



The New Zealand species of *Libertia* (Iridaceae)

L. B. Moore

To cite this article: L. B. Moore (1967) The New Zealand species of *Libertia* (Iridaceae), *New Zealand Journal of Botany*, 5:2, 255-275, DOI: [10.1080/0028825X.1967.10428745](https://doi.org/10.1080/0028825X.1967.10428745)

To link to this article: <http://dx.doi.org/10.1080/0028825X.1967.10428745>



Published online: 20 Feb 2012.



Submit your article to this journal [↗](#)



Article views: 167



View related articles [↗](#)



Citing articles: 8 View citing articles [↗](#)

THE NEW ZEALAND SPECIES OF *LIBERTIA* (IRIDACEAE)

L. B. MOORE

Botany Division, Department of Scientific and Industrial Research,
Christchurch

(Received for publication 9 March 1967)

SUMMARY

Specific criteria in *Libertia* are described. Seven specific epithets have been applied to New Zealand plants and the types of these are discussed. The four species accepted and compared, with notes on distribution and intraspecific variation, are: *L. ixioides* (Forst. f.) Spreng. (12-ploid); *L. grandiflora* (R. Br.) Sweet (hexaploid); *L. pulchella* (R. Br.) Spreng. (diploid); *L. peregrinans* Ckn. et Allan (hexaploid). All are endemic except *L. pulchella*, which is recorded also from Australia, including Tasmania, and from the mountains of New Guinea.

INTRODUCTION

Sprengel (1824, p. 127) established the genus *Libertia* in Irideae under Triandria, Monogynia, Spathaceae with the following circumscription: "Cor. 6 partita rotata laciniis exterioribus minoribus angustioribus. Filamenta distincta. Stigmata 3 simplicia. Caps. subglobosa." In it he placed (p. 168) three species: *Sisyrrinchium paniculatum* R.Br. and *S. pulchellum* R.Br., both from "Nov. Holland", and *S. ixioides* Forst. which he attributed to "Chili" and New Zealand. The genus has been maintained by later writers and other species have been described within it, but it is not very homogeneous and its limits, and especially its relationships to apparently closely allied genera, have not been critically assessed. One commonly accepted genus character, the difference in size of outer and inner tepals, is not at all striking in *L. pulchella*. In some keys (e.g. Diels, 1930, p. 470) this last species falls into *Belamcanda* because of its approximately equal tepals and its capsule characters, although *Libertia* differs, *inter alia*, in having a short style with long branches.

Libertia is a *nomen conservandum* with *L. ixioides* (G. Forster) C. Sprengel as the type species. Species currently placed in the genus belong to South America (Colombia and Bolivia to Chile), New Zealand, Tasmania, mainland eastern Australia, and the mountains of New

Guinea. The names of the New Zealand species have become confused, partly because in older descriptions (e.g. Hooker, 1864; Cheeseman, 1906, 1925) flowers of one species are associated with fruits of another.

SPECIFIC CRITERIA

HABIT

The plants are perennial, evergreen, with tufted fans of equitant leaves and numerous fibrous roots. Leaves are normally crowded on the fan, but exceptionally, as after burying with silt, the internodes elongate. The inflorescence is terminal; after flowering, a bud in the axil of at least one foliage leaf (usually not either of the two immediately below the inflorescence) develops to form a new fan. New fans arise also from buds in the axils of scale leaves below the green leaves of the parent fan, usually one on each side; these buds develop in one of two different ways. Most commonly the internodes remain short, the proximal two or three nodes bearing scale leaves and the more distal nodes green foliage leaves, the first few of which are shorter than those that follow. Alternatively the new axis elongates into a distinct stolon on which scale leaves are numerous and separated by long internodes, and the new fan of green leaves with its associated roots is then produced at some distance from the parent fan. Some short shoots can always be found on plants producing stolons, and probably any lateral bud is capable of elongating; exceptionally a stolon develops in the axil of a foliage leaf. The stoloniferous habit is therefore not an absolute species criterion, but the tendency to produce stolons is much stronger in some species than in others, and accounts for contrasts in the general appearance of plants. In plants growing in sand, peat, or loose soil, stolons run below the surface, but in firm soil (as seen in flower pots) stolons may arch upwards and take on a strong yellow colour where they are exposed to air and light.

LEAVES

Width and length of leaf vary greatly, not only within the same plant if subjected to different growing conditions, but also between plants that on most other criteria can be considered conspecific (Fig. 1). The two leaf surfaces are glabrous and usually both equally smooth, but leaves of *L. pulchella* are notably duller on one side. The median nerves, several in number, are always the thickest; in some plants they form a strong cord or "midrib" that holds the leaf rather rigidly erect, while in others the gradation from median to lateral nerves is less abrupt, and such leaves are more inclined to droop at the tip. Though often conspicuous, a strong "midrib" is not equally well developed in all plants of a species and it is therefore of limited value for identification. The leaf margin is thickened with a band of sclerenchyma on which minute scabrid teeth may occur. This scabridity, which can be felt



