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Two new genera of tokoriro (Orthoptera: Rhaphidophoridae: Macropathinae) from Aotearoa New Zealand

STEVEN A. TREWICK
Wildlife & Ecology, Massey University, Private Bag 11-222, Palmerston North, New Zealand.
s.trewick@massey.ac.nz; https://orcid/org/0000-0002-4680-8457

Abstract

Two new genera and three new species of forest inhabiting Macropathinae (Orthoptera: Rhaphidophoridae) are described from Aotearoa New Zealand. *Crux* Trewick **gen. nov.** is described with two new species, *Crux boudica* **sp. nov.** from Rakiura Stewart Island and southwest South Island and *Crux heggi* sp. nov. from northwest South Island. The monotypic genus *Occultastella* Trewick **gen. nov.** is represented by *Occultastella morgani* **sp. nov.** from northwest South Island.

Key words: Cave wētā, Camel cricket, Biodiversity, West Coast, Rakiura, Wet forest

Abstract Mâori

E rua nga puninga hou me nga momo hou e toru o nga Macropathinae noho ngahere (Orthoptera: Rhaphidophoridae) e whakaahuatia ana mai i Aotearoa. *Crux* Trewick **gen. nov.** e whakaahuatia ana me nga momo hou e rua, ko *Crux boudica* sp. nov. mai i Rakiura me te hauauru o Te Waipounamu me *Crux heggi* sp. nov. mai i te hauauru o Te Waipounamu. Ko te puninga monotypic *Occultastella* Trewick **gen. nov.** Ko *Occultastella morgani* **sp nov.** mai i te hauauru o Te Waipounamu.

Introduction

Despite being Aotearoa New Zealand's most recognised endemic insects, the taxonomy of the flightless orthopteroids broadly known as wētā in the families Anostostomatidae and Rhapidophoridae is incomplete. The Rhaphidophoridae, or Camel Crickets, of New Zealand are commonly referred to as or Cave Wētā although few species are associated with caves. The indigenous name, tokoriro, provides a useful distinction from the true wētā (Anostostomatidae) a term that now has some currency outside New Zealand (Johns 1997). The endemic rhaphidophorid fauna is speciose and ecologically diverse with many species frequenting the alpine zone and forest where they live among leaf litter and in vegetation. Despite contributions to the fauna by Brunner (1888), Walker (1869), Karny (1929), Chopard (1923), Hutton (1897) and Richards' numerous papers of the 1950's and 60's (e.g. Richards 1954, 1965), many species remain to be described and genus level taxonomy is undergoing revision (Trewick 1999; Cook *et al.* 2010; Johns & Cook 2014; Fitness *et al*. 2018; Hegg *et al*. 2019; Hegg *et al.* 2022). Although recent detailed genetic and morphological analysis has shown that some genus names are redundant and have been synonymised (e.g. *Weta* Chopard into *Pleioplectron* Hutton: Hegg *et al.* 2019), others that were previously synonymised have needed to be resurrected (e.g. *Miotopus* Hutton: Fitness *et al.* 2018).

Although most new species are not recognised as such in the field when first encountered (Fontaine *et al*. 2012), that was not the case for the taxa here. In both instances the first individuals seen in the field were of unexpected appearance and immediately recognised as novel. In one case this came about during a deliberate and intensive survey event (Forest & Bird Denniston Bioblitz 2012: Platt 2012) intended to document as many species in an area as possible; a salient reminder that species discovery is mostly limited by taxonomist time and not lack of taxa remaining to be encountered (Edie *et al.* 2017).

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Time calibrated phylogenetic analysis (Figure 1) of DNA sequences representing entire mitochondrial genomes and several nuclear loci confirm that the distinctive taxa reported here represent separate deep evolutionary lineages within the Rhaphidophoridae of Aotearoa New Zealand (New genus-1 and New genus-2 in Dowle *et al.* 2024).

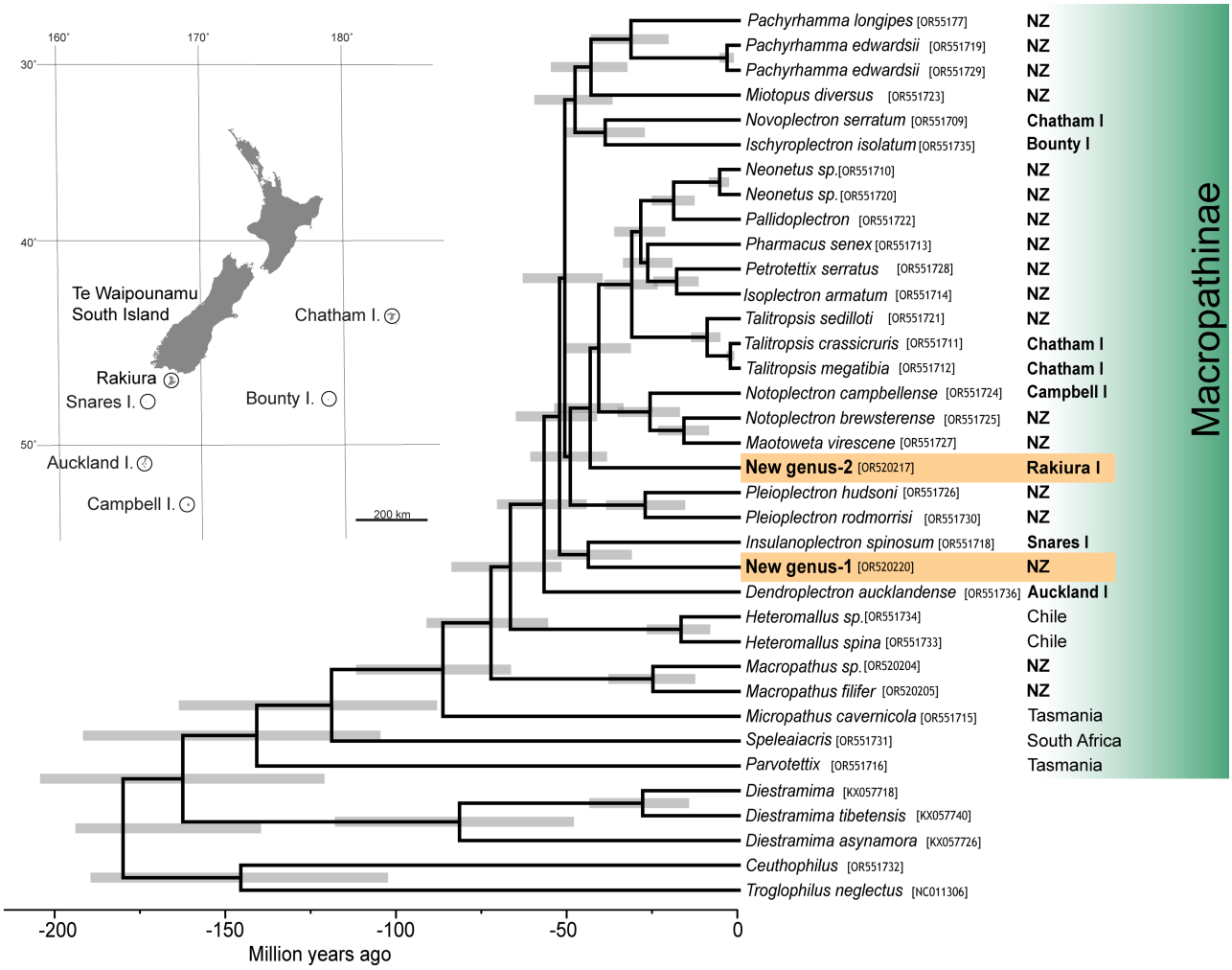

FIGURE 1. Time calibrated phylogeny of Aotearoa New Zealand Macropathinae with complete mitochondrial genome sequences (Dowle *et al.* 2024) including representatives of all recognised genera and two novel lineages. [Genbank accession numbers]. Inset shows position of New Zealand main and offshore islands.

