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INSECTS OF CAMPBELL ISLAND. ORTHOPTERA: RHAPHIDOPHORIDAE OF AUCKLAND AND CAMPBELL IS.[1]

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Abstract: The Rhaphidophoridae of Auckland Is. and Campbell I. are described, and reference is made to the paucity of Orthoptera in this region. Two new monotypic genera, *Dendroplectron* n. gen. and *Notoplectron* n. gen., are erected, and the species *D. aucklandensis* n. sp. and *N. campbellensis* n. sp. are described. These are the only known members of the family occurring on the islands.

To the south of New Zealand lie a number of islands which have become known collectively as the Subantarctic Islands of New Zealand. These islands include the Antipodes Is., Auckland Is., Bounty Is., Campbell I. and the Snares. In 1839, the first scientific expedition visited the islands, when the corvettes *Astralobe* and *Zelee*, under Admiral D'Urville, called at Auckland I. This French expedition was accompanied by the naturalists Hombron and Jacquinot. Although insects were collected, there is no record of any Orthoptera. The following year, Sir James Ross visited Campbell and Auckland Is. in H.M.S. *Erebus* and *Terror*. Insects collected on this expedition were later presented to the British Museum, but again there is no mention of Orthoptera.

In 1874, a French Expedition visited Campbell I. to observe the transit of Venus, and at the same time a German Expedition visited the Auckland Is. In both cases extensive scientific collecting was carried out. H. Krone, of the German Expedition, lists the insects collected as Diptera, Lepidoptera and Coleoptera (see Gourlay, 1950). From then on, because of the periodic visits of the New Zealand Government steamer, numerous scientific visits were made to the islands. In the 1890's the first Orthoptera to be recorded from these islands was collected from the Bounty Is. by Captain Fairchild of the New Zealand Government steamer *Hinemoa*. It consisted of a single species which Hutton (1897) placed in a monotypic genus belonging to the family Rhaphidophoridae as *Ischyroplectron isolatum* Hutton. Its habitat was recorded as being "under rocks." Hudson (1909) referred to the species as being endemic to the Bounty Is.

In 1907, a major expedition, consisting of leading New Zealand scientists, visited the subantarctic islands. In 1909, the results were published by the Philosophical Institute of Canterbury in two volumes as *The Subantarctic Islands of New Zealand*. Only one orthopteran is recorded from this expedition—"*Onosandrus pallitarsis* Walker?" (fam. Henicidae) found on Snares by H. B. Kirk. G. V. Hudson (1909) considered it to be "closely allied to, if

1. Partial results of field work supported by National Science Foundation grant G-23720 from the U. S. Antarctic Research Program.

not specifically identical with *O. pallitarsis* Walker" a species already described from New Zealand. Salmon (1950) placed *O. pallitarsis* in his new genus *Zealandosandrus* as *Z. subantarcticus* Salmon after examination of Hudson's material and fresh specimens collected by Dr. R. A. Falla. He records the insect as being found "in burrows of petrels."

During the 1939–45 war, members of the New Zealand military forces were stationed on Campbell I. and the Auckland Is. They were requested to collect zoological specimens under the direction of Dr. R. A. Falla, then of the Canterbury Museum, Christchurch. This was known as the Cape Expedition. It was during this period that the first specimens of Rhaphidophoridae were collected from both these areas. Unfortunately the material was not adequate for detailed examination.

In December 1962 and January 1963, an expedition sponsored by the New Zealand Government, and known as the Dominion Museum/D. S. I. R. Auckland Islands Expedition 1962/3, spent some time on the Auckland Is. During this period an excellent series of Rhaphidophoridae was collected from the northern islands of the group.

The Campbell I. specimens described in this paper were collected by J. H. Sorensen, who was stationed on the island during and just after the 1939–45 war; and also by collectors from Bishop Museum, Honolulu, in 1962. Unfortunately this material does not form a good series, the majority of the specimens being very immature nymphs. Further collecting of this species is required in the future.