Photo—C. J. Miles

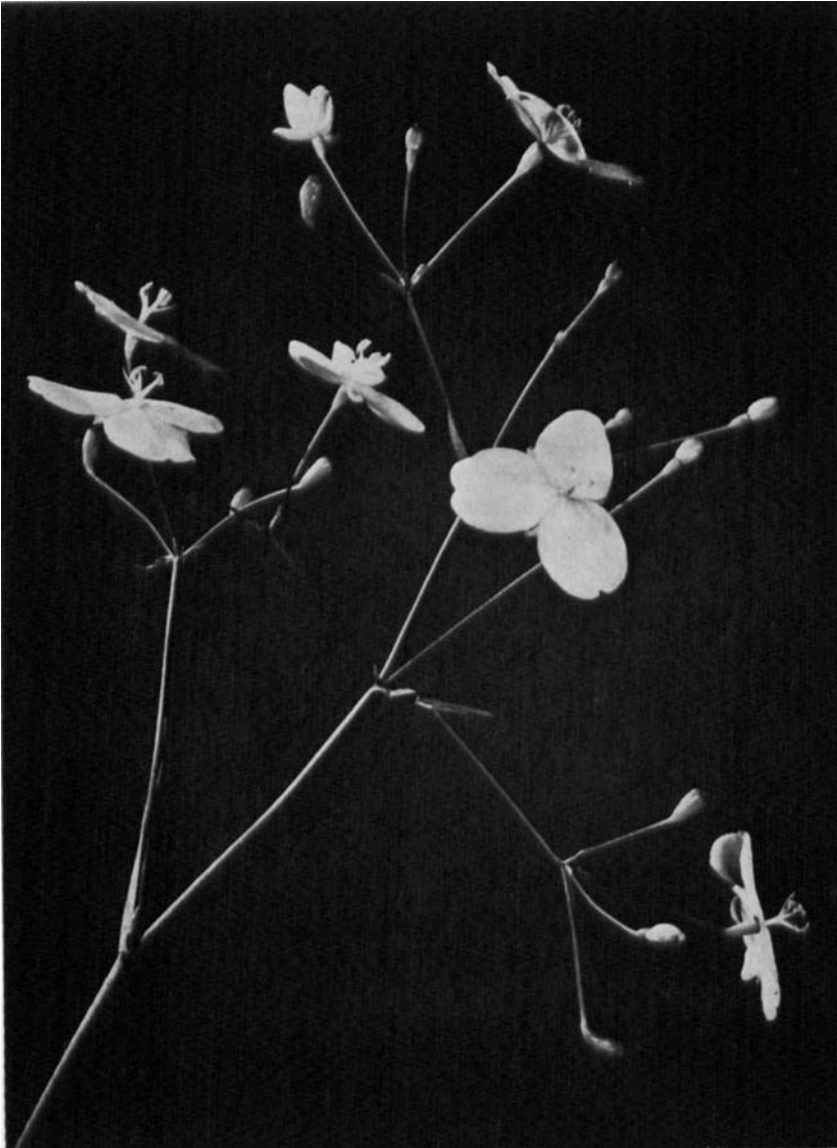
FIG. 1.—*Libertia grandiflora*. Left to right: Mt Piripiri, Marlborough Sounds; Lake Pounui, Wairarapa; Mt Rimutaka; Days Bay, Wellington. $n=57$ in each plant. None stoloniferous. Scale in inches.

by running a finger down the leaf, was used as a principal key character by Klatt (1861–62, p. 381), but it is not constant throughout a species. It is found most frequently in seedlings and on the first few leaves of a new fan, near the tip of later leaves, and on the short cauline leaves of the peduncle, but in certain populations it extends down the full length of the leaf. Leaf colour offers two characters: (a) within the leaf the contrast between median and lateral regions is sometimes marked, especially in stiff-leaved plants; (b) functioning leaves tend to turn yellow or copper-coloured in certain species. No good characters have been found in the leaf sheaths.

INFLORESCENCE

(Figs. 2, 3)

The peduncle is never winged and neither its flatness nor any attribute of the sterile spathes below the panicle (size, number, position) seems useful to separate species. In some species the inflorescence is lightly built and open and overtops the leaves, while in others it is sturdier and more compact and remains shorter than the leaves even after the elongation that accompanies fruit ripening. The cymose panicle is composed of clusters of branchlets and at each successive forking the bracts become smaller and more membranous. Bracts of the last series are relatively large or strongly coloured in some species. The South American *L. formosa* (sometimes wrongly determined as *L. grandiflora* in New Zealand gardens) contrasts with all indigenous species in its large scarious bracts enclosing tight clusters of short-pedicelled flowers.



Photo—C. J. Miles

FIG. 2.—Inflorescence: *Libertia grandiflora*, Mt Rimutaka.



Photo—C. J. Miles

FIG. 3—Inflorescence: *Libertia ixioides*, Port Hills, Canterbury.

Fine pubescence is anomalous in the genus, but occurs on the inflorescence in most forms of *L. pulchella*.

FLOWERS

The flower bud provides useful characters in the shape and colour of the ovary and especially in its size compared with that of the perianth just before anthesis. The wide-spreading tepals are uniformly white to faintly cream on the upper surface, firm and almost waxy; veins show only in old flowers. In New Zealand species, except *L. pulchella*, the outer three tepals are much shorter and narrower than the inner three, and most appear even smaller and more pointed because they are deeply concave; they may be slightly green, brownish or pink to dull red externally. The broad, shortly unguiculate inner tepals range from orbicular to broadly obovate or oblong. The three flattened staminal filaments are usually connate below into a short tube. Size and colour of anthers help to differentiate species; in *L. pulchella* the broad triangular connective is distinctive. Pollen provides no strong contrasts, as that described by Cranwell (1953), and attributed to the three larger species, showed only small size differences. The short style is partly or wholly hidden within the staminal tube and gives off three channelled branches which project between and beyond the filaments; style branches differ between species in the width of the petaloid wings.

FRUITS

Differences discernible in the young ovaries become more marked as the fruits mature, and two contrasting types can be recognised. In the species with long inflorescences, ripening proceeds continuously and within about three months of flowering the pericarps have become dry without passing through a brightly coloured stage; dehiscence follows soon, but in sheltered places old infructescences may remain on plants long after the capsules open. In species with short inflorescences, the pericarps are slightly more fleshy and tend to turn yellow during much slower ripening; the capsules may remain unopened for as long as a year. Capsule size and shape vary widely, depending partly on number of seeds developing, but, especially when colour is considered, the unopened fruits are a good guide to identification. Only in *L. pulchella* are the capsules acutely angled and here too the valves become most strongly recurved after loculicidal dehiscence. In *L. peregrinans* the fruit appears not to open at all, the seeds being freed only when the pericarp finally disintegrates.

SEEDS

Seeds are numerous, biseriata in each loculus, and attached by long funicles. The surface pattern is reticulate-foveolate and the obliquely placed tip of the seed is usually sunken in a small pit. Colour ranges from light stramineous through orange to bright tangerine and dull red brown. All seeds are approximately isodiametrical, but the darkest ones are more angular and of horny consistency, and the paler ones more rounded and less compact.

CHROMOSOME NUMBERS

Hair, Beuzenberg, and Pearson (1967) record the basic number as 19, and $2n$ numbers of 38, 114, and 228 occur in New Zealand, i.e. plants are diploid, hexaploid, and 12-ploid.