Methods

Specimens were collected by hand and preserved in ethanol in the Phoenix insect collection at Massey University, Palmerston North (MPN). Specimens were examined and anatomical features photographed and measured using an Olympus SZX7 Zoom Stereomicroscope with an attached SC100 digital camera and Cellsens software. Additional measurements were obtained using digital callipers accurate to 0.01mm. Anatomical features were examined as previously described (Taylor-Smith *et al*. 2013; Fitness *et al.* 2018). Comparison of the shape and size of adult specimens, their colour patterns and combinations of apical spines of leg elements, and secondary sexual characteristics, in combination with analysis of mitochondrial DNA sequences (Dowle *et al.* 2024) provided evidence of the distinct taxonomic status of these tokoriro.

Mitochondrial DNA cytochrome oxidase subunit I 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. Homologous segments of published complete mitochondrial DNA sequences (Dowle *et al.* 2024) were obtained from Genbank for comparison (See Figure 1). DNA sequence checks, data alignment and analysis used DNADynamo (Blue Tractor Software Ltd) with Maximum Likelihood analysis in iQ-Tree2 through

IQ-Tree tools (Trifinopoulos *et al.* 2016; Minh *et al.* 2020) using model selection (Kalyaanamoorthy *et al.* 2017) and ultrafast bootstrapping (Hoang *et al.* 2018). Partition models (Chernomor *et al.* 2016) were applied and optimised in ML analyses, initially considering genes and codon position using ModelFinder (Lanfear *et al.* 2012) and the merge function.

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

Results

Comparison of short DNA sequences representing partial mtDNA COI indicate three novel clusters of variation consistent with three new species within two genera (Figure 2). Genetic variation within these clusters is low with an average K2P among specimens of *Occultastella morgana* sp. nov. sampled across the known geographic range of 0.4%. Similarly, the average distance within the *C. heggi* sp. nov. (1.4%) and *C. boudica* sp. nov. (0.7%) are typical of intraspecific distances at this locus in insects. The highest genetic distance (1.35%) among *C. boudica* sp. nov. was between individuals from the two most distance locations (Rakiura and Skippers Range). Across *Crux* **gen. nov.** as a whole the K2P distances (mean 10.2%) are consistent with two well differentiated species.

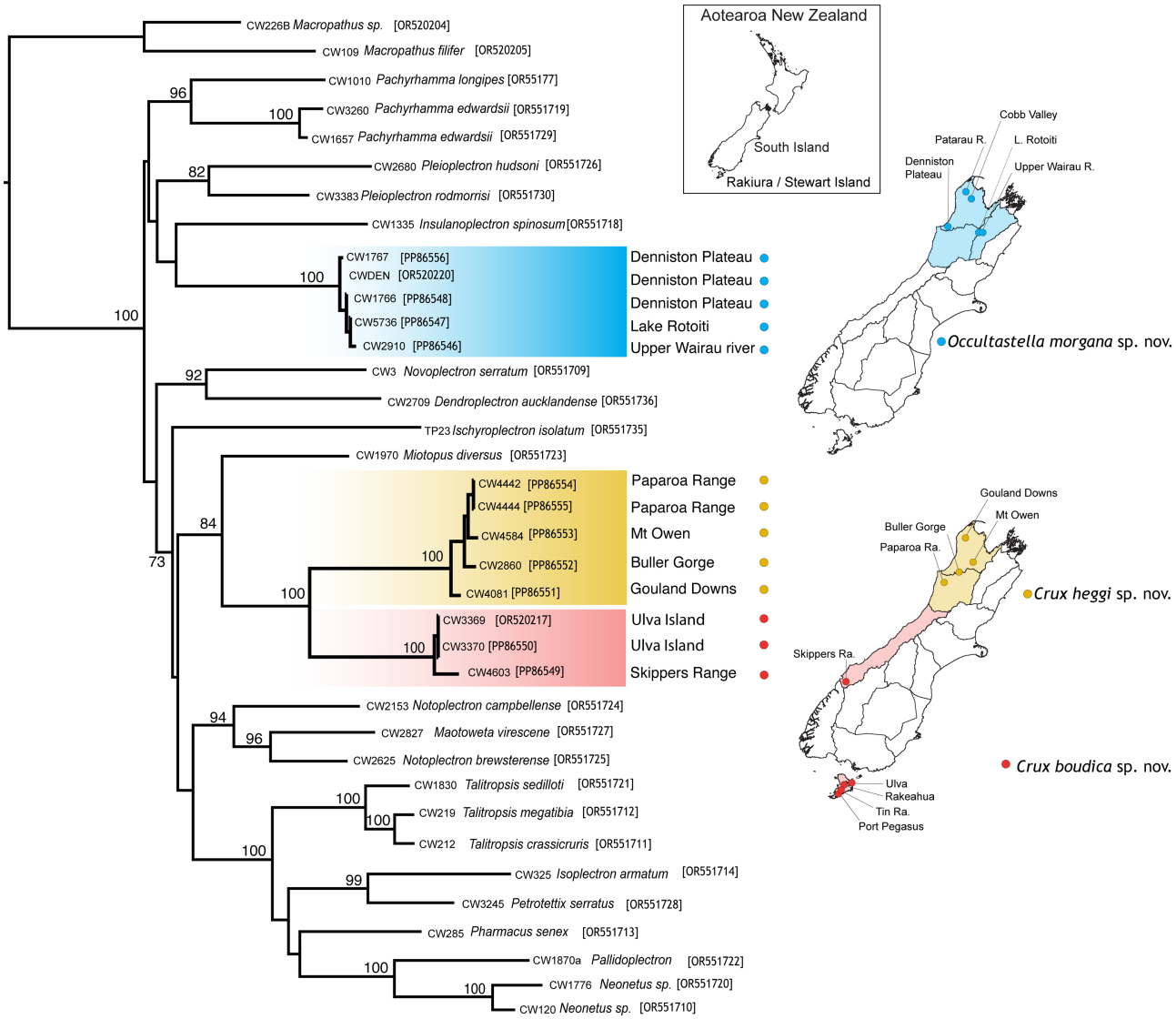

FIGURE 2. Maximum Likelihood analysis of mtDNA COI sequences of New Zealand Rhaphidophoridae with representatives of known genera (Dowle *et al.* 2024) and data from individuals of two new genera. Node support values >70% are from 1000 ML bootstrap replicates. South Island map includes entomological region boundaries (Crosby *et al.* 1998).

FIGURE 3. New species of Macropathinae from New Zealand. a) *Crux boudica* sp. nov., male, Rakiura (D. Hegg). b) *Crux boudica* sp. nov., female, Skippers Range (D. Hegg). c) *Crux heggi* sp. nov., male, Paparoa Range (D. Hegg). d) *Crux heggi* sp. nov., female, Saxon River (D. Hegg). e) *Occultastella morgana* sp. nov., male, Buller River (T. Jewell). f) *Occultastella morgana* sp. nov., female, Cobb Valley (A. McDonald).

Taxonomy

Order ORTHOPTERA Burmeister, 1839

Suborder Ensifera Chopard, 1920

Family Rhaphidophoridae Walker, 1869
Subfamily Macropathinae Karny, 1930

Crux Trewick gen. nov.

