

THE NEW ZEALAND SPECIES OF BEROETHIDAE (INSECTA: NEUROPTERA)

K.A.J. WISE

AUCKLAND INSTITUTE AND MUSEUM

Abstract. The one described New Zealand species of Berothidae, *Protobiella zelandica* Tillyard, 1923, was previously known from only 2 female specimens. Additional records are noted. A new description, based on male and female specimens, is given. It is concluded that *P. zelandica* stands alone as a separate endemic species and is the only New Zealand Berothid.

The New Zealand Berothid lacewing *Protobiella zelandica* was described by Tillyard (1923) from two specimens. One, which he collected on 6 February 1921 in the Nelson area, was designated as the holotype. He designated the other specimen as a paratype. It was collected at Waitati on 13 December 1916, probably by C.E. Clarke, an amateur entomologist of Dunedin, who collected another lacewing at Waitati on 11 December 1916 (*Micromus tasmaniae* Walk., C.E. Clarke collection, Auckland Museum).

G.V. Hudson, of Wellington, collected the species several times in a valley near Wellington between 1921 and 1925. After his collection on 6 December 1923, he wrote a note the next day describing the living insect (Hudson 1924). Later (Hudson 1950), he gave further similar information apparently based on observations in the same valley on 13 January 1938, but no specimens of this date have been found in collections.

Navás (1929), in his revision of the Family Berothidae, included short descriptions of both *Protobiella* and *P. zelandica* based on the descriptions and figure of Tillyard (1923). Wise (1963, 1991) gave known distribution limits, Wise (1977) listed the species and MacLeod & Adams (1967) and Oswald & Penny (1991) listed the genus.

Tillyard (1923) had designated his two specimens as a holotype male and a paratype female, but Aspöck & Aspöck (1985) and Aspöck (1986) found that both specimens are females and re-described and figured this sex. Male specimens have now been discovered so the species is here re-described and figured (Fig. 1), and collecting data from all known specimens are given.

Specimens are in the collections of Auckland Institute and Museum (AMNZ); British Museum (Natural History), London, England (BMNH); Canterbury Museum, Christchurch (CMNZ); National Museum, Wellington (NMNZ); and Landcare Research (previously Plant Protection Entomology, DSIR), Auckland (NZAC).

