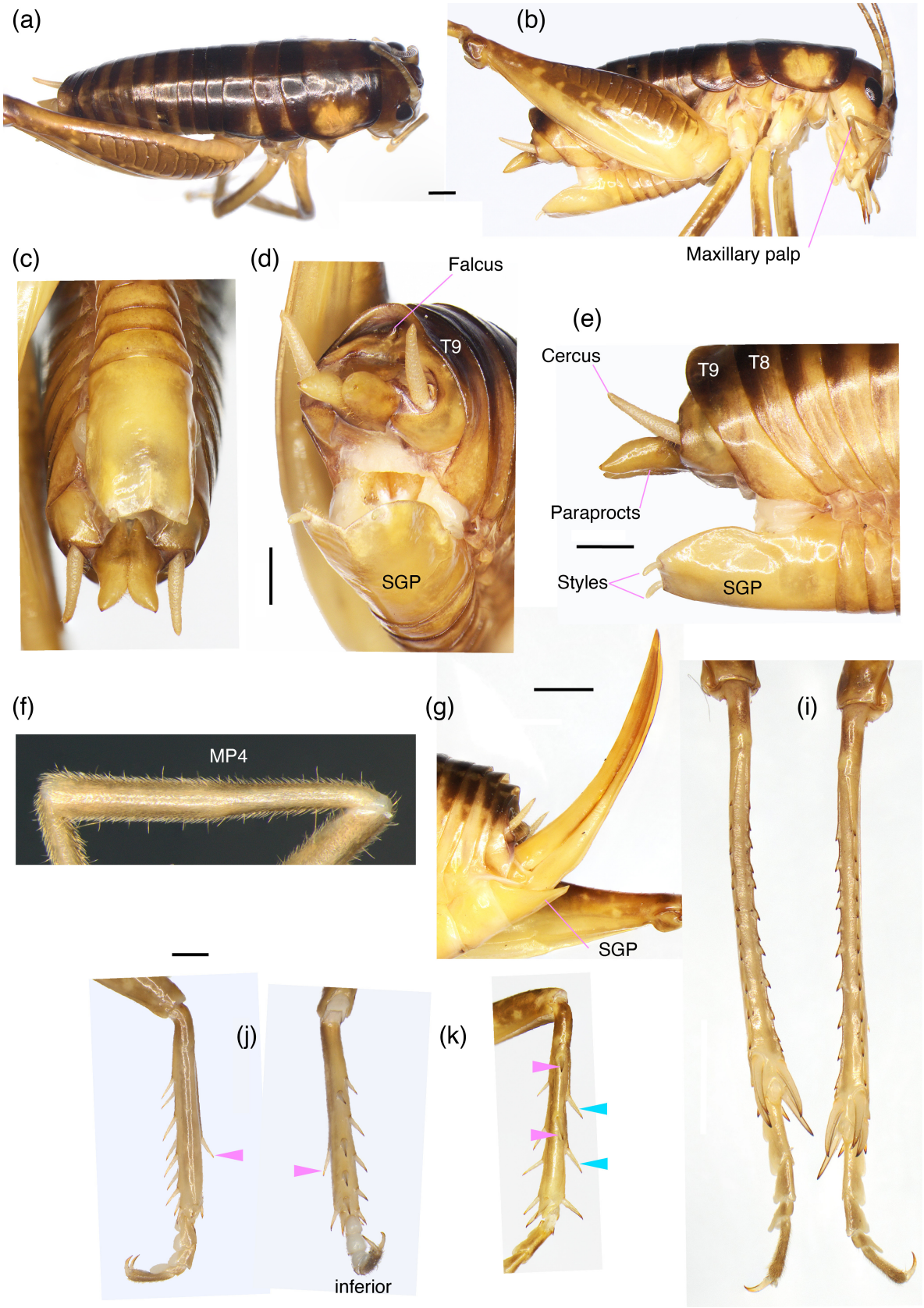

FIGURE 2. External morphology of adult *Anderus rakiura* **sp. nov.** Male whole body (a) dorsal view, (b) lateral view. Male terminalia (c) ventral, (d) posterior and (e) lateral views including subgenital plate (SGP) and abdominal tergites T8, T9. Adult female (f) detail of maxillary palp showing continuous pilosity along MP4, (g) ovipositor lateral view. Tibiae, (i) dorsal view of hind tibiae, (j) fore tibia in retrolateral and inferior views, and (k) mid tibia showing superior prolateral (pink arrows) and retrolateral spines (blue arrows). Scale bars 1 mm.