Like those from the Bounty Is., the Rhaphidophoridae of Campbell I. and the Auckland Is. are represented in each case by a monotypic genus. The Bounty Is. material has not been examined by me, but from Hutton's description these three genera seem to be in no way related. The poor representation of Orthoptera, and the lack of spiecation in these islands is strange when compared with the large number of species present on the North and South Islands of New Zealand, but is in agreement with the paucity of species occurring on the Chatham Is. (Richards, 1958).

Rhaphidophorids are nocturnal insects, hiding during the day and emerging at night to feed on the surrounding vegetation. It is possibly due to this behavior that they escaped detection by the scientific expeditions of the last century. On Bounty Is. they were found under rocks. On Campbell I. they occurred in tussock, or on *Coprosma* and *Dracophyllum*, often associated with moss and lichen. On Auckland Is. they were most commonly taken at night from the trunks of rata and *Olearia*, and during the day from under the bark of *Olearia*; they were also collected from under logs, from rocks near a shag colony and were found living in petrel burrows. One specimen collected from the burrow of *Pterodroma lessoni* (the White-headed Petrel) had the spines on the hind tibiae worn down, presumably due to digging. Rhaphidophorids have been found in petrel burrows on the Chatham Is. (Richards, 1958), and on off-shore islands round the coast of New Zealand, and it is my opinion that they probably also occupy this ecological niche on Campbell I. and the Bounty Is.

Genus **Dendroplectron** Richards, n. gen.

Body clothed with numerous short setae. Legs long and slender. Antennae very long and tapering, almost touching at their bases; scape about 4× as large as pedicel, which is narrower than scape, but broader than other segments; from segment 4 onwards seg-

ments subequal in length, although steadily decreasing in size; all segments thickly clothed with short setae. A single anterior, median ocellus present. Fastigium rising abruptly, convex, grooved medianly and longitudinally. Maxillary palps with segments 3 & 4 subequal in length. Metasternum bearing a median tubercle. Fore coxae each armed with a retrolateral spine. All femora sulcate ventrally. Apical spines on femora, tibiae, proximal segments 1 & 2 of hind tarsi constant in number. Fore femur bears 2 apical spines beneath, 1 prolateral and 1 retrolateral; fore tibia bears 4 apical spines, 1 above and 1 beneath both prolaterally and retrolaterally; fore tarsus unarmed. Mid femur bears 2 apical spines beneath, 1 prolateral and the other retrolateral; mid tibia bears 4 apical spines, 1 above and 1 beneath, both prolaterally and retrolaterally; mid tarsus unarmed. Hind femur unarmed; hind tibia bears a pair of long apical spurs above, a pair of subapical spines above and a pair of short apical spurs beneath, 1 from each pair being prolateral and the other retrolateral; 2 proximal segments of hind tarsus each bear 2 apical spines above, 1 prolateral and 1 retrolateral; the other 2 segments unarmed. Subgenital plate of ♀ absent. Subgenital plate of ♂ triangulate with a median groove; it bears 2 large lobes.

Type species: *Dendroplectron aucklandensis* n. sp.

Dendroplectron aucklandensis Richards, n. sp. Fig. 1.

Color: Basic color light brown, with pronotum, mesonotum, metanotum and abdominal terga irregularly mottled with mid brown and ochreous; femora and tibiae banded with light brown and ochreous; tarsi ochreous; antennae light brown; ovipositor light reddish brown. *Body*: Length up to 20 mm. Body thickly clothed with setae. Ovipositor 0.65× length of body. Antennae broken. Fastigium longer than high, with base touching scape of antennae. Pronotum margined anteriorly and laterally; mesonotum margined laterally. *Antenna*: As in generic description. Segment 3 on dorsal aspect 1.4× as long as pedicel; on ventral aspect 1.5× as long as pedicel. Sexual dimorphism absent. No spines present on flagellum of either ♂ or ♀. *Legs*: Fore and mid legs subequal in length, with hind leg 1.6× length of fore and mid legs. Sexual dimorphism absent. Tibiae and proximal 2 segments of hind tarsi armed with variable numbers of linear spines. No linear spines occur on femora or fore or mid tarsi (tab. 1). Apical spines constant in number, as in generic description. Length of proximal segment of hind tarsus subequal with other 3 segments together. Ratio of length of legs to length of body: fore leg 1.2 : 1; mid leg 1.2 : 1; hind leg 1.9 : 1.

