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Autor: Heads, Michael J.

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Biogeography and biodiversity in New Zealand *Pimelea* (Thymelaeaceae)

MICHAEL J. HEADS

RÉSUMÉ

HEADS, M. J. (1994). Biogéographie et biodiversité chez *Pimelea* (Thymelaeaceae) en Nouvelle-Zélande. *Candollea* 49: 37-53. En anglais, résumés français et anglais.

Cet article comprend des cartes de répartition des 19 espèces de *Pimelea* arrangées selon leur affinités putatives. Une concentration marquée des espèces se situe dans les provinces de Nelson et du Marlborough septentrional. Un bon nombre de types de distribution en Nouvelle-Zélande peut être mis en corrélation avec des mouvements tectoniques Mésozoïques, tout comme la disjonction Gondwanienne: Afrique — Inde — Malésie — Australasie chez *Pimelea* et les genres apparentés.

ABSTRACT

HEADS, M. J. (1994). Biogeography and biodiversity in New Zealand *Pimelea* (Thymelaeaceae). *Candollea* 49: 37-53. In English, French and English abstracts.

This paper includes distribution maps of the 19 New Zealand species of *Pimelea*, arranged according to their putative affinities. A pronounced massing of species occurs in Nelson/northern Marlborough provinces. Many of the distributions within New Zealand can be correlated with Mesozoic tectonics, as can the Gondwanic disjunction: Africa — India — Malesia — Australasia in *Pimelea* and related genera.

KEY-WORDS: Biogeography — Biodiversity — *Pimelea* — THYMELAEACEAE — South Pacific — New Zealand.

Introduction

Pimelea Banks & Sol. ex Gaertn. 1788 is a genus of shrubs in the family Thymelaeaceae which is made up of about 110 species. There are 90 species in Australia (RYE, 1990), all endemic, 19 in New Zealand and the Chatham Is. (ALLAN, 1961), again all endemic, and one on Lord Howe I. (OLIVER, 1917) (*P. congesta* Moore & Muell., treated as the New Zealand *P. longifolia* (Fig. 3 below) by BENTHAM, 1873). New Zealand and Lord Howe I. plants are usually placed in sect. *Pimelea* which also occurs in Australia.

RYE (1990) treated the closely related *Thecanthes* Wikstr. as a separate genus, characterised by a funnel-shaped receptacle. THRELFALL's (1982) classification differs from that of Rye by including *Thecanthes* as a section of *Pimelea* and restricting sect. *Pimelea* to Tasmania and New Zealand. Another closely related genus is *Kelleria* Endl. (HEADS, 1990b). In fact the unusual stamen number of two is the only constant character of *Pimelea* (incl. *Thecanthes*) which sets it apart from other members of tribe Gnidiaceae, especially *Kelleria*. The geographic ranges of these three genera are shown in Figure 1. The genus *Gnidia* of Africa and India is also related and this group has been treated (HEADS, 1990b) as a good example of a Gondwanic affinity. The three genera mapped in Figure 1 show an interesting pattern with *Kelleria* replacing *Thecanthes* and *Pimelea*



Fig. 1. — Members of the tribe Gnidiaceae in Malesia and Australasia. *Kellera*: hatched line; *Pimelea*: solid line; *Thecanthes*: stippled line.

in central New Guinea-Borneo (DING HOU, 1960). The only region where all three genera occur is NE Queensland/Papua, that is around the Coral Sea/Torres Strait region, well-known as an important biogeographic centre (HEADS, 1990a).

The Australian species of *Pimelea* are treated by RYE (1990) under seven sections. Ecological notes for each of these are given here as an introduction to the New Zealand species.

Sect. 1. *Heterantheros*. A single species with an unusual concave receptacle. Western Australia (Dirk Hartog I. and environs), close to coast, associating with outcropping limestone, in sand pockets and rock crevices.

Sect. 2. *Pimelea*. 20 species, mostly on sand and rock: coastal limestone, around salt-lakes, mallee shrubland, forest, alpine. Includes a spinescent species (Victoria) and a species with flowers with a single stamen (northern Tasmania). From the west to the east of Australia in the southern half of the country, and also in New Zealand, but absent from the SW region of Western Australia, like sect. 3, but unlike sects. 5 and 7 which are endemic there.

Sect. 3. **Epallage**. 18 species. Sandy and clayey soils. Rocky areas, woodland, shrubland, alpine moorland (1500 m). Wide in Australia but, apart from records in NE Queensland, absent in the far north and west of the country.

Sect. 4. **Calyptrastegia**. 33 species. Very widespread in southern Australia, but absent in the north of Western Australia, Northern Territory and Queensland and a large part of central Australia. Sand, clay, rocks. Coastal limestone, plains, dunes. Mallee and other shrublands, woodlands, seasonally waterlogged depressions, alpine (2000 m). At least one species known from swamps. *P. cracens* has one subspecies in wetlands, and one in mallee. *P. ammocharis* approaches the whipcord ericoid form. *P. octophylla* approaches *P. oreophila* of New Zealand, but judging from Rye's plate (RYE, 1990: Fig. 48) has phyllotaxis in 2/5.

Sect. 5. **Macrostegia**. One species, *P. physodes* — the Qualup Bell, of SW Western Australia growing in sand. The inflorescences have very large, brightly coloured bracts which are the most highly differentiated in the genus.

Sect. 6. **Stipostachys**. One species of Hammersley Ra. (Western Australia) and two in central Queensland. This disjunct section is characterised by the stem nodes not protruding abaxially. Nodes, or "leaf bases" do protrude in the other Australasian species, a further peculiar parallel with the *Hebe* complex (Scrophulariaceae), where pulvinate leaf-bases are conspicuous (HEADS, 1993b).

Sect. 7. **Heterolaena**. 14 species of SW Western Australia. Sand, clay, laterite, granite. Seasonally waterlogged flats on coastal dunes, plains and limestone, *Eucalyptus marginata* (jarrah) forest, mallee woodland and shrubland.

In some species of *Pimelea* the inflorescence receptacle elongates, resulting in what resembles a raceme. On the other hand, in *Pimelea* sect. *Heterantheros* and in *Thecanthes* the inflorescence receptacle is hollowed out, being respectively concave or funnel-form. This extension/hollowing out of the receptacle is also seen in the flowers of Magnoliaceae/Monimiaceae. Although the structures involved in *Pimelea* are, of course, inflorescences and not flowers, the morphocline appears to show the same basic pattern. The petaloid bracts of *P. physodes* mark further parallels between these inflorescences and flowers.

New Zealand members of *Pimelea* are recorded from open places, from coastal rocks and sand dunes through to lowland, montane and even high alpine sites (to 2000 m) such as snow banks. Plants are usually found in well-drained sites, such as gravelly places, river terraces, clay banks and rocky ridges. The vegetation inhabited is shrubland, grassland, herbfield, fellfield and snow-bank (ALLAN, 1961; MARK & ADAMS, 1973).

Ecoclines are evident in *Pimelea* ranging from coastal limestone, cliffs and sand, through to mallee and other shrublands, through to forest and to alpine habitats. The Australian forms, like those of New Zealand, are interpreted here as the result of evolution along ancient coastlines, followed by "stranding" inland when these seas receded. Some pre-adapted populations have even survived uplift to alpine heights.