***Anderus rakiura* sp. nov.**

Type material: Holotype. Male, Mount Allen, Tin Range, Rakiura, New Zealand, latitude -47.08575, longitude 167.79894, 11.I.2018, D. Hegg. https://inaturalist.nz/observations/9593056. MPN_GW1393, MNZ_AI.083173. Paratype. Female, Islet Cover, Port Pegasus, Rakiura, latitude -47.19996, longitude 167.63831, 17.I.2018, D. Hegg. MPN_GW1389. MNZ_AI.083174.

Etymology: The Māori name for Stewart Island where this species is endemic.

Description: A small, slim, ground wētā recorded only on Rakiura-Stewart Island (Figure 2). Head, thorax and abdomen predominantly dark brown above but with a prominent large cream patch on either side of the pronotum (Figure 2). Small lateral pale patches also on mesonotum, metanotum and tergites. Hind femora dark above, pale below. Hind tibiae predominantly cream, slightly darker on dorsal surface. Femora without spines. Fore and mid tibiae have four apical spines each (Figure 2). Foretibiae with 1 prolateral superior linear spine, 4 prolateral and 4 retrolateral inferior linear spines. Midtibiae with 2 prolateral and 2 retrolateral superior linear spines, 4 prolateral and 4 retrolateral inferior spines. Two rows of about 10 small, pale, fixed spines along distal three quarters of superior surface. Male—with simple, oblong subgenital plate bearing small, cylindrical styles on each rounded corner. Paraprocts are short, stout and tapering abruptly, directly rearwards. Cerci pale, slender, similar in length to paraprocts. Female—ovipositor long but less than length of hind femur, pale and stout at base but tapering rapidly, gently curved upwards, and grading to orange-brown at tip, with no serrations. Subgenital plate pale, simple triangle (Figure 2).

Dimensions: Holotype: HD 5.6, BL14.2, HFL 10.7, HFW 3.3, HTL 8.8, PL 2.9, PW 3.7. Paratype: HD 6.6, BL 14.6, HFL 12.4, HFW 4.1, HTL 11, PL 4.3, PW 5.0, OL 10.2.

Distribution: SI. Rakiura—Stewart Island including Big Moggy and Big South Cape islands (Figure 3). CMNZ_2005.56.804–831. MPN_GW075, MPN_GW933, MPN_GW1389–1394. Also, https://inaturalist.nz/observations/262247477, 262247478, 255127879, 255127146.

Comments: The same entity referred to as *Anderus* 'Rakiura' (Trewick *et al.* 2024) and probably the entity referred to as *Hemiandrus* "saxatilis" (Johns 2001). Phylogenetically sister to *A. subantarcticus* on Snares Island.