Genitalia: ♀: Suranal plate, fig. 1a (SAP), concave laterally, distal margin very slightly trilobed; distal margin clothed with short setae. Subgenital plate, apparently absent, as not present in 10 specimens examined; a small V-shaped flap of intersegmental membrane, fig. 1b (V), was present in some specimens. ♂. Suranal plate, fig. 1c (SPL), concave laterally, distal margin trilobed and deeply emarginate between lobes, all lobes pointed apically; median lobe 1.3× as long as lateral lobes; entire plate sparsely clothed with setae. Subgenital plate, fig. 1 c, d (H), triangulate, convex proximally, tapering distally to a rounded apex which is indented medianly. Proximal portion of plate bearing 2 large lobes clothed with setae. Distal portion of plate with a median groove on both dorsal and ventral surfaces. On dorsal surface, proximal portion of plate bears setae, distal portion glabrous; on ventral surface plate clothed with short setae. Laterally, plate bears 2 styli clothed with setae. Proximal 1/2 of prolateral margin of each stylus fused to subgenital plate;

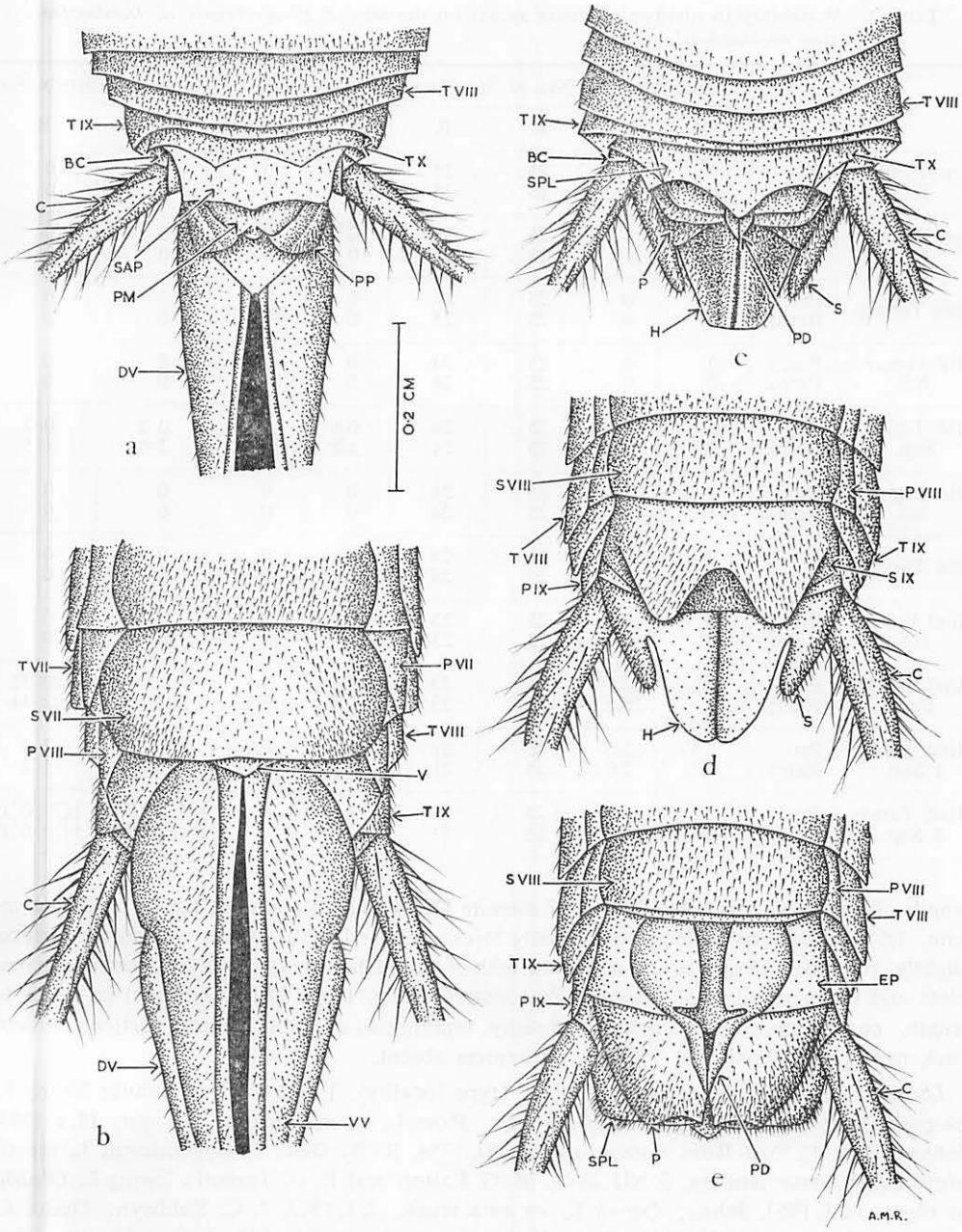

Fig. 1. *Dendroplectron aucklandensis* n. sp. a, ♀ genitalia, dorsal view; b, ♀ genitalia, ventral view; c, ♂ genitalia, dorsal view; d, ♂ genitalia, ventral view; e, ♂ genitalia, ventral view, subgenital plate removed to expose structures beneath.

Table 1. Variability in number of linear spines on the legs of 25 specimens of *Dendroplectron aucklandensis* n. sp.