As an indication of biodiversity, numbers of species of *Pimelea* in each degree square of New Zealand are shown in Figure 2. There is a strong main massing of species in Nelson/northern Marlborough, which corresponds to the main massing of *Hebe* species in New Zealand in the same two degree squares (HEADS, 1993a).

Biogeography

The mapping conventions used here follow those used by HEADS (1989, 1993a). Locality records were obtained from collections in New Zealand herbaria (OTA, CHR, WELT), from the literature and from personal observations.

1. *P. longifolia* (Thunb.) Sol. ex Wikstr.
2. *P. gnidia* (J. R. & G. Forst.) Willd.
3. *P. poppelwellii* Petrie
4. *P. crosbysmithiana* Petrie
5. *P. traversii* Hook. f.

Fig. 3. This is a group of related, large-leaved species. *P. gnidia* shows the common disjunction along the Alpine Fault (HEADS, 1989, 1993b), attributable to massive lateral displacement on the Fault during Tertiary time pulling apart plant and animal communities. *P. longifolia* ranges north of the Alpine Fault and also occurs along the “northeast horstian” arcs of distribution (HEADS, 1989) involving the Barrier Islands, NE Auckland, etc. As indicated above, there may be an affinity between this species and the Lord Howe Island *Pimelea*.

6. *P. buxifolia* Hook. f.
7. *P. concinna* Allan
8. *P. aridula* Cockayne

Fig. 4. *P. concinna* and *P. aridula* are related, *P. buxifolia* is probably nearer the species shown on Figure 3 and is mapped here for convenience. The species in Figure 4 show important breaks in range and/or taxonomic differentiation at nodes in central Otago, Lake Tennyson region and NW Ruahine Ra. *P. aridula* shows a common pattern of coastal records at Marlborough, Wellington and Hawkes Bay (coastal cliffs, limestone, etc.), together with Otago records which are all inland.

9. *P. tomentosa* (J. R. & G. Forst.) Druce

Fig. 5. ALLAN (1961) described this as “a complex group of forms”. Seemingly linear tracks follow both the Alpine Fault and the northeast horsts (including Three Kings Is.), as in *P. gnidia* above. Three Kings plants are unusual in their spreading, sometimes almost prostrate habit (cf. *Hebe insularis*, HEADS, 1993a).

10. *P. lyallii* Hook. f.
11. *P. pseudolyallii* Allan
12. *P. sp. aff. pseudolyallii*

Fig. 6. *P. lyallii* is a classic example of distribution around the Foveaux Strait biogeographic centre (HEADS, 1989). The mutual boundary with *P. pseudolyallii* appears to lie along or close to the Southland Syncline, with the two meeting near False Islet, Cannibal Bay. This important locality is also the southern limit of *Hebe rakaiensis* (Scrophulariaceae) (HEADS, 1993a) and the only known locality for a distinct form of *Mazus* (Scrophulariaceae) with peloric flowers (pers. obs.). The other obvious node in this group is in NW Nelson, with a notable disjunction between there, D’Urville I. and NW Ruahine Ra. (limestone cliffs near Reporoa Bog). Similar South Island — NW Ruahine Ra. disjunctions are seen in taxa such as *Euphrasia disperma*, Scrophulariaceae).

13. *P. arenaria* Cunn.

Fig. 7. This species is practically confined to sand-dunes. The distribution appears to comprise several strikingly disjunct sectors. On the west there are populations at western North I. —

NW Nelson, on the east there are records at Dunedin — Chatham Is. — Wellington. It has probably been extinct in the Dunedin area since the 1970s (Mr. B. Patrick, pers. comm. 1993).

14. *P. oreophila* Burrows (= *P. laevigata* var. *monticola* Petrie)

15. *P. suteri* Kirk

Fig. 8. BURROWS (1962) cites several morphologically distinct races of *P. oreophila* in the North Island, one in Nelson/Marlborough, several in central South Island, and one or more in Otago. Mr. B. Patrick (pers. comm. 1993) cites a distinct new species in this affinity which is common at 1600-1700 m on the Pisa Ra., central Otago. Burrows also notes that some populations from Dun Mt. and Richmond Ra. “show some intermediacy” between *oreophila* and *suteri*. D’Urville I. specimens (G. Kelly, CHR), appear unusual as they are very hairy with long internodes.

16. *P. pulvinaris* Burrows

17. *P. sericeovillosa* Hook. f.

These two species (Fig. 9) are allied by BURROWS (1962). Like the species shown in Figures 11 and 12, these two species show a distinctive, narrow track running along the middle of South Island. This trend does not correlate with what are at present the highest mountain ranges, which lie further west, but may be the result of evolution along the shores and cliffs of a Tertiary coastline, with subsequent stranding inland (HEADS, 1989).

18. *P. urvilleana* A. Rich.

Fig. 10. This and the remaining taxa comprise a complex of forms around *P. prostrata*. This ranges around the coast, but gaps are apparent in Fiordland and most of Stewart I. The inland Canterbury record is a strange specimen collected by J. B. Hair at Castle Hill Basin.

19. *P. prostrata* (J. R. & G. Forst.) Willd.

Fig. 11. This species is closely related to the last, and is its inland vicariant. The distribution pattern is one of “inner” and “outer” components, as in *Parahebe lyallii* and *P. decora* (Scrophulariaceae), but here there may be a region with neither present, e.g. most of Fiordland and Stewart I.

19a. *P. prostrata* var. *alpina* Cheesem. (incl. *P. microphylla* Col.).

19b. *P. prostrata* var. *erecta*

Fig. 12. These two forms need revising, but appear to reflect some distinctive differentiation from typical *P. prostrata*. *P. prostrata* var. *alpina* is very distinct, with hairy stems and conspicuous raised, glabrous leaf-bases reminiscent of *Kelleria patula*.