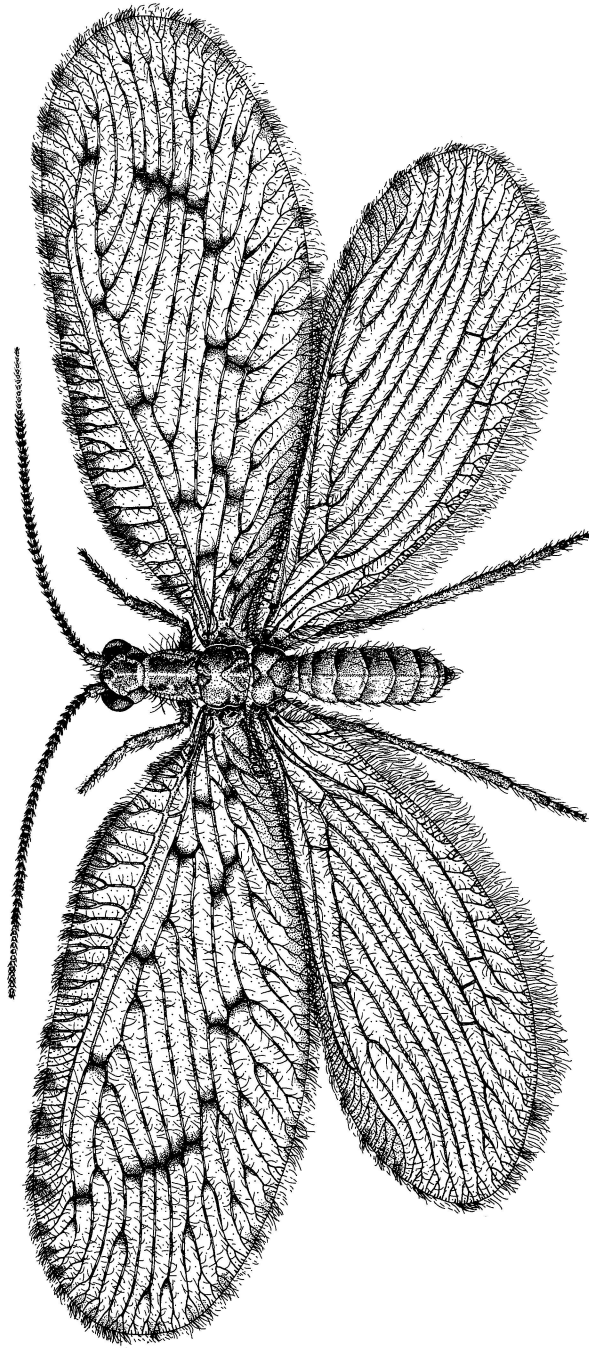


Fig. 1. *Protobiella zelandica* Tillyard, 1923. Female. Wayby Gorge. (Del. J. Liddiard).

FAMILY BEROTHIDAE

Subfamily BEROTHINAE

Genus **Protobiella** Tillyard, 1923

- Protobiella* Tillyard, 1923, Trans. Proc. N.Z. Inst. 54: 218 (NZ).
Protobiella : Navás, 1929, Mems Acad. Cienc. Exact. Fis.-Quim. Nat. Zaragoza 2: 90 (NZ).
Protobiella : MacLeod & Adams, 1967, Psyche 74(3): 258 (NZ).
Protobiella : Aspöck & Aspöck, 1985, Z. ArbGem. Österr. Ent. 36(3, 4): 75, 80 (NZ).
Protobiella : Aspöck, 1986, Recent Research Neuropterology, 89-92, 100 (NZ).
Protobiella : Oswald & Penny, 1991, Occas. Pap. California Acad. Sci. No. 147: 50 (NZ).
Protobiella : Wise, 1991, Rec. Auckland Inst. Mus. 28: 212, 223 (NZ).

Protobiella zelandica Tillyard, 1923

(Figs. 1-10)

- Protobiella zelandica* Tillyard, 1923, Trans. Proc. N.Z. Inst. 54: 219 (NZ).
Protobiella zealandica : Hudson, 1924, Ent. Mon. Mag. 60: 40 (NZ), [in error for *zelandica*].
Protobiella zelandica : Tillyard, 1926, Insects Australia New Zealand, 316 (NZ).
Protobiella zelandica : Navás, 1929, Mems Acad. Cienc. Exact. Fis.-Quim. Nat. Zaragoza 2: 91 (NZ).
Protobiella zelandica : Hudson, 1950, Fragments New Zealand Entomology, 116 (NZ).
Protobiella zelandica : Wise, 1963, Pacific Ins. 5(1): 54 (NZ).
Protobiella zelandica : Wise, 1977, Bull. Auckland Inst. Mus. 11: 132 (NZ).
Protobiella zelandica : Aspöck & Aspöck, 1985, Z. ArbGem. Österr. Ent. 36(3, 4): 75 (NZ).
Protobiella zelandica : Aspöck, 1986, Recent Research Neuropterology, 98 (NZ).
Protobiella zelandica : Wise, 1991, Rec. Auckland Inst. Mus. 28: 212, 214 (NZ).

Small brown species with yellow-brown markings on head and thorax, showing laterally as interrupted stripe. Antennae of medium length, setose, dark brown but pale apically. Head and body with black setae. Wings speckled with brown, darker brown spots showing as a transverse subapical stripe and two short inner posterior stripes on anterior wings. Underside of body and legs pale brown, legs darker apically with a distinct pale mark basally on tarsus.

Antennae with elongate basal segment (scape) ca. 3 times long as wide, 36-45 flagellar segments, dark brown basally with apical ca. 12 segments very pale. Flagellar segments - ♂♂ : 36-39, ♀♀ : 41-45. Head shining brown with yellow markings, face-mouthparts yellow except clypeus-lower edge of frons with transverse dark brown band. Dorsally head brown anteriorly extending between antennae (top of frons) with a dark brown wart on each side, dorsum dark brown, yellow laterally; posteriorly with 2 transverse non-setose warts.

Thorax shining brown with yellow markings. Pronotum slightly elongate with flange on each side, dark brown with thin pale yellow median stripe, the yellow lateral stripes showing dorsally as stripes or spots. Mesothorax dark brown dorsally with elongate yellow spot on each side anteriorly. Metathorax brown with pale median area. Legs setose (? more so in females); pale brown, darker apically on tibia and tarsus; basal tarsal segment long with basal half paler showing as a distinct pale mark.