		Arith. Mean		No. of Specimens		Std. Dev.		Range (or distribution)	
		L	R	L	R	L	R	L	R
Fore Femur Inf.	Pro.	0	0	25	25	0	0	0	0
	Retro.	0	0	25	25	0	0	0	0
Fore Tibia Inf.	Pro.	1	1	25	25	0	0	0	0
	Retro.	1	1	25	25	0	0	0	0
Fore Tarsus	Pro.	0	0	25	25	0	0	0	0
	Retro.	0	0	25	25	0	0	0	0
Mid Femur Inf.	Pro.	0	0	25	24	0	0	0	0
	Retro.	0	0	25	24	0	0	0	0
Mid Tibia Sup.	Pro.	0.9	0.9	25	24	0.8	0.9	0-2	0-3
	Retro.	3.5	3.2	25	24	1.2	1.1	2-6	1-5
Mid Tibia Inf.	Pro.	1	1	25	24	0	0	0	0
	Retro.	1	1	25	24	0	0	0	0
Mid Tarsus	Pro.	0	0	25	24	0	0	0	0
	Retro.	0	0	25	24	0	0	0	0
Hind Femur Inf.	Pro.	0	0	25	23	0	0	0	0
	Retro.	0	0	25	23	0	0	0	0
Hind Tibia Sup.	Pro.	24.4	23.8	25	23	2.4	2.5	20-33	20-32
	Retro.	25	25.5	25	23	2.2	2.5	20-31	22-34
Hind Tarsus 1 Sup.	Pro.	2.3	2.5	25	21	0.6	0.6	1-3	2-4
	Retro.	2.7	2.6	25	21	0.8	0.7	1-4	1-4
Hind Tarsus 2 Sup.	Pro.	0	0	25	21	-	-	1(1), 0(24)	1(2), 0(19)
	Retro.	0	0	25	21	-	-	1(1), 0(24)	1(3), 0(18)

length of each stylus is 0.5× length of sternite IX (S IX). Parameres, fig. 1 c, e (P), elongate, 1.6× as long as wide; retrolaterally thickly clothed with setae; on ventral surface, slightly proximal from apex, each plate with a raised band extending horizontally across plate and down retrolateral margin. Pseudosternite, fig. 1 c, e (PD), subequal in width to length, convex proximally, concave distally, tapering to a point; lateral portions curved back over plate. Penis not visible. Paraprocts absent.