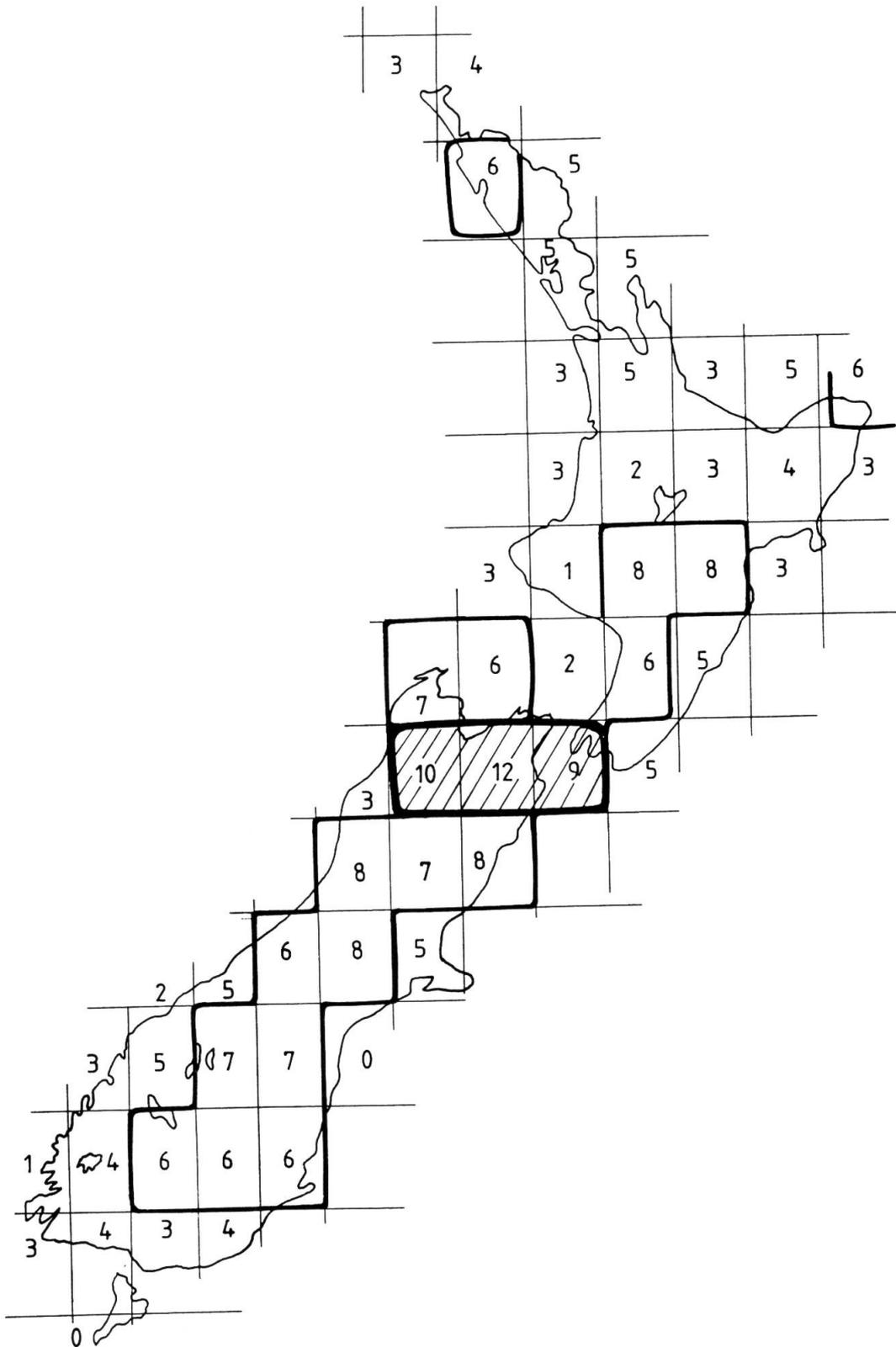


Fig. 2. — Numbers of species and varieties of *Pimelea* in each degree square of New Zealand.

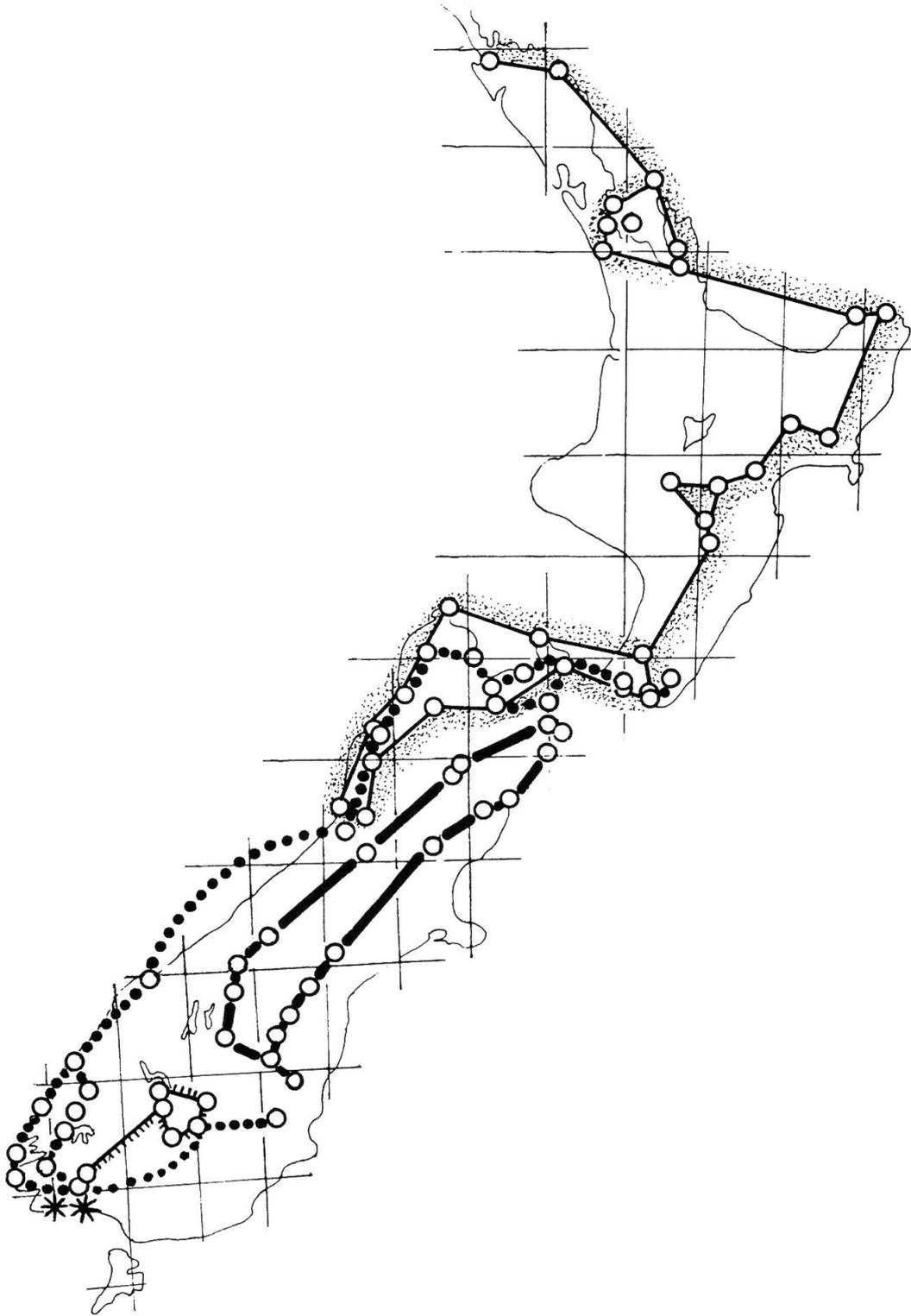


Fig. 3. — *Pimelea longifolia*: stippled line; *P. gnidia*: dotted line; *P. poppelwellii*: hatched line; *P. crosbysmithiana*: asterisks; *P. traversii*: solid line.

