# MITES OF THE GENUS *Ledermuelleria* OUDMS. (PROSTIGMATA, STIGMAEIDAE) FROM NEW ZEALAND, WITH RECORDS OF ONE SPECIES FROM SOME SOUTHERN PACIFIC ISLANDS

By T. G. WOOD, Entomology Division, Department of Scientific and Industrial Research, Nelson*

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## *Summary*

Nine new species of the genus *Ledermuelleria* are described from New Zealand, and a key is given for their identification. These species are *L. mixta, L. corticola, L. simplex, L. dumosa, L. clavigera, L. granulosa, L. manapouriensis, L. brevisetosa,* and *L. distincta.* Their distribution is discussed briefly. *L. mixta* is recorded from Fiji (Viti Levu), Cook Islands (Rarotonga), Niue, and Tahiti in the southern Pacific.


## INTRODUCTION

The features of the genus *Ledermuelleria* Oudms. have been fully described by Summers (1957). The genus can be readily distinguished from other genera in the family Stigmaeidae by the following features: dorsum entirely covered by three sculptured plates; a propodosomal, bearing four pairs of setae and usually one pair of eyes; a hysterosomal, bearing six pairs of setae, which overlaps the body laterally; and a suranal, bearing two pairs of setae. Humeral plates large, triangular, displaced ventrally with apex intruding between coxae II and III, and bearing one pair of setae. Legs shorter than the idiosoma. Gnathosoma attached to idiosoma below overhang of propodosoma; chelicerae not joined together; palps stout, not longer than genu-tibia-tarsus of leg I; palp-tibial claw well developed and with small basal claw; palp tarsus with distinct apical, trifid seta.

Summers (1957) and Summers and Price (1961) described five new species from North America and redescribed six species previously known from Europe. They listed seven other described species of Stigmaeidae which they believed to belong to *Ledermuelleria,* two of which have since been transferred to another genus (Wood, 1964). Chaudhri (1965) described five new species from North America, three from Chile and three parasitic on sandflies (*Phlebotomus*) from Panama. The fact that nine new species of *Ledermuelleria* have been found in New Zealand suggests that when collections are made from other parts of the world, such as South America, Africa, Asia, and Australia, the genus may become very large.

*Present address: CSIRO, Division of Soils, Private Bag No. 1, Glen Osmond, South Australia.

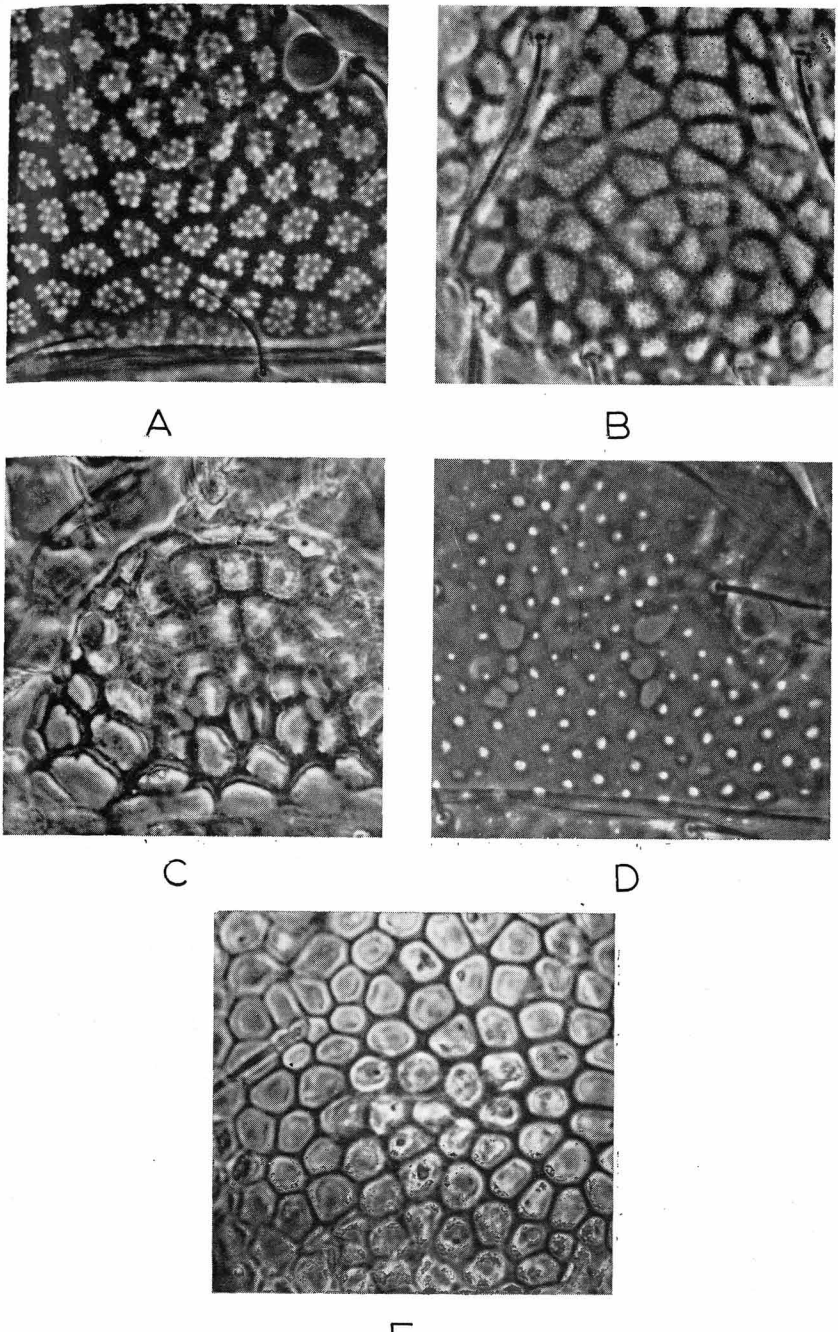


FIG. 1—Phase contrast photomicrographs of dorsal plates of five species of *Ledermuelleria* from New Zealand, illustrating details of dorsal sculpturing: A. *L. corticola* n. sp., propodosoma; B. *L. mixta* n. sp., hysterosoma; C. *L. dumosa* n. sp., propodosoma; D. *L. granulosa* n. sp., propodosoma; E. *L. distincta* n. sp., hysterosoma.