TYPES OF NEW ZEALAND SPECIES

L. *ixioides* (Forst. f.) Spreng. *Syst. Veg.* 1, 1824, 168. *Sisyrrinchium ixioides* Forst.f. *Prodr.* 1786, 61.

Forster's original description is: "No. 325. *S. Ixioides* foliis ensiformibus conduplicatis longissimis, panicula trichotoma, petalis exterioribus dimidio minoribus. F. Noua Zeelandia".

TYPE: Four Forster specimens have been seen, all probably conspecific. Those at Paris (No. 179) and at Göttingen (No. 233) have very long leaves (to 100 cm \times 7 mm) and each has only the base of a peduncle, the inflorescence having been removed. At Kew there is a much smaller complete plant (presented by the Corporation of Liverpool) with leaves about 4 mm wide and an inflorescence shorter than the leaves; the flowers and pedicels are diseased and show numerous small pustules. At the British Museum (Natural History), Sheet No. 199 has one long leaf coiled up and the upper 20 cm of an inflorescence carrying both buds and flowers. At the British Museum also is a pencil drawing by G. Forster, labelled "325 *Sisyrrinchium ixioides*, Charlotte Sound"; the inflorescence is small, overtopped by the leaves, and the perianth looks more frilled than is usual in a fully opened *Libertia* flower. The British Museum specimen is here chosen as lectotype, and Queen Charlotte Sound is assumed to be the type locality. The *Resolution* was at Ship Cove in November 1773—also October–November 1774. In Queen Charlotte Sound matching plants are still to be found on banks just above high-tide mark, e.g. CHR* 159060 from Resolution Bay, October 1965. In the Hookerian Herbarium at Kew some, but possibly not all, specimens labelled *L. ixioides* var. β belong to this species, but Lyall's specimen from Port Cooper, which Hooker (1864, p. 274) determined as *L. grandiflora*, is also *L. ixioides*.

R. Sweet (1824) gave an excellent illustration of this species from a garden plant, naming it "*Renalmia grandiflora* Brown Prodr." He stated, however, "Mr Brown was so obliging as to favour us with a sight of a drawing from a native specimen; in this the plant was

*Names of herbaria are abbreviated as follows: AK—Auckland Institute and Museum; BM—British Museum (Natural History); CHR—Botany Division, D.S.I.R.; K—Royal Botanic Gardens, Kew; WELT—Dominion Museum, Wellington.

much stronger, the flowers larger, and the panicle 4 times the size of ours, so that it will become a handsome plant when of larger growth." Flower and panicle sizes are, however, by no means only a matter of larger growth, and Sweet's remarks support other evidence that his plant was in fact *L. ixioides* and specifically distinct from that in the drawing of *R. grandiflora* shown him by Brown.

L. grandiflora (R.Br.) Sweet *Hort. Brit.* ed. 2, 1830, 498. *Renalmia grandiflora* R. Br. *Prodr.* Add. 1810, 592 (non *Renalmia* Linn.f. 1781).

Brown's original description is in the form of an observation under *R. paniculata* (which he had described as *Sisyrrinchium paniculatum* on p. 305 of the same work) and reads: "OBS. Species altera (*R. grandiflora*) ab Illust. Banks. in Nova Zelandia lecta, quae huic affinis et pariter monadelphæ, differt perianthii foliolis interioribus 4-5-ies majoribus." The description of *R. paniculata*, for comparison, is "caule paniculato, foliis (10-18-unc.) nervosis margine sæpius scabris, perianthii foliolis exterioribus lineari-lanceolatis: interioribus vix duplo majoribus obovato-oblongis, filamentis ad medium connatis".

TYPE: The type of *R. grandiflora* R.Br. should be a Banks and Solander specimen, and unpublished notes and illustrations at the British Museum (Natural History) have a bearing on the choice.

Brown's phrase "perianthii foliolis interioribus 4-5-ies majoribus" agrees closely with Solander's two almost identical descriptions of the perianth of "*Sisyrrinchium exaltatum*", first in his field notebook ("Plantae Australiæ (N. Zeelandiæ) MS. Cook's First Voyage," p. 91) "3 inter. . . exterioribus quintuplo majores" and then in his unpublished "Primitiæ Floræ Novæ Zelandiæ" (p. 542) "Tria Interiora quintuplo majora". The length of the outer tepals is given as 2½ lines (= 5 mm), of the inner as a little more than half an inch (= 12.5 mm), and "quintuplo" must be a rough estimate of area. In *L. paniculata* in contrast the outer tepals are little shorter than the inner and are probably about half the area. Solander's field notes give the habitat of *S. exaltatum* as "Tolago sylvis umbrosis" and Parkinson's sketch ("Cook's First Voyage, Plants of New Zealand, Parkinson IV") shows a panicle with flowers, as would be expected at the season when the *Endeavour* was at Tolaga Bay (23-29 October). (It may be noted that Hodder's painting and the copper plate engraving (both unpublished) differ in a number of details from Parkinson's original and have less resemblance to living plants.)

No New Zealand specimens of *Libertia* from Cook's first voyage (except *L. pulchella*) were found at the British Museum, but at least five sheets are held in New Zealand herbaria. Amongst these a specimen showing the diagnostic perianth characters can properly be selected as lectotype of *L. grandiflora*, and WELT 31860 is so designated. AK 103853 and 103854 appear to be of the same gathering, and Tolaga

Bay may be regarded as the most probable place of origin. The lectotype has leaves 50–60 cm × 6 mm in dry state, and an open inflorescence standing, with its culm, 72 cm high; ultimate bracts are pale and membranous, pedicels mostly about 2.5 cm long, ovaries of the numerous flowers and buds small, stamens long with evident filament-tube, and style-branches erect at their tips. Plants resembling the type still grow at Cooks Cove, Tolaga Bay (e.g. CHR 141265, *L. B. Moore*, 8 Feb. 1965, fr.). This species also grows at Resolution Bay, Queen Charlotte Sound, where it was collected in flower in coastal *Leptospermum* scrub in October 1965 (CHR 159057).

In the "Primitiae" Solander listed three localities for "*S. exaltatum*": "prope Tolaga, Oपुरagi, Totaranui." The *Endeavour* was at Totaranui (Queen Charlotte Sound) from 15 January to 5 February and fruiting plants were probably collected there; those represented by WELT 31861 and AK 103855 have the large showy fruits of *L. ixioides*, not the small dark ones of *L. grandiflora*, i.e. they are not conspecific with the flowering specimens with which they have always been associated.