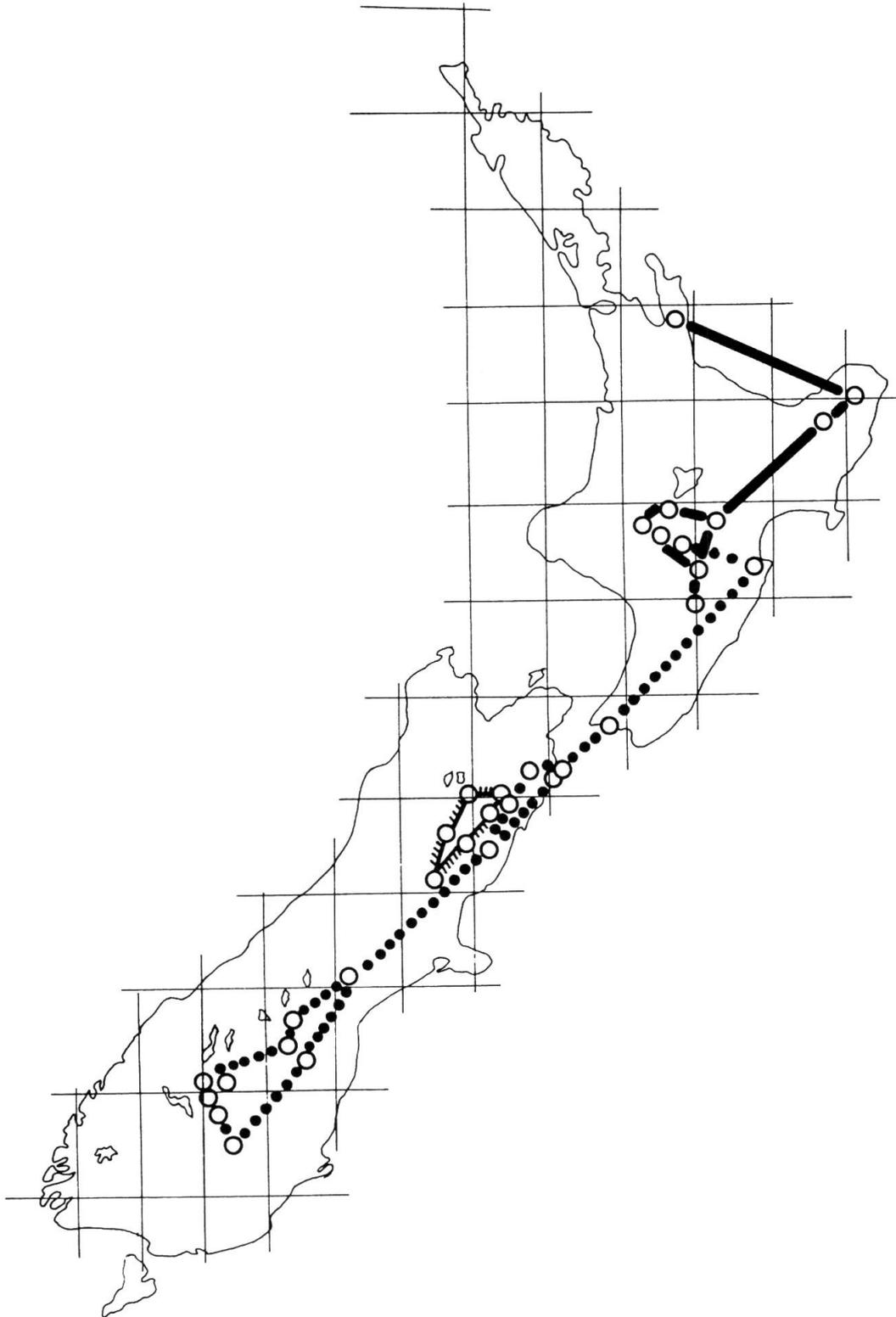


Fig. 4. — *Pimelea concinna*: hatched line; *P. buxifolia*: solid line; *P. aridula*: dotted line.

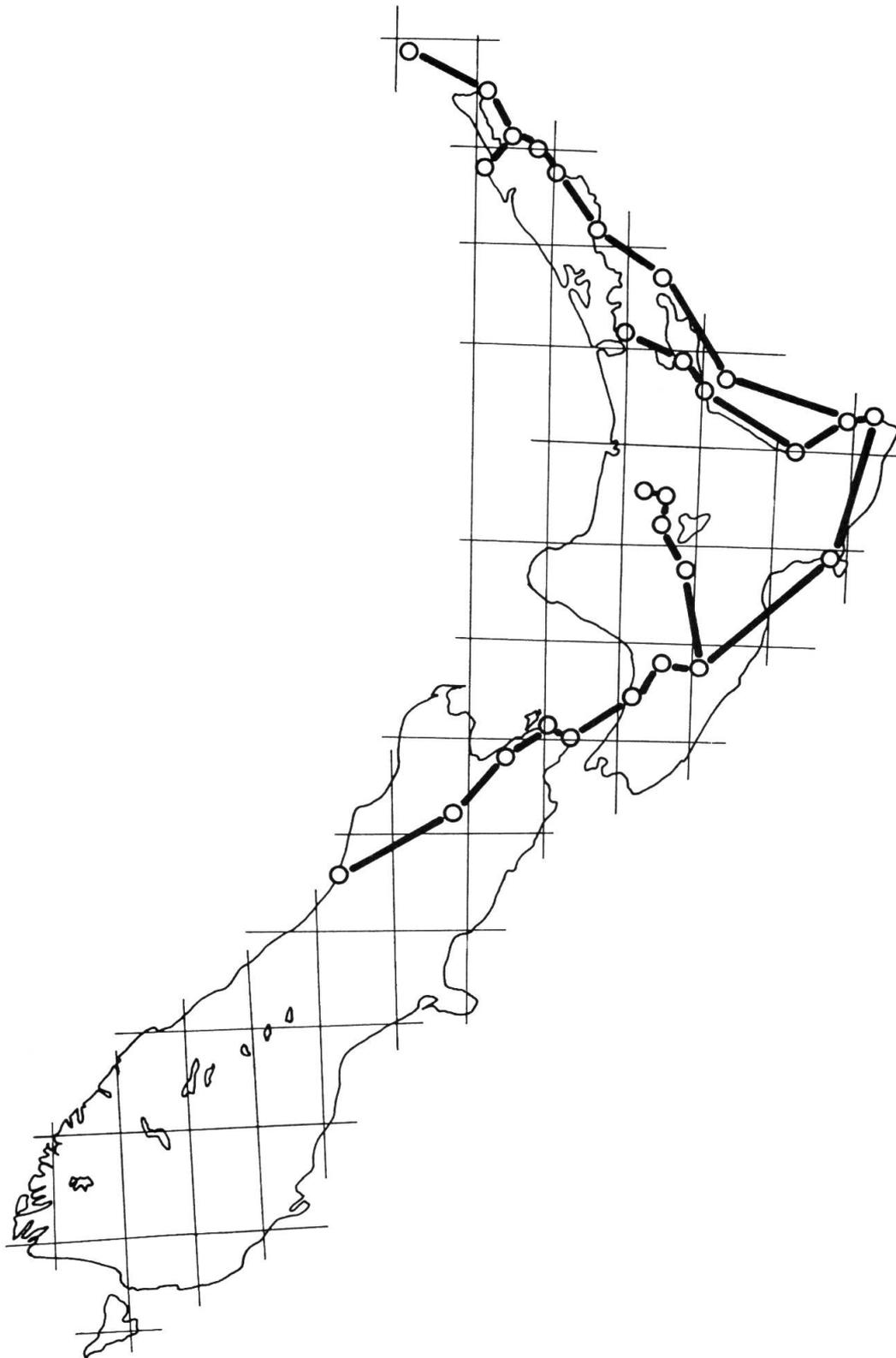


Fig. 5. — *P. tomentosa*.