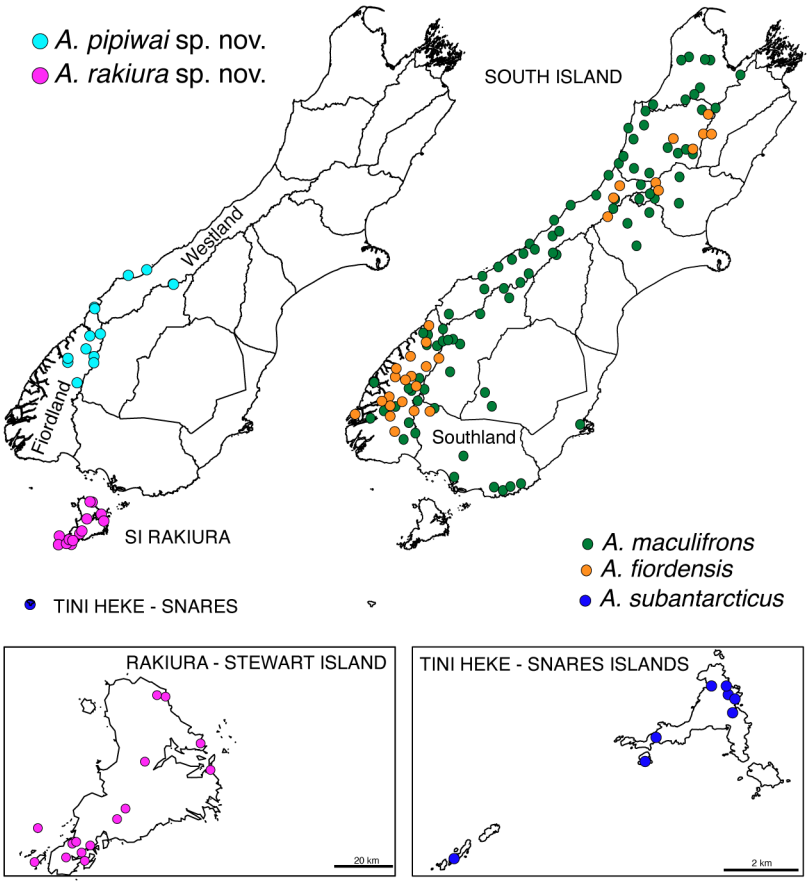

FIGURE 3. Distribution of five southern *Anderus* ground wētā species in South Island, Tini Heke-Snares Islands and Rakiura-Stewart Island, New Zealand. Localities based on records in MPN, CMNZ and iNaturalist collections.