Females are more abundant than males, so that problems of identifying single males seldom arise. Holotypes and the descriptions in this paper have been based on females, emphasis being placed on those features considered to be useful for distinguishing between species. The following features are important in this respect: details of dorsal sculpturing; nature and lengths of dorsal (including humeral) setae, and in the case of certain setae their relative positions; occurrence of callosities on the humeral integument; extent of fusion of the endo-coxal plates; number of genital setae and the relative lengths of the three pairs of anal setae; numbers of setae on the legs. Although the shape of certain leg setae can be used to distinguish between species, these differences are more obvious by examination of the dorsal setae and thus details of leg chaetotaxy have been confined to quantitative data.

## NEW ZEALAND SPECIES OF *Ledermuelleria*

### KEY TO FEMALES

1. Dorsal setae curved, more or less obviously bilaterally spinulate or plumose; one pair of genital setae; no callosities in humeral region; no spine *k* on genu II or solenidion *ω* on tarsus IV ("segnis" group). 2.
– Dorsal setae bush-like; three pairs of genital setae; no callosities in humeral region; spine *k* present on genu II; no solenidion on tarsus IV ("pectinata" group). Only one New Zealand species known.

***L. dumosa*** n. sp.

– Dorsal setae acicular or slightly claviform; two pairs of genital setae (some other described species have three pairs); callosities may be present on humeral integument; spine *k* present on genu II and solenidion *ω* present on tarsus IV, although the latter is absent in some other described species ("maculata" group). 4.
2. Dimples on dorsum vacuolated (Fig. 1A, B). 3.
– Dimples on dorsum not vacuolated.

***L. simplex*** n. sp.

3. Each dimple with 7–15 vacuoles; dorsal setae slender, slightly spinulate, those on hysterosoma less than 45 *μ* long.

***L. corticola*** n. sp.

– Each dimple with 20–40 vacuoles; dorsal setae more robust, distinctly spinulate or pectinate, those on hysterosoma 60–65 *μ* long.

***L. mixta*** n. sp.

4. Setae *ce* noticeably reduced, less than one-third the length of setae *be*. 7.
– Setae *ce* more than half the length of setae *be*. 5.
5. Dorsal sculpturing a regular polygonal reticulum; *c–c* slightly shorter than or equal to *li–li*. 6.
– Dorsal sculpturing an irregular pattern of small circular dimples; *c–c* distinctly longer than *li–li*.

***L. manapouriensis*** n. sp.

6. Dorsal setae long, rod-like, with hyaline sheath; *ce* about three-fifths as long as *be*.

***L. distincta*** n. sp.

– All dorsal setae of roughly equal length; stick-like, slightly capitate and tufted distally.

***L. clavigera*** n. sp.

7. Dorsal setae acicular, moderately long (50–80 μ, except *ce*); *c–c* distinctly longer than *li–li*.

***L. granulosa*** n. sp.

– Dorsal setae stout, short (15–45 μ, except *ce*), with hyaline sheath; *c–c* equal to *li–li*.

***L. brevisetosa*** n. sp.

### MALES

With the exception of *L. brevisetosa,* males have been found in all the New Zealand species. Except for features of the anogenital region and the relative lengths of certain dorsal setae, characters used for distinguishing females can also be used for males. Males of the "segnis" and "pectinata" groups have setae *li* distinctly longer than other hysterosomal setae. Males of the "maculata" group have short median suranal setae *e*, and some species (*L. granulosa* n. sp. and *L. clavigera* n. sp.) have very short dorso-median setae *c*. The length of the sex-associated solenidion ω ♂ on tarsus I varies between species and may be very long (Fig. 5F) so that it reaches to the base of setae *tc'* and *tc''* (*L. simplex* n. sp., *L. dumosa* n. sp., *L. distincta* n. sp., and *L. manapouriensis* n. sp.); very short, not reaching as far as the base of solendidion ω (*L. corticola* n. sp. and *L. clavigera* n. sp.); or of medium length reaching between the bases of setae *tc'*, *tc''* and solenidion ω (*L. mixta* n. sp. and *L. granulosa* n. sp.).

## The "segnis" group

### *Ledermuelleria mixta* n. sp.

#### FEMALE

Length of idiosoma 320 μ. Dorsal plates strongly sclerotised with a regular pattern of indented dimples separated by coarse reticulum; lining of each dimple with 20–40 weakly sclerotised vacuoles (Fig. 1B). A number of small, shallow unvacuolated dimples distributed as shown in Fig. 2A: two pairs on propodosoma and six or seven pairs on hysterosoma. One pair of eyes. Dorsal setae bilaterally spinulate (Fig. 2C), situated on distinct tubercles, lengths as follows: *ae, be, b, c* 70–75 μ; *le* 43 μ, *e* 38 μ; others 60–65 μ. Setae *a* longer than distance *a–a* and *a–b*; *li* longer than *li–li*; *b* about same length as *b–b* but less than *b–c*; distance *c–c* more than 1·5 times greater than length of setae *c*.

Endocoxal plates of propodosoma and metapodosoma distinctly separated in mid-line and faintly reticulated as in *L. corticola* (see Fig. 2F). Numbers of setae including sensillae on legs I to IV as follows: tarsi 14–9–8–7, tibiae 7–6–6–6, genua 4–3–1–1, femora 6–4–3–2. Genital plate distinctly separated from ventral rami of suranal plate and bearing one pair of setae as in *L. corticola* (see Fig. 2F). Three pairs of setae on anogenital covers, as long as distance between their successive alveoli. Natural colour red.

### MALE

Length of idiosoma 270 $\mu$. Features as in female except for normal sex differences; setae *li* relatively longer (60–65 $\mu$, Fig. 2B) in relation to body length than in female; endocoxal plates either completely or incompletely fused. Solenidion $\omega$ $\sigma$ on tarsus I of medium length, reaching between solenidion $\omega$ and base of setae *tc'* and *tc''*.

The above descriptions apply to the "typical" form which constitutes about 70% of the specimens examined. The other 30%, which were collected in widely separated areas, show a number of morphological variations which have been indicated in Table 1. These variants possess one or more of the following features: smaller size; *be* more than 1·6 times longer than *ce*; *a* shorter than distances *a–a* and *a–b*; *li* shorter than in the "typical" form so that the ratio *li/li–li* is only slightly greater than one (1·1); dorsal setae slightly thicker than in the "typical" form and with shorter, more widely spaced spinules (Fig. 2D); endocoxal plates either fused in propodosomal region or fused in both propodosomal and metapodosomal regions; dimples on dorsal plates with less (15–30) than the "typical" number of vacuoles. But for the existence of the "small intermediate" forms showing features of the "typical", "fused" and "small" forms, there would have been good reasons for regarding the "fused" and "small" forms as separate species. It is possible that this range of specimens includes more than one species which cannot be separated on the basis of the material available, and in view of this possibility the holotype and paratypes have been designated from "typical" forms so that should further collecting reveal the existence of more than one species there will be no confusion over the species described here as *mixta*.