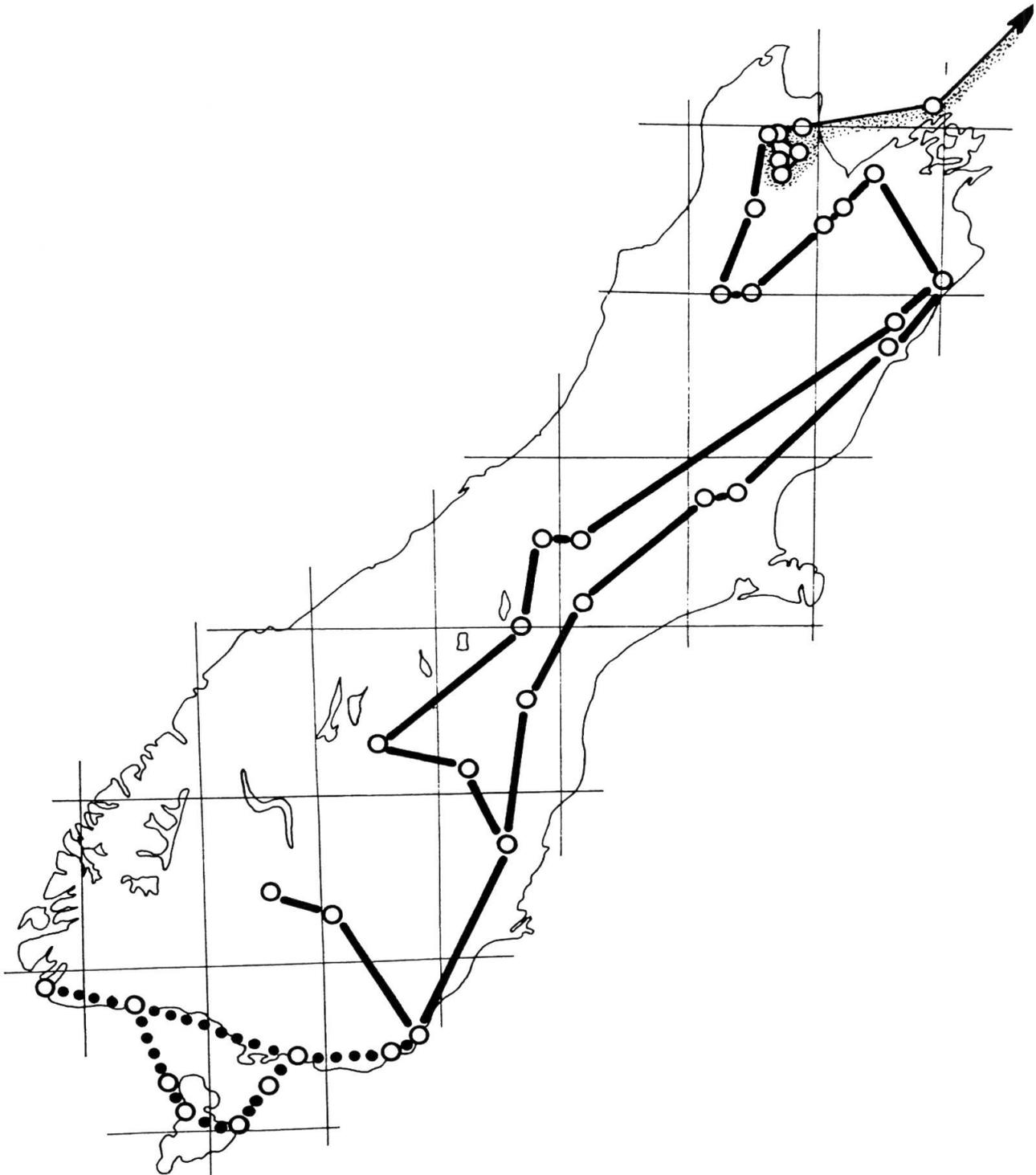


Fig. 6. — *Pimelea lyallii*: dotted line; *P. pseudolyallii*: solid line; *P. sp. aff. pseudolyallii*: stippled line (for additional record at NW Ruahine Ra., see Fig. 7).