Diagnosis. A medium sized, medium to dark brown tokoriro with stout body and relatively short, stout legs. In general proportions most reminiscent among New Zealand Rhaphidophoridae, of *Talitrsopis sedilloti* Bolivar, 1882. Fore femora lack apical spines, mid femora bear a single articulated retrolateral apical spine, and hind femora have at least one small, stout fixed spine towards the distal end of prolateral inferior carina and one or more slightly larger similar spines on the retrolateral inferior carina. Fore and mid tibiae each with four articulated apical spines, one articulated retrolateral, inferior, linear spine and two articulated prolateral, inferior linear spines; all narrow and sharp. Hind tibiae well-armed on posterior surface with two rows of about nine dark, stout, fixed spines (Figure 3, 4).

Etymology. A genus first detected in the deep south, named for the well-recognised constellation of the southern sky, the Southern Cross or Crux. Rakiura-Stewart Island, the type location is the southern-most of the main islands of Aoteatora New Zealand.

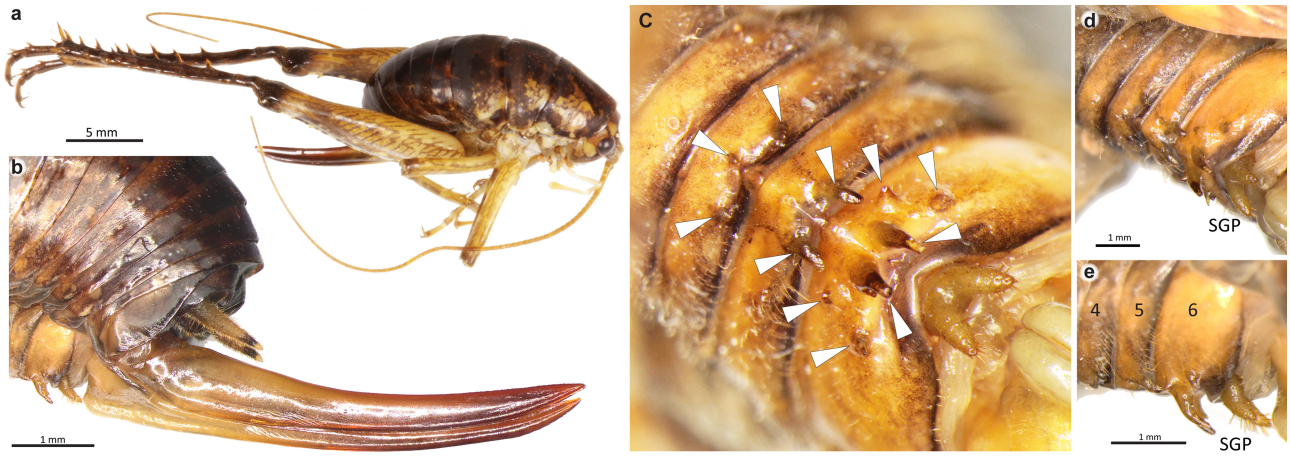

FIGURE 4. *Crux boudica* sp. nov. Female holotype. a) Whole animal. b) Ovipositor detail showing sternite projections. c) Abdomen ventral view, white arrows indicate sternite projections. d, e) Sternites and subgenital plate (SGP).

Type Species: *Crux boudica* Trewick sp. nov.

(Figures 3–6)

Material. Holotype ♀. Ulva Island, Rakiura-Stewart Island, S.A. Trewick 23, April 2012, MPN CW3370, NMNZ AI.062526; Paratype: ♂. Same data as holotype. MPN CW3369, NMNZ AI.062527. Found together in decaying log. Other material (Table 1).

Description.

Dimensions: Adult female total length (from anterior of head to posterior tip of ovipositor) about 25.9 mm; antennae 3–3.5 body length; length (anterior of head to posterior of abdomen) 16.15 mm; pronotum length 4.65 mm; ovipositor 12.6 mm; fore femur length 8.67 mm; mid femur length 7.68 mm; hind femur length 13.6 mm and depth 4.07 mm; fore tibia 7.76 mm; mid tibia 7.27 mm; hind tibia length 14.7 mm (Figure 4).

Legs: Femora, fore tibiae and mid tibiae paler than dorsal abdomen, but with some darker markings. Legs are robust and glabrous except for inferior surfaces, which are clothed in fine gold-brown hairs. Hind tibiae and femora similar in length, approximately equal to the body length. Fore femora with no apical spines. Mid femora with one retrolateral apical spine. Hind femora short, stout, with stout, fixed, spines towards the posterior end of the prominent inferior carinae; 1 retrolateral and 1 (sometimes 2) prolateral. Fore tibiae with three inferior linear spines, 2 prolateral and 1retrolateral. Fore tibiae with 2 superior apical spines (1 prolateral and 1 retrolateral), and 2 inferior apical spines spines (1 prolateral and 1 retrolateral). Mid tibiae with same spine combination as fore tibiae. Hind tibiae naked above, fine gold hairs beneath and with two rows of prominent, stout, sharp, fixed spines; ~7 along superior prolateral margin and ~8 along superior retrolateral margin. Hind tibiae with a pair of small articulated, inferior apical spines, a pair of articulated, lateral apical spines, and a pair of longer, articulated superior apical

spines. Hind tarsi with 1st and 4th segments longer than the 2nd and 3rd; unarmed except 1st and 2nd segments each bear a pair of backward leaning, stout, fixed spines near distal end of superior surface (Figure 5).

FIGURE 5. *Crux boudica* sp. nov. Female holotype. Prolateral and retrolateral views of (a) fore and mid (b) legs with inset of mid femur showing apical retrolateral spine. c) Hind femur. d) Hind tibia lateral and superior views. e) Hind tarsi, retrolateral view. Pink arrows indicate linear spines.

Female. Posterior sternites armed with backward pointing projections either side of midline (Figure 4). Sternites with some hairs. Sternite IV has at least one pair of triangular, light-coloured projections. Sternite V has a pair of longer pale projections extending beyond the posterior margin of the sternite. Sternite VI has several pairs of projections on the ventral surface and posterior margin, that are dominated by a pair of long, stout, curved, dark-tipped structures that extend beyond the posterior margin of the sternite. This sternite (VI) has a broad medial notch from under which a pale orange-brown tumescent subgenital plate emerges. The bifid subgenital plate bears numerous pale, outward pointing setae (cactus-like). The internal span of this structure is similar in width to the adjacent ovipositor keel. Ovipositor long and straight, curving only slightly upwards towards the posterior end. Very pale cream at base especially on underside, rich amber brown in posterior half. Valves are smooth, although ventral valves slightly undulating near the tip. Cerci stout, with fine amber hairs, and a dark ring below a cream tip.

Colouration: Mid to dark brown with cream patches on pro-, meso- and metanotum, sometimes with a hint of pale posterior-pointing V across tergites (Figure 3, 4).

Male: Similar to female in colour and leg spine combinations. Length 18.4mm; fore femur length 8.16 mm; mid femur length 7.52 mm; hind femur length 13.69mm; fore tibia 7.84 mm; mid tibia length 7.2 mm; hind tibia length 14.45 mm. Subgenital plate short, broad, simple with concave posterior margin. Tergite IX with hairy, depressed central lobe terminating in two sharp, downward-pointing teeth. Styli narrow, cylindrical with pale tip, numerous hairs, projecting away from body and curving gently downwards. Cerci stout and tapering towards tip, diffuse darker band prior to pale tip, abundant long and short golden hairs. Paraproct extends beyond subgenital plate but similar length to styli. Paraprocts are two cupped lateral valves forming a cone that is pale beneath, and with pale orange lateral surfaces and bearing a prominent tuft of stout ginger hairs at the tip (Figure 6).