Wings with membrane mainly clear, veins setose, edges thickly setose; pterostigma not delineated, area thickly setose. Forewing broad; apex rounded, slightly tapering in males well-rounded in females; membrane with series of brown marks along costa, brown spots elsewhere at vein forks and cross-veins with in some specimens extra spots in transverse stripes; main veins with subequal light and dark dashes; setae unicolorous, dark, except small patches of pale (ginger) setae on costa between adjacent dark membrane spots, small patches of pale (straw to golden-straw) setae variously around apex and posterior margin. Hindwing narrow, tapering apically; membrane clear without spots; setae unicolorous brown except some small pale (straw to golden-straw) patches around margin.

Wing venation (Figs. 2, 3). Forewing with Costa (C) bowed near base, costal area broadest at ca. $\frac{1}{4}$ of wing, humeral vein simple but variable, many forked veinlets, pterostigma not differentiated. One basal cross-vein Subcosta-Radius (Sc-R), Sc fused with R apically (Sc+R), with forked veinlets at margin. Remainder of veins also with forked veinlets at margin. Radial sector, Medius anterior (Rs, Ma) partially fused, with Ma basad from Rs+Ma, several branches of Rs apicad. Three cross-veins R-Rs. Branches of Rs variable in number from 4 or more in males to 7 in females, also with occasional variations (see Fig. 3. forewing Rs5); with cross-veins in gradate series to Ma variable. Base of Ma present as apparent cross-vein (b) at Rs+Ma -Medius posterior (Mp), apical cross-vein Ma-Mp. Mp forked, with cross-vein closing fork; 3 cross-veins M, Mp - Cubitus (Cu). Cu arises separately with 2 branches Cubitus anterior, Cubitus posterior (Cua, Cup), with cross-vein closing fork; 1 cross-vein Cup - Anal (A). Three A (A1, A2, A3) arise separately, with 1 cross-vein A1-A2.

Hindwing with costal area narrow, many simple veinlets, pterostigma not differentiated. No cross-veins Sc-R, Sc fused with R apically, with forked veinlets to margin. Remainder of veins also with forked veinlets to margin. Rs, Ma partially fused, with Ma basad from Rs+Ma, several branches of Rs apicad. Two cross-veins R-Rs. Branches of Rs variable in number, 4 or more in males, to 6 in females, no gradate cross-veins. Base of Ma present as apparent cross-vein (b) at Rs+Ma-Mp, 1 apical cross-vein Ma-Mp in some (? females). Mp forked with cross-vein closing fork; 1 apical cross-vein Mp-Cua. Cua arises separately, 1 cross-vein Cua-A; 2 or 3 A present. Rs branches, M, Cua noticeably long, slightly curved, sub-parallel to each other and to posterior margin.

Abdomen brown dorsally with darker median stripe, various darker patches on 6 basal segments, pale straw-colour ventrally extending up posterior edges of basal segments, terminal segments straw-colour.

Genitalia (Figs. 4-10). ♂. Tergite VIII (T VIII) little differentiated, narrow. T IX fused with ectoproct (e), elements visible, rounded on both sides. Torulus absent. Sternite VIII (S VIII) little differentiated, narrow. S IX separate with short setae; coxopodite (c) elongate, thick plate, straight-sided, trilobed apically, hinges upwards against ectoproct; paramere-mediuncus complex (pm) ventrally in coxopodite in median line, almost parallel-sided, slightly dilated apically, apex truncate, with 3 or 4 long, pointed setae. Gonarcus (g) with 2 elongate, upcurved processes (gp) medially. Hypandrium internum (hi) triangular. ♀. Tergite VII (T VII) little differentiated; T VIII elongate laterally. T IX fused with ectoproct (e). Ventral genital area anteriorly with Sternite VII (S VII) little differentiated;