Locality: Rose I., under bank at night (type locality), 1. XII. 1963, P. Johns; Ewing I., ex rocks near shag colony, 1. I. 1963, Johns; Rose I., ex rata trunks at night, 11. I. 1963, Johns; Rose I., Port Ross, under logs, 19. III. 1954, R. K. Dell; Disappointment I., top of north ridge above landing, 9. XII. 1944, M. G. Easton and E. G. Turbott; Ewing I., *Olearia* at night, 14. I. 1963, Johns; Ocean I., ex rata trunk, 2. I. 1963, J. C. Yaldwyn; Ocean I., ex petrel burrow, 17. IX. 1943, R. A. Falla; Ewing I., 18. XI. 1943, Falla; French Islet, Auckland I., ex burrow of *Pterodroma lessoni* (White-headed Petrel), 29. XII. 1962, Falla; Adams I., 2. II. 1944, Falla; Ocean I., 5. I. 1943, Falla; Auckland I, II. 1943, W. H. Dawbin; Ewing I., under bark of *Olearia*, 5. I. 1963, J. L. Gressitt; Ewing I., boatshed, no date (probably 1942), G. Prichard Paire.

Types: Holotype ♂, allotype ♀ and paratypes 2♂♂ and 2♀♀ in Canterbury Museum, Christchurch, New Zealand. Paratypes ♂ and ♀ in Dominion Museum, Wellington, New Zealand; paratypes 2♂♂ and 2♀♀ in Bishop Museum, Honolulu.

Remarks: Possibly due to its isolation, the genus *Dendroplectron* appears to be in no way related to any of the known genera of Macropathinae (Rhaphidophoridae) occurring in the Southern Hemisphere. Its main distinguishing characters are the number of its apical spines and the structure of the ♂ genitalia.

Genus **Notoplectron** Richards, n. gen.

Body clothed with numerous short setae. Legs long and slender. Antennae very long and tapering, almost touching at their bases; scape about 4× as large as pedicel, which is narrower than scape, but broader than other segments; from segment 4 onwards segments subequal in length, although steadily decreasing in size; all segments thickly clothed with short setae. A single, anterior, median ocellus only. Fastigium rising abruptly, convex, grooved medianly and longitudinally. Maxillary palps with segments 3 & 4 subequal in length. Fore coxae each armed with a retrolateral spine. All femora sulcate ventrally. Apical spines on femora, tibiae, proximal segments 1 & 2 of hind tarsi constant in number. Fore femur unarmed; fore tibia bears 4 apical spines, 1 above and 1 beneath both prolaterally and retrolaterally; fore tarsus unarmed. Mid femur bears 1 prolateral apical spine beneath; mid tibia bears 4 apical spines, 1 above and 1 beneath, both prolaterally and retrolaterally; mid tarsus unarmed. Hind femur unarmed; hind tibia bears a pair of long apical spurs above, a pair of subapical spines above, a pair of short apical spurs beneath and a pair of subapical spines beneath, 1 from each pair being prolateral and the other retrolateral; 2 proximal segments of hind tarsus each bear 2 apical spines above, 1 prolateral and 1 retrolateral; the other segments unarmed. Subgenital plate of ♀ trilobed. Subgenital plate of ♂ bilobed and slightly keeled distally; it bears 2 small tubercles, 1 on either side of keel; distal portion of plate consisting of several layers.

Type species: *Notoplectron campbellensis* n. sp.

Notoplectron campbellensis Richards, n. sp. Fig. 2.