Distribution: Rakiura, Stewart Island, New Zealand. Skippers Range, Fiordland. Entomological Regions Westland WD, Stewart Island SI.

TABLE 1.

MPNcode	Location	Date	Name	Sex	iNaturalist NZ	Latitude	Longitude	Collector	NMNZcode	Genbank
CW3369	Ulva Island, Rakiura	23/04/2017	*Crux boudica* sp. nov.	M		-46.927993	168.115868	S.A. Trewick	AI.062527	
CW3370	Ulva Island, Rakiura	23/04/2017	*Crux boudica* sp. nov.	F		-46.927993	168.115868	S.A. Trewick	AI.062526	PP86550
CW3635	Port Pegasus, Rakiura	16/01/2018	*Crux boudica* sp. nov.	F	iNat 9591542	-47.217828	167.596669	D. Hegg		
CW3636	Rakeahua Hut, Rakiura	09/01/2018	*Crux boudica* sp. nov.	F	iNat 9591691	-46.9822477	167.881042	D. Hegg		
CW3637	Rakeahua Hut, Rakiura	09/01/2018	*Crux boudica* sp. nov.	M	iNat 9591691	-46.9822477	167.881042	D. Hegg		
CW3638	Rakeahua Hut, Rakiura	09/01/2018	*Crux boudica* sp. nov.	M	iNat 9591691	-46.9822477	167.881042	D. Hegg		
CW4096	Rakeahua Hut, Rakiura	05/03/2018	*Crux boudica* sp. nov.	M	iNat 10189739	-46.9822477	167.881042	D. Hegg		
CW4097	Tin Range, Rakiura	10/01/2018	*Crux boudica* sp. nov.	F	iNat 9591787	-47.138213	167.770466	D. Hegg		
CW4098	Tin Range, Rakiura	10/01/2018	*Crux boudica* sp. nov.	F	iNat 9591787	-47.138213	167.770466	D. Hegg		
CW4099	Tin Range, Rakiura	10/01/2018	*Crux boudica* sp. nov.	M	iNat 9591787	-47.138213	167.770466	D. Hegg		
CW4100	Tin Range, Rakiura	10/01/2018	*Crux boudica* sp. nov.	M	iNat 9591787	-47.138213	167.770466	D. Hegg		
CW4101	Tin Range, Rakiura	10/01/2018	*Crux boudica* sp. nov.	M	iNat 9591787	-47.138213	167.770466	D. Hegg		
CW4102	Tin Range, Rakiura	10/01/2018	*Crux boudica* sp. nov.	M	iNat 9591787	-47.138213	167.770466	D. Hegg		
CW4587	Slip Hill, Skippers Range, Fiordland	01/02/2019	*Crux boudica* sp. nov.	M	iNat 20483146	-44.376172	168.131332	D. Hegg		
CW4588	Slip Hill, Skippers Range, Fiordland	01/02/2019	*Crux boudica* sp. nov.	M	iNat 20483147	-44.376172	168.131332	D. Hegg		
CW4602	Skippers range, Fiordland	05/02/2019	*Crux boudica* sp. nov.	F	iNat 20484316	-44.417002	168.164905	D. Hegg		
CW4603	Skippers range, Fiordland	05/02/2019	*Crux boudica* sp. nov.	F	iNat 20484316	-44.417002	168.164905	D. Hegg		PP86549
CW4604	Skippers range, Fiordland	05/02/2019	*Crux boudica* sp. nov.	F	iNat 20484316	-44.417002	168.164905	D. Hegg		
CW4081	Gouland Downs, NW Nelson	04/02/2018	*Crux heggi* sp. nov.	F	iNat 9747141	-40.891525	172.354492	D. Hegg		PP86551
CW2983	Saxon Hut, Kahurangi NP	22/04/2016	*Crux heggi* sp. nov.	F	iNat 3053748	-40.884895	172.30868	D. Hegg	AI.074305	
CW4274	Branch Creek Hut, Mt Owen	11/01/2019	*Crux heggi* sp. nov.	juv	iNat 19634848	-41.524647	172.511277	D. Hegg		
CW4372	Buckland Peaks, Paparoa Range	08/12/2018	*Crux heggi* sp. nov.	M	iNat 18935772	-41.874256	171.628331	D. Hegg		
CW4373	Buckland Peaks, Paparoa Range	08/12/2018	*Crux heggi* sp. nov.	F	iNat 18935766	-41.874256	171.628331	D. Hegg		
CW4442	Ces Clarke Hut, Paparoa range	06/04/2019	*Crux heggi* sp. nov.	M	iNat 22185782	-42.290072	171.39307	D. Hegg		PP86554
CW4443	Ces Clarke Hut, Paparoa range	06/04/2019	*Crux heggi* sp. nov.	M	iNat 22185782	-42.290072	171.39307	D. Hegg	AI.074306	
CW4444	Ces Clarke Hut, Paparoa range	06/04/2019	*Crux heggi* sp. nov.	F	iNat 22185780	-42.290072	171.39307	D. Hegg		PP86555
CW4445	Ces Clarke Hut, Paparoa range	06/04/2019	*Crux heggi* sp. nov.	F	iNat 22185780	-42.290072	171.39307	D. Hegg		
CW2860	Lower Buller Gorge/ Ohikanui R.	04/01/2016	*Crux heggi* sp. nov.	M		-41.843794	171.71207	T. Jewell		PP86552
CW4582	Branch Creek Hut, Mt Owen	11/01/2019	*Crux heggi* sp. nov.	F	iNAT 19634847	-41.523393	172.511135	D. Hegg		

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TABLE 1. (Continued)

MPNcode	Location	Date	Name	Sex	iNaturalist NZ	Latitude	Longitude	Collector	NMNZcode	Genbank
CW4583	Branch Creek Hut, Mt Owen	11/01/2019	*Crux heggi* sp. nov.	F	iNAT 19634847	-41.523393	172.511135	D. Hegg		
CW4584	Branch Creek Hut, Mt Owen	11/01/2019	*Crux heggi* sp. nov.	F	iNAT 19634847	-41.523393	172.511135	D. Hegg		PP86553
CW5616	Denniston Plateau, West Coast	23/10/2022	*Occultastella morgana* sp.nov.	F	iNat 139891780	-41.763867	171.819675	D. Hegg	AI.062529	
CW2736	Kahurangi, ND, near Paturau River	26/02/2014	*Occultastella morgana* sp. nov.	M		-40.650990	172.463471	B.L.T. Smith	AI.062528	
CW2737	Kahurangi, ND, near Paturau River	26/02/2014	*Occultastella morgana* sp. nov.			-40.650990	172.463471	B.L.T. Smith		
CW1764	Denniston Plateau, West Coast	01/07/2012	*Occultastella morgana* sp. nov.	F		-41.737734	171.772356	S.A. Trewick		
CW1765	Denniston Plateau, West Coast	01/07/2012	*Occultastella morgana* sp. nov.	M		-41.737734	171.772356	S.A. Trewick		
CW1766	Denniston Plateau, West Coast	01/07/2012	*Occultastella morgana* sp. nov.	F		-41.737734	171.772356	S.A. Trewick		PP86548
CW1767	Denniston Plateau, West Coast	01/07/2012	*Occultastella morgana* sp. nov.	M		-41.737734	171.772356	S.A. Trewick		PP86556
CW2910	Upper Wairau river, Rainbow Road	15/03/2016	*Occultastella morgana* sp. nov.			-41.905482	172.916295	S.A. Trewick		PP86547
CW5736	Lake Head, Rotoiti, St Arnaud	12/05/2006	*Occultastella morgana* sp. nov.	F		-41.855896	172.835230	DOC		PP86546
CW5737	Lake Head, Rotoiti, St Arnaud	12/05/2006	*Occultastella morgana* sp. nov.	F		-41.855896	172.835230	DOC		