L. pulchella (R.Br.) Spreng. *Syst.Veg.* 1, 1824, 169. *Sisyrinchium pulchellum* R.Br. *Prodr.* 1810, 305. *Renealmia pulchella* (R.Br.) *Prodr.* Add. 1810, 592 (non *Renealmia* Linn.f. 1781).

Brown's description is: "*S. pulchellum*, caule subsimplici, foliis margine laevibus, perianthii laciniis exterioribus ovali-oblongis; interioribus obovatis subunguiculatis, filamentis distinctis. (J) v.v." The description is repeated verbatim in the Addenda except that "(3–4–unc.)" is added after "foliis" and the word "laciniis" is altered to "foliolis". "(J)" denotes the neighbourhood of the colony of Port Jackson, including the banks of the estuary named Hunter's River or Coal River in New South Wales.

TYPE: No R. Brown specimen has been seen.

L. micrantha A. Cunn. in *Compan. bot. Mag.* 2, 1837, 375.

Cunningham's description is: "308. *L. micrantha*; scapo subsimpliciter [sic.] s. simpliciter diviso bracteato bifloro, pedicellis villosiusculis, foliis (3–5 uncialibus) nervosis margine scabris, filamentis basi connatis, perianthii foliolis interioribus ovalibus exterioribus ovato-oblongis parum minoribus. New Zealand (Northern Island). In dense woods, growing on naked roots of trees; Whangaroa, &c. A. Cunningham; also on humid rocky banks of the Keri-Keri River, below the Falls.—1834, R. Cunningham."

TYPE: K. "in close woods growing on the naked roots of trees, Whangaroa, Nov. 1826, No. 30 A. Cunningham"—a flowering specimen. On the same sheet are fruiting specimens of R. Cunningham 1834, 255. R. Cunningham was in Bay of Islands in March–April 1834.

L. pulchella and *L. micrantha* as described differ in scabridity of leaf margins and distinctness of staminal filaments, neither very reliable criteria in *Libertia*. Leaves in New Zealand plants are scabrid only near the tip (if at all), and similar scabridity has been seen in Australian specimens, while filaments are at most extremely shortly connate. Australian mainland plants attain much larger sizes than any seen in New Zealand; in Tasmania both small and large plants occur, but in the rather meagre range of specimens examined no satisfactory discontinuities were found. Without better evidence the two species can hardly be regarded as distinct.

L. macrocarpa Klatt in *Linnaea* 31, 1861–62, 384

Klatt placed his species in the group with smooth-margined leaves and concolorous perianth segments; significant parts of his diagnosis are: “foliis . . . caulem superantibus; . . . laciniis perigonii exterioribus ovatis, acutis, carinatis, interioribus ovato-cordatis, apice arcuatis; bracteis lineari-acutis; capsula oblonga, trigona, sexlineata, glabra. Synon. *Libertia grandiflora* Hort. Angl. et Hort. Berol. ex Herb. Kunth”. The measurements he gives, converted from feet and lines, are: stem 18–30 cm; radical leaves 30–60 cm \times 6.5 mm; pedicels 2–5 cm; ovary 9 mm long; inner tepals 10 \times 6.5 mm; stamens 4.5 mm long; capsule 20 \times 10 mm.

TYPE: The type of *L. macrocarpa* should be from the Berlin Gardens and in Herb. Kunth. From enquiries addressed to the Director of the Botanischer Garten und Museum, Berlin-Dahlem, it is learned that although the Kunth herbarium is held there, it contains no specimen that could be considered the type of *L. macrocarpa*.

Klatt determined a number of *Libertia* specimens at Kew, among them five as *L. macrocarpa*; these, according to the scheme adopted here, can be placed as follows: three in *L. ixioides* (Sinclair two, without locality; Lyall, Port Cooper); one in *L. peregrinans* (Travers, Chatham Island); and one probably in *L. grandiflora*, this last disagreeing with the diagnosis because the inflorescence overtops the leaves (R. Cunningham, Kerikeri Mission Station). A specimen in Paris determined by Klatt as *L. macrocarpa* also seems to belong (excluding the contents of the attached packet which are not *Libertia* at all) to *L. ixioides* sens. str. and as it is “ex hort. bot. Vindobonensi” [Vienna], it may represent the form being grown in European botanical gardens at that time. The only other early garden specimen seen (not annotated by Klatt) is at Kew “Cultivated specimen from the garden of Mr Edward Leeds, Received May 1876”, and it also is referable to *L. ixioides* sens. str.

Klatt determined 12 sheets at Kew as *L. ixioides*; two and portions of three others seem to belong to *L. ixioides* sens. str. and four to *L. peregrinans*, while five and part of another have long peduncles and probably belong in *L. grandiflora*. Klatt placed “*L. grandiflora* Sweet” in synonymy under *L. ixioides* (erroneously rendering the name as

“restioides”) and quoted, under the same name, Reichenbach Tab. 157 (*Ic. Exot.* 1827, p. 23). Sweet's plate based on a garden plant shows a short stout inflorescence and large ovaries (i.e. = *L. ixioides* sens. str.), while that of Reichenbach (recorded as “Ad specimen spontaneum Forsterianum e Nova Seelandia, e Herb. ill. Sprengelii”) depicts a lax open inflorescence above the leaves and relatively small ovaries, and is likely to represent *L. grandiflora*. The reputedly Forster specimen in Herb. Sprengel has not been seen in the present investigation.

Viewed against a knowledge of living plants Klatt's determinations seem confused, and in the absence of a type specimen the name *L. macrocarpa* remains of slightly uncertain status, though the evidence strongly suggests that it should fall into synonymy under *L. ixioides*.

L. orbicularis Col. in *T.N.Z.I.* 15, 1883, 329.

Colenso's rather detailed description concludes: “*Hab.* Dry sides of stony hills, margins of forests, between Norsewood and Dannevirke, Hawke's Bay district, North Island; flowering in November; *W.C.*: and, at Pohue, high hills near Petane, Napier; *Mr A. Hamilton.* A species having pretty close affinity with *L. ixioides* and *L. grandiflora*, but differing in its truly orbicular petals, tufted sepals, pencilled stigmas, globular seeds, and finely serrulate bracts and leaves; it also has affinity with the Australian species *L. paniculata*.”