Color: Basic color light brown. Color pattern variable; some specimens with pro-, meso-, metanotum and abdominal terga irregularly mottled with mid brown and ochreous; others with a broad, median, longitudinal band of ochreous down all thoracic and abdominal terga, in the center of which is a narrow longitudinal band of light brown expanding in width from mesonotum to abdominal tergum 2; lateral to ochreous band on either side is a narrow longitudinal band of mid brown extending to abdominal tergite 9; rest of tergites irregularly mottled with mid brown and ochreous. Femora banded with light brown and ochreous; tibiae banded with mid brown and ochreous; tarsi ochreous. Antennae light brown. Ovipositor reddish brown. *Body*: Length 18 mm in ♀, and 14 mm in ♂. Body thickly clothed with setae. Ovipositor 0.4× length of body. Antennae broken. Fastigium longer than high, with base touching scape of antennae. Pro- and mesonotum margined laterally. Abdominal sternum 7 in ♀ with 2 well developed lateral tubercles, 1 to each side, thickly clothed with long setae. *Antenna*: As in generic description. Segment 3 on dorsal and ventral aspects subequal in length with pedicel. Sexual dimorphism ab-

sent. No spines present on flagellum of ♂ or ♀. *Legs*: Fore and mid legs subequal in length, with hind leg 1.7× length of fore and mid legs. Sexual dimorphism absent. Fore, mid and hind tibiae armed with variable numbers of linear spines. No linear spines occur on femora or tarsi (tab. 2). Apical spines constant in number, as in generic description. Length of proximal segment of hind tarsus subequal with other 3 segments together. Ratio of length of legs to length of body: Fore leg, ♂ 1 : 1; ♀ 0.7 : 1. Mid leg, ♂ 1 : 1; ♀ 0.7 : 1. Hind leg, ♂ 1.6 : 1; ♀ 1.2 : 1.

Table 2. Variability in number of linear spines on the legs of 16 specimens of *Notoplectron campbellensis* n. sp.

		Arith. Mean		No. of Specimens		Std. Dev.		Range (or distribution)	
		L	R	L	R	L	R	L	R
Fore Femur Inf.	Pro.	0	0	16	16	0	0	0	0
	Retro.	0	0	16	16	0	0	0	0
Fore Tibia Inf.	Pro.	3	3	16	16	0	–	0	3(15), 2(1)
	Retro.	2	2	16	16	0	0	0	0
Fore Tarsus	Pro.	0	0	16	16	0	0	0	0
	Retro.	0	0	16	16	0	0	0	0
Mid Femur Inf.	Pro.	0	0	16	16	0	0	0	0
	Retro.	0	0	16	16	0	0	0	0
Mid Tibia Sup.	Pro.	0	0	16	16	0	0	0	0
	Retro.	0	0	16	16	0	0	0	0
Mid Tibia Inf.	Pro.	3	3	16	16	–	–	3(15), 2(1)	3(14), 2(1), 4(1)
	Retro.	2	2	16	16	–	0	2(15), 1(1)	0
Mid Tarsus	Pro.	0	0	16	16	0	0	0	0
	Retro.	0	0	16	16	0	0	0	0
Hind Femur Inf.	Pro.	0	0	16	12	0	0	0	0
	Retro.	0	0	16	12	0	0	0	0
Hind Tibia Sup.	Pro.	9.9	9.9	16	12	0.5	0.6	9-11	9-11
	Retro.	10.2	10.5	16	12	0.8	0.9	9-11	9-12
Hind Tarsus 1 Sup.	Pro.	0	0	16	12	0	0	0	0
	Retro.	0	0	16	12	0	0	0	0
Hind Tarsus 2 Sup.	Pro.	0	0	16	12	0	0	0	0
	Retro.	0	0	16	12	0	0	0	0

Genitalia: ♀. Suranal plate, fig. 2a (SAP), concave laterally; distal margin rounded and clothed with long setae. Subgenital plate, fig. 2b (SGP), trilobed, each lobe rounded apically, 2 lateral lobes 0.2× longer than median lobe; distal portions of lateral lobes clothed with setae, median lobe glabrous. Sternite VII bears 2 large tubercles, each thickly clothed with long setae around distal border. ♂. Suranal plate, fig. 2c (SPL), concave laterally; distally the plate is curved back onto ventral surface, distal margin indented medianly and clothed with long and short setae, rest of plate clothed with short setae. Subgenital plate, fig. 2d (H), triangulate, convex proximally changing to concave distally;