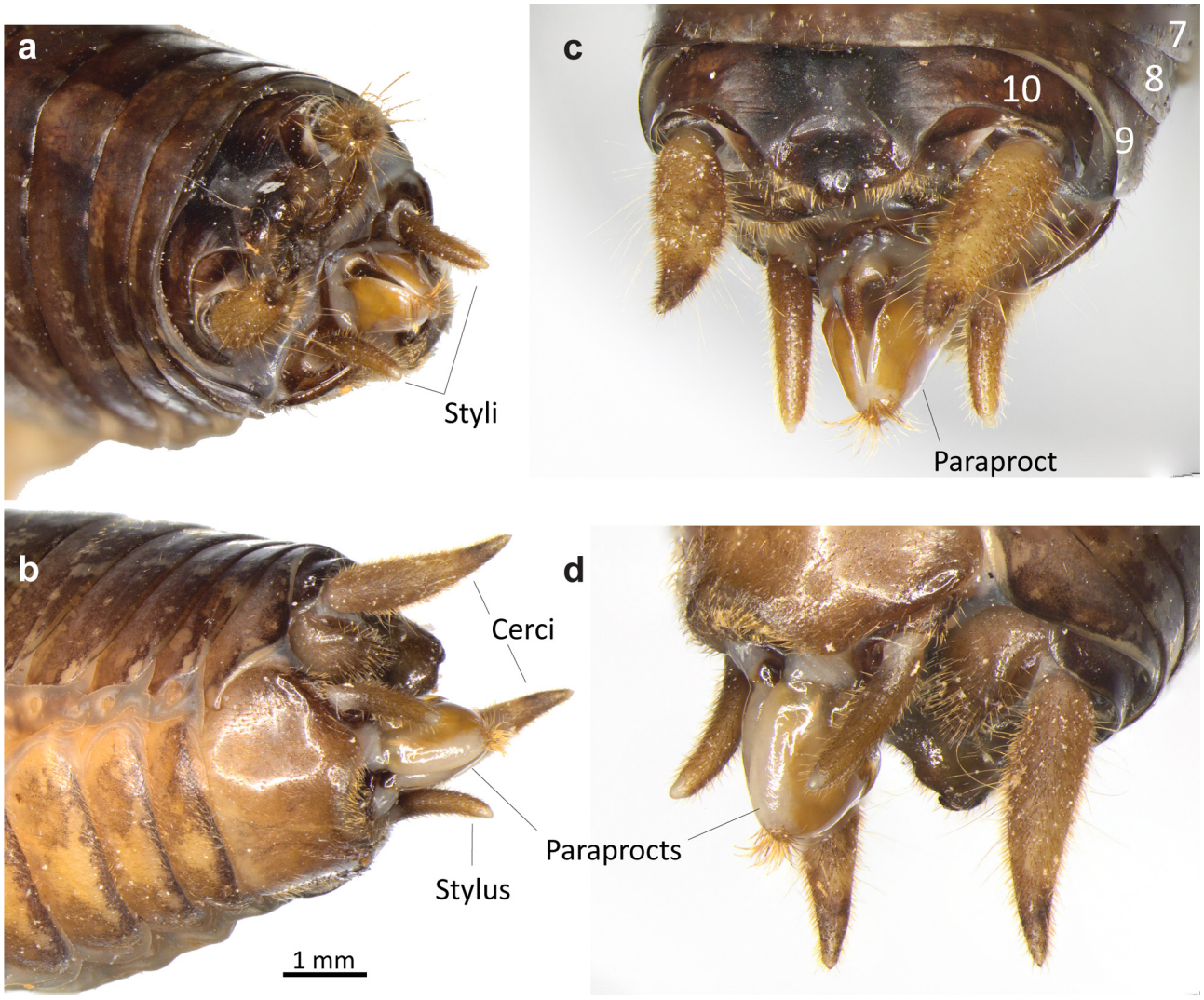

FIGURE 6. *Crux boudica* sp. nov. Male Paratype. Terminalia. a, b) Oblique dorsal and ventral views indicating cerci, styli and paraprocts. c) Posterior dorsal view indicating tergites 7–10. d) Posterior ventral view.

Etymology. After Boudica the renowned warrior queen of the Icene, who is said to have ridden a scythed chariot; in recognition of the unusual 'armaments' carried by the female.

***Crux heggi* Trewick sp. nov.**
(Figures 3, 7–9)

Material. Holotype ♀. Saxon hut, Heaphy Track, Kahurangi NP, New Zealand, D. Hegg, 22/04/2016, MPN CW2983, NMNZ AI.074305. Paratype ♂. Ces Clarke Hut, Paparoa Range, New Zealand, D. Hegg, 06/04/2019, CW4443, NMNZ AI.074306.

Description.

Dimensions: Adult female total length (from anterior of head to posterior tip of ovipositor) about 28.54 mm; antenna 3–3.5 body length; length (anterior of head to posterior of abdomen) 13.59 mm; pronotum length 4.59 mm; ovipositor 14.5 mm; fore femur length 8.14 mm; mid femur length 7.24 mm; hind femur length 15.56 mm and depth 3.82 mm; fore tibia 8.4 mm; mid tibia 7.56mm; hind tibia length 15.71 mm (Figure 3, 7).

FIGURE 7. *Crux heggi* sp. nov. Female holotype. a) Lateral view body. b–d) Detailed views of ovipositor showing position and shape of subgenital plate. Pink triangle indicates subgenital plate.