### DISTINGUISHING FEATURES

The shape and relative lengths of the dorsal setae, setae *a* and *li* being distinctly longer than *a–a* and *li–li* respectively, the lateral positioning of setae *c* and the vacuolation are diagnostic.

### COLLECTION DATA—NEW ZEALAND

Holotype: adult female from moss among beech (*Nothofagus*) forest litter, near Cobb reservoir, Takaka, 1,000 m, 18.ix.64 (T. G. Wood). Allotype: adult male from moss on rocks in native beech forest, Abel Tasman National Park, 29.xi.63 (T. G. Wood). Other localities: NORTH ISLAND—moss on roadside cutting, near Taheke (G. S. Grandison); moss around kauri (*Agathis australis* Salisb.) trees, Waipoua forest (G.S.G.); moss growing on beech trees, Awakino Gorge (G.S.G.); moss and litter, *Podocarpus* forest, 10 miles W. of Tokaanu, Lake Taupo (N. A. Walker); moss on roadside cutting, Maungaturoto, near Whangarei (G.S.G.); SOUTH ISLAND—from *Podocarpus totara* G. Benn. ex Don (beating sample), near Takaka (E. Collyer); moss on rocks, summit of Takaka Hill (T.G.W.); moss in manuka (*Leptospermum*) scrub, Takaka Hill (G. W. Ramsay); moss on rocks, Tauranga Bay, Westport (T.G.W.); moss growing on native beech, near Fox Glacier (T.G.W.); moss among shingle, near Arthur's Pass village (T.G.W.); moss among beech forest litter, Arthurs Pass

TABLE 1—Morphological Variation in *Ledermuelleria mixta* n. sp.; Comparison of "Typical" Form with the variants

| Form | "Typical" Form | "Fused" Form | | | "Small" Form | "Small-intermediate" Form | |
|---|---|---|---|---|---|---|---|
| Locality | — | Totara: Takaka, Nelson Province | Moss: Waipori Falls, Dunedin | Moss on Beech: Awakino Gorge | Moss: Taheke | Moss: Arthur's Pass | Moss: Canaan, Nelson Province |
| No. of specimens | 40 | 6 | 1 | 1 | 4 | 1 | 3 |
| Length of idiosoma ($\mu$) | 320 | 320 | 330 | 320 | 280 | 270 | 280 |
| *be/ce* | 1·2 | 1·2 | 1·3 | 1·2 | 1·7 | 1·3 | 1·2 |
| *a/a–a* | 1·1 | 1·0 | 1·1 | 1·1 | 0·7 | 1·0 | 1·1 |
| *a/a–b* | 1·1 | 1·1 | 1·2 | 1·2 | 0·9 | 1·1 | 1·1 |
| *li/li–li* | 1·4 | 1·1 | 1·1 | 1·1 | 1·1 | 1·3 | 1·4 |
| Shape of dorsal setae | typical | atypical | atypical | atypical | typical | atypical | typical |
| Endocoxal plates | typical | completely fused | completely fused | completely fused | typical | typical | fused anteriorly |
| Vacuolation | typical | atypical | atypical | atypical | typical | atypical | typical |

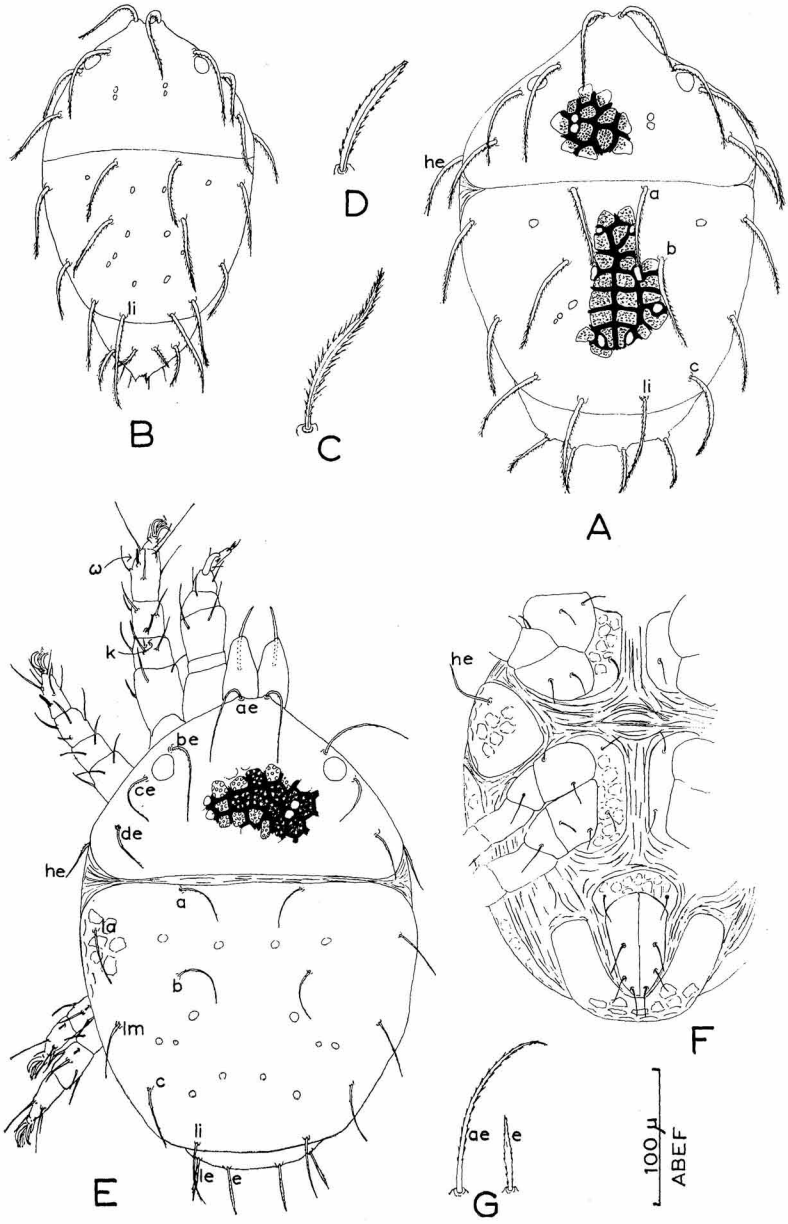


FIG. 2—*Ledermuelleria mixta* n. sp.: A. Female dorsal; B. Male dorsal; C. Female seta *il* of "typical" form; D. Female seta *il* of "extreme" form. *Ledermuelleria corticola* n. sp.: E. Female dorsal; F. Female ventral; G. Dorsal setae.