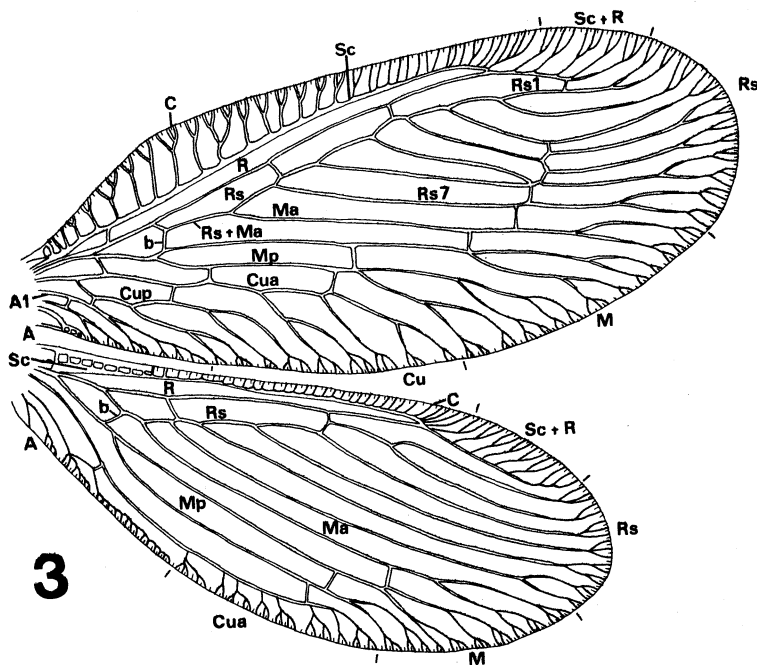
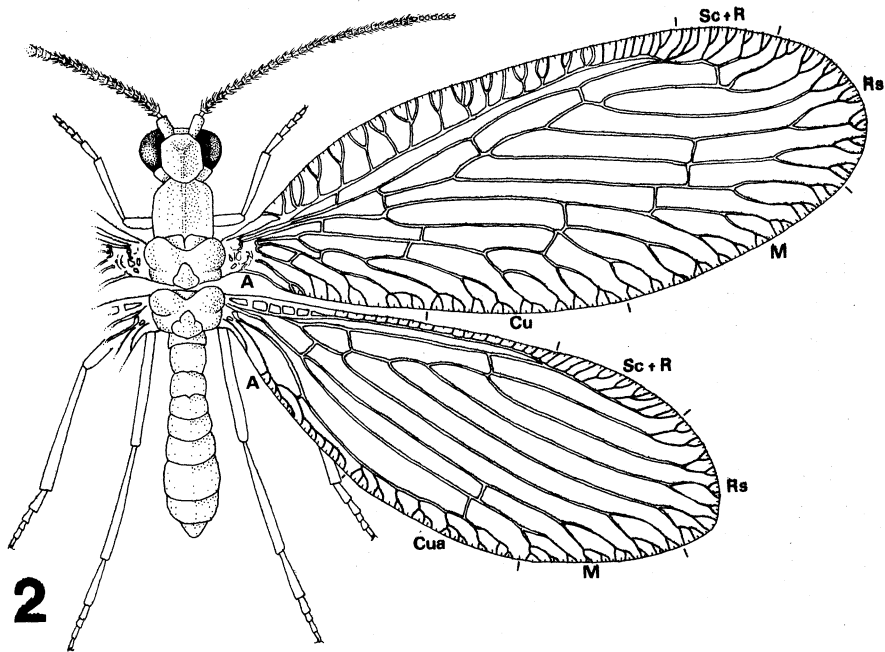


Fig. 2, 3. *Protobiella zelandica* Tillyard, 1923. Wing venation. 2.♂. 3.♀. (For abbreviations see description). (Del. J. Liddiard).