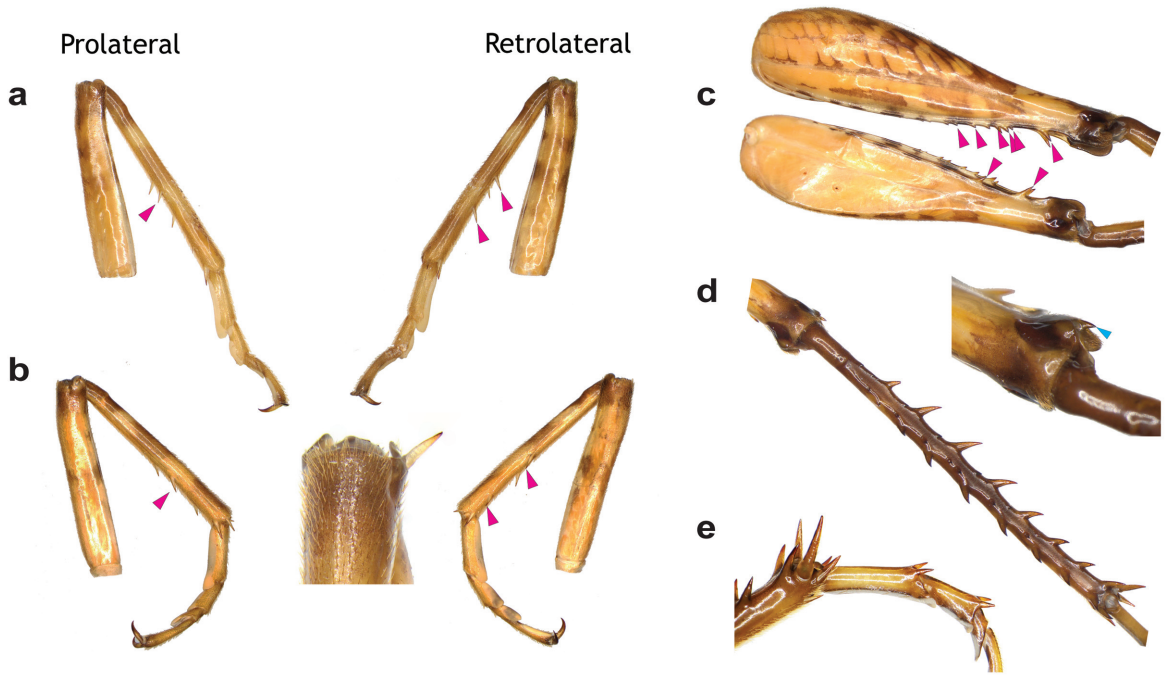

FIGURE 8. *Crux heggi* sp. nov. Female holotype. Prolateral and retrolateral views of (a) fore and mid (b) legs with inset of mid femur showing apical retrolateral spine. c) Hind femur prolateral and retrolateral views. d) Hind tibia posterior view and detail of apical spine on hind femur (blue arrow). e) Hind tarsi, retrolateral view. Pink arrows indicate linear spines.

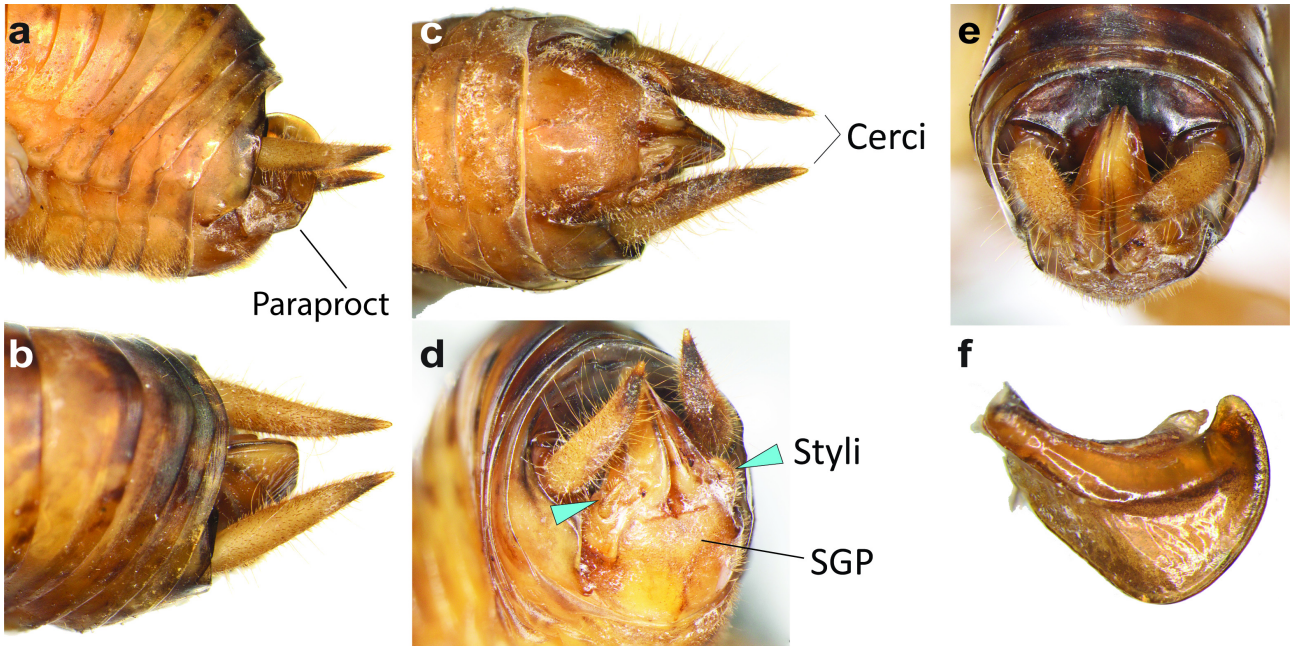

FIGURE 9. *Crux heggi* sp. nov. Male Paratype. Terminalia. a–c) Lateral, dorsal and ventral views of posterior end of abdomen. d) Oblique posterior view of terminalia showing subgenital plate, and styli (blue arrows) pressed against paraprocts. e) Posterior view. f) Disarticulated fused paraproct structure (MPN CW4372).

Legs: Femora, fore tibiae and mid tibiae paler than dorsal abdomen, but with some darker markings. Legs are robust and glabrous except for inferior surfaces, which are clothed in fine gold-brown hairs. Most spines are dark and stout. Hind tibiae and femora similar in length, approximately equal to the body length. Fore femora with no apical spines. Mid femora with one retrolateral apical spine. Hind femora short, stout, with stout, fixed, spines towards the posterior end of the prominent inferior carinae; 2 retrolateral and 1 main prolateral towards distal end plus several small spines. Hind femora bear a short, fixed, retrolateral apical spine on knee. Fore tibiae with three inferior linear spines, 2 prolateral and 1retrolateral. Fore tibiae with 2 superior apical spines (1 prolateral and 1 retrolateral), and 2 inferior apical spines spines (1 prolateral and 1 retrolateral). Mid tibiae with same spines as fore tibiae. Hind tibiae naked above, fine gold hairs beneath and with two rows of prominent, stout, sharp, fixed spines; ~7 along superior prolateral margin and ~8 along superior retrolateral margin. Hind tibiae with a pair of small articulated, inferior apical spines, a pair of articulated, lateral apical spines, and a pair of longer, articulated superior apical spines. Hind tarsi with 1st and 4th segments longer than the 2nd and 3rd; unarmed except 1st and 2nd segments which each bear a pair of backward leaning, stout, fixed spines near distal end of superior surface (Figure 8).

Female. Ventral surface of sternites hirsute. A small bifid subgenital plate with few hairs. Ovipositor long and almost straight (notably along the ventral margin), curving only slightly upwards towards the posterior end. Very pale cream at base especially on underside, rich amber brown in posterior half. Valves mostly smooth, but ventral valves with undulations at the tip. Cerci stout, pale, with fine amber hairs, and a dark ring below a cream tip (Figure 7).

Colouration: Predominantly cream/beige with dark brown markings primarily on dorsal surface of thorax and abdomen (Figure 3, 7).

Male: Similar to female in colour and leg spine combinations. Length 17mm; fore femur length 9.16 mm; pronotum length 4.74; mid femur length 8.27 mm; hind femur length 15.58mm; fore tibia 9.0 mm; mid tibia length 8.86 mm; hind tibia length 16.95 mm. Tergite IX simple. Subgenital plate broad, simple with straight or slightly concave posterior margin. Paraprocts extend beyond subgenital plate and styli to about middle of cerci. Paraprocts large, sturdy, and in close contact with each other forming a median carina on a sturdy, almost angular, hook that turns up and then forward to the tip of the abdomen under tergite IX. Styli short and pressed against the paraprocts and so difficult to see. Cerci gently tapering towards tip and extending well beyond the paraprocts and subgenital plate, diffuse darker band prior to pale tip, abundant long and short golden hairs (Figure 9).