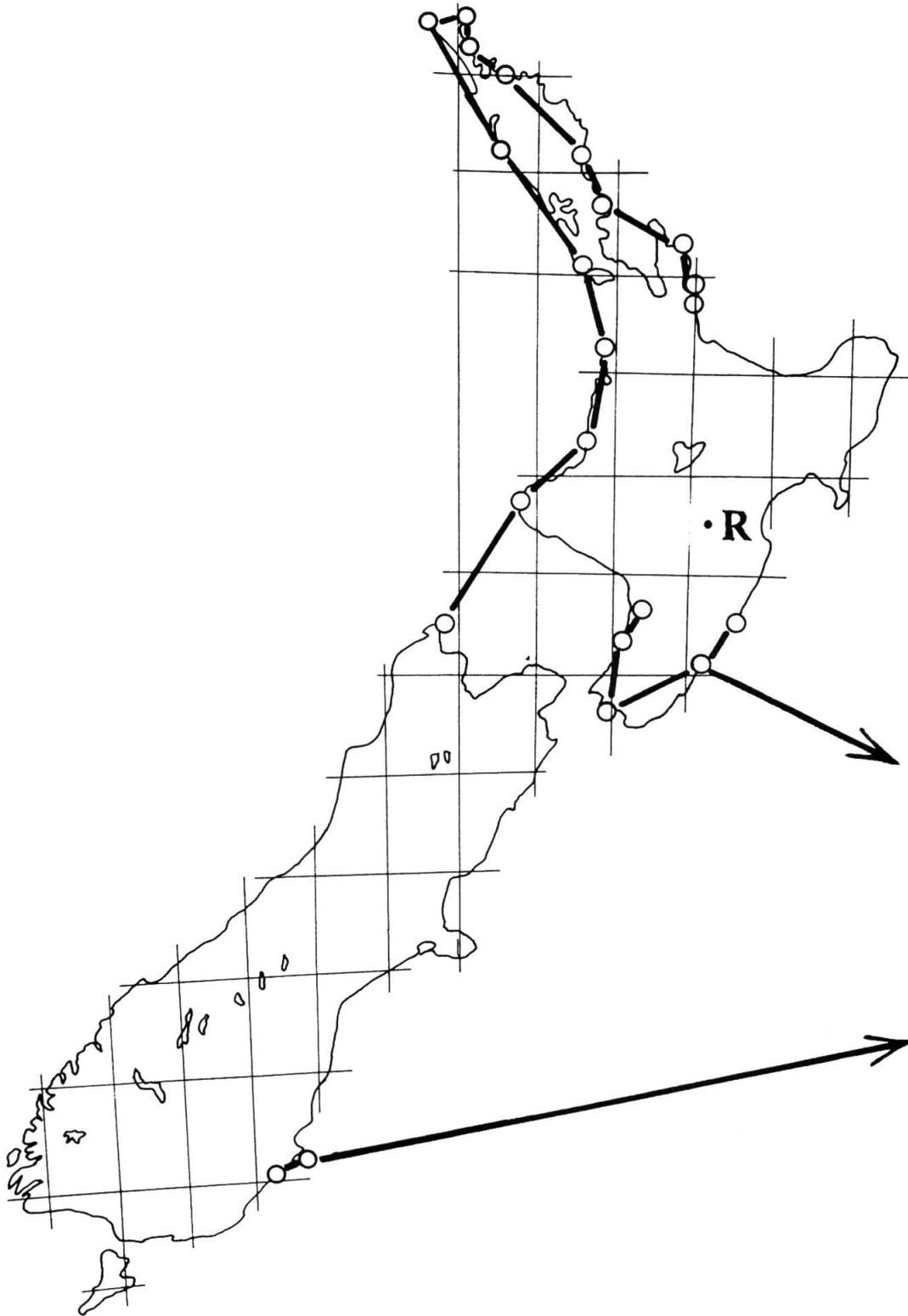


Fig. 7. — *Pimelea arenaria*: solid line. Arrows indicate records on Chatham Is. NW Ruahine Ra. (disjunct record of *P. sp. aff. pseudolyallii*) at R.

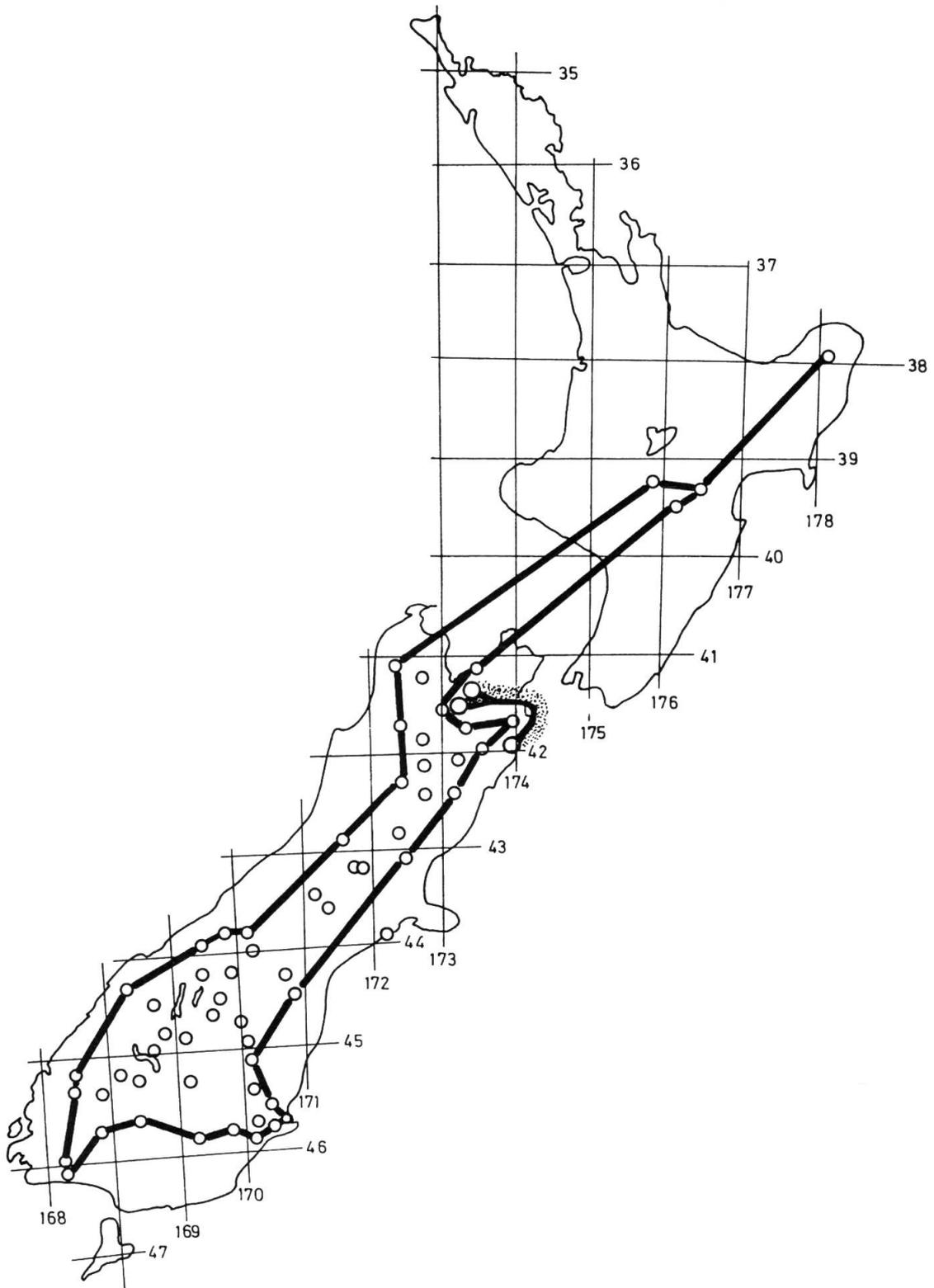


Fig. 8. — *Pimelea oreophila*: solid line; *P. suteri*: stippled line.