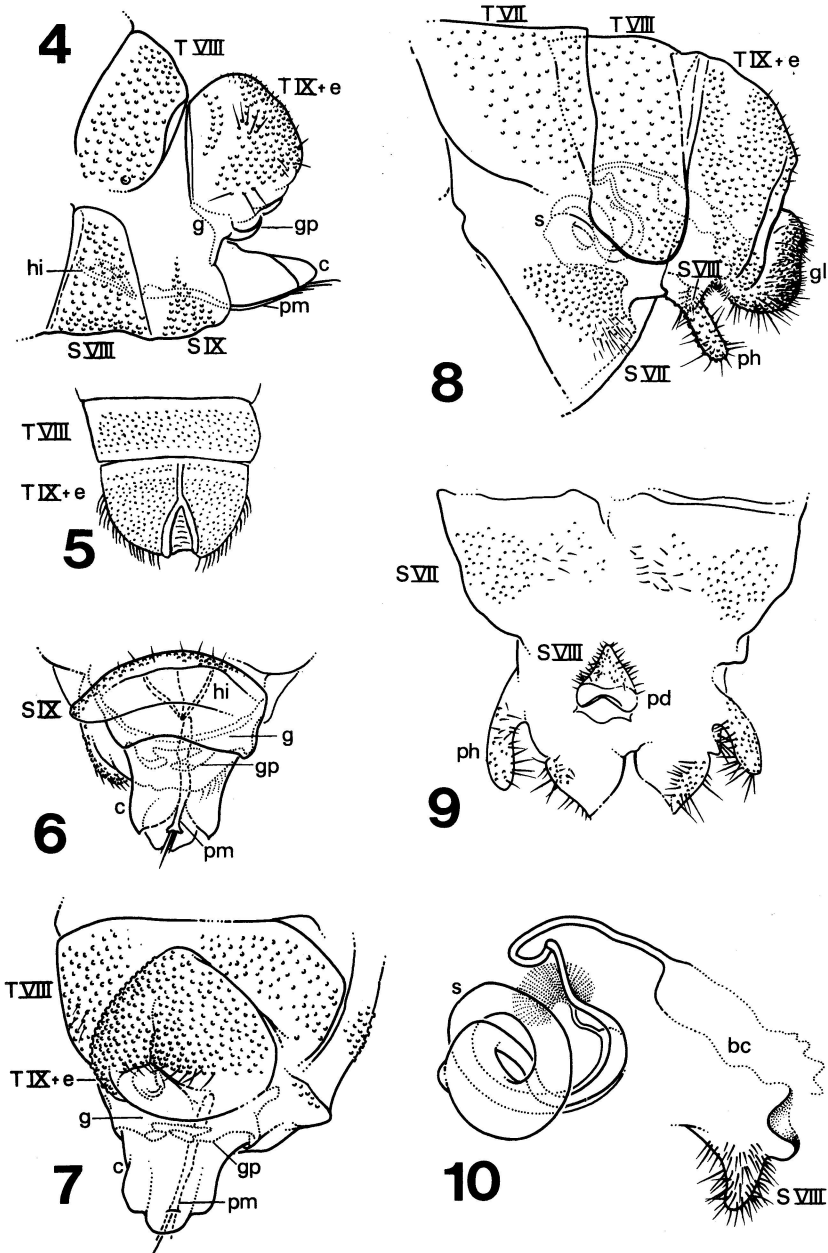


Fig. 4-10. *Protobiella zelandica* Tillyard, 1923. Genitalia. 4-7.♂. 4. Lateral. 5. Dorsal. 6. Ventral. 7. Dorso-caudal. 8-10.♀. 8. Lateral. 9. Ventral. 10. Spermatheca and bursa copulatrix to exterior. (For abbreviations see description). (Del. 4, 6-10 P. Quinn, 5 K.A.J.W.).

S VIII small, pointed, setose, with rounded transverse pudiculum (pd) posteriorly. T IX+e elongate laterally; a pair of large finger-like processes (pseudohypocaudae - Aspöck & Aspöck 1985, ph) projecting ventrally; gonapophyses laterales (gl) elongate, without hypocaudae. Spermatheca (s) with 2 thick coils, one through other, a thin tube to large bursa copulatrix (bc).

Measurements. Anterior wing: ♂♂ 6.75-9.0 mm, ♀♀ 7.0-9.0 mm. Posterior wing: ♂♂ 6.0-7.5 mm, ♀♀ 6.0-7.75 mm.

Specimens examined. South Island: Holotype ♀. Takaka, 6.II.1921, R.J. Tillyard. *Protophiella zelandica* Till. Type ♂ R.J.T. (Tillyard 1923 - Terakohe, near Takaka, Golden Bay). Paratype ♀. [Data label missing.] *Protophiella zelandica* Type ♀ R.J.T. (Tillyard 1923 - Waitati, 13.XII.1916). Fletchers Ck, West Inangahua SF, BR, 25.I.1972, J.S. Dugdale, H.P. McColl. ♂.

All 3 specimens are in NZAC and they are the only South Island specimens available.

North Island: Wayby Gorge, 30.XII.1926. C.E. Clarke collection. *Protophiella zelandica* det. K.A.J.W. 1959. ♀. Ohakune, -.1.1927, T.R. Harris. ♂.

53a, 53b (G.V. Hudson. Beaten out of forest growth, Gollans Valley, 24.XII.1921).

1 ♂ 1 ♀.

53c (G.V.H. Beaten out of forest growth, Gollans Valley, 25.I.1922). Gollans Valley, Wellington, 25.I.1922, G.V. Hudson. *Protophiella zelandica* Till. ♂ Det. by R.J. Tillyard. ♀.