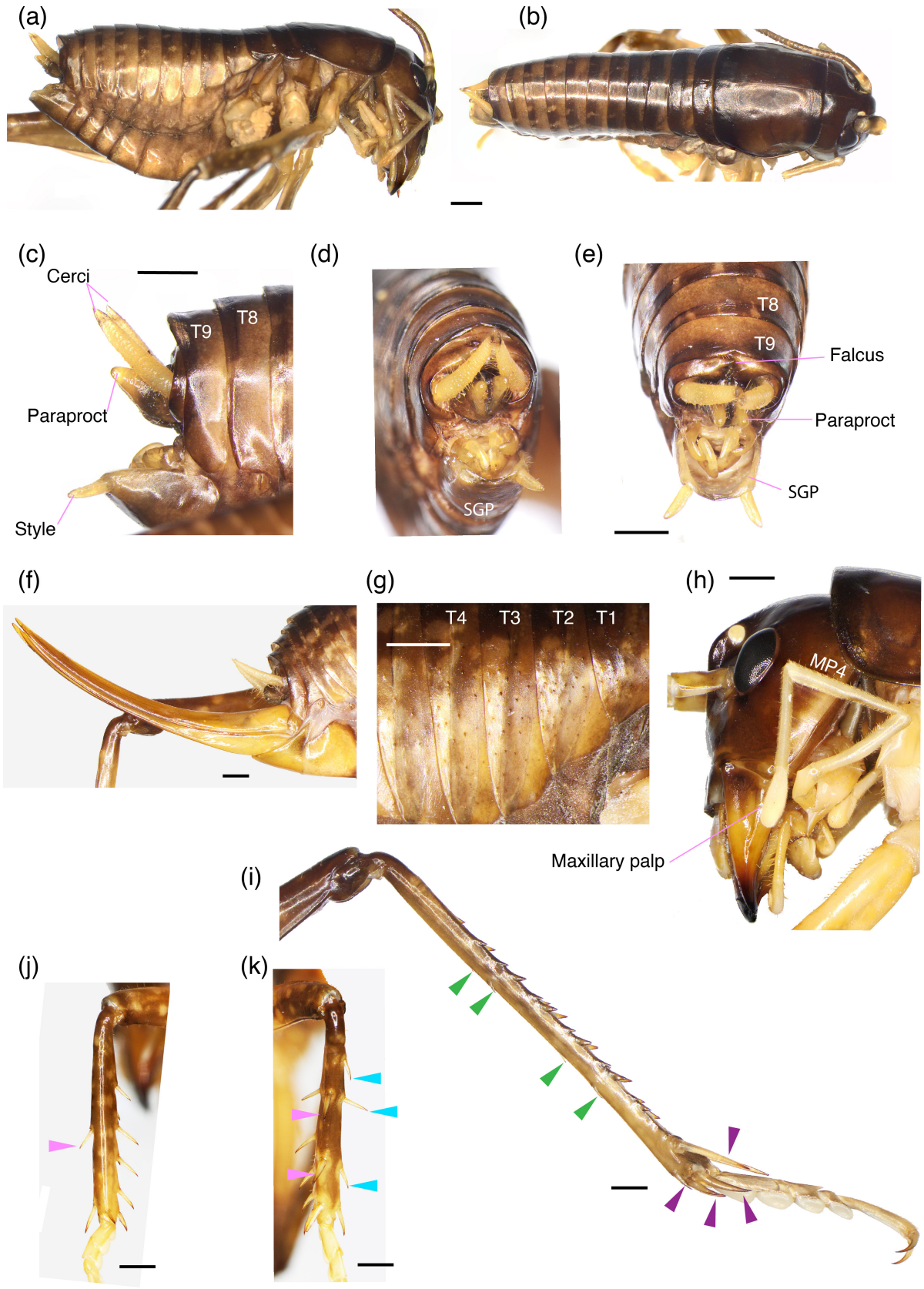

FIGURE 4. External morphology of adult *Anderus pipiwai* **sp. nov.** Male (a) lateral and (b) dorsal view. Male terminalia (c) lateral (d) posterior and (e) dorsal views. Female lateral view of (f) ovipositor, (g) flank showing sparse stridulatory pegs, and (h) head showing maxillary palps. Legs, (i) prolateral view of hind tibia and tarsus showing inferior spines (green arrows) and apical spines (mauve arrows), (j) fore tibia and (k) mid tibia showing superior prolateral (pink arrows) and retrolateral spines (blue arrows). Scale bars 1 mm.

***Anderus pipiwai* sp. nov.**

Type material: Holotype. Male, Brewster Hut Track, Haast Pass, New Zealand, latitude -44.08194, longitude 169.39138, 24.II.2017, D. Hegg, MPN_GW1403, MNZ_AI.083175 Paratype. Female, Brewster Hut Track, Haast Pass, New Zealand, latitude -44.08194, longitude 169.39138, 24.II.2017, D. Hegg, MPN_GW1402, MNZ_AI.083176.

Etymology: Māori word pīpīwai meaning damp or humid in reference to the very moist environment in the forested valleys of the West Coast region.

Description: A small dark wētā (Figure 4). Head, thorax and abdomen predominantly dark brown, nearly black at dorsal limits, lacking pale patches on thoracic and abdominal segments. Legs dark brown on dorsal surfaces grading laterally to yellow-brown. Abdominal sternites brown including male subgenital plate, but female subgenital plate yellow. Cerci and styles (of male) yellow-brown. Numerous discrete, pale spots on dark areas of legs and posterior-lateral of abdomen. Stridulatory pegs on flanks of abdominal tergites T1, T2 and T3 small and sparse. Femora unarmed. Fore and mid tibiae have four apical spines. Foretibiae with 1 prolateral superior linear spine, 4 prolateral and 4 retrolateral inferior linear spines. Midtibiae with 2 prolateral and 3 retrolateral superior linear spines, 4 prolateral and 4 retrolateral inferior spines. Hind tibiae with 2 pale prolateral and retrolateral spines on inferior surface. Two rows of about 10 small or very small, fixed spines along distal three quarters of superior surface. Male—subgenital plate in ventral view oblong, blunt, slightly longer than wide. Stout pale styles with few hairs. Cerci pale, longer than paraprocts, cylindrical, with long fine hairs. Paraprocts stout, triangular and blunt. Abdominal tergite T9 simple with shallow, medial indent and only slightly raised at medial posterior margin. Subgenital plate simple, square, straight posterior margin curved slightly downwards at posterior margin, and ventral surface Falci hidden by tergite 9. Female—ovipositor wide base, pale yellow-brown at base tapering and becoming darker rapidly to the tip, curved upwards. Cerci and subgenital plate pale, similar colour to base of ovipositor. Subgenital plate simple triangle.