TYPE: Specimens seen, all corresponding fairly well with the description, but none including seeds, are: (a) WELT 24292 (A and B), in Herb. Colenso, with Colenso's label “Norsewood, *Libertia orbicularis*” and Cheeseman's label “*Libertia ixioides* Spr. Norsewood. Type of *L. orbicularis* Col.” (b) At Kew with label “*Libertia orbiculata* Colenso, Comm. W. Colenso N. Zealand, 9/83” annotated in pencil “*L. ixioides* Spr.; *orbicularis* in *Tr. N.Z. Inst.* xv 329”.

Nothing in specimens or description serves to distinguish *L. orbicularis* from *L. grandiflora* as understood here. WELT 24292A is selected as lectotype and the name falls into synonymy.

L. peregrinans Ckn. et Allan in *T.N.Z.I.* 57, 1926, 56.

This species is defined as being similar to *L. ixioides* but easily distinguished by the widely spreading rhizomes. A detailed Latin description “is drawn up from plants collected in sand-hollows near Foxton” and the distribution is given as “Northern, Central and Southern Botanical Provinces; Chatham Islands; forming extensive colonies in sand hollows”. *L. peregrinans* is still to be found in sand hollows near Foxton, and no other species of *Libertia* is known from Chatham Islands.

TYPE: No Cockayne or Allan specimen suitable for a lectotype has been found, but there is no doubt how the name should be applied (Fig. 4).



Photo—C. J. Miles

FIG. 4—*Libertia peregrinans*. Left, Goulard Downs; right, Mt Snowden, NW Nelson. $n=57$, counted in Mt Snowden plant only. Both stoloniferous. Scale in inches.

Plants of this species appear in a number of earlier collections variously named as *L. ixioides*, *L. ixioides* var. β , and *L. grandiflora*. Colenso sent plants from shores of Palliser Bay to Kew as “n.sp.?” and supplied a manuscript name. B. C. Aston recognised it as distinct and he made useful notes on specimens collected in 1895 and determined by him as *L. grandiflora* and by Petrie as *L. ixioides*. The note on WELT 31129, 22.12.95 from North Otago Heads reads “In cultivation the leaves grow much broader and stiffer. It flowers about December, a month later than *L. ixioides* here. I tried to get specimens of the last-named to compare but the flowers were all blown.” (Recent observations confirm that the main flowering of this species is usually several weeks later than that of the other tall *Libertias*.) WELT 31132, 25.12.95 is annotated: “Plentiful along Bluff–Invercargill Rly line near Kew, etc. This also occurs at Otago Heads in sandy loam near sea.” Capsules in the Kew herbarium dated 1907 are accompanied by Aston’s note “I have for years thought this ‘variety’ a good species. The Capsules appear to be indehiscent. The habit totally different to the type. It is the *Libertia ixioides* Spreng. var. β of Hooker. Habitat littoral, sand hills or rather hollows”.

SYNOPSIS OF NEW ZEALAND SPECIES

- I. Leaves slightly dorsiventral, one surface smooth, the other marked by smooth nerves between dull bands of papillate cells; pedicels usually finely pubescent; ovary very much shorter than perianth at flowering ($\frac{1}{3}$ - $\frac{1}{2}$ of perianth length); tepals \pm oblong, all of about same length and not differing greatly in shape, though inner three have more complex veining; pollen sacs narrow, connective broad; capsule acutely angled, widest near top, width greater than length; pericarp turning from pale green to light straw-colour, ripe valves spreading widely at dehiscence and \pm recurved. n=19. **L. pulchella**
(Fig. 9)
- II. Both surfaces of leaf smooth; pedicels glabrous; ovary shorter to slightly longer than perianth (rarely less than $\frac{1}{3}$); inner tepals broad-obovate to almost orbicular to oblong, always distinctly both longer and wider than outer three; pollen sacs broader than narrow connective; capsule rarely if ever acutely angled, variously shaped but width before dehiscence not greater than length; pericarp turning yellow, brown or almost black, ripe valves rarely recurved.
1. Inflorescence dainty with wide-angle branching, usually overtopping leaves at fruit; capsule comparatively thin-walled, sometimes with outlines of seeds visible, ripening rapidly to very dark brown or black and opening, sometimes very widely, early in the autumn following flowering; leaves tending to droop at tip, midrib rarely very clearly defined, whole leaf remaining green or at least never bright orange-yellow, even where exposed to strong sun; ovary in just-opening bud often much shorter than perianth; style-branches only very narrowly winged, tips usually upturned; includes stoloniferous forms. n=57. **L. grandiflora**
(Figs. 1, 2, 6, 7, 8)
2. Inflorescence stout with narrow-angle branching, overtopped by leaves at fruit; capsule thick-walled, often yellow, ripening slowly and often remaining unopened on plant for a year or more; leaves rather stiff, usually with \pm sharply defined and often distinctively coloured midrib, and inclined to turn yellow or orange in strongly insolated habitats.
- a. Plants without stolons (except in one geographically restricted form); leaves minutely but palpably scabrid near extreme tip; membranous bracts usually pale; ovary in bud inclined to be pale, usually parallel-sided and squarely truncate at top and often as long as the smallish perianth or longer; outer tepals barely half length of inner three and appearing pointed; anthers small (2-2.5 mm) and pale; style branches wide-spreading with broad delicate wings; capsule yellow becoming paler with age; valves spreading little at dehiscence, splitting only a short way from top, rounded yellow seeds remaining \pm enclosed within valves. n=114. **L. ixioides**
(Figs. 3, 5, 6, 9)
- b. Plants peregrinating widely by stolons; leaves usually not scabrid even at extreme tip, spathes only occasionally very slightly so; membranous bracts brown; ovary in bud green, narrowly to broadly elliptic in outline and up to as long as the rather large perianth; outer tepals at least half as long as inner ones and broadly obtuse giving a full appearance to flower; anthers large (3-3.5 mm) and usually dark brown; style branches rising at ca. 45° angle, keel thick and wings narrow; capsule yellow or brown, becoming black with age, indehiscent; seeds light brown, rounded. n=57. **L. peregrinans**
(Figs. 4, 6, 8)