53d, 53e, 53g (G.V.H. Beaten out of silver tree ferns, Upper Gollans Valley, 6.XII.1923). Gollans Valley, Wellington, 6.XII.1923, G.V. Hudson. B.M.1931-328. 2 ♂♂ 1 ♀.

53f (G.V.H. Beaten out of silver tree ferns, Upper Gollans Valley, 6.XII.1923). ♂.

53h (G.V.H. Ditto [Beaten out of silver tree ferns, Upper Gollans Valley] 1.II.1924. Gollans Valley, 1.II.1924, G.V. Hudson. B.M.1933-274. ♂.

53k (G.V.H. Beaten out of forest growth, Gollans Valley, 20.I.1925). Gollans Valley, 24.XII.1921 [in error], G.V. Hudson. B.M. 1932-218. ♀.

53l (G.V.H. Beaten out of forest growth, Gollans Valley, 20.I.1925). 1.

53m (G.V.H. Ditto [Beaten out of forest growth, Gollans Valley] 23.XII.1925). Gollans Valley, 6.XII.1923 [in error], G.V. Hudson. B.M. 1931-328. ♂.

53n, 53p, 53q, 53r (G.V.H. Beaten out of dead leaves of *Cordyline indivisa*, Erua, 31.XII.1931). 2 ♂♂ 1 ♀ 1.

123 (G.V.H. Beaten from dead leaves of *Cordyline indivisa*, Erua, 31.XII.1931). Erua, 31.XII.1931, G.V. Hudson. B.M. 1932-218. 1 ♂ 2 ♀♀.

The G.V. Hudson labels are tiny number/letter (species/specimens) labels and the data given above in brackets is from the G.V. Hudson collection register in NMNZ; data from other labels (where present) follows. Two printed BMNH labels have been given dates of earlier collections in error. North Island specimens are in AMNZ, BMNH, CMNZ and NMNZ.

Type localities (Fig. 11). New Zealand: South Island. The holotype ♀ label data is "Takaka" but it is recorded (Tillyard 1923) from "Terakohe, near Takaka, Golden Bay", which is undoubtedly Tarakohe on the Golden Bay coast ca. 10 km from inland Takaka. The paratype ♀ data is recorded (Tillyard 1923) as Waitati which is ca. 15 km north of Dunedin.

Distribution (Fig. 11). One specimen has been collected north of Auckland and several in the central North Island but most have been taken near Wellington. Two specimens are from the north-western corner of the South Island and one from the south-eastern. The South Island male is labelled from "Fletchers Ck" in West Inangahua State Forest. Fletcher Creek is ca. 10 km south of Inangahua and is ca. 150 km southwards from Tarakohe.

Life history. The elliptical, white eggs, without sculpture, are supported at the end of a long filament, singly or more often in a cluster on one filament (Hudson 1924). Hudson (1924, 1950) also observed that the brown insect rests with the antennae close together and the tips appressed to the substrate which gives the appearance of a small dead leaf, particularly when on a twig.

Gourlay (1930), Clark (1932) and Valentine (1967) have recorded *Protobiella zelandica* as a predator but no specimens have been found to support these records and they are possibly based on misidentification. All the references listed by Valentine (1967: 1147), including Gourlay (1930), appear to arise from the work of A.F. Clark who recorded the species (Clark 1932) as an infrequent predator of Adelgids in pine plantations. Recently cleared abdomens of two adult specimens had what appeared to be pieces of plant material in the gut; the larva is not yet known to the present author.

DISCUSSION

Protobiella zelandica appears to have a secondary sexual character in the number of antennal flagellar segments. In specimens so far seen, males have less than 40 and females more than 40.

Aspöck & Aspöck (1985) related *Protobiella zelandica* Tillyard, 1923 to *Austroberothella rieki* Aspöck & Aspöck, 1985 of Australia. The wings of both species are figured in Aspöck & Aspöck (1985: 83) and both the colour pattern and wing venation are noticeably different. Those authors, however, related the female genitalia of *P. zelandica* to that of *A. rieki*, being of the same pattern with pseudohypocaudae and without hypocaudae; the males of both species were not then known.