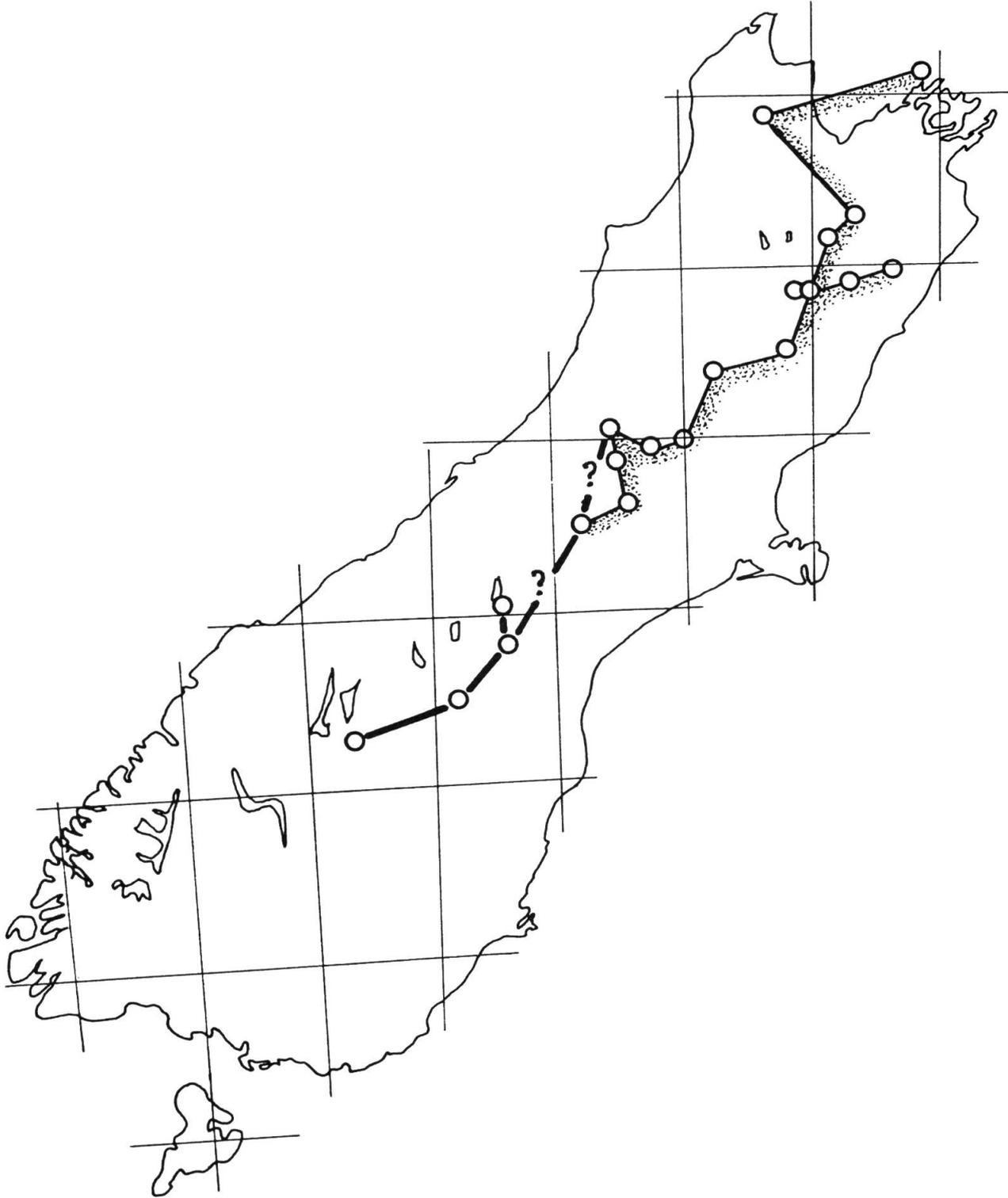


Fig. 9. — *Pimelea pulvinaris*: solid line; *P. sericeo-villosa*: stippled line.

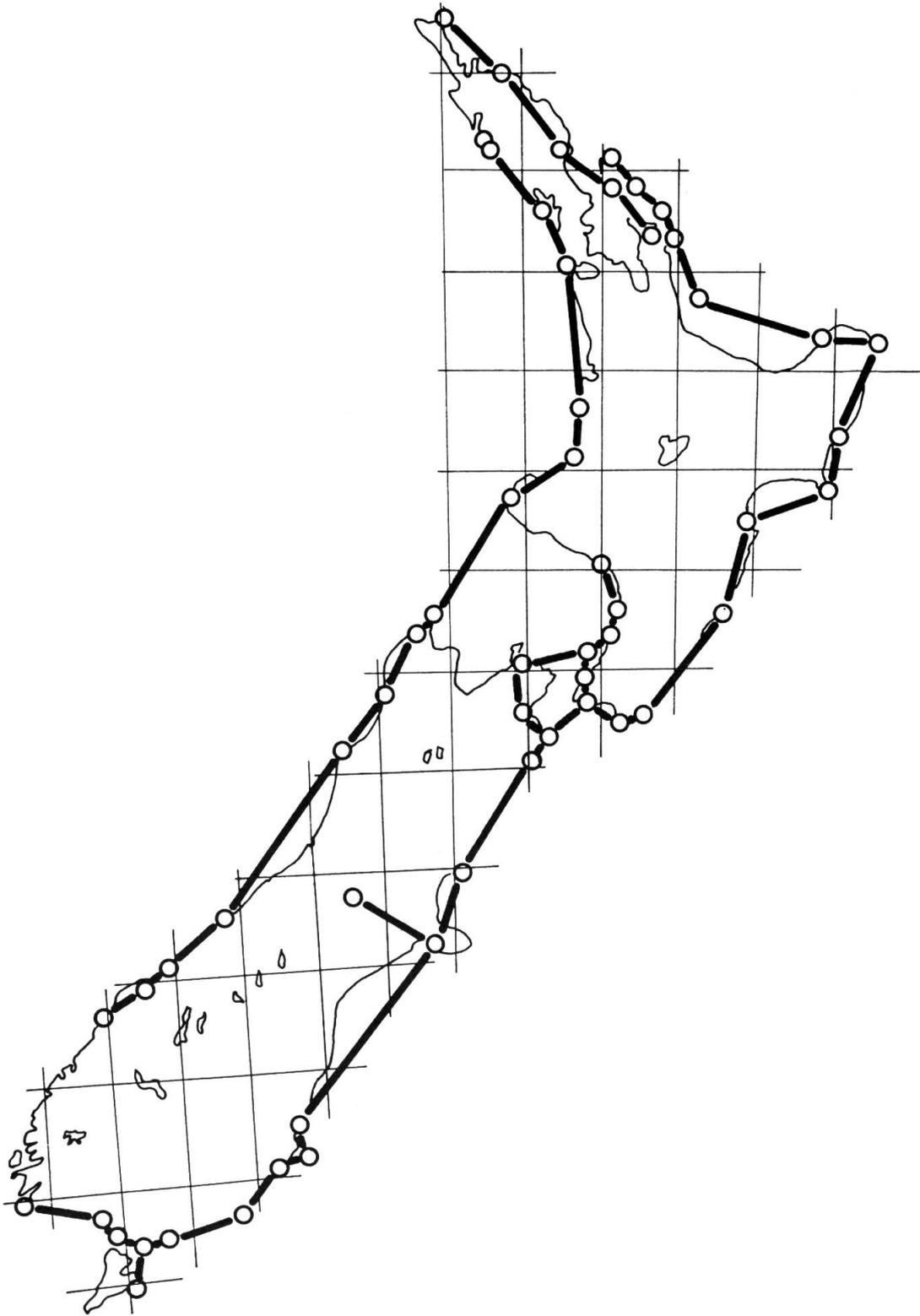


Fig. 10. — *Pimelea urvilleana*.