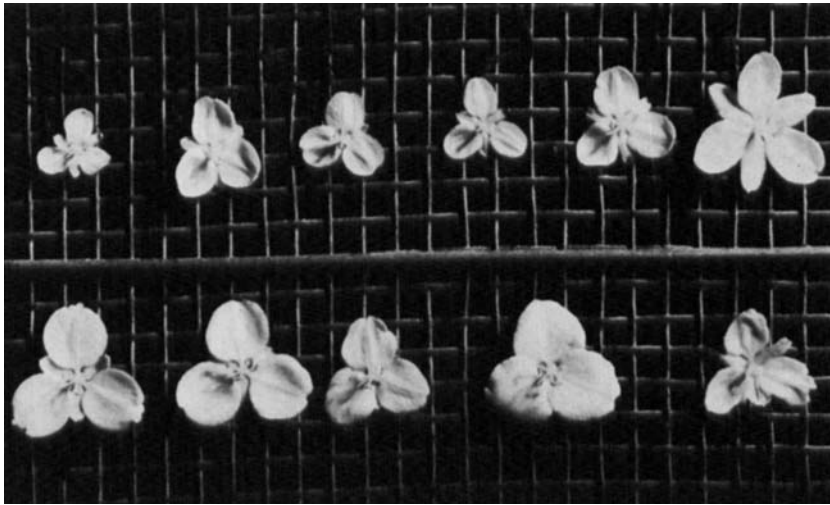
Photo—C. J. Miles

FIG. 5—*Libertia ixioides*. Left, Peel Forest, Canterbury; right, Mt Duvauchelle, Banks Peninsula. $n=114$ in each plant. Neither stoloniferous. Scale in inches.

INTRASPECIFIC VARIATION AND GEOGRAPHIC RANGE

1. *L. grandiflora*

The plants assembled under this name are heterogeneous in appearance. Fig. 1 illustrates something of the range of sizes, and differences of this order are maintained during long periods in cultivation under more or less uniform conditions. South Island plants tend to be amongst the smallest. The tufted habit is the most common, but certain plants, both narrow-leaved and broad-leaved, are vigorously stoloniferous, each retaining its own characters in culture. A selection of perianths is shown in Fig. 6, but the full range of size and form is much greater, the largest flowers having broadly oblong inner tepals fully twice the length of those of the smallest. Broadly orbicular inner tepals that quite cover the outer tepals are found both in widely stoloniferous plants (e.g. from Wairarapa, Fig. 6) and in tufted fine-leaved plants (e.g. one from Nelson vegetatively similar to that from Mt Piripiri in Fig. 1). Ovaries range from globose to narrowly clavate and capsules are likewise diverse. Commonly the capsule barely opens, and the seeds within are dark and angular, but in some plants the mode of dehiscence approaches that of *L. pulchella*, in that the valves separate widely, leaving very yellow rounded seeds forming a central cone. These capsules are



Photo—C. J. Miles

FIG. 6—*Libertia* perianths. Upper row, *L. ixioides*, left to right (a) from tufted plants: Woodstock, Canterbury; Flora Track, Nelson; Port Hills, Canterbury; Mt. Egmont; Silverdale, Auckland; (b) from stoloniferous plant: East Cape district.

Lower row, left to right *L. grandiflora* (a) from tufted plants: Pukeokahu, Central North Island; Waioeke Valley, Bay of Plenty; Days Bay, Wellington; (b) from stoloniferous plant: Western Lake Reserve, Wairarapa. *L. peregrinans*, stoloniferous plant: Mt Snowden, NW Nelson. Squares of wire grid ca. 6 mm side.

often associated with broad soft leaves and the first such plant examined (at both meiosis and mitosis) proved to be 12-ploid (Fig. 7).^{*} Eighteen other plants were also examined cytologically (Hair, *et al.*, 1967, p. 187); each came from a different population, some resembled the 12-ploid superficially, some were quite different, and at least one was stoloniferous. All were found to be 6-ploid. No good correlations between characters could be found and no satisfactory subdivisions can be suggested. Plants isolated before flowering can set good seed and it is perhaps not surprising that a self-fertile species with such a high level of ploidy should exhibit a wide range of forms. Plants from different districts do

^{*}A second plant from this same population (at Mt Tamahunga) has also been found to be 12-ploid. Plants growing some 8½ miles away (at Martins Falls, Warkworth) are very similar in size and habit and also match the 12-ploid plants in having unusually strongly scabrid leaf margins, but cytologically they differ, having the hexaploid number of chromosomes.



Photo—C. J. Miles

FIG. 7—*Libertia grandiflora*. Unique 12-ploid plant from Mt Tamahunga, Big Omaha, Rodney County. $n=114$, count made on buds from this inflorescence, leaving only some of the flowers to mature. Scale in inches.

not flower simultaneously when grown side by side at Lincoln. Occasionally a short inflorescence is found on an individual that previously had produced only the typical long inflorescences.

DISTRIBUTION: Widespread in North Island but not known south of Nelson and Marlborough (Fig. 8), growing mostly in lowlands near stream banks or in partial shade, occasionally on dry sunny banks. Endemic.

2. *L. ixioides*

Plants show a wide range in size and in paleness of "midrib" (Fig. 5). In starved plants, flowers may be dwarfed to a diameter of only 1 cm to