In general pattern, the male genitalia are similar to those of *Trichoma gracilipenne* Tillyard 1916, as figured by Aspöck & Aspöck (1985). The obvious torulus, seen in the figures of male genitalia of three Australian species which they described, has not been seen in males of *P. zelandica* but a median pair of elongate gonarcial processes occurs in this species and not in the others. These differences, together with differences in the female genitalia, may indicate a separation at a supra-generic level. Later, Aspöck & Aspöck (1988) described and figured the male genitalia of *Austroberothella rieki* which are quite distinct and do not appear to be particularly close to those of *Protobiella zelandica*.

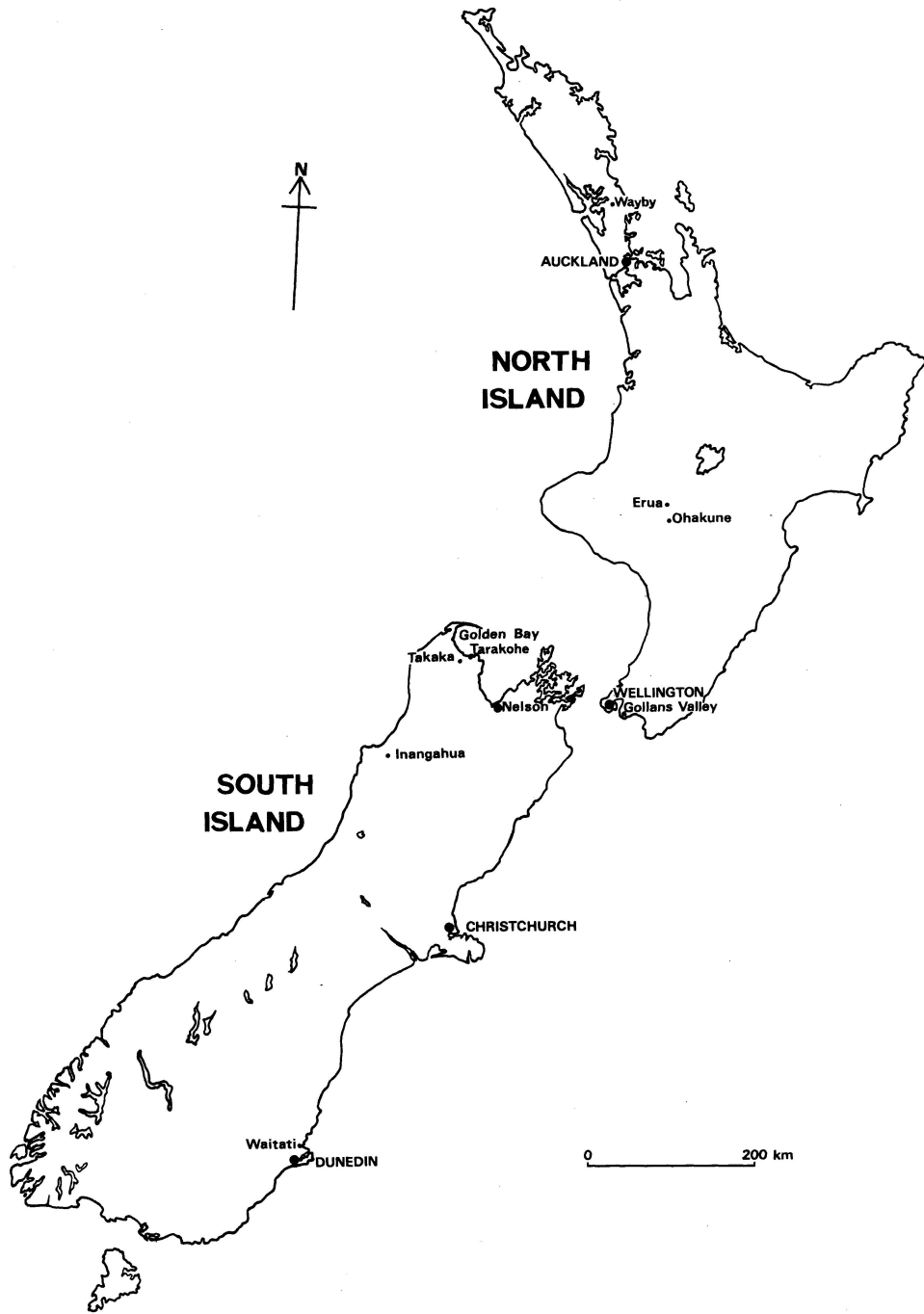


Fig. 11. Map of New Zealand with localities for *Protobiella zelandica* Tillyard, 1923. (Del. R. Gilbert).