Dimensions: Holotype: HD 7.2, BL 18.5, HFL 12.4, HFW 3.4, HTL 12.0, PL 4.9, PW 5.0. Paratype: HD 7.3, BL 17.8, HFL 13.4, HFW 3.7, HTL 13.2, PL 4.7, PW 5.1, OL 9.6. Average male (n=2) HD 7.2, BL 17.4, HFL 12.3, HFW 3.35, HTL 11.65, PL 4.875, PW 5.3. Average female (n=4) HD 7.8, BL 18.0, HFL 15.75, HFW 3.85, HTL 13.45, PL 5.375, PW 5.5, OL 11.575.

Distribution: FD, WD. Northern Fiordland and southern Westland including Taumaka Island. MPN_GW36A, MPNGW561–563, MPN_GW1066, MPN_GW1402–1407, MPN_GW1622–1624, CMNZ_ 2005.56.717–730 (Figure 4).

Comments: This taxon is probably the entity informally referred to as *Hemiandrus* "madisylvestris" (Johns 2001). This species is an important food item for stoats in high elevation Fiordland forest (Smith *et al.* 2005).

Discussion

The terminalia of adult males of each *Anderus* species are distinct (Figure 5). For example, the middle of the posterior margin of T9 is strongly raised in adult male *A. rakiura* **sp. nov.** but only slightly in *A. pipiwai* **sp. nov.** Paraprocts of *A. rakiura* **sp. nov.**, are stout, cylindrical and the same length as cerci but in *A. pipiwai* **sp. nov.** the cerci are much longer than paraprocts; *A. subantarcticus* has cerci the same length as paraprocts, the posterior portion of which is narrow and with a sclerotized tip (Figure 5). Falci of *A. subantarcticus* form much more prominent large hooks than either of the new *Anderus* species. The subgenital plate of *Anderus pipiwai* **sp. nov.** is more pigmented than *A. rakiura* **sp. nov.**, which is proportionally longer and has a strong medial crease near the posterior margin (Figure 5).

These two new species of *Anderus* bring the total in this genus to eight. Both are relatively small brown wētā but are adults readily identified in the hand. On Rakiura-Stewart Island two ground wētā species are present, but only one *Anderus.* Identification of *A. rakiura* **sp. nov.** is, therefore, simple even for nymphs as shown for ground wētā in Nelson Lakes region (Chikwature *et al.* 2025). *Hemiandrus focalis*, which had previously been considered absent from Rakiura (Johns 2001) was reported via iNaturalist in January 2025 (https://inaturalist.nz/observations/260132904). The geographically closest congener of *A. rakiura* **sp. nov.** is across Foveaux Strait in Southland where *A. maculifrons* is present at its eastern range limit (Figure 3). The phylogenetic sister of *A. rakiura*

sp. nov. is *A. subantarcticus* that is endemic to tiny islands of Tini Heke—The Snares, about 100km southwest. *Anderus pipiwai* **sp. nov.** is most closely related to *A. fiordensis* with which it is sympatric in the Fiordland area (Smith *et al.* 2005), but it is more similar in size to another sympatric species—*A. maculifrons* (Jewell 2007) (Figure 3).

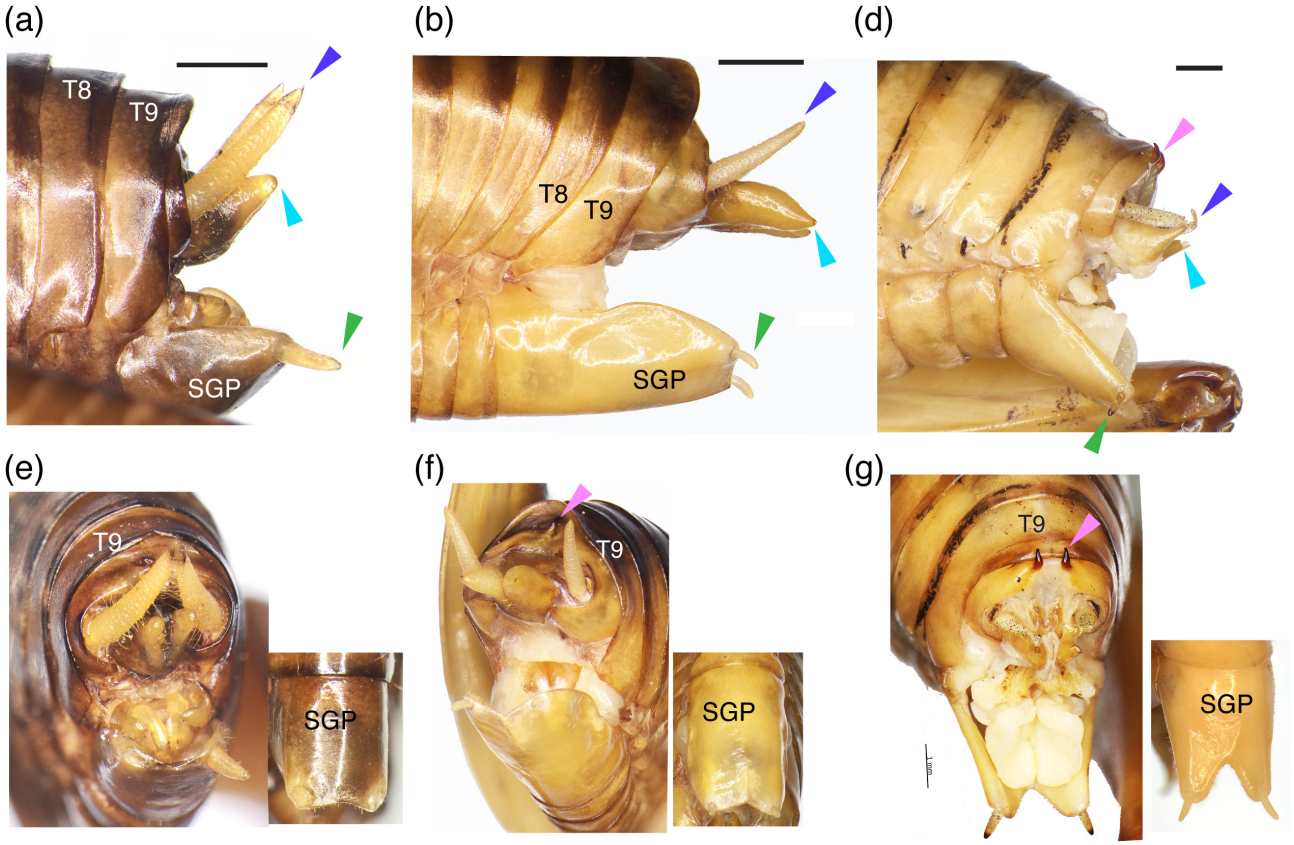

FIGURE 5. Comparison of male terminalia of three species of southern *Anderus*. Lateral (top), posterior and ventral (bottom). (a, e) *Anderus pipiwai* **sp. nov.**, (b, f) *A. rakiura* **sp. nov.**, and (d, g) *A. subantarcticus*. Cerci (dark blue arrows), paraprocts (pale blue arrows), styles (green) and falci (pink). Tergites T8 and T9 and subgenital plate SGP indicated. Scale bar = 1mm.

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