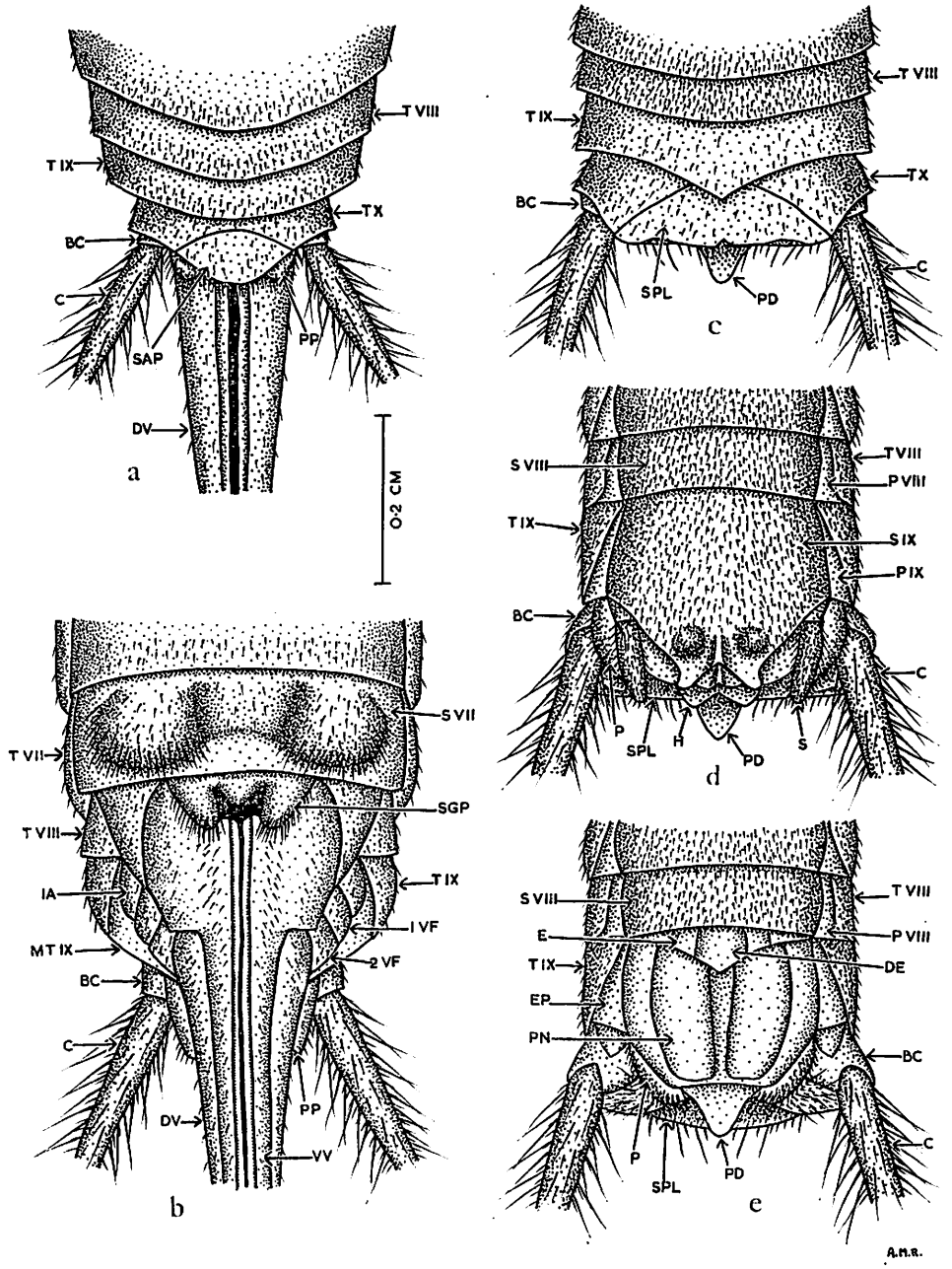

Fig. 2. *Notoplectron campbellensis* n. sp. a, ♀ genitalia, dorsal view; b, ♀ genitalia, ventral view; c, ♂ genitalia, dorsal view; d, ♂ genitalia, ventral view; e, ♂ genitalia, ventral view, subgenital plate removed to expose structures beneath.