One male of *Protobiella zelandica* from the South Island has been compared with males from the North Island and there is no obvious difference to suggest that there is more than one species. So far as is known this species stands alone as a New Zealand endemic in the Family Berothidae.

Acknowledgements. Loans of specimens were made by Mr Stephen Brooks, British Museum (Natural History), London, England; Mr Ron Ordish, National Museum of New Zealand, Wellington; Mr Anthony Savill, Canterbury Museum, Christchurch and Dr Trevor Crosby, New Zealand Arthropod Collection, Landcare Research, Auckland. Information was provided by Dr John Ward, Canterbury Museum and Dr Jean Legrand, Muséum National d'Histoire Naturelle, Paris, France.

Thanks are also given to Mr Jurgen Herbke, of Auckland, for translation from German; Miss Joanna Liddiard, Middlesex Polytechnic, Barnet, England, and Mr Peter Quinn, Auckland, for figures; and to Miss Rosemary Gilbert, Auckland Museum, for continuing assistance with specimens, figures and maps.

REFERENCES

- ASPÖCK, U.
 1986 The present state of knowledge of the Family Berothidae (Neuropteroidea: Planipennia). pp. 87-101. In *Recent Research in Neuropterology*. Proc. 2nd. Int. Symp. Neuropterology. J. Gepp, H. Aspöck, H. Hölzel (Eds.). Graz. 176p.
- ASPÖCK, U., and H. ASPÖCK
 1985 Die Berothiden Australiens (und Neuseelands) II: Die Genera *Trichoma* Tillyard, *Trichoberothena* Handschin, *Protobiella* Tillyard und *Austroberothenella* n.g. (Neuropteroidea: Planipennia: Berothidae). *Z. ArbGem. Österr. Ent.* 36(3, 4): 65-85.
 1988 Die Berothiden Australiens V: Zur systematischen stellung von *Austroberothenella rieki* U.A. & H.A. (Mit einem kurzen Überblick über die Erforschung der Berothidae Australiens) / (Neuropteroidea: Planipennia). *Stapfia* 17: 135-146.
- CLARK, A.F.
 1932 Insects infesting *Pinus radiata* in New Zealand. *N.Z. J. Sci. Tech.* 13(4): 235-243.
- GOURLAY, E. S.
 1930 Preliminary host-list of the entomophagous insects in New Zealand. *Bull. N.Z.D.S.I.R.* 22: 1-13.
- HUDSON, G. V.
 1924 Note on the habits of *Protobiella zelandica* Tillyard. *Ent. Mon. Mag.* 60: 40-41.
 1950 *Fragments of New Zealand Entomology*. Wellington, Ferguson & Osborn. 188p.
- MACLEOD, E. G., and P. A. ADAMS
 1967 A review of the taxonomy and morphology of the Berothidae, with the description of a new subfamily from Chile (Neuroptera). *Psyche* 74(3): 237-265.
- NAVÁS, R.P.L.
 1929 Monografía de la Familia de los Berótidos (Insectos Neurópteros). *Mems Acad. Cienc. Exact. Fis.-Quim. Nat. Zaragoza* 2: 1-107.

OSWALD, J.D., and N.D. PENNY

- 1991 Genus-group names of the Neuroptera, Megaloptera and Raphidioptera of the world. *Occas. Pap. California Acad. Sci.* 147: 1-94.

TILLYARD, R. J.

- 1923 Descriptions of new species and varieties of lacewings (Order Neuroptera Planipennia) from New Zealand, belonging to the Families Berothidae and Hemerobiidae. *Trans. Proc. N.Z. Inst.* 54: 217-225.
- 1926 *The Insects of Australia and New Zealand.* Sydney, Angus & Robertson. 560p.

VALENTINE, E. W.

- 1967 A list of the hosts of entomophagous insects of New Zealand. *N.Z. J. Sci.* 10(4): 1100-1209.

WISE, K. A. J.

- 1963 A list of the Neuroptera of New Zealand. *Pacific Ins.* 5(1): 53-58.
- 1977 A synonymic checklist of the Hexapoda of the New Zealand sub-region. The smaller Orders. *Bull. Auckland Inst. Mus.* 11: 1-176.
- 1991 Distribution and zoogeography of New Zealand Megaloptera and Neuroptera. *Rec. Auckland Inst. Mus.* 28: 211-227.

K.A.J. WISE, c/o Auckland Institute and Museum, Private Bag 92018, Auckland.