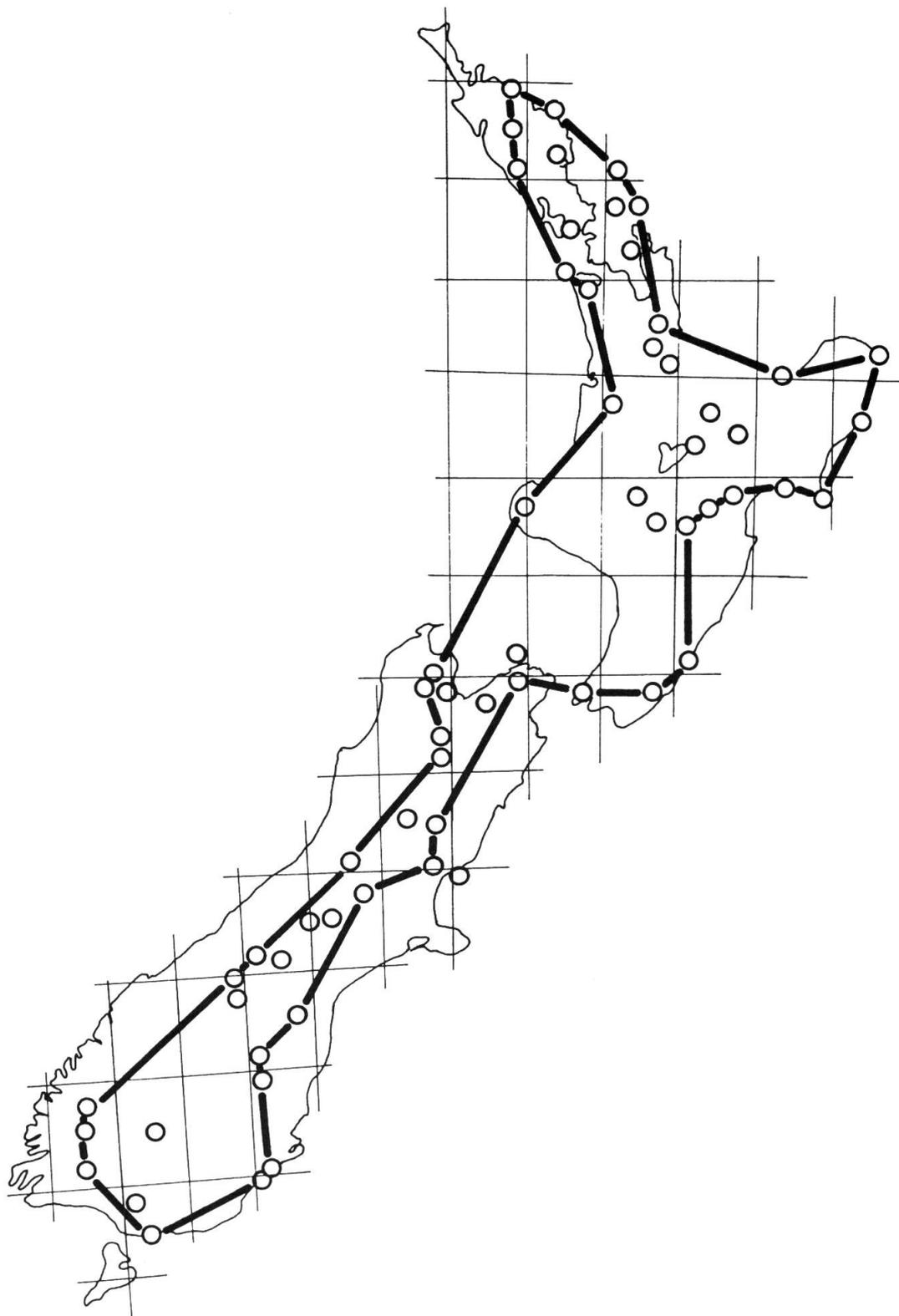


Fig. 11. — *Pimelea prostrata*.

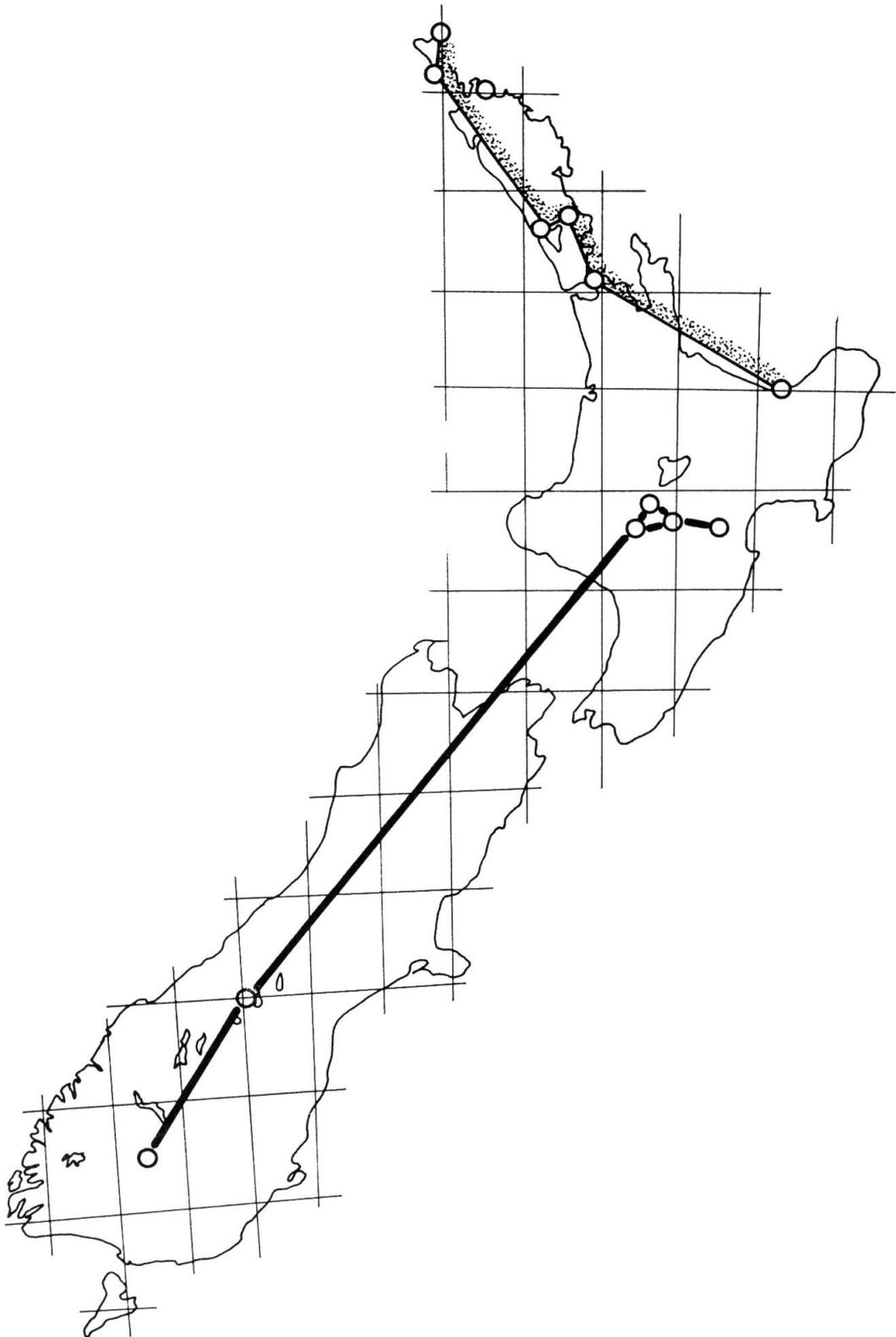


Fig. 12. — *Pimelea prostrata* var. *alpina*: solid line; *P. prostrata* var. *erecta*: stippled line.

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