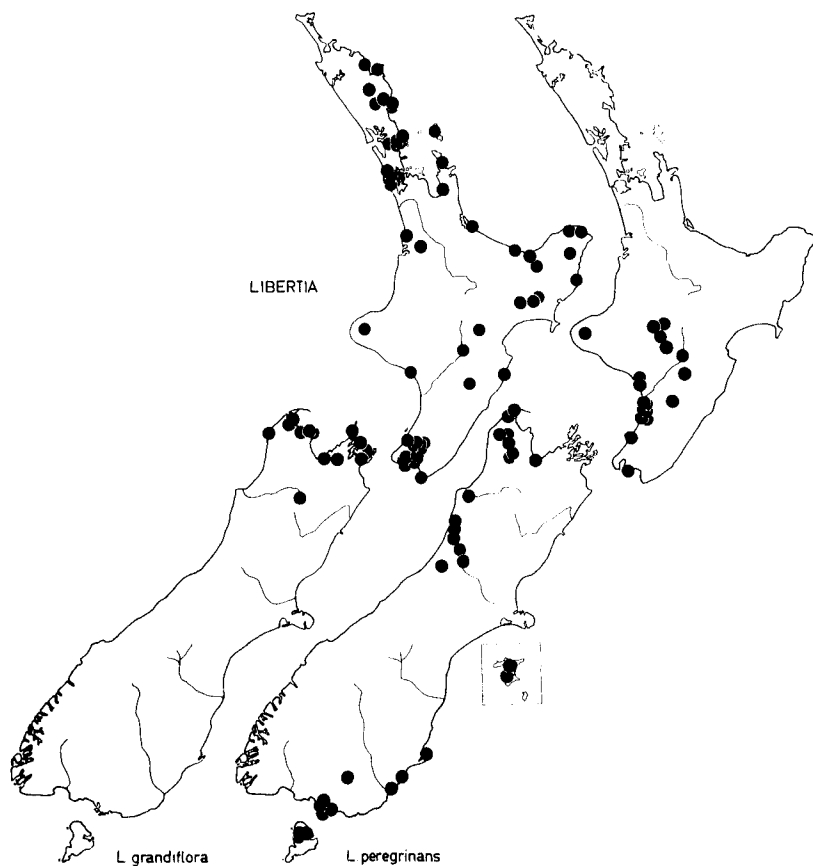


FIG 8—Distribution maps for specimens examined of *L. grandiflora* and *L. peregrinans*. Inset: Chatham Islands.

be followed by correspondingly small fruits, but apart from immediate habitat influences, there are innate differences (Fig. 6) and in more northern districts capsules seem to be of greater average size and perhaps of more nearly globular shape. Occasionally capsules are elongated and narrowly clavate.

Plants are strictly tufted in most districts, but near East Cape is a very robust form producing vigorous stolons, distinctive flowers (Fig. 6) and capsules as large as 20×15 mm. All known living plants of this form can be traced back to one colony occurring naturally near the head of the Kōpuapouamu stream, a tributary of the Awatere River arising in the Raukumara Range. Some were transplanted to a nearby garden by Mr W. F. Metcalfe as early as 1942 (CHR 36028) and from there have been distributed to the many gardens (including Kew) where they are

now grown. These plants are 12-ploid, as are non-stoloniferous plants of *L. ixioides* (Hair *et al.*, 1967, p. 188). A few older herbarium specimens, unlikely to have been gathered in such a remote valley, suggest that this form may occur also nearer East Cape, though none show whether stolons were present or not: (a) at Kew, numbered 18, presented by W. Colenso 1897 "*Libertia* —? an sp. nov. from E. Cape, only seen in this state", a stout infructescence shorter than the leaves, with almost globular undehisced capsules to *ca.* 13×11 mm (dry); (b) two sheets in Herb. T. Kirk both collected by W. L. Williams at East Cape, WELT 31067 with flowers, WELT 31068 with fruits; (c) AK 3270 Hawkes Bay, Bishop Williams. More collections are required from the East Cape district to show whether intermediates bridge the gap between this form and the known morphological range of non-stoloniferous *L. ixioides*.

DISTRIBUTION: In many parts of South Island often in rocky places; in North Island it is widespread but less common (Fig. 9). There is one record from Stewart Island. Endemic.

3. *L. peregrinans*

This appears to be a very uniform species apart from differences in size and colour easily correlated with habitat conditions. Leaf margins seem to be almost entirely without scabrid projections. A form in cultivation produces at each upper node of the inflorescence a neat group of yellow-brown fruits on even-length, rather slender pedicels giving a most attractive effect.

DISTRIBUTION: North, South, Stewart, and Chatham Islands (Fig. 8). Most collections are from near the coast, but the species also grows inland to an altitude of 3,000 ft in peat, pumice, and gravelly soils. A few doubtful records from north of *ca.* lat. 39° await confirmation. Endemic.

4. *L. pulchella*

Some fairly clear-cut regional differences have been recognised in minor characters. In North Island specimens and in a few from Nelson pedicels and upper peduncles are consistently pubescent and leaf margins are minutely scabrid for a short distance just below the tip. Plants from Fiordland and as far north as Burma Road in the Buller district have glabrous inflorescences and entirely smooth leaf margins. In NW Nelson and almost as far south as Buller River pedicels are pubescent but leaves lack scabridity. Australian specimens have corresponding pubescence on the inflorescence and at least some leaf margins are scabrid.

Peduncles are usually long enough to carry the whole of the short, rather simple panicle well above the leaves. Stolons 2–5–(8) cm long occur commonly, though not on all plants; fans are often elongated and many-leaved, the leaf-bearing section of the axis sometimes exceeding the leaf length. In the growing plant the fan of leaves spreads obliquely rather than standing erect and it is the upper surface, in this position,