(T.G.W.); moss on roadside cutting, near Dunedin (T.G.W.); moss among beech forest litter, Waipori Falls, near Dunedin (T.G.W.); moss on rocks, 4 miles S. of Alexandra (T.G.W.); moss on rocks Kurow, N. Otago (T.G.W.); moss among shingle, Birdlings Flat, Lake Ellesmere (T.G.W.); litter, moss and lichens, beech forest, 17 miles N of Lake Paringa (N.A.W.); litter and moss, beech forest 16 miles N. of Te Anau (N.A.W.); beech litter, 2 miles W. of Otira (N.A.W.).

COLLECTION DATA—SOUTH PACIFIC ISLANDS

Leaf litter, Lomaivuna, Viti Levu, 16.vi.65 (G. W. Ramsay); moss on rocks, Alofi, Niue, 15.x.64 (A. C. Eyles); moss on fallen log, Huvalu, Niue, 22.ix.64 (A.C.E.); moss and leaf litter Avana, Rarotonga, 9.v.65 (G. W. Ramsay); leaf litter Mataiea, Tahiti, 23.v.65 (G.W.R.).

MATERIAL

Holotype, allotype, and paratypes in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History) and United States National Museum.

## *Ledermuelleria corticola* n. sp.

FEMALE

Length of idiosoma 350 μ. Sculpturing of dorsal plates as in *L. mixta* except that each dimple has only 7–14 vacuoles (Fig. 1A). Two pairs of small, shallow unvacuolated dimples on propodosma and six or seven pairs on hysterosoma (Fig. 2E). One pair of eyes. Dorsal setae slender, faintly spinulate and situated on minute tubercles; suranal setae slightly stouter (Fig. 2G). Length of setae as follows: *ae, be* 75–80 μ; *c, li* 45 μ; *le, e* 30–35 μ, others about 40 μ. Distances *a–a* and *b–b* more than twice the length of setae *a* and *b* respectively; distance *c–c* about three times the length of *c*; *li–li* greater than length of *li*.

Endocoxal plates distinctly separated in mid-line and faintly sculptured (Fig. 2F). Numbers of setae on legs as for *L. mixta*. Genital plate distinctly separated from ventral rami of suranal plate and bearing one pair of setae. Three pairs of setae on anogenital covers, longer than the distance between their successive alveoli and of equal lengths. Natural colour red.

MALE

Length of idiosma 250 μ. Features as in female except for normal sex differences; setae *li* relatively longer (38 μ) in relation to body length than in female. Solenidion ω ♂ on tarsus I very short, not reaching as far as base of solenidion ω.

DISTINGUISHING FEATURES

The shape and relative lengths of the dorsal setae, setae *a* and *li* being distinctly shorter than *a–a* and *li–li* respectively, the lateral positioning of setae *c* and the vacuolation are diagnostic.

COLLECTION DATA

Holotype: adult female from bark of manuka (*Leptospermum*), Dun Mt. track (50 m), Nelson, 27.vi.64 (T. G. Wood). Allotype: adult male from litter and moss, *Podocarpus* forest, 10 miles W. of Tokaanu, Lake Taupo, 500m, 21.iv.65 (N. A. Walker). Other localities (South Island only): bark of gum (*Eucalyptus*), Nelson (T.G.W.); *Podocarpus ferrugineus* G. Benn. ex Don (beating sample), Wairau Valley, near Blenheim (B. B. Given); bark of willow (*Salix*) Appleby, Nelson (T.G.W.); moss among rocks, 1,700 m, Mt. Gomorrah, Nelson (T.G.W.); mixture of living and dead ferns, beech (*Nothofagus*) forest, head of Eglinton Valley (N.A.W.).

MATERIAL

Holotype, allotype, and paratypes in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History) and United States National Museum.

## *Ledermuelleria simplex* n. sp.

FEMALE

Length of idiosoma 300 $\mu$. Dorsal plates with sculpturing as a regular pattern of indented dimples without vacuoles. Two pairs of small, shallow dimples on propodosoma and five or six pairs on hysterosoma (Fig. 3A). One pair of eyes. Dorsal setae fairly slender, bilaterally spinulate, situated on small tubercles (Fig. 3C). Lengths of setae as follows: *ae, be, b, c, li* 60–65 $\mu$; *le, e* 35–40 $\mu$; others 55–60 $\mu$. Setae *a* shorter than *a–a,* and *a–a* greater than *b–b*; *li* longer than *li–li*; *c–c* more than 1·5 times longer than setae *c*.

Endocoxal plates completely fused in mid-line and faintly reticulated (Fig. 3B). Numbers of setae on legs as for *L. mixta.* Genital plate faintly reticulated, bearing one pair of setae. Three pairs of subequal anal setae, about as long as distance between their successive alveoli.

MALE

Length of idiosoma 240 $\mu$. Features as in female except for normal sex differences and setae *li* relatively longer (52 $\mu$) in relation to body length. Solenidion $\omega$ ♂ on tarsus I long, reaching as far as base of setae *tc′* and *tc″*.

DISTINGUISHING FEATURES

The shape of the dorsal setae, relative lengths and positions of setae *a, b, c* and *li,* the absence of vacuolation and the median fusion of the endocoxal plates are useful diagnostic features.