distal portion of plate several layers thick forming a complex structure, 2 upper layers slightly keeled, all layers bilobed, upper layer deeply emarginate between lobes; it bears 2 small tubercles, 1 on either side of keel. Entire plate, except for distal lobes, thickly clothed with setae. Laterally, plate bears 2 styli clothed with setae, length of each stylus being 0.4× length of sternite IX (S IX). Parameres, fig. 2 d, e (P), elongate, approximately 1/2 as wide as long, retrolaterally thickly clothed with setae. Pseudosternite, fig. 2 c–e (PD), subequal in length to width, convex laterally, tapering to a rounded apex; from proximal margin distad 0.7 length of pseudosternite plate is overlaid by a thin chitinous plate. Penis, fig. 2e (PN), 2-lobed, each lobe approximately 2× as long as wide. Paraprocts absent.

Locality: Campbell I. (type locality), Tucker Valley, moss on *Dracophyllum* trees, 13.VIII. 1962, K. P. Rennell; Courrejolles Point, east slope, ex tussock, 12. II. 1962, K. A. J. Wise; Beeman, ex *Coprosma*, 13. VIII. 1962, 14. XII. 1962, Rennell; Beeman Hill, moss, lichen, low plants, 11. II. 1963, Wise; Beeman Cove, ex *Coprosma*, 25. VIII. 1962, Clark; Beeman Hill, ex *Coprosma*, 13. VIII. 1962, Clark; Beeman Camp, 28. VII. 1962, Rennell; Campbell I., 16. X. 1944, C. Doley; Tucker Cove Valley, ex lichen on *Dracophyllum scoparium*, 13. VIII. 1947, 15. VIII. 1947, Sorenson; Campbell I., 26. V.1942, V. 1946, Sorenson.

Types: Holotype ♂, allotype ♀, and paratype ♂ in Dominion Mus., Wellington, New Zealand.

Remarks: Although differing in the number and position of the apical spines on the femora, the genus *Notoplectron* shows some affinities with *Pleioplectron* Hutton (as redefined in Richards, 1959) in the structure of the ♂ and ♀ external genitalia. It appears to be unrelated to any of the other known genera of Macropathinae.

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INDEX TO TABLES

Arith. Mean—Arithmetic mean.
L.—Left leg.
Pro.—Prolateral.
Retro.—Retrolateral.
Std. Dev.—Standard Deviation.
Inf.—Inferior.
Mid.—Middle.
R.—Right leg.
Sup.—Superior.

INDEX TO TEXT-FIGURES

BC—basal segment of cercus.
C—cercus.
DE—ductus ejaculatorius.
DV—dorsal valve.
E—endapophysis.
EP—endoparamere.
H—subgenital plate, ♂.
IA—intersegmental apodeme.
MT IX—membrane of tergite IX.
P—paramere (ectoparamere).
P VII, P VIII, P IX—pleurite VII, VIII, IX.
PD—pseudosternite.
PM—perianal membrane.
PN—penis.
PP—paraproct.
S—stylus.
S VII, S VIII, S IX—sternite VII, VIII, IX.
SAP—suranal plate, ♀.
SGP—subgenital plate, ♀.
SPL—suranal plate, ♂.
T VII, T VIII, T IX, T X—tergite VII, VIII, IX, X.
1 VF—1st valvifer.
2 VF—2nd valvifer.
VV—ventral valve.
V—V-shaped flap.