Distribution: West Coast and Tasman, South Island, New Zealand. Entomological regions Northwest Nelson NN, Buller BR.

Etymology: Named for the orthopterist Danilo Hegg who collected specimens of this taxon and who has contributed extensively to revision of the New Zealand Rhaphidophoridae.

Occultastella Trewick gen. nov.

(Figures 3, 10–12)

Diagnosis: A small, dark, delicate tokoriro with slim body and fine legs. Distinctive, contrasting, pale, flame-shaped markings on pronotum.

Etymology: Latin Occulta: concealed, in recognition of the cryptic habits of this animal that allowed it to remain undocumented. Latin stella: star, in reference to the distinctive pale, flame-shaped markings in the dorsal surface of the head. Hidden star.

Type Species: *Occultastella morgana* Trewick sp. nov.,

Material. Holotype ♂; Dry Road, Paturau River, Kahurangi National Park, New Zealand (-40.6523243, 172.4593968, 270m), NN, New Zealand, B.L.T. Smith & N. Smith 26/2/14, MPN CW2736, NMZNZ AI.062528. Paratype ♀; Denniston Plateau, Westport, West Coast, New Zealand (-41.763867, 171.819675) D. Hegg 23/10/22, MPN CW5616, NMNZ AI.062529. Other material (Table 1).

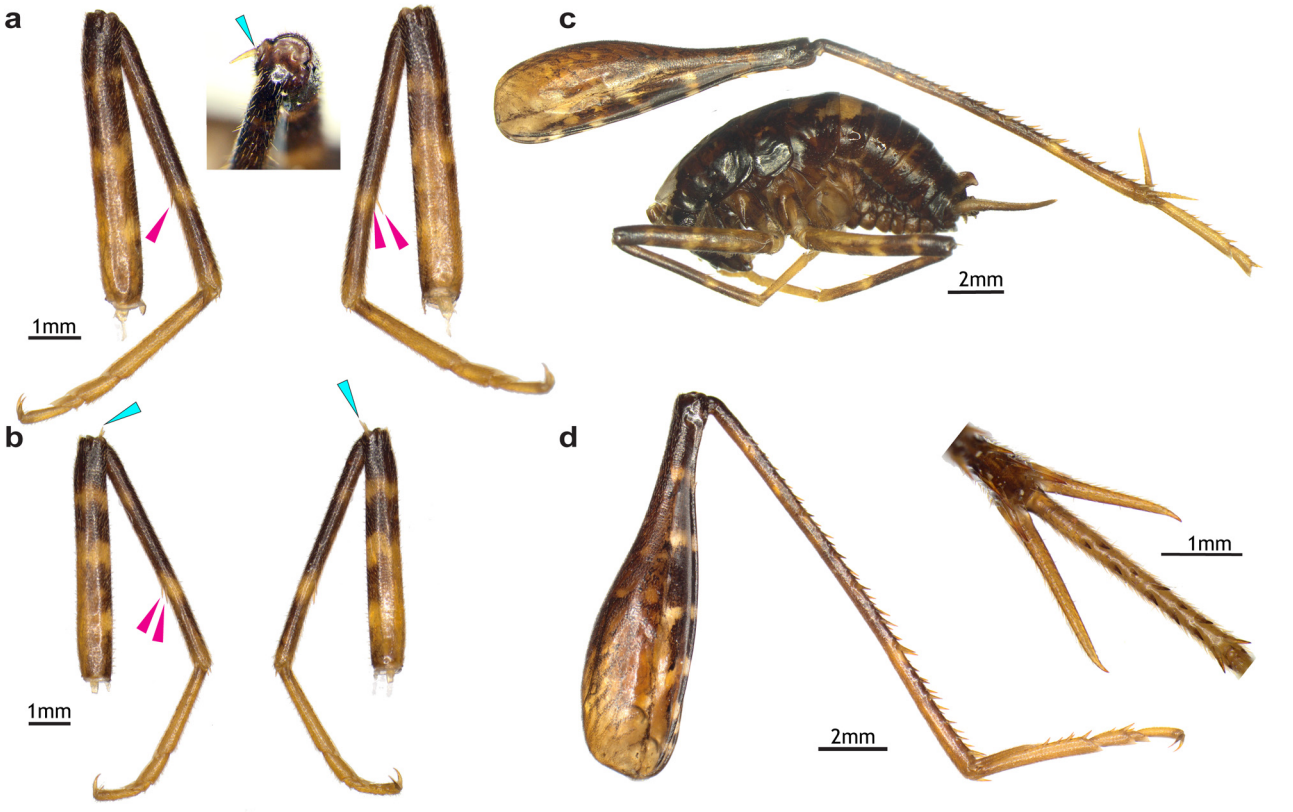

FIGURE 10. *Occultastella morgana* sp. nov. Male holotype legs. a) Fore leg and b) mid leg showing linear spines on tibiae (pink arrows) and apical spines on femora (blue arrows). c) Whole animal with disarticulated hind leg at same scale. d) Hind leg with detail of first tarsus.

Description. Holotype Male.

Dimensions. Adult

Body length 11.09 mm, fore femur 4.9 mm, mid femur 5.9mm, hind femur length 11.3 mm, fore tibia length 5.4 mm, mid tibia length 5.4 mm, hind tibia length 13.2. Antennae, little longer than the body (~14 mm).

Legs: Fore femur with articulated, prolateral apical spine, mid femur with an articulated prolateral and an articulated retrolateral apical spine, hind femur with several tiny, fixed spines on inferior retrolateral carina near distal end. Fore and mid tibiae with typical four articulated, apical spines and pair of linear spines about halfway along underside of fore and mid tibiae. Hind tibia with two rows of approximately 20 very short or short, articulated spines, on the prolateral and retrolateral margins of the superior surface. Hind tibia with four pairs of apical spines including a pair of long, spurs that project about halfway along the first tarsus. Tarsi with numerous golden short setae. First tarsus long with twelve stout articulated spines on the superior surface that are alternate near the proximal end but paired distally. Second tarsus with four stout spines (Figure 10).

Male: Terminalia complex. A distinctive two lobed structure extends from the 10th tergite; tergites 8 and 9 have indented posterior margin associated with this. From the dorsal surface the structure appears as a Y with two posterior pointing arms. Subgenital plate wide and short but equipped with long, narrow projection with tip bearing a tuft of beige hairs positioned below and between paraprocts. Cerci are long, narrow, cylindrical, long and gently curved towards the midline but not meeting, pale above with sparse hairs and setae, darker below. Styli short, pilose, dorso-ventrally flattened, leaf-shaped, arched with tip pointing down; like little limp paws (Figure 11).

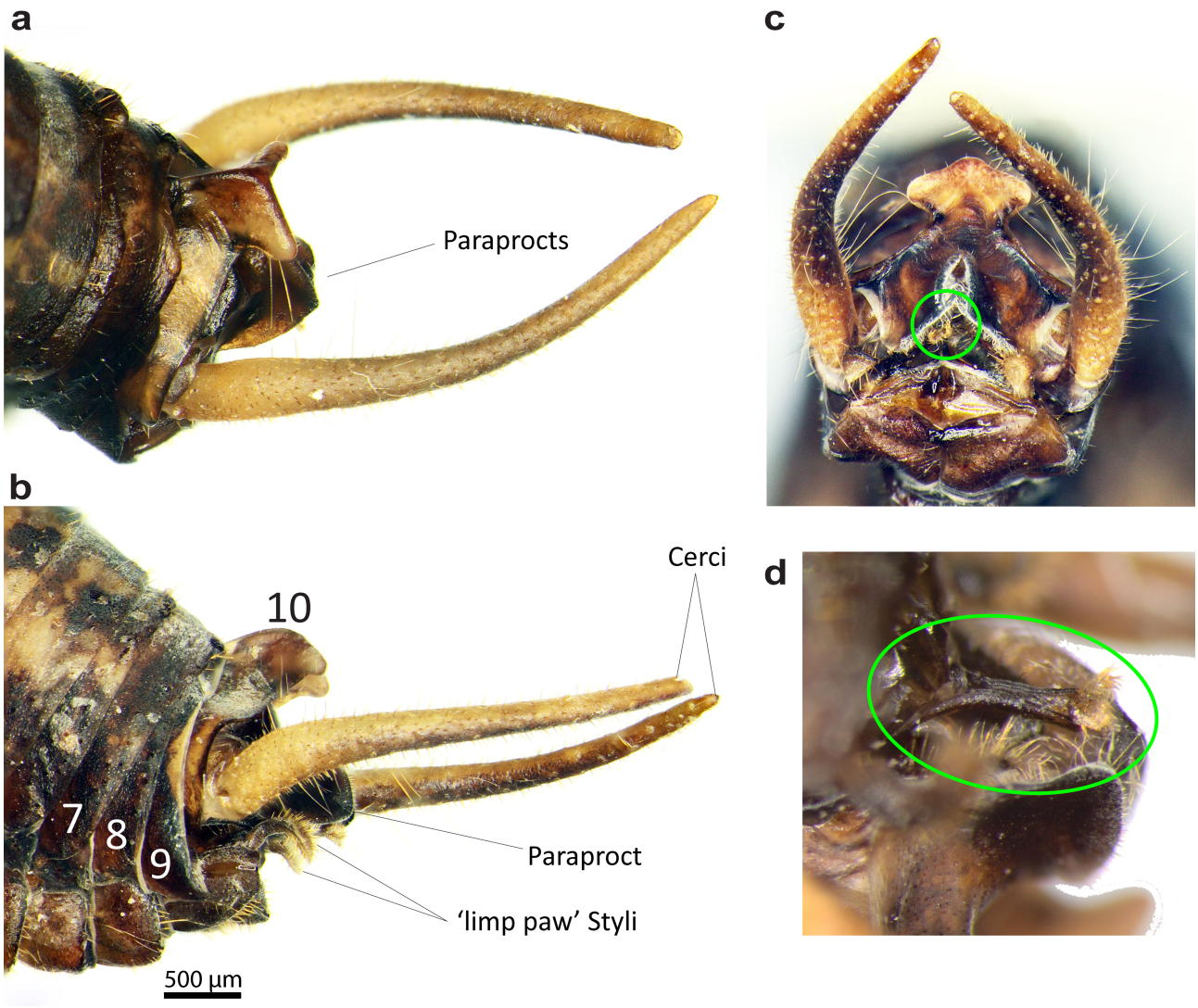

FIGURE 11. *Occultastella morgana* sp. nov. Male holotype. Terminalia. a–c) Oblique dorsal, lateral and ventral views showing cerci, styli and modified 10th tergite. d) Ventral detail of subgenital plate (SGP) with tufted projection (green ellipse in c also).

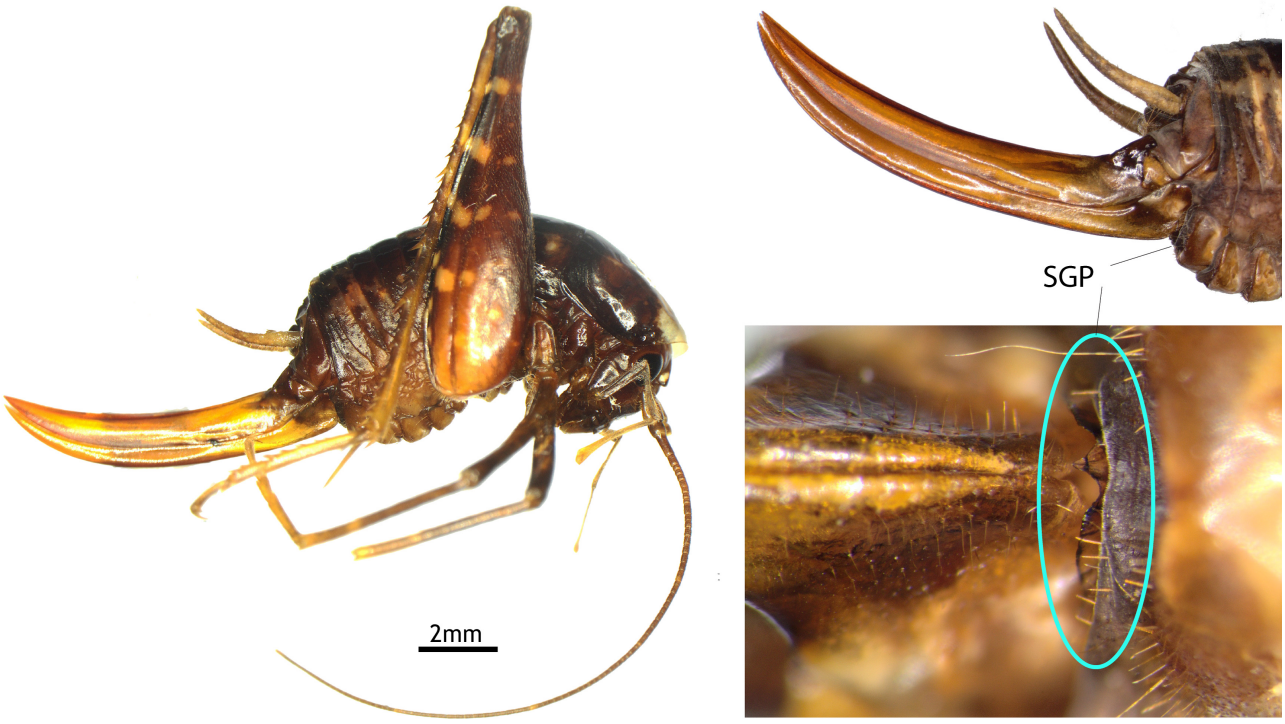

FIGURE 12. *Occultastella morgana* sp. nov. Female. Whole body, lateral view of ovipositor and ventral view of last sternite and subgenital plate (SGP) (blue ellipse).

Female. Ovipositor long (about 80% of body length) fine widely spaced teeth towards tip on ventral valves (Figure 10). Subgenital plate small and mostly concealed by posterior margin of last sternite at base of ovipositor, translucent brown with sinuous margin consisting of shallow lobe on either side and central point (Figure 12).

Colouration: Head, antennae, thorax and abdomen and legs predominantly dark brown to black. Two-lobed fastigium between antennae bears white spot on each lateral surface (ocelli). Body has some irregular cream marks on flanks and legs and larger pale patches on dorsal surface of abdomen. Long pronotum bears a distinctive cream/white 'candle-flame' marking on each side of the midline extending from the anterior edge of dorsal surface to about half its length. Each 'flame 'bears a darkened (brown) spot in its widest part. Feint pale midline sometimes apparent (Figure 3, 10).

Etymology: Named for the orthopterist Mary Morgan-Richards who has contributed extensively on the ecology, systematics and taxonomy of New Zealand Rhaphidphoridae and Anostostomatidae.

Distribution: Northwest South Island, New Zealand. Entomological regions: Northwest Nelson NN, Marlborough MB, Buller BR.

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