COLLECTION DATA

Holotype: adult female from moss around kauri (*Agathis australis*) trees, Waipoua forest, N. Auckland, 13.xi.64 (G. S. Grandison). Allotype: adult

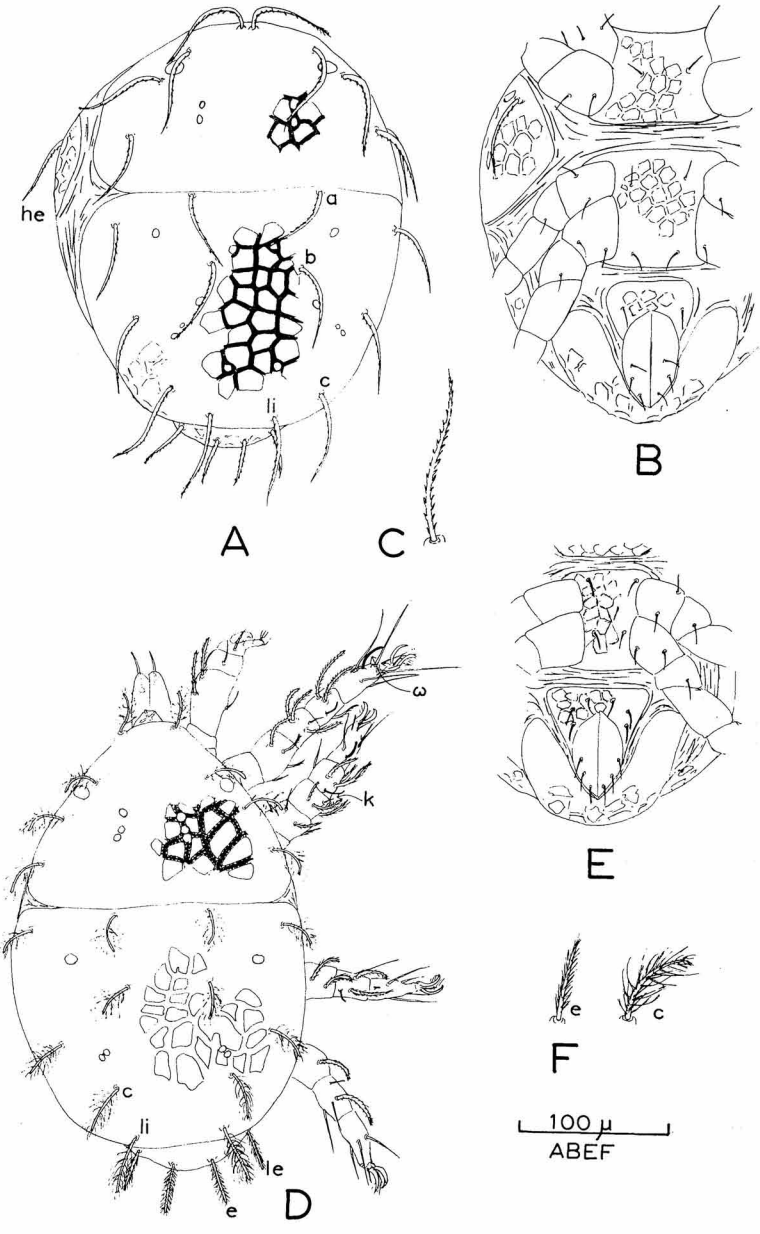


FIG. 3—*Ledermuelleria simplex* n. sp.: A. Female dorsal; B. Female ventral; C. Dorsal seta. *Ledermuelleria dumosa* n. sp.: D. Female dorsal; E. Female ventral; F. Dorsal setae.

male from moss among *Podocarpus* litter, lower Kauronga River, near Thames, 5.ix.64 (E. Collyer). Other localities: North Island—moss on logs in exotic pine plantation, Waitangi (G.S.G.); moss on rotting logs in mixed *Podocarpus–Dacrydium* forest, Waitakere range, Auckland (T. G. Wood); moss on roadside cutting, Maungaturoto, near Whangarei (G.S.G.); moss growing on beech (*Nothofagus*) trees, Awakino gorge (G.S.G.); litter and moss, kauri forest, Waipoua, N. Auckland (N. A. Walker); litter, moss, and lichen among kauri trees, Waitakere range, Auckland (N.A.W.); South Island—moss on rocks, Wairoa Gorge, Nelson (I. Townsend); moss among beech forest litter, Tennyson inlet, Marlborough Sounds (G. W. Ramsay); moss among beech forest litter at 1,000 m, Cobb reservoir, near Takaka (T.G.W.); moss on roadside cutting, Skippers road, near Queenstown (T.G.W.)

MATERIAL

Holotype, allotype, and paratypes in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History) and United States National Museum.

## The "pectinata" group

### *Ledermuelleria dumosa* n. sp.

FEMALE

Length of idiosoma 300 $\mu$. Dorsal plates strongly sclerotised with an irregular pattern of deeply indented dimples which are finely vacuolated (Figs 1C, 3D). Dimples either small, elongate or roughly circular (more than 20 vacuoles each), or large, elongate or irregular in outline (more than 40 vacuoles each). Reticulum separating dimples is thin and under phase contrast illumination the peripheral vacuoles of adjacent dimples appear close together. Six pairs of small, circular, shallow, unvacuolated dimples, often difficult to locate. Conical protuberance of propodosoma protrudes anteriorly between and below vertical setae *ae*. One pair of eyes. Dorsal setae bushy, subequal 25–30 $\mu$ long, except *c* and *li* which are slightly longer (35–40 $\mu$); *le* and *e* not bushy, with lateral spines of equal length (Fig. 3F). Setae situated on small tubercles.

Endocoxal plates of propodosoma and metapodosoma completely fused in mid-line and faintly reticulated (Fig. 3E). Numbers of setae including sensillae on legs I–IV as follows: tarsi 14–10–8–7; tibiae 7–6–6–6; genua 4–4–1–1; femora 5–4–3–2. Trifid seta on palp-tibia sessile. Three pairs of setae on genital plate. Three pairs of setae on anogenital covers, subequal, as long as distance between their successive alveoli. Colour in life orange.

MALE

Length of idiosoma 210 $\mu$. Distinctly smaller, fusiform as in males of "segnis" group. Solenidion $\omega$ ♂ on tarsi noticeably thicker than solenidion $\omega$,

and very long reaching as far as base of setae *tc'* and *tc''*. Setae *li* long (45–50 μ), as in males of "segnis" group; *le* 30 μ, *e* 20 μ. No obvious small unvacuolated dimples on dorsum.

#### DISTINGUISHING FEATURES

The presence of only five setae on femur I and four setae on femur II, one pair of eyes, reticulated endocoxal plates, the shape of the setae, and the distribution of small, thickened dimples distinguish this species from the four other described species of the "pectinata" group (see Summers and Price, 1961).

#### COLLECTION DATA

Holotype (adult female) and allotype (adult male) from moss on roadside cutting near Maungaturoto, Whangarei, 12.xi.64 (G. S. Grandison). Also known from moss on rocks in manuka (*Leptospermum*) scrub, Fringe Hill, Nelson (T. G. Wood).

#### MATERIAL

Holotype, allotype, and paratype in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History) and United States National Museum.

## The "maculata" group

### *Ledermuelleria granulosa* n. sp.

#### FEMALE

Length of idiosoma 440 μ. Dorsal plates well-sclerotised, dimples roughly circular separated from each other by distances greater than their diameters (Fig. 1D, 4A); reticulum around dimples very faint. Characteristic shallow depressions ("fossettes") occur on propodosomal (three or four pairs) and hysterosomal (three pairs) plates as shown in Fig. 4A. Suranal plate hidden under hysterosomal plate. One pair of eyes. Distinct callosity in humeral region lying on pleural membrane between setae *ce* and *de*. Dorsal setae acicular with minute spinules on distal half, not situated on tubercles (Fig. 4D). Lengths of setae as follows: *c* 115 μ; *lm* 80 μ; *he, le, e* 45 μ; *ce* 20 μ; others 60–75 μ. Distance *c–c* distinctly longer than *li–li*.

Endocoxal plates on propodosoma completely separated in mid-line; distinctly dimpled with obvious reticulum. Numbers of setae on legs I–IV as follows: tarsi 14–10–8–8; tibiae 7–6–6–6; genua 4–4–1–1; femora 6–5–3–2. Solenidion ω present on tarsus IV. Dimpling evident on basal podomeres of legs and palps. Genital plate with two pairs of setae (Fig. 4B) and with obvious dimples. Three pairs of subequal anal setae, longer than distance between their successive alveoli. Natural colour greenish-black.

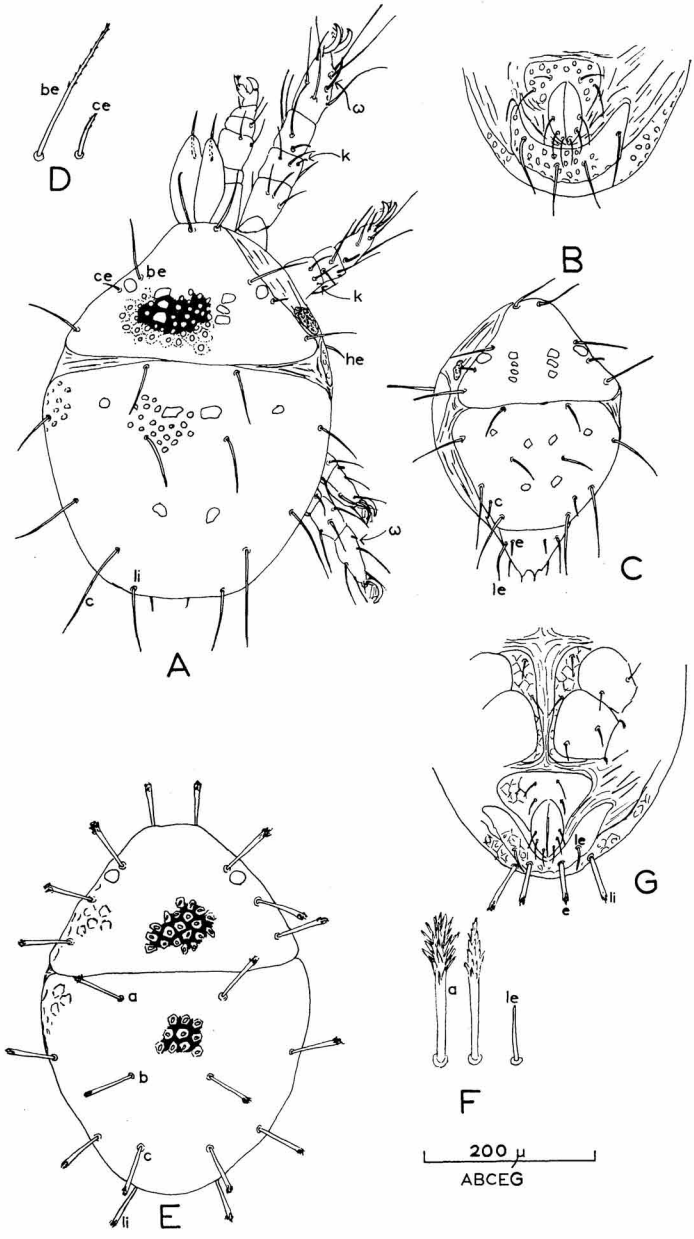


FIG. 4—*Ledermuelleria granulosa* n. sp.: A. Female dorsal; B. Female ventral; C. Male dorsal; D. Dorsal setae. *Ledermuelleria clavigera* n. sp.: E. Female dorsal; F. Dorsal setae; G. Female ventral.

MALE

Length of idiosoma 310 μ. (Fig. 4C). Sculpturing of dorsal plates and venter as in female. Recognisable by diminutive setae *c* and *e* (20 μ). Setae *a* and *b* relatively shorter than in female.

DISTINGUISHING FEATURES

The species is similar to *L. schusteri* Summers in the nature of the sculpturing, presence of ω on tarsus IV, single callosity, two pairs of genital setae, and in the relative lengths of dorsal setae in male and female, but can be distinguished from this species by the shape of the setae and the larger size.

COLLECTION DATA

Known from only one locality: moss on logs, Aparima river, near Mossburn, 8.v.64 (T. G. Wood). Holotype (adult female), allotype (deutonymph male).

MATERIAL

Holotype, allotype, and paratype in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History) and United States National Museum.

*Ledermuelleria manapouriensis* n. sp.

FEMALE

Length of idiosoma 480 μ. A robust, broad-bodied species with propodosomal and hysterosomal plates overlapping laterally more so than in other species, leaving only a narrow strip of integument between the dorsal and the humeral plates. Ornamentation similar to *L. granulosa* except that no reticulum observed dorsally. Dimples circular, shallow, difficult to observe dorsally in well-cleared specimens and most obvious in profile near down-curved margins of dorsal plates. Diameters of these peripheral dimples and also of a few on the posterior margin of the propodosomal plate greater than the distance separating individual dimples; mid-dorsal dimples very small, appearing as small punctures (Fig. 5A). No fossettes on dorsal plates or callosities on humeral integument. One pair of eyes. Dorsal setae acicular, with indefinite distal sheath and a few minute spinules, and situated on minute tubercles (Fig. 5D). Sheath and spinules more obvious on certain leg setae (Fig. 5E). Lengths of dorsal setae as follows: *c* 120 μ; *be, li* 105 μ; *ce, e* 60 μ; *he* 70 μ; *le* 35 μ; others 80–85 μ. Distance *c–c* distinctly longer than *li–li.*

Endocoxal plates of propodosoma and metapodosoma completely separated in mid-line and distinctly reticulated. Numbers of setae on legs as in *L. granulosa.* Genital plate smooth, elongate, with two pairs of setae (Fig. 5C). Three pairs of anal setae, distinctly longer than distance between their successive alveoli; posterior pair nearly 1·5 times longer than other two pairs.

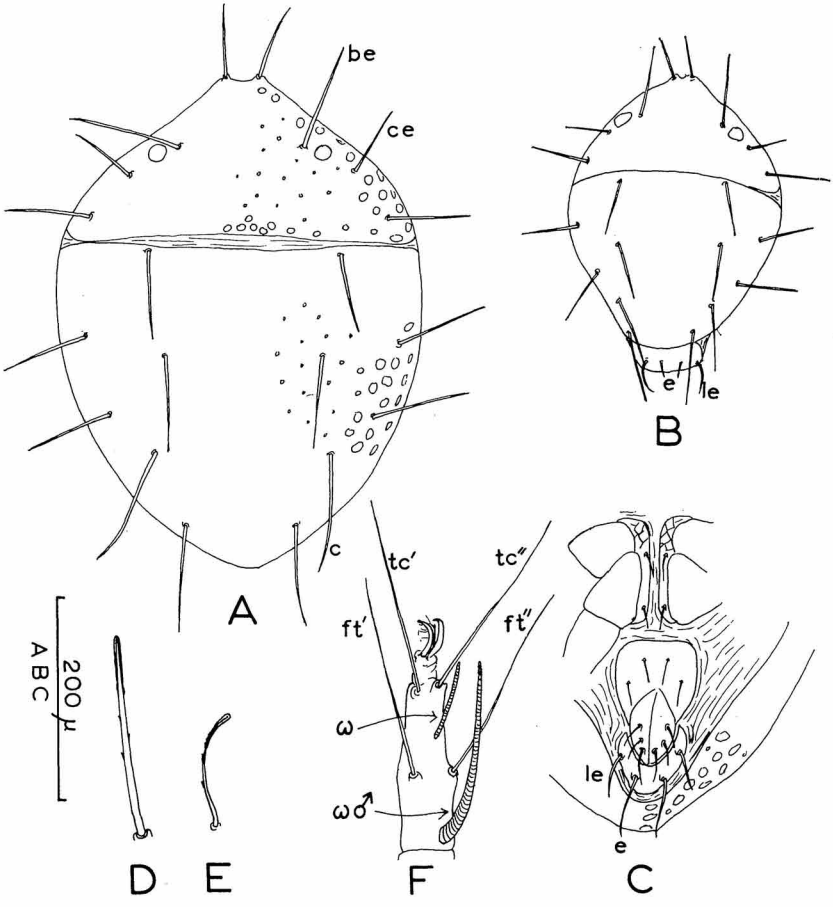


FIG. 5—*Ledermuelleria manapouriensis* n. sp.: A. Female dorsal; B. Male dorsal; C. Female ventral; D. Dorsal seta; E. Seta on femur I; F. Male tarsus I.

## MALE

Length of idiosoma 280 μ (Fig. 5B). Sculpturing, shape, and relative lengths of dorsal setae as in female except setae *le* (35 μ) longer than *e* (20 μ). Solenidion ω ♂ long, reaching as far as base of setae *tc'* and *tc"* (Fig. 5F).

## DISTINGUISHING FEATURES

Superficially this species resembles *L. ottavii* (Berl.) and *L. rhodomela* (Koch), but can be distinguished from these species by the presence of only two pairs of setae on the genital plate, the length of the humeral setae *he* relative to the dorsal setae, and the shape of the dorsal setae.

COLLECTION DATA

Known from only only one locality: moss and litter, beech (*Nothofagus*) forest, mouth of Spey river, Lake Manapouri, 22.ii.65 (N. A. Walker). Holotype (adult female), allotype (adult male).

MATERIAL

Holotype, allotype, and paratypes in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History) and United States National Museum.

### *Ledermuelleria clavigera* n. sp.

FEMALE

Length of idiosoma 440 $\mu$. A robust, well sclerotised species, with dorsal plates uniformly dimpled. Dimples deep, pit-like, with non-vacuolated roughly circular bases, and separated by thick polygonal reticulum (Fig. 4E). Suranal plate covered by posterior margin of hysterosomal plate. No fossettes on dorsal plates or callosities in humeral region. One pair of eyes. Dorsal setae not situated on tubercles, stout, slightly capitate, tufted distally with spicules. Specimens from the North Island (Rotorua) had the spicules opened out to give a distinct capitate shape to the setae, whereas specimens from the South Island (Queenstown and Takaka) had the spicules closely appressed (Fig. 4F). These differences did not appear to be artifacts created by the mounting process. Propodosomal and hysterosomal setae subequal (105 $\mu$); *he* and *e* distinctly shorter and more slender (75–80 $\mu$); *le* short (42 $\mu$), acicular with only minute spicules. Distance *c–c* equal to *li–li*.

Endocoxal plates of propodosoma and metapodosoma completely, but narrowly separated in mid-line and with obvious reticulum (Fig. 4G). Hind coxae close together (about 30 $\mu$ apart) so that legs IV are largely hidden in dorsal view and are directed posteriorly rather than posterolaterally. Numbers of setae on legs as in *L. granulosa*. Genital plate with two pairs of setae and distinctly reticulated. Three pairs of subequal anal setae, longer than distance between their successive alveoli.

MALE

Length of idiosoma 290 $\mu$. Features as in female except for normal sex differences and relative lengths of setae *c* (13 $\mu$), *le* (35 $\mu$) and *e* (10 $\mu$). Solenidion $\omega$ ♂ on tarsus I short, not reaching as far as base of solenidion $\omega$.

DISTINGUISHING FEATURES

The shape of the dorsal setae are characteristic of this species.

COLLECTION DATA

Holotype: adult female from moss on stones and logs by lakeside, Rotorua, 11.xi.64 (G. S. Grandison). Also known from moss among beech

(*Nothofagus*) forest litter, Cobb reservoir, 1,000 m, near Takaka, Nelson (T. G. Wood); moss on roadside cutting, Skippers Road, near Queenstown (T.G.W.).

MATERIAL

Holotype, allotype, and paratypes in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History) and United States National Museum.

## *Ledermuelleria brevisetosa* n. sp.

FEMALE

Length of idiosoma 340 μ. Dorsal sculpturing well-developed, similar to *L. clavigera* except walls separating dimples not quite as thick (F.gi 6A). A small rotund species with suranal plate covered by posterior margin of hysterosoma and thus not evident dorsally. No fossettes on dorsal plates or callosities in humeral region. One pair of eyes. Dorsal setae very short, not situated on tubercles, and consist of an acicular axial core surrounded by a hyaline sheath which is most obvious distally so that the setae are slightly clavate (Fig. 6B). Lengths of setae as follows: *be* 45 μ; *ae, de, a* 25–28 μ; *ce* 8 μ; others 15–20 μ. Distance *c–c* equal to *li–li*.

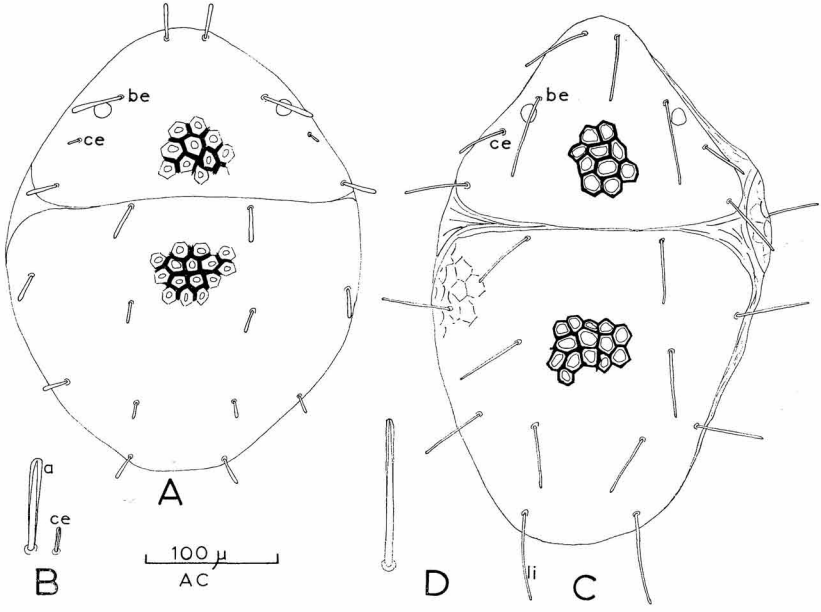


FIG. 6—*Ledermuelleria brevisetosa* n. sp.: A. Female dorsal; B. Dorsal setae. *Ledermuelleria distincta* n. sp.: C. Female dorsal; D. Dorsal seta.

Endocoxal plates of propodosoma and metapodosoma only narrowly separated in mid-line and noticeably dimpled. Hind coxae close together (15–20 μ) apart as in *L. clavigera* so that legs IV largely hidden under body and tarsi visible terminally rather than laterally. Numbers of setae including sensillae on legs I to IV as in *L. granulosa*. Two pairs of setae on genital plate which is noticeably dimpled. Three pairs of anal setae, longer than the distance between their successive alveoli, posterior pair slightly longer than the other two pairs.

MALE

Not observed.

DISTINGUISHING FEATURES

The small size, shape of dorsal setae and length of postoculars *ce*, are distinctive.

COLLECTION DATA

Holotype: adult female from moss on a grassy roadside verge, near Maxwell, Wanganui, 16.xi.64 (G. S. Grandison). Also known from moss growing on rocks, beech forest, near Mangamuka (G.S.G.).

MATERIAL

Holotype and paratype in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History) and United States National Museum.

## *Ledermuelleria distincta* n. sp.

FEMALE

Length of idiosoma 390 μ. Dorsal plates with fairly shallow, evenly spaced dimples separated by thin walls which show as a distinct reticulum (Fig. 1E, 6C). Suranal plate ventral rather than terminal. No fossettes on dorsal plates or callosities in humeral region. One pair of eyes. Dorsal setae moderately long; *be, li* 65 μ; *ce* 38 μ; others 45–52 μ. Distance *c–c* slightly shorter than *li–li*. Setae long and rod-shaped, with acicular axis surrounded by hyaline sheath so that width is uniform throughout their length (Fig. 6D).

Endocoxal plates of propodosoma completey separated in mid-line and noticeably dimpled. Dimples also on genital plate and basal podomeres of legs. Numbers of setae on legs as in *L. granulosa*. Two pairs of setae on genital plate. Three pairs of anal setae, subequal, longer than distance between their successive alveoli.

MALE

Length of idiosoma 260 μ. Features as in female except for normal sex differences; setae *be* longer (73 μ) than in female and twice as long as *ce*; *e* very short (10 μ), *le* (36 μ). Solenidion ω ♂ on tarsus I very long reaching as far as base of setae *tc'* and *tc''*.

### DISTINGUISHING FEATURES

The dorsal sculpturing and shape and lengths of dorsal setae distinguish this species from other species with two pairs of genital setae and a solenidion on tarsus I.

### COLLECTION DATA

Holotype: adult female from moss and litter, *Podocarpus* forest; 10 miles W. of Tokaanu, Lake Taupo, 500 m, 21.iv.65 (N. A. Walker). Allotype: adult male from *Podocarpus litter,* Lake Okataina, near Rotorua, 400 m, 10.iv.65 (N.A.W.). Other localities (North Island only): moss on roadside cutting near Maungaturoto, Whangarei (G. S. Grandison); moss, litter, and lichen under kauri (*Agathis australis*) trees, Waitakere range, Auckland (N.A.W.); litter under kauri trees, Waipoua forest, N. Auckland (N.A.W.).

### MATERIAL

Holotype, allotype, and paratype in collection of Entomology Division, D.S.I.R., Nelson. Paratypes sent to British Museum (Natural History), and United States National Museum.

## DISCUSSION

More than 140 moss samples, 60 litter samples, and 12 bark samples extracted in Tullgren funnels provided material on which this paper is based. The species described occurred much more frequently in the moss samples (34% occurrence) than in the litter samples (7% occurrence), and one species, *L. distincta,* provided most of the records from litter. One species, *L. corticola,* occurred in 4 of the 12 bark samples examined, but in only 3 of the moss and litter samples. With the exception of a single record of *L. mixta* from *Podocarpus totara, L. corticola* is the only known bark-inhabitant in the genus *Ledermuelleria,* as all other known species, including the ones in the present paper, are moss or litter-inhabitants or parasitic on insects. *L. mixta* and *L. simplex* are the commonest species, the former occurring predominantly in the South Island and the latter predominantly in the North Island. *L. mixta* may be distributed throughout the southern Pacific as it has been found on four widely separated islands in this region. The other species of *Ledermuelleria* are sparsely distributed and have been recorded from less than 5 of the 200 samples examined.

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