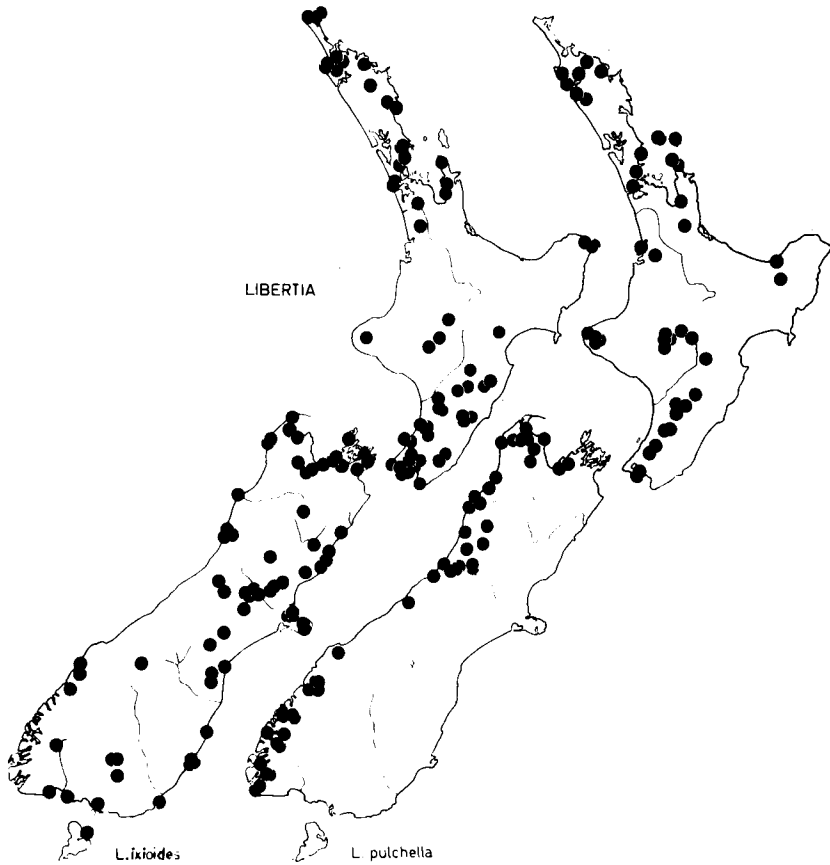


FIG. 9—Distribution maps for specimens examined of *L. ixioides* and *L. pulchella*.

that is smooth, while the downward facing one is mostly covered with papillate cells. In New Zealand, leaves are commonly about 2–10 cm × 2–4 mm, the broadest leaves measured, from Mt Egmont, being 6.5 mm wide when dry. Most Australian specimens seen have leaves 10–15 cm long and more than 3 mm wide, and inflorescences at 20–25 cm tall exceed the usual size in New Zealand. Specimens from the mountains of New Guinea determined as *L. pulchella* are even coarser and look very different from the modest New Zealand representatives.

DISTRIBUTION: A common plant on the floor of upland forests in high rainfall areas, descending to sea level in Fiordland (Fig. 9). Two records for Stewart Island have been published (Petrie, 1896, p. 576; Cockayne, 1909, p. 53), but no supporting specimens have been seen and the species is not included in later lists (e.g., Fineran, 1964; Scott and Armstrong,

1966). Mrs E. Willa has not found the species in a long residence on the island (pers. comm.), nor has it been noted by several botanists visiting the island in recent years.

ACKNOWLEDGMENTS

Many herbaria, including all those mentioned, were visited in the course of this investigation, and the Keepers are cordially thanked for their co-operation. Original documents were examined in the libraries of the Botany Department of the British Museum (Natural History) and of the Royal Botanic Gardens, Kew. Numerous collectors, many of them known by correspondence only, contributed specimens, and with this generous help plants from a wide range of localities (about 100 accession numbers) have been grown in pots under the care of Mr I. C. Brown. Chromosome counts, made from selected plants by Mr E. J. Beuzenberg and Dr J. B. Hair, have helped materially in assessing relationships. Miss Ann Latter and Miss Jean Clarke gave technical assistance and prepared the maps, and the D.S.I.R. photographers are thanked for many pictorial records, as well as those selected to illustrate this text.

REFERENCES

- BROWN, R. 1810: "Prodromus Florae Novae Hollandiae et Insulae Van Diemen". R. Taylor et Soc., London. 592 pp.
- CHEESEMAN, T. F. 1906: "Manual of the New Zealand Flora". Government Printer, Wellington. 1199 pp.
- 1925: "Manual of the New Zealand Flora". 2nd ed. Government Printer, Wellington. 1163 pp.
- COCKAYNE, L. 1909: Report on a botanical survey of Stewart Island. *App. J. House Rep. [N.Z.] C. 12*. 68 pp.
- COCKAYNE, L. and ALLAN, H. H. 1926: Notes on New Zealand floristic botany, including descriptions of new species, &c. (No. 5). *Trans. N.Z. Inst.* 57: 48-72.
- COLENSO, W. 1883: Descriptions of a few new indigenous plants. *Trans. N.Z. Inst.* 15: 320-39.
- CRANWELL, L. M. 1953: "New Zealand Pollen Studies. The Monocotyledons". Harvard University Press, Cambridge, Massachusetts. 91 pp.
- CUNNINGHAM, A. 1837: *Florae Insularum Novae-Zelandiae Praecursor*. *Comp. bot. Mag.* 2: 358-78.
- DIELS, L. 1930: Iridaceae. In *Pflanzenfamilien* 2nd ed. 15a: 463-505.
- FINERAN, B. A. 1964: Some plant records from Port Pegasus, Stewart Island. *N.Z. Jl Bot.* 2: 380-4.
- FORSTER, G. 1786: "Florulae Insularum Australium Prodrromus". Gottingae, Dieterich. 103 pp.
- HAIR, J. B., BEUZENBERG, E. J., and PEARSON, B. 1967: Contributions to a chromosome atlas of the New Zealand flora—9, Miscellaneous families. *N.Z. Jl Bot.* 5: 185-96.

- HOOKER, J. D. 1864: "Handbook of the New Zealand Flora", Part I, pp. 1–392. Reeve, London.
- KLATT, F. W. 1861–62: Berichtigungen und Nachträge zu der Monographia generis *Sisyrrinchium*. Nebst Monographie der Gattung *Libertia*. *Linnaea* 31: 371–386.
- PARKINSON, S.: "Cook's First Voyage. Plants of New Zealand. Parkinson IV". Unpublished, at British Museum (Natural History).
- PETRIE, D. 1896: List of flowering plants indigenous to Otago, with indications of their distribution and range in altitude. *Trans. N.Z. Inst.* 28: 540–91.
- REICHENBACH, H. G. L. 1827: "Iconographia Botanica Exotica". Lipsiae.
- SCOTT, G. A. M. and ARMSTRONG, J. M. 1966: The altitudinal sequence of climax vegetation on Mt Anglem, Stewart Island. Part 2. Ground and epiphytic vegetation. *N.Z. Jl Bot.* 4: 283–99.
- SOLANDER, D.: "Primitiae Florae Novae Zelandiae". Unpublished, at British Museum (Natural History).
- : "Plantae Australiae (N. Zeelandiae) MS. Cook's First Voyage". Unpublished, at British Museum (Natural History).
- SPRENGEL, C. 1824: "Linnaeus Systema Vegetabilium" 16th ed. Vol. 1. 992 pp.
- SWEET, R. 1824: "The British Flower Garden" Vol. 1: 64. R. Sweet, Chelsea.
- 1830: "Hortus Britannicus" 2nd ed. J. Ridgway, London. 622 pp.