

## THE LINDSAEOID FERNS OF THE OLD WORLD VII. AUSTRALIA AND NEW ZEALAND

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### ABSTRACT

Kramer, K.U. (*Botanic Gardens and Institute for Systematic Botany of the University of Zürich, Switzerland*) and Mary D. Tindale (*National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia*) 1976. *The Lindsaeoid Ferns of the Old World VII. Australia and New Zealand. Telopea 1 (2): 91-128, Plates VII-X.*—A taxonomic revision of the genus *Lindsaea* (14 species) for Australia and New Zealand (3 species) is provided. *Chlorolindsaea* Tindale & Kramer sect. nov. is described.

### INTRODUCTION

Although the fern flora of Australia is relatively well known, no modern comprehensive treatment for the continent is available. There are, however, modern floras (for some States and portions of States) that include pteridophytes e.g. J.M. Black's *Flora of South Australia*, pt. 1, ed. 2 (1960), J.H. Willis' *Handbook to Plants in Victoria*, Vol. 1, ed. 2 (1972) and M.D. Tindale in Beadle, Evans and Carolin's *Flora of the Sydney Region* (1972). Five families have been completed in the series "Pteridophyta of South Eastern Australia" which is being published in the *Flora of New South Wales* (formerly *Contributions from the New South Wales National Herbarium, Flora Series*). The latter series may be used for identifying pteridophytes in southern Queensland, New South Wales, Victoria and Tasmania. There is also a "Census of the Pteridophyta of Western Australia" by G.G. Smith (1966). The works dealing with the flora of the State richest in ferns and fern-allies, namely Queensland, are now very much out-of-date (F.M. Bailey, 1874, 1881, 1892, 1902) but a modern handbook is being prepared at the Queensland Herbarium.

The data on pteridophytes of New Zealand are readily available in modern floras: Crookes & Dobbie (ed. 6, 1963) and Allan's *Flora of New Zealand* (Vol. 1, 1961).

The present paper deals with the Lindsaeoid ferns of Australia and New Zealand, based on the study of specimens from a considerable number of herbaria all over the world cited by their standard abbreviations. In addition there have been some field studies of the Australian species by the second author.

Several species are represented by a single record from north-eastern Queensland. It is to be expected that further collections of these taxa and probably some Malaysian species may be made sooner or later in the moister parts of tropical Australia. The reader who fails to succeed in identifying collections from the latter area is advised to resort to the key in the senior author's account of this fern group for *Flora Malesiana* (Kramer 1971) and to communicate his conclusions to one of the present authors.

### PHYTOGEOGRAPHIC NOTES

The assortment of Lindsaeoid ferns in Australia is not particularly large. The most striking fact is that only the genus *Lindsaea* is represented, neither *Tapinidium* nor *Sphenomeris* having been found. The former is abundantly represented in

New Guinea, several species occurring at low elevations, and extends to Melanesia; its absence from Queensland (and from New Caledonia) is not readily explained. This is even more the case with *Sphenomeris*, represented by four species in New Caledonia and by the ubiquitous *Sphenomeris chinensis* in nearby New Guinea.

Of the fourteen species known at present from Australia, four are widespread in South Eastern Asia-Oceania, namely *L. repens*, *L. ensifolia*, *L. walkerae* and *L. obtusa*. *L. pulchella* var. *blanda* extends to Malaysia as a whole but *L. media* only to New Guinea, whereas *L. trichomanoides* is confined to New Zealand and Australia. *L. dimorpha* is found in New Caledonia and Australia, while *L. linearis* occurs in both of these countries as well as New Zealand. The four remaining species are endemic: *L. brachypoda*, *L. fraseri*, *L. incisa* and *L. microphylla*, not an impressive number of the total. As *Lindsaea* is essentially a genus of forest-floor plants or epiphytes of dense, moist forests, it is not surprising that only a small number of species reach Australia, and that the locally more widespread taxa either prefer open habitats or are rather euryoecious. Some of the uncommon species such as *L. fraseri*, *L. incisa* and *L. dimorpha* also grow in open, sometimes swampy situations.

There are three species in New Zealand, the two taxa mentioned above and the endemic *L. viridis*, a taxonomically isolated plant placed here in a monotypic section.

The picture of the variety and distribution of the Australian Lindsacoids is rather different from that given by Posthumus (1938). At that time some species had not yet been recorded from Australia, records of others (*L. "davallioides"*, *L. "cultrata"*) were due to misidentifications, and still others were reported from areas where they do not really occur, e.g. *L. microphylla* from New Zealand and New Caledonia.

### CYTOTAXONOMY

All available data on the cytotaxonomy of the Lindsacoid ferns have been assembled in the introductory paragraph on the senior author's treatment of the group for Flora Malesiana. The counts applying to species from the area under discussion may here be quoted again: *L. viridis*:  $n = \pm 88$  (Brownlie 1961); *L. trichomanoides* ("*cuneata*"):  $n = \pm 42$  (ibid., 1957a); *L. "concinna"* (= *brachypoda*?):  $n = 47$  (Manton in Kramer 1957); *L. linearis*:  $n = 34$  (Brownlie 1957b).

### ACKNOWLEDGEMENTS

The authors express their gratitude to the Directors and Curators of the herbaria who put their material generously at their disposal as well as to Mr R.J. Chinnock for lending specimens from his own collection. The senior author wishes to thank the Director of the Flora Malesiana under whose auspices most of his work was carried out.

The second author wishes to convey her thanks to the Public Service Board of New South Wales for granting an official tour to Great Britain and the Continent. This enabled her to have discussions with the senior author in Zürich, as well as to examine types and other collections of *Lindsaea* in European herbaria.

The authors also wish to acknowledge a grant from the Australian Biological Resources Study Interim Council for the provision of a herbarium Assistant, Miss N. McIntyre, who has been of considerable help in the later stages of this project. In accordance with the terms of this grant all material collected for this revision has been placed in the National Herbarium of New South Wales, as the second author is a member of that staff.

Our thanks are due to Mr R.C. Coveny for making special collections of *Lindsaea* and to Miss N. McIntyre for checking the latitudes and longitudes of a large number of the localities in which specimens were collected. We are also grateful to Miss C.L. Payne for the preparation of the maps.

## TAXONOMIC TREATMENT

For general notes on the *Lindsaea* group of ferns see Kramer (1957, 1968, 1970, 1971). Species already described in other papers but occurring in Australia have been quoted in the text, so that the revision would be as complete as possible. These descriptions cover Australian material, although few specimens were available in some taxa, e.g. *L. repens* and *L. pulchella*.

A very considerable portion of the herbarium work was undertaken by the senior author. Specimens of *Lindsaea* in the following herbaria were examined by K.U. Kramer:— B, BISH, BM, BO, BRI, B-WILLD, E, GH, HBG, K, LAE, L, MICH, NSW, P, PR, SING, S-PA, U, US, W and Z; whereas M.D. Tindale saw material in the following herbaria:— AD, BM, BRI, CANB, CBG, E, G, GOET, HO, JCT, K, L, MEL, NT, NSW, PERTH, P, S, UPS and the private collection of R.J. Chinnock.

## LINDSAEA

Dryander in J.E. Smith in Mém. Acad. Sci. Turin 5: 401 (1793): Trans. Linn. Soc. London 3: 39 (1797). The name is often misspelled "*Lindsaya*".

As to the terminology employed, the reader is reminded that the term "pinnule" is always used in this paper for an ultimate free division of a compound leaf, regardless of whether the leaf is once or more times compound.

The following description of the genus *Lindsaea* is cited from Kramer in Fl. Males. Ser. 2, 1 (3): 198 (1971):—

"Small to medium-sized, terrestrial, epilithic, scandent, or epiphytic ferns with a Lindsaeoid protostele, the xylem with an internal phloem strand, or in some small epiphytes open. Scales variable in shape, mostly entire. *Lamina* rarely simple, mostly once or twice pinnate, sometimes more dissected, to decomposed, anadromous; ultimate divisions various, most often dimidiate, sometimes partly or entirely equal-sided, rarely euncate and dichotomously divaricate. Veins free, connivent, or anastomosing without free included veinlets. *Sori* terminal on the veins, bi- to plurinerval, less often uninerval, mostly very close to the margin. Indusium short, roundish, ovate, or hippocrepiform and then free at the sides, or more elongate, and laterally free or adnate, rarely fugacious. Bicellular filiform paraphyses present in some, probably in all species. Spores trilete or (very rarely in the Old World species) monolete."

TYPE SPECIES: *Lindsaea trapeziformis* Dryander (neotropical).

DISTRIBUTION: About 150 species, two-thirds of which occur in the Old World but few in continental Africa; extending north to Japan, south to Australia (Tasmania) and east to the Marquesas.

## ARTIFICIAL KEY TO THE SPECIES OF *LINDSAEA* IN AUSTRALIA AND NEW ZEALAND

1. Fertile lamina simply pinnate or rarely with an odd pinnate pinna in *L. brachypoda*.  
Fertile pinnules entire or shallowly incised.
2. Rhizome long-scandent, epiphytic, with a strongly dorsiventral stele.
3. Rhizome (1.5–) 2–3 mm in diam., persistently scaly, or, when eventually scaleless, usually not polished. Larger pinnules at least 1.5 cm long .. *L. repens* 13.
- 3.\* Rhizome not over 1.2 mm in diam., soon largely scaleless and polished.  
Larger pinnules not over 12 mm long ..... *L. pulchella* 14.

- 2.\* Rhizome terrestrial, short-, or occasionally more long-creeping; stele radially symmetric or nearly so.
4. Pinnules dimidiate or euneate.
5. Veins anastomosing. Full-grown plants rarely with sterile leaves  
..... *L. obtusa* 11.
- 5.\* Veins free, except as joined by the receptacle. Sterile leaves nearly always present beside fertile leaves.
6. Petiole and rachis dark ..... *L. linearis* 8.
- 6.\* Petiole and rachis stramineous to medium brown.
7. Fertile pinnules dimidiate, entire or rarely crenate. Sterile pinnules crenate ..... *L. brachypoda* 9.
- 7.\* Fertile pinnules cuneate-flabellate or subdimidiate, entire or the lower ones cleft. Sterile pinnules cleft and crenate. . *L. dimorpha* 7.
- 4.\* Pinnules neither dimidiate nor cuneate (or cuneate at the base only).
8. Veins free, except as joined by the receptacle ..... *L. walkerae* 12.
- 8.\* Veins anastomosing.
9. Basal pinnules in full-grown plants 2 × or at most 3 × as long as wide; terminal pinna or lobed leaf-apex in all plants 0.2–1 cm long ..... *L. fraseri* 3.
- 9.\* Basal pinnules in full-grown plants 3 × to 10 × as long as wide; in juvenile plants where the basal pinnules are sometimes 2 or 3 × as long as wide then the large, free or almost free, terminal pinna is 2–10 cm long ..... *L. ensifolia* 4.
- 1.\* Fertile lamina more than once pinnate, or, if only truly once pinnate, at least the basal pinnules incised beyond the middle.
10. At least some veins of larger pinnules anastomosing.
11. Mature plants with bipinnate leaves and a conform terminal pinna. All pinnules dimidiate ..... *L. obtusa* 11.
- 11.\* Mature plants with bipinnate or partly tripinnate leaves, without a conform terminal pinna. Many pinnules dimidiate, with narrow, stalk-like bases. Apices of pinnae small, rhombic or triangular ..... *L. media* 2.
- 11.\*\* Lamina not fully bipinnate, or in the few cases where this is so, the pinnules decurrent at the base, connected by narrow wings, and not truly dimidiate. .see 9.
10. Veins free, except as joined by the receptacle.
12. The lowermost pinnules cleft, with 2 or 3 divisions, the others simple. Fertile lamina linear, simply pinnate or subbipinnate at the base. Sterile leaves always present besides, difform, their pinnules cleft and crenate ..... *L. dimorpha* 7. (bis)
- 12.\* Most or all primary divisions deeply incised or one to several times pinnate. No distinctly difform sterile leaves present. Lamina variously dissected.
13. Lamina linear, not over 1.5 cm wide. Rachis stramineous ..... *L. incisa* 6.
- 13.\* Lamina not linear, or, if so, broader than 1.5 cm and/or the rachis darker.
14. Petiole and at least the basal part of the (primary) rachis reddish brown or atropurpureous to black.
15. Primary rachis abaxially obtusely carinate. Secondary rachises abruptly pale. Spores monolete. Indusium basally not concave, more than 0.5 mm wide ..... *L. viridis* 10.
- 15.\* Primary rachis abaxially bi-angular, often obtusely so, ± sulcate. Secondary rachises in fully bipinnate leaves gradually paler. Spores trilete. Indusium of longer sori basally concave, up to 0.5 mm wide ..... *L. trichomanoides* 5.
- 14.\* Petiole (except the extreme base) and rachis mostly stramineous to light brown. Spores trilete.
16. Ultimate free or almost free divisions cuneate-flabellate ..... *L. microphylla* 1.
- 16.\* At least the larger ultimate divisions distinctly dimidiate . . . free-veined forms of ..... *L. media* 2. (bis)

## A. SUBGENUS LINDSAEA

## I. SECTION SCHIZOLOMA

Section *Schizoloma* (*Gaudichaud*) *Kramer*\*

**1. *Lindsaea microphylla* Swartz** in J. Bot. (Schrader) (1800)<sup>2</sup>: 79 (1801); F. Mueller, *Fragm.* 5: 119 (1865-66); F.M. Bailey, *Handb. Ferns Queensland*: 19 (1875); Bentham, *Fl. Austral.* 7: 721 (1878); F.M. Bailey, *Fern World Australia*: 40 (1881); F.M. Bailey, *Lithogr. Ferns Queensland*: Pl. 54 (1892); F.M. Bailey, *Queensland Fl.* 6: 1955 (1902); F.M. Bailey, *Compr. Cat. Queensland Pl.*: 641 (1913); Domin in *Biblioth. Bot.* 20 (85<sup>1</sup>): 84 (1913); Wakefield, *Ferns Victoria & Tasmania*: 26, with fig. (1955); Brownlie in *Trans. Roy. Soc. New Zealand* 87: 196 (1959); Willis, *Handb. Fl. Victoria* 1: 23 (1962); Tindale in Beadle, Evans & Carolin, *Handb. Vasc. Pl. Sydney Distr.*: 61 (1963); Tindale in Beadle, Evans & Carolin, *Fl. Sydney Region*: 66 (1972); non Presl (1825).

SYNONYMY: *Adiantum microphyllum* (Swartz) Poirct in Lamarck, *Encycl. Suppl.* 1: 140 (1810), non Swartz (1788), ncc. auct. al. *Odontosoria microphylla* (Swartz) J. Smith, *Hist. Fil.*: 264 (1875). *Schizoloma microphyllum* (Swartz) Kuhn, *Chaetopt.*: 346 (1882). *Spheomeris microphylla* (Swartz) Tardieu-Blot in *Amer. Fern J.* 48: 34 (1958).

*Lindsaea microphylla* Swartz var. *gracilescens* Domin in *Biblioth. Bot.* 20 (85<sup>1</sup>): 85 (1913). SYNTYPES: Katoomba Falls, Blue Mountains, New South Wales, *Domin* 184, 1910 (PR), Blue Mountains *Domin* 183 (PR).

*Steunoloma lindsayoides* Fée, *Gen. Fil.*: 330, Pl. 27 bis A, fig. 5 (1852), *epith. nov. superfl.*

HOLOTYPE: Without date or locality, (S), consisting of one fertile frond.

DISTRIBUTION†: Eastern Australia: Queensland (Cook, Leichhardt, Burnett and Moreton Districts), New South Wales (North and Central Tablelands, North, Central and South Coast) and Victoria. Fig. 1 (p. 97).

HABITATS: In wet or dry sclerophyll forests or in thick scrub or more rarely in exposed positions above rain forest ravines, on hillsides and in moist gullies, commonly in rock crevices or under rock ledges, often in sandy or alluvial soil, mostly associated with sandstone but sometimes on shales or granite, sea level to 1100 m.

*Rhizome* shortly creeping, 1-2 mm in diam.; scales honey-coloured to light reddish brown, almost acicular, the greater part biseriate, the base bi- or triseriate, the apical  $\frac{1}{3}$  or  $\frac{1}{4}$  uniseriate, up to 2.5 mm long. *Leaves* clustered; petioles (stipes) stramineous to light reddish brown or mottled, with darker base, or sometimes darker with age, 4-15 cm long, very much shorter than the lamina, adaxially broadened and shallowly sulcate, the adaxial face often laterally surpassing the lateral faces, abaxially obtusely bi-angular to subterete. *Lamina* narrowly oblong, c. 10-50 cm long, (2-) 4-6 cm wide, 2-6 × as long as the petiole, mostly pale or bright green or olivaceous when dry, herbaceous, bipinnate + deeply pinnatifid. *Major pinnae*, c. 10-20 on each side, the lower subopposite, especially the larger strongly ascending, the lower ones up to 6 cm apart, the upper ones gradually closer, all subcontiguous to contiguous by their ascending position, ovate to triangular in outline; primary rachis stramineous, in structure like the petiole (stipe). *Primary*

\* The publication of the genus *Hymenotomia* Gaudichaud in Freycinet, *Voyage Bot.*: 379 (1826), cited, e.g., by Christensen (*Ind. Fil.*, 1906) is in the authors' opinion invalid. Under *Schizoloma* (as genus) Gaudichaud said: "La troisième section, peut-être digne aussi de former un genre, *hymenotomia*, réunirait les *lindsaea* *microphylla* [sic], *media*, *decomposita*, &c., caractérisés par les tiges . . ., des nervures entièrement dichotomes; des téguments marginaux, membraneux, dentés ou laciniés comme le bord des folioles, &c. . . ." However, on p. 381 *L. microphylla* is cited under *Lindsaea*, not under *Schizoloma*. *L. microphylla* therefore cannot be the type of *Hymenotomia*, as stated by Christensen (l.c.) and others, e.g., Domin (1913, as subgenus). Gaudichaud's classification of species, and the conditional "réunirait", show, in the authors' opinion, that he did not really accept a taxon *Hymenotomia*, in any rank, and it was never validly published.

† There is also a dubious record from the Northern Territory (without specific locality) by Dämel (HBG). *L. microphylla* has been incorrectly reported from New Zealand and New Caledonia by Posthumus (1938) and others, due to confusion with other species.

*pinnae* with a stalk of a few mm, their rachis basally stramineous, greenish above; major *pinnae* 3–10 cm long, c. 1.5–3 cm wide, 2–3 × as long as wide; one or two basal pairs of *pinnae* often slightly reduced; upper *pinnae* gradually and strongly reduced, confluent into a pinnatifid leaf-apex. *Secondary pinnae* of major primary *pinnae* c. 4–8 to a side, alternate, somewhat ascending, variously cleft, pinnatifid, or pinnate + pinnatifid, from base to apex gradually of simpler structure, the basal ones shortly (a few mm) petiolulate, the upper sessile, the pinnate ones with 2–4 (rarely more) pinnules; terminal segment (pinnule) of primary and secondary *pinnae* cuneate-flabellate. *Ultimate divisions* cuneate-flabellate, usually distinctly asymmetric, of very variable size, the major fertile ones often 2–3 mm long and wide, sometimes a little wider than long, joined by basal wings or free, entire or variously cleft, usually evenly broadened from base to apex, less often subspathulately broadened at the sorus; lateral margins straight or faintly convex, outer margin truncate, erose. *Veins* free, once or twice forked. *Partly or entirely sterile leaves* not rarely present, their segments as a rule larger than the fertile, apically unevenly crenate-dentate. *Sori* single or paired along the outer margin of the ultimate segments, occupying (1–) 2–4 vein-ends; indusium pale, laterally adnate or not and convex, pale, thin, c. 0.5 mm wide, its strongly erose edge equalling or almost equalling the margin, bulging but scarcely reflexed at maturity. *Spores* honey-coloured, smooth, trilete, with prominent ridges, c. 25–29 μm across as seen from the tetrad side, at right angles to it often rather elongate and with long ridges and observed from that side not rarely seemingly monoletic.

AUSTRALIA: QUEENSLAND: Cook District: between Cairns and Herberton, *Wild* (BR1 59316); Stannary Hills, *Bancroft* 202, 1908 (BR1). Leichhardt District: Blackdown Tableland, 12 miles [c. 19 km] SSE. of Bluff, 2200 ft [c. 670 m] alt., above North Scarp, in open eucalypt forest on sandy soil with numerous rock outcrops, in shade of sandstone boulders, *R.W. Johnson* 951, 9.1959 (CANB, BRI, NSW); Blackdown Tableland, 23° 05' S, 149° 00' E, c. 32 km SE. of Blackwater, camp-site on Mimosa Creek, alt. 600 m, in damp crevices in sandstone very close to water's edge in open *Eucalyptus* forest, *Henderson* 622, *Andrews & Sharpe* 4.1971 (BRI, CANB, NSW), *Simmonds* 9.1937 (BR1 59319); Carnarvon Range, on scree slope on Clematis sandstone near mouth of gorge, *Butler* 1.1960 (BR1 25261); Carnarvon National Park, in Gorge 1 mile [1.6 km] W. of entrance to Gorge, on sandstone slope below high cliffs among rocks, sheltered shady site under tall *Eucalyptus maculata* forest, *Briggs* 2149a, 8.1968 (NSW); Isla Gorge, c. 18 miles [c. 29 km] SW. of Theodore, 25° 09' S, 149° 57' E, dissected plateau of sandstone in moist gully, *Everist* 8062, 9.1968 (BRI, CANB, NSW). Burnett District: "Broomia", near Mundubbera, *Young* 9–10.1926 (BR1 59304). Moreton District: Nambour, in gully, *Kenny* 10.1906 (BR1 84653); Maroochie, *F.M. Bailey* 7.1879 (BR1 59310); Cruickneck, Glasshouse Mts, under rocks on middle slopes, *Goy* 5.1935 (BR1 59318); Glasshouse Mountains area, 50 miles [c. 80 km] N. of Brisbane, near Gun-Gun, in sandy rock crevices in open forest, *Schodde* 296, 12.1956 (CANB, NSW, AD, L); Crows Nest, North Darling Downs, *C.T. White* 10.1921 (BR1 59313), *Kenny* 10.1921 (BR1 59315); Taylor Range, near Brisbane, c. 700 ft [c. 215 m] alt., amongst *Theleda australis* in open *Eucalyptus* forest, rocky mountain slopes, *Hubbard* 3758 (BRI, K, L); Moreton Bay, *Mueller* (BM); Helidon-Ravensbourne, *Hockings* 8.1963 (BR1 51812); Mt Gravatt, Brisbane, *Manski* 9.1958 (BR1 12669); Brisbane River, *Dietrich* 1863–65 (L, BM); Cherside, near Brisbane, at the bottom of the dry gully on ridge of Ordovician shales, in open *Angophora woollsii* woodland, *Melville* 3404 & *S.T. Blake*, 3.1953 (K, NSW, BRI); Wellington Point, *F.M. Bailey* NSW P2678, 6.1892 (NSW); Canungra, on dry hillsides, rather rare, *C.T. White* 7818, 8.1931 (BR1); Binna Burra, Lamington National Park, 2600 ft [c. 800 m] alt., *Dickson* NSW P5499, 9.1947 (NSW); Springbrook, alt. 2000 ft [c. 600 m], under rock on hillside in dry *Casuarina* forest, *Goy & L.S. Smith* 234, 1.1938 (BR1); Mt Maroon, on summit between north peak and south peak, alt. c. 900 m, in moist soil under overhanging rock on edge of gully, *Everist* 7107, 3.1962 (BR1, NSW); Tambourine Mountain, *Shirley* NSW P2677, 12.1915 (NSW); Mt. Barney slopes, 3500 ft [c. 1070 m] alt., growing under rocks, frequent, on granite, *Constable* NSW P6546, 11.1952 (NSW), alt. c. 1000 ft [c. 300 m], in crevice beneath an overhanging rock, in rather damp situation, *Everist* 1369, 10.1935 (BR1).

NEW SOUTH WALES: North Coast: North Obelisk, 1 mile [1.6 km] WSW. of Urbenville, frequent among rocks on steep hillside, alt. 650 m, *Constable* 6641, 12.1965 (NSW, U); near Tuntale Falls, 5 miles [c. 8 km] NE. of Nimbin, 28° 34' S, 153° 17' E, in grey heavily leached forest soil at edge of wet sclerophyll forest, common, alt. 150 m, *Covey* 4502 & *Rodd*, 9.1972 (BM, LE, NSW, PERTH, U); Drake, *Boorman* NSW P2692, 10.1901 (NSW); Barcoongre State Forest, c. 17 miles [c. 27 km] N. of Coffs Harbour, *McGillivray* 25, 3.1965 (NSW); Port Macquarie, *Boorman* NSW P2687, 6.1915 (NSW); The Rapids, Ellenborough River, *Watts* NSW P2684, 4.1915 (NSW); Kendall, *F.M. Bailey* NSW P1653, 9.1929 (NSW); c. 1 mile [c. 1.6 km] S. of "Hut" at Ferny Creek, W. of Wallis Lake, *Salasoo* 3310, 1.1967 (NSW). Northern Tablelands: Lookout Point, Gibraltar Range, 30 miles [c. 48 km] NE. of Glen Innes, occasional on rocky granitic hillside, 3360 ft [c. 1025 m] alt., *Constable* NSW P7391, 4.1956

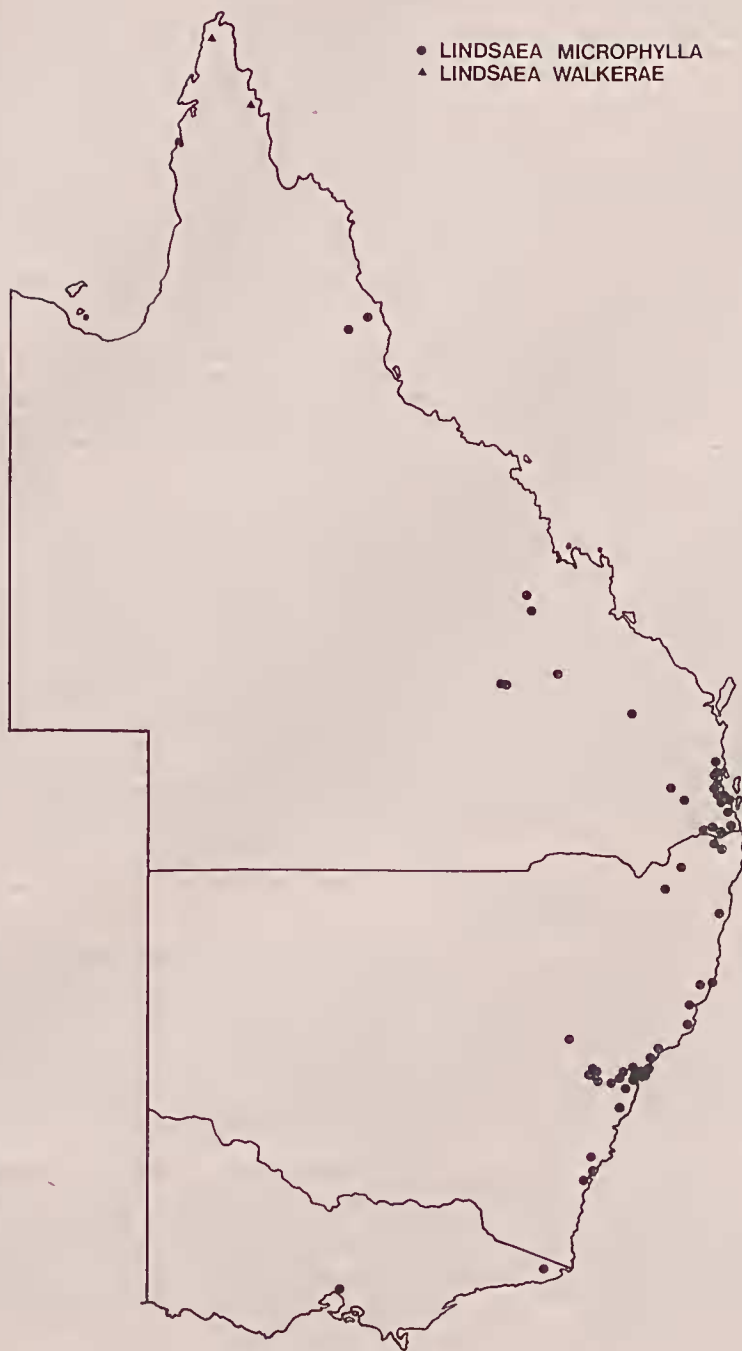


Fig. 1. Map of Eastern Australia (excluding Tasmania) showing the distribution of *Lindsaea microphylla* and *L. walkerae*.

(NSW, U). Central Coast: near Lake Macquarie, *Lomont* 291, 10.1887 (BM); Flat Rock, near Pearl Bay, *Helms NSW P2681*, 10.1900 (NSW); Somersby, on steep sandy slope leading to rain forest, *Chippendale NSW P6561*, 8.1953 (NSW); Bobbin Head, e. NE. of Hornsby, alt. 500 ft [c. 150 m], on moist rock face, in shallow soil, *Constable NSW P7152*, 8.1948 (NSW); Berowra, *Boorman NSW P6070*, 6.1905 (NSW, B, K, W, Z); Fish Ponds, Hornsby, alt. 150 ft [c. 46 m], growing under rocks, sandstone, *Constable NSW P6264*, 1.1950 (NSW); Kinka Reserve, Duffy's Forest, 33° 40' S, 151° 12' E, *Hain* 100, 8.1970 (CBG); Davidson Park, St Ives, off Douglas St., in sand between sandstone boulders, 33° 44' S, 151° 11' E, *Pulley JP 510*, 8.1970 (CBG); Oxford Falls, *Pichi-Sermolli* 6136 (Pie-Ser); Brookvale, *Staer* 7.1910 (P); Gordon, *Kaspiew* 1025, 2.1959 (L); Cheltenham, sandstone, *Ford NSW P5506*, 3.1948 (BM, L, NSW); Castle Cove, in sandstone gully in dry sclerophyll forest, *C.L. Wilson* 495, 3.1957 (NSW); Castle Crag, sandstone, scrub forest in crevice of boulder, *Tindale NSW P6499*, 2.1948 (NSW); Argyle to Parramatta, *Hügel* (W); Fig Tree, Parramatta River, *Boorman NSW P2685*, 8.1914 (NSW); Sydney, *Brenning* 785 (B, MICH), *U.S. Expl. Exped.* (B, GH, K); near Sydney, *Robertson* (E), *Cuttlar* 153 (E); Port Jackson, *R. Brown* 83 (E), *R. Brown* (P), *F. Bauer* (W), *Mossman* 71 (HBG, W); Cumberland Co., *Alkin* (Z); Botany Bay, *Mossman* 671 (B); *Mossman* 71 (E, P); Botany Bay and Port Jackson, *Mossman* 671 (E); Sutherland, *Campfield NSW P1583*, 1.1895 (NSW); Springwood, *Constable NSW P1139*, 2.1947 (NSW), 750 ft [c. 225 m] alt., *Constable NSW P7147*, 2.1949 (BM, BO, K, L, LAE, NSW, U), *Podenzana* 1891-93 and 8.1902 (BM); Woodford, *Bauerlen NSW P1634*, 7.1899 (NSW); Mulgoa, *Rupp NSW P2694*, 9.1915 (NSW); National Park, *Constable NSW P8117*, 5.1960 (BM, K, NSW, U); Garie Beach, National Park, occasional on sandstone hillside, *Constable NSW P7485*, 9.1955 (NSW); National Park, near Sydney, *Melville* 3753 (K); road to Avon Dam, alt. 900 ft [c. 275 m], beside dry watercourse in thick scrub, *Constable NSW P226*, 7.1947 (NSW, Pie-Ser); Nepean Dam, Bargo, frequent amongst sandstone rocks, *Constable NSW P6689*, 11.1953 (NSW, SING). Central Tablelands: Cudgegong River, below Mt Cudgegong, occasional in dry sclerophyll forest with thick understory, *T. & J. White* 3271, 8.1969 (NSW); Mt Irvine, in moist sandy soil, *Haigh NSW P148*, 7.1942 (NSW); Coal Creek, Mt Wilson, on rocky sandstone hillside, *Constable NSW P5312*, 12.1948 (NSW); Mt Victoria, *Weber* (HBG); Hazelbrook, Blue Mountains, terrestrial on bank on hillside in sandy soil, in dry sclerophyll forest, sandstone, *Tindale NSW P9376*, 4.1966 (NSW); Erskine Creek, King's Tableland, 18 miles [29 km] SE. of Wentworth Falls, locally frequent on sandstone hillside near creek, *Constable NSW P7409*, 5.1956 (L, NSW, U); 2 miles [3.2 km] S. of Queen Victoria Homes, King's Tableland, Wentworth Falls, on moist bank near edge of road, sandstone, 2850 ft [c. 870 m] alt., *Constable* 4236, 6.1963 (NSW); above Minnamurra Falls, alt. 2200 ft [c. 670 m], in an exposed position in rain forest ravine above the stream, *Judd NSW P7159*, 5.1955 (NSW). South Coast: Budawang Range, on The Castle, on damp sandstone shelf below the second cliff line, 35° 17' S, 150° 12' E, *Pulley & Telford BR 576*, 6.1971 (CBG); Yadboro State Forest, Kalianna Ridge track towards The Castle, 35° 18' S, 150° 11' E, *Canning* 2.1968 (CBG 2264); near Nelligen, *Gauba* 8.1953 (CBG 1717); Nelligen-Runnyford, in forest, *Phillips* 3.1961 (CBG 1887); Araluen Valley, 10 miles [c. 16 km] NW. of Moruya, 35° 50' S, 150° 00' E, alt. 250 m, in wet sclerophyll forest in dense undergrowth, *van Balgooy* 1640, 8.1971 (L).

VICTORIA: Karlos Creek, Mt Drummer, *Wakefield NSW P2676*, 12.1940 (NSW); Melbourne, *Lucas NSW P2688* (NSW).

The leaf architecture, the scales of the rhizome, and some soral characters of *L. microphylla* are strongly reminiscent of the genus *Sphenomeris*, where it has been placed by some authors. The fact that the indusium is at least sometimes laterally free as well as the distinct affinity with some species in section *Schizoloma*, e.g., *L. media* (see also below), and the lack of affinity with any species of *Sphenomeris*, show that its natural place is in *Lindsaea*, although it is undoubtedly close to the common source of the two genera, which is also phytogeographically interesting.

Two specimens in the Queensland Herbarium are probably hybrids of *L. microphylla*. One specimen viz. *L.S. Smith* 324 from Mt Gravatt near Brisbane, is approximately intermediate between *L. microphylla* and *L. media* and its spores are abortive. The other, *S.T. Blake* 4820 from Beerburum, Moreton District, Queensland, has characters of both *L. microphylla* and *L. ensifolia* ssp. *agatii*. Its spores are also abortive. These intermediates strengthen the conclusion that *L. microphylla* is a member of *Lindsaea* section *Schizoloma*.

2. *Lindsaea media* R. Br., Prodr.: 156 (1810); F.M. Bailey, Handb. Ferns Queensland: 18 (1874); Kramer, Fl. Males., Ser. 2, 1 (3): 208, fig. 20 (1971).

SYNONYMY: *Schizoloma medium* (R. Br.) Kuhn, Chactopt.: 346 (1882). *Schizoloma ensifolium* (Swartz) J. Smith var. *medium* (R. Br.) Domin in Biblioth. Bot. 20 (85<sup>1</sup>): 78 (1913).



*Lindsaea flabellulata* Dryander var. *multipinulata* F.M. Bail. in Queensl. Agric. J. 29: 349, Pl. 36 (1912). LECTOTYPE: Hinchinbrook Island, North Kennedy District, Queensland, H. Tryon 1912 (BRI 59253). SYNTYPES: Cook District, Thursday Island, J. Douglas 6.1893 (BRI 59254) and Cardwell, North Kennedy District, Queensland, K. Broadbent (BRI 59252).

*Lindsaea subtripinnata* Copeland in J. Arnold Arbor. 24: 441 (1943). HOLOTYPE: Tarara, W. Div., Papua, Brass 8491 (MICH). ISOTYPES: (BO, GH, L).

HOLOTYPE: North Coast, Island G 2 (Australia), R. Brown 82, 18-24.ii.1803 (BM). ISOTYPES: (K, E). Possible ISOTYPES: (P, U).

MISAPPLIED NAMES: *Lindsaea trichomanoides* auct. non Dryander; ? F. Mueller, Fragm. 5: 118 (1965-66). *Lindsaea orbiculata* auct. non (Lam.) Mett. ex Kuhn; Domin in Biblioth. Bot. 20 (85<sup>1</sup>): 82 (1913). *Lindsaea cuneata* auct. non (Forst. f.) C. Chr.; Domin, l.c. 83. *Lindsaea tenera* auct. non Dryander; F. Mueller, l.c. 119.

DISTRIBUTION: Papua and Australia (Cook, North Kennedy, Port Curtis and Moreton Districts of Queensland as well as a very dubious record from New South Wales). Fig. 2 (p. 100).

HABITATS: Terrestrial or amongst boulders, often in rich alluvial soils along the banks of streams, in densely shaded situations or in open grassy sites, in low scrub, in savanna forests, in eucalypt or *Casuarina* forests, in semi-deciduous mesophyll vine-forests, on the margins of gallery woods or in rain forest undergrowth, in soils derived from sandstone, volcanic or a mixture of granite and metamorphic rocks, from sea level to c. 500 m alt.

*Rhizome* rather shortly creeping, c. 1-1.5 mm in diam., rather thinly and deciduously paleaceous; scales yellow, ovate-triangular, with a short, uniseriate, unthickened apical portion, up to 6-seriate at the base, to c. 1 mm long. *Leaves* clustered to c. 0.5 cm apart; petioles (stipes) stramineous or fawn-coloured, adaxially bi-angular below, channelled above, abaxially terete below, upward gradually obtusely or acutely bi-angular or flattened, 10-40 cm long, equalling or mostly longer than the lamina. *Lamina* herbaceous or chartaceous, olivaceous, brownish, or medium to dark green when dry, 10-30 cm long, 4-17 cm wide, 2-3 × as long as wide, triangular or oblong, bipinnate or bipinnate + pinnatifid or + pinnatifid, rarely tripinnate at the base. *Primary rachis* adaxially deeply sulcate, abaxially flattened and bi-angular. *Pinnæ* spreading or slightly, rarely more strongly ascending, the major pinnæ c. 4-10 to a side, most or all subopposite, the largest basal pinnæ 2.5-10 cm long, 12-18 mm wide, not narrowed at the base, rather evenly narrowed in the upper half or throughout; upper pinnæ gradually and evenly reduced, no conform terminal pinna present. *Secondary rachises* adaxially flattened, bi-angular, the greater part with a green margin. *Basal pinnules* on both sides of the lower pinnæ at least of large leaves usually pinnatifid to pinnatifid or rarely pinnate, with few tertiary divisions. *Ultimate free pinnules* variable in size and shape, largely depending on the degree of dissection and on their place in the lamina but always distinctly dimidiate-subflabellate; larger ones trapezoidal, subquadratic, sessile, the larger undissected pinnules up to 5 × 3.5 to 10 × 6 mm, if dissected the larger ones with incisions on both sides, the smaller only on the anterior side. *Upper pinnules* reduced, not strongly so in paucijugate pinnæ, the terminal segment then obliquely rhombic, obtuse, free or almost so, to 5 mm long, more strongly reduced in plurijugate pinnæ, the upper pinnules denticuliform, confluent into a narrow pinnatifid pinna-apex. *Juvenile plants* with paucijugate laminas with a few patent, paucijugate-pinnate pinnæ at the base. *Upper and outer margin* of the sterile pinnules sharply dentate but obscurely or mostly distinctly crose in the fertile pinnules. *Veins* immersed, usually not evident, 1-3 × forked, c. 0.5 mm apart, free, connivent, or sporadically and irregularly anastomosing; leaves of adult plants hardly ever without any anastomoses, but often many pinnules, especially smaller ones, quite free-veined. *Sori* continuous except as interrupted by the incisions of the margin; indusium pale, erose to deeply and irregularly incised, almost reaching to slightly exceeding the margin, 0.3-0.5 mm wide, neither reflexed nor concealed at full maturity. *Spores* medium brown, trilete, smooth, c. 25 µm.

AUSTRALIA: QUEENSLAND: Cook District: Lockerbie, 10 miles [c. 16 km] WSW. of Somerset, 10° 47' S, 142° 28' E, abundant on outer edge of gallery woods on banks of stream, alt. 30 m, Brass 18411, 4.1948 (BRI, K, L, CANB); Scrubby Creek, Cape York Peninsula,



Fig. 2. Map of Queensland showing the distribution of *Lindsaea media* and *L. fraseri*

*Whitehouse* (BRI 59295); Cockatoo Creek, Cape York Peninsula, *Whitehouse* 1943 (BRI); Cape Grenville, on creeks in volcanic country, 11° 58' S, 143° 14' E, *Young* 37, 7.1923 (BRI); Ducie River, Gulf side of Cape York Peninsula, 12° 01' S, 142° 00' E, *Whitehouse* 2.1943 (BRI 59300); Ayles Hills, Portland Roads, 12° 36' S, 143° 25' E, *Brass* 18945, 5.1948 (L); Junie Creek, in rain forest, 12° 40' S, 143° 15' E, *Dockrill* 584, 10.1972 (BRI); Iron Range, 12° 42' S, 143° 18' E, gregarious locally amongst grasses in savanna-forest, alt. 50 m, *Brass* 19127, 6.1948 (BRI, CANB, L, K); Kennedy Rd., 13 miles NNE. of Pascoe River Crossing, 12° 45' S, 143° 05' E, *Gittins* 8.1965 (BRI 85585); Tozer Range, 0.5 miles [0.8 km] E. of Mt Tozer, 12° 47' S, 143° 13' E, common in rain forest undergrowth, *Brass* 19468, 7.1948 (CANB, BRI, K, L); Leo Creek, Upper Nesbit River, 13° 33' S, 143° 28' E, gregarious locally in very dense shade in rain forest undergrowth, 420 m alt., *Brass* 19931, 8.1948 (BRI, CANB, L); Lankelly Creek, on western fall of Mellwraith Range, approx. 13° 55' S, 143° 15' E, alt. approx. 200 m, in semi-deciduous mesophyll vine-forest along stream on alluvial soils derived from a mixture of granite and metamorphic rocks, some sclerophyll emergents—*Melaleuca argentea* and *Eucalyptus pellita*, permanent waterhole in creek at this point, *Webb & Tracey* 9653, 10.1969 (BRI); Kennedy River, 14° 29' S, 143° 57' E, in spring at branch of river, *Hann* 1890 (BRI) juvenile specimen; Altanmoui, 14° 35' S, 144° 35' E, in low scrub, under sandstone boulders, *Hyland* 6326, 7.1972 (BRI); Rossville, 15° 45' S, 145° 16' E, *Percival* 5.1973 (BRI 165027); Shipton's Flat, 15° 47' S, 145° 14' E, gregarious on dry shady banks of a stream, 275 m alt., *Brass* 20012, 9.1948 (BRI, CANB, K, L); Parrot Creek, c. 1 mile [c. 1.6 km] S. of Shipton's Flat, in open forest, c. 185 m alt., *L.S. Smith* 14329, 5.1969 (BRI); Mossman area in open grassy forest, 16° 02' S, 145° 02' E, *Percival* 8.1972 (BRI 165030); Pebbly Beach, 16° 37' S, 145° 03' E, *Dockrill NSW P8681* (U); Barron Falls (Kuranda), 16° 50' S, 145° 39' E, alt. 1071 ft [326 m], common above the falls on steep grassy slope with *Schizoloma fraseri* (i.e. *Lindsaea fraseri*), *Goy* 397, 7.1938 (BM, BRI); Black Mountain Rd., near Kuranda, frequent in colonies in *Casuarina* open forest, c. 1200 ft [c. 488 m] alt., *Flecker* 8.1967 (BRI 84725); Cairns, *Warburg* 19266 pp. (B); Yarrabah, *Messmer NSW P2883*, 7.1952 (NSW, U), *Domini* 162, 169 and 174 (PR); Fitzroy Island, 16° 56' S, 146° 00' E, *J. MacGillivray* 6.1848 (K), *C. Moore* 1879 (P); Walsh's Pyramid, 17° 08' S, 145° 49' E, *Bellenden Ker Expedition* 1889 (BRI 59298); Bellenden Ker Ranges, *S. Johnson* 62, 1891 (P). North Kennedy District: Goold Island, *J. MacGillivray* 5.1848 (K); Rockingham Bay, *Mueller* 9.1877 (K), *Hill* 38, 1845 (BM), *ex Herb. Mueller* (P); Ingham Range, 18° 03' S, 146° 01' E, on steep shady creek banks and rich soil, *Percival* 7.1973 (BRI 165007); Wallaman Falls, 60 miles [c. 97 km] NW. of Ingham, 18° 35' S, 145° 50' E, amongst rocks in *Eucalyptus* forest on edge of gorge, *Vessey & Fox* 85, 8.1963 (BRI, JCT); between Cleveland Bay and Rockingham Bay, *Hill* 38, 1.1866 (K). Port Curtis District: Percy Isles, in dry thickets, *A. Cunningham* 6.1829 (K); Rosedale, North Coast Line, 24° 38' S, 151° 55' E, *Dovey* 420, 12.1931 (BRI). Moreton District: Moreton Bay, Glasshouses, 26° 54' S, 152° 54' E, *F. Mueller* 1857 (K).

NEW SOUTH WALES: A specimen marked "New South Wales", without further data (GH).

Described long ago, this species has almost fallen into oblivion. Herbarium material was mostly identified as *L. orbiculata* (or *L. flabellulata*), *L. tenera*, or as a variety of *L. ensifolia* or *L. heterophylla*. The affinity is, in our opinion, with *L. microphylla*, *L. ensifolia* var. *agatii* and perhaps also with *L. orbiculata*.

A collection from Tozer Range, C.Y.P., *Brass* 19468 (L), has cuneate, largely sterile, sharply dentate pinnules and probably represents a shade form, as it was collected in rain forest.

A specimen from Port Essington, N. Australia (probably collected by R. Brown) 38 (K) with subbipinnate leaves and free veins, has strongly erose pinnules and more intramarginal sori than *L. media*. It has been determined as *L. flabellulata*, and is not unlike *L. orbiculata* var. *commixta*, but, as this species does not occur in or near Australia, it is better regarded as an aberrant form of *L. media*.

**3. *Lindsaea fraseri* Hooker**, Sp. Fil. 1: 221, Pl. 70B (1846); F. Mueller, *Fragm.* 5: 118 (1865-6); Bentham, *Fl. Austral.* 7: 721 (1878); F. M. Bailey, *Fern World Australia*: 40 (1881); F. M. Bailey, *Lithogr. Ferns Queensland*: Pl. 56 (left) (1892); F. M. Bailey, *Queensland Fl.* 6: 1955 (1902); F. M. Bailey, *Compr. Cat. Queensland Pl.*: 641 (1913); Tindale in *Rec. Amer.-Austral. Sci. Exp. Arnhem Land* 3: 177 (1958).

SYNONYMY: *Schizoloma fraseri* (Hooker) Fée, *Gen. Fil.*: 108 (1852); F. M. Bailey, *Handb. Ferns Queensland*: 20, fig. a, b (1874). *Schizoloma ensifolium* Swartz var. *fraseri* (Hooker) Domin in *Biblioth. Bot.* 20 (85): 80, fig. 15, 8 (1913). *Schizolegnia fraseri* (Hooker) Alston in *Bol. Soc. Brot.*, 2<sup>a</sup> sér., 30: 24 (1956).

LECTOTYPE: Stradbrook (Stradbroke) Island, Queensland, *Fraser 171* (K). ISOTYPE?:  
 ♂ Nov. Hollandianum, *Fraser 1829* (K).

A specimen collected by *G.L. Davis NSW P7556* at Noosa Heads, Wide Bay, Queensland, in August 1956 (NSW) is a good match for the lectotype which is here designated for the first time.

DISTRIBUTION: Australia (Wide Bay and Moreton Districts of Queensland). Fig. 2 (p. 100).

HABITATS: In *Melaleuca* swamps, in sclerophyll forests or grassy forests or in wallum near the sea.

*Rhizome* rather long-creeping, ferruginous, 1–2 mm in diam.; scales honey-coloured, almost acicular, approximately the apical  $\frac{1}{3}$  uniseriate, the greater part biseriate, up to 4-seriate at the base, to 2 mm long. *Leaves* not close, c. 0.5–1 cm apart; petioles (stipes) stramineous with a darker base, or darker with age, quadrangular and  $\pm$  sulcate, c. 4–25 cm long, c.  $\frac{1}{4}$ – $\frac{2}{3}$  of the length of the lamina. *Lamina* very narrowly lanceolate to linear, c. 17–35 cm long, 1.5–3.5 cm (usually 2–3 cm wide), usually widest just above the base, gradually narrowed to the apex, simply pinnate (or if quite or basally sterile a few pinnac at or just above the base, or less often some lower fertile pinnules, subpinnate or pinnate). *Pinnules* c. 12–20, often c. 18 on each side, at least the basal ones subopposite; texture herbaceous or chartaceous, colour yellowish green to olivaceous when dry. *Rachis* sulcate as in the upper part of the petiole (stipe). *Pinnules* spreading, or more often at least the larger ones distinctly ascending, the lower ones remote, several times their width apart, the upper closer but scarcely contiguous. *Major pinnules* of full-grown plants lanceolate or subhastulate with subcordate base,  $\pm$  asymmetrical, very obtuse, c. 12–20 mm long, 5–15 mm wide, about as long as wide to c. 3  $\times$  as long, with a petiolule c. 1 mm long; smaller pinnules, most or all pinnules of sterile leaves, and pinnules of pinnate pinnae rhombic, suborbicular-flabellate, or subreniform-flabellate, about as long as wide or wider than long, with transitions between the two extreme shapes. *Upper pinnules* gradually reduced but not denticuliform; terminal pinnule rhombic-lanceolate, c. 0.5–1 cm long, superficially crenate-lobate, free or slightly connected with 1 or 2 reduced pinnules; terminal pinnules of pinnate pinnae often larger and more obtuse. *Margin of sterile pinnules* crenate-dentate but entire or with occasional shallow incisions in the fertile. *Veins* immersed, evident at least in transmitted light; larger pinnules with a stramineous, nearly percurrent costa, this gradually less distinct as the pinnules become smaller and/or less elongate. *Lateral veins* close, c. 0.3–0.5 mm apart, 1–3  $\times$  forked, ending in the teeth of the sterile margin, rather to quite regularly anastomosing in larger pinnules, irregularly in smaller pinnules, free or nearly so in the smallest, with a single series of very elongate areoles. *Sori* continuous around the pinnule-apex, or interrupted by an occasional incision; indusium pale or greenish, entire or subentire, 0.5–0.6 mm wide, equalling the margin or nearly so, not reflexed and scarcely bulging at maturity. *Spores* abortive in the samples examined by the authors.

AUSTRALIA: QUEENSLAND: Wide Bay District: Inland from Happy Valley on eastern side of Fraser Island, 25° 05' S, 153° 15' E, in sclerophyll forest, *Baxter 903*, 5.1967 (BRI); "Boonaroo", Maryborough, wallum near the sea, *Clemens 10.1948* (K). Moreton District: 2 miles [3.2 km] S. of Buderim Mountain, 26° 43' S, 153° 03' E, grassy forest, *C.L. Wilson 660*, 5.1957 (BRI); Mooloolah and Maroochy Rivers, *C.T. White 4.1916* (BRI 59588); Glasshouse Mountains, 26° 54' S, 152° 54' E, *F.N.C. Excursion 9.1909* (BRI 59580), *F.M. Bailey?* 7.1879 (BRI 59578); Bribie Island, N. end of Moreton Bay, alt. e. sea level, in a very peaty soil from decaying vegetation and sand, growing under a shade of ti-trees and tall reeds, in dense ti-tree swamp, in water (not at all seasons, as it grows near the edge of swamps) and with a damp steamy atmosphere, *G.K. Jackson 34*, 8.1931 (K), *Clemens* (UC); Brisbane River, Moreton Bay, shaded woods, *A. Cunningham 185*, 1828 (K); Kedron, Brisbane 27° 25' S, 153° 00' E, *Simmonds 5.1888* (BRI 59587); Wellington Point, 27° 29' S, 153° 15' E, *C.T. White 11.1914* (BRI 59536, 59576–7, 59586); Dunwich, 27° 30' S, 153° 24' E, *F.M. Bailey?* 3.1892 (BRI 59581); Cleveland, *Mueller* (K); Moreton Bay, *Fitzallan* (K), *Fraser 98* (BM); Russell Island, *C.T. White 9.1913* (BRI 59582); Tambourine Mountain, *Domin 167* (PR).

This species is morphologically close to *L. media* on the one hand and to *L. ensifolia* ssp. *agatii* on the other: juvenile specimens cannot always be readily distinguished. The abortive spores suggest an F<sub>1</sub>-hybrid, presumably between these two species. It is interesting that sterile, apparently not full-grown specimens are often bipinnate or subbipinnate, whereas fertile ones are simply pinnate or rarely subbipinnate.

It was previously considered that *L. fraseri* extended to the Northern Territory (see Tindale in Specht (1958) page 177) based on a rather puzzling specimen collected by Specht 451 at South Bay, Bickerton Island in the Gulf of Carpentaria, N.T., 6.1948 (BRI, K, L, LAE, NSW, US). This material is somewhat intermediate between *L. fraseri* and *L. ensifolia* Swartz ssp. *ensifolia* but is perhaps closer to the latter.

*L. fraseri* probably does not occur north of the Wide Bay District in Queensland. There are two doubtful records, viz. Rossville, Cook District, *Pereival* 5.1973 (BRI) which is a poor specimen, and Dulhunty River, W. (Gulf) side of Cape York Peninsula, Cook District, *Whitehouse* 1943 (BRI) which may be juvenile material of *L. media*.

4. *Lindsaea ensifolia* Swartz in J. Bot. (Schrader) (1800): 77 (1801); F. Mueller, *Fragm.* 5: 118 (1865-6); Bentham, *Fl. Austral.* 7: 721 (1878); F.M. Bailey, *Fern World Australia*: 40 (1881); F.M. Bailey, *Lithogr. Ferns Queensland*: Pl. 57 (1892); F.M. Bailey, *Queensland Fl.* 6: 1955 (1902); F.M. Bailey, *Compr. Cat. Queensland Pl.*: 641 (1913); Tindale in *Rec. Amer.-Austral. Sci. Exp. Arnhem Land* 3: 176 (1958); Kramer in *Acta Bot. Neerl.* 15: 579 (1967); Kramer in *Blumea* 15: 564 (1968); Brownlie, *Fl. Nouvelle-Calédonie* 3: 126 (1969); Kramer in *Blumea* 18, 1: 170 (1970); Kramer in *Fl. Males.* 2, 1 (3): 211 (1971).

SYNONYMY: *Schizoloma ensifolium* (Swartz) J. Smith in *J. Bot. (Hooker)* 3: 3 (1841); F.M. Bailey, *Handb. Ferns Queensland*: 20 (1874) as *S. ensifolia*; Domin in *Biblioth. Bot.* 20 (85): 74-77 (1913). *Schizolegnia ensifolia* (Swartz) Alston in *Bol. Soc. Brot.*, 2<sup>a</sup> sér., 30: 24 (1956).

For further synonymy see Kramer in *Fl. Males.*, ser. 2, 1 (3): 211-212. As indicated previously (Kramer (1967) l.c.) there are two subspecies in the Pacific zone and Eastern Malesia but they are not sharply distinct and intermediates occur where they overlap in distribution.

HOLOTYPE: Mauritius, unknown collector (S-PA).

#### KEY TO THE SUBSPECIES OF *L. ENSIFOLIA* IN AUSTRALIA

1. Upper pinnules scarcely or not abbreviated; terminal pinnule large, free or nearly so, entire or rarely hastate at the base ..... *L. ensifolia* ssp. *ensifolia*
- 1.\* Upper pinnules ± gradually reduced, confluent into a lobed or pinnatifid leaf-apex; lamina sometimes bipinnate or subbipinnate, rarely even subtripinnate at the base ..... *L. ensifolia* ssp. *agatii*

a. *L. ensifolia* ssp. *ensifolia*, see Bailey (l.c. 1892), Pl. 57 (right).

DISTRIBUTION: Africa to S. China, S. Japan, Melanesia, Micronesia, Hawaii and Australia (northern Western Australia, the northern region of the Northern Territory and the Cook, Port Curtis, Wide Bay and Moreton Districts of Eastern Queensland).

HABITATS: Terrestrial or in rock crevices, frequently in sandy alluvium near fresh-water streams or on the margins of *Melaleuca*, mangrove or cyperaceous swamps, in monsoon forests or in low-lying sandy areas in dry sclerophyll forests, on cliffs near the sea or in moist shaded gorges, often associated with sandstone.

The following description of ssp. *ensifolia* by the senior author is cited from *Fl. Males.* 2, 1 (3): 212 (1971):

"*Rhizome* sometimes short-creeping, (1-) $1\frac{1}{2}$ -2(- $2\frac{1}{2}$ ) mm  $\phi$ ; scales light reddish brown, narrowly triangular, to 2 mm long, to 5-seriate at the base, about the apical  $\frac{1}{3}$  uniseriate. Leaves to 2 cm apart. *Petioles* c. 10-35 cm long,  $\frac{1}{2}$ -1 times as long as, rarely longer than the lamina,

stramineous to reddish brown, rarely darker, abaxially at least upward bi-angular and sometimes also sulcate, if dark not or hardly pale-margined. *Lamina* very variable, c. 15–45 cm long, mostly once pinnate, rarely simple, very rarely subbipinnate; if simple lanceolate, c. 10 by 1½–3 cm, or linear, c. 10 cm by 3–10 mm. Pinnate lamina with the rachis like the upper part of the petiole, abaxially sharply bi-angular and mostly also sulcate. *Lateral pinnae* one odd one to 12 to a side, most often in 2–8 pairs, not contiguous, spreading to strongly ascending, the larger ones usually subpetiolulate, lanceolate to linear, — evenly narrowed from base to apex, subacute to acuminate, 10–22 cm long, 4–25 mm wide, 4 to over 25 times as long as wide (the great variability at least in part due to the presence of juvenile yet fertile plants), the base broadly to narrowly cuneate, the basiscopic side usually slightly longer and narrower. Texture herbaceous to chartaceous, rarely thicker; colour dark green or olivaceous when dry. *Sterile leaves* (not common) with fewer, relatively broader pinnae; sterile margin (in fertile pinnae often present at the apex) serrate, less often subentire. *Upper pinnae* little reduced, in large leaves c. ½ the size of the lower ones; terminal pinna conform, with asymmetric base, of the size of the larger lateral ones, free or slightly connected with 1 or 2 not lobe-like upper pinnae. Costa stramineous, not carinate. Areoles of veins ½–1½(–2) mm wide. *Indusium* entire, 0.4–0.5 mm wide, strongly reflexed and concealed at maturity. Spores light yellow, c. 25–28 µm.”

AUSTRALIA: NORTHERN TERRITORY: Wessel Islands, 11° 11' S, 136° 44' E, rare in monsoon forest in damp soil, *Latz 3229*, 9.1972 (NT 36751), *Latz 3228*, 9.1972 (NSW); Trepang Bay South, Cobourg Peninsula, in moist soil near base of *Melaleuca* sp., in swamp areas, 11° 14' S, 131° 56' E. *Letts NT 8312*, 10.1960 (NSW); 3.1 miles [5 km] S. of Raffles Bay, common near small stream, 11° 20' S, 132° 24' E, *Chippendale NT 8206*, 7.1961; Yirrkala, Arnhem Land, 12° 12' S, 136° 47' E, growing at edge of a freshwater marsh, *Specht 881*, 8.1948 (BRI, NSW); Oenpelli, Arnhem Land, 12° 18' S, 133° 04' E, at edge of dry watercourse on top of sandstone scarp, *Specht 1093*, 9.1948 (BRI, NSW); Mindil Beach, Darwin, common on shelves of rock face near beach, 12° 26' S, 130° 49' E, *Chippendale NT 4467*, 5.1958 (NSW); Port Darwin, *Holtze NSW P891* (NSW); Darwin, *Bleeser 652* (B); 2 miles [3.2 km] S. of East Alligator River Crossing, sandy alluvium near creek, 12° 27' S, 132° 56' E, *Byrnes 2186*, 6.1971 (NSW); 13 miles [c. 21 km] SE. of Darwin, common in small area on creek bank, *Chippendale NT 4446*, 5.1958 (NSW, BRI); Howard Springs area, 16 miles [c. 26 km] SE. of Darwin, infrequent, in monsoon forest, 12° 28' S, 131° 03' E, *Chippendale NT 6171*, 5.1959 (NSW); Delissaville, Cox's Peninsula, Arnhem Land, at water's edge of freshwater stream, 12° 31' S, 130° 44' E, *Specht 116*, 3.1948 (NSW, BRI); South Bay, Bickerton Island, in the Gulf of Carpentaria, 13° 45' S, 136° 06' E, in crevice above waterhole in sandstone hills, *Specht 451*, 6.1948 (NSW, K, L, LAE, US, BRI 59560 and 24392); Jasper Gorge, Victoria River district, 16° 02' S, 130° 45' E, *Beaglehole 46701* & *G.W. Carr 2922*, 7.1974 (NT, AD, NSW); Tallaputta Gorge†, 30 miles [c. 48 km] W. of Haast Bluff, in masses in shaded moist gorge in a small area, *Chippendale NT 3569*, 7.1957 (BRI, K, NSW); Talipata Gorge, 23° 22' S, 131° 22' E, common on ledges of rock face of grotto, permanently damp from dripping water, *Henshall 11906*, 12.1974 (NSW); Kings Canyon, George Gill Range, c. 24° 16' S, 131° 32' E, along rock faces, upper gorge, *Beaglehole 26719*, 7.1968 (NT, AD, NSW), terminal segment slightly lobed.

QUEENSLAND: Cook District: Cape York, *Dämel 2* (P, U); *Dämel* (B, K), *J.F. Mueller* (GH); near Nine Mile Scrub, Bamaga, at the tip of Cape York Peninsula, 10° 54' S, 142° 23' E, in swampy places, *Webb & Tracey 6446*, 7.1962 (BRI); 3 miles [4.8 km] from Point Archer towards Cooktown, 15° 36' S, 145° 18' E, in low-lying sandy area in dry sclerophyll forest, *Wrigley & Telford NQ 1319*, 6.1972 (CBG); Bailey's Creek, N. of Daintree River, 16° 13' S, 145° 28' E, on mangrove swamp margin, *Wrigley & Telford NQ 955*, 6.1972 (CBG). Port Curtis District: Rosedale, 24° 38' S, 151° 55' E, *Dovey 421*, 12.1931 (BRI). Wide Bay District: Fraser Island, 25° 15' S, 153° 10' E, *C.T. White* 10.1921 (BRI 59547). Moreton District: Beerwah-Glasshouse Mts trace, 26° 51' S, 152° 58' E–26° 54' S, 152° 54' E, *Phillips* 8.1961 (CBG 1912); Moreton Island, 27° 04' S, 153° 23' E, in swamp approx 2 km ENE. of Bulwer, sedgeland dominated by *Galunia sieberana* and Cyperaceae, soil a peaty sand, growing at margin of swamp, *Durrington 338*, 3.1973 (BRI); Stradbroke Island, 27° 35' S, 153° 28' E, *C.T. White* 9.1913 (BRI 59544), *C.T. White* 4.1917 (BRI 59545), *Percival* 7.1972 (BRI 16500).

WESTERN AUSTRALIA: Northern Province: Hann District: Osborne Island, Bonaparte Archipelago, 14° 19' S, 126° 00' E, *P.G. Wilson 11130*, 6.1973 (PERTH); Lawley River, 14° 40' S, 125° 54' E, *Gardner 1462\**, 7.1921 (PERTH, NSW); Boonagaree Island, Prince Frederick Harbour, prob. 15° 05' S, 125° 10' E, *P.G. Wilson 11392\**, 7.1973 (PERTH); Unwin's Island, Brunswick Island, Brunswick Bay, 15° 18' S, 124° 48' E, freshwater stream, *P.G. Wilson 11439*, 7.1973 (PERTH); Charnley River, near F<sup>A</sup>B 33, 16° 20' S, 125° 16' E, *Fitzgerald 1402*, 8.1905 (PERTH). Fitzroy District: King's Sound, 16° 50' S, 123° 25' E, *Froggatt NSW P2337*, 1888 (NSW); Derby, 17° 18' S, 123° 38' E, *Froggatt NSW P2386\**, 1886–7 (NSW). Ord District: Cave Range, near Kununurra, c. 15° 31' S, 128° 50' E, in sand at foot of cliff, near spring,

† Tallaputta and Talipata are alternative spellings for the names of a gorge at the western end of the Macdonnell Ranges, N.T.

\* Somewhat intermediate with ssp. *agatii*.

*Beard* 4304, 6.1965 (PERTH);  $\pm$  6.5 km W. of King River, S. side of Cockburn Range, Kimberleys, c. 15° 55' S, 128° 06' E, *Beaglehole* 47234 & *G.W. Carr* 3356, 7.1974 (NSW, PERTH); in gorge near Thompson's Springs, 42 miles [c. 68 km] SW. of Kimberley Research Station, 16° 01' S, 128° 57' E, tufted plant 1 ft [0.3 m] high growing in wet places, *Perry* 2955, 7.1952 (CANB, BRI, NSW, US); Thompson's Springs, Argyle, Ord River, wet shady spots, 16° 01' S, 128° 57' E, *Gardner* 7378, 6.1944 (PERTH); near overflow of Lake Argyle Creek Area, Kimberleys, *Beaglehole* 46877 & *G.W. Carr* 3118, 7.1974 (NSW, PERTH). Uncertain District (Hann/Fitzroy?):  $\pm$  200 km E. of Derby, Galvins Gorge, Kimberleys, *Beaglehole* 47929 & *G.W. Carr* 4151, 7.1974 (CANB, NSW, PERTH).

*L. ensifolia* ssp. *ensifolia* is common in the Northern Territory and northern Western Australia as well as occurring in Queensland. There are a few records of *L. ensifolia* ssp. *agatii* from the northern part of the Northern Territory and a large number from Queensland. Although the latter subspecies has not been recorded from Western Australia, some specimens show a tendency towards ssp. *agatii*.

b. *L. ensifolia* ssp. *agatii* (*Brackenridge*) *Kramer* in *Acta Bot. Neerl.* 15: 579, 573, fig. 1C, D (1967); *Kramer* in *Blumea* 18 (1): 170 (1970).

SYNONYMY: *Schizoloma agatii* *Braekenridge* in *U.S. Expl. Exped.* 16: 216, Pl. 30, fig. 1 (1854). TYPE: *U.S. Expl. Exped. s.n.*, Fiji (US?, not seen). ISOTYPE: (K).

*Schizoloma ensifolium* (*Swartz*) *J. Smith* var. *heterophyllum* (*Dryander*) *Domin* f. *rhomboideum* *Domin* in *Biblioth. Bot.* 20 (85<sup>1</sup>): 77, fig. 14, 3 (1913). HOLOTYPE: Yarraba, Queensland, *Domin* 170 (PR). *Schizoloma ensifolium* (*Swartz*) *J. Smith* var. *heterophyllum* (*Dryander*) *Domin* f. *angustipinnum* *Domin* in *Biblioth. Bot.* 20 (85<sup>1</sup>): 78 (1913). SYNTYPES: Yarraba, by Waterfall Creek, N. Queensland, *Domin* 164 (PR), Yarraba, *Domin* 163 (PR). *Schizoloma ensifolium* (*Swartz*) *J. Smith* var. *intercedens* *Domin* in *Biblioth. Bot.* 20, (85<sup>1</sup>): 80 (1913). HOLOTYPE: Yarraba, N. Queensland, *Domin* 173 (PR).

MISAPPLIED NAMES: *Lindsaea ensifolia* *Swartz* as in *F.M. Bailey*, *Lithogr. Ferns Queensland: Pl.* 57 (left), (1892). *L. heterophylla*, *L. ensifolia* var. *heterophylla*, *Schizoloma heterophyllum* or *Schizoloma ensifolium* var. *heterophyllum* *auctt.* as to Australian plants.

DISTRIBUTION: Ambon, Timor and New Guinea, northwards and eastwards to Micronesia, New Caledonia, Tonga and Samoa, Australia (the northern region of the Northern Territory and eastern Queensland (Cook, North Kennedy, Port Curtis, Wide Bay and Moreton Districts)).

HABITATS: Terrestrial or amongst rocks, usually near streams or in swamps, in lowland rainforest, in mixed xerophytic or poor eucalypt forest, in savanna woodland or *Melaleuca* woodland, sometimes on sandy flood banks, usually in peaty loam or sandy soil.

The following description of *L. ensifolia* ssp. *agatii* by the senior author is cited from *Fl. Males.* 2, 1 (3): 211-212 (1971):

"Rhizome not very shortly creeping, 1½ mm thick; scales as in ssp. *ensifolia*. Leaves ½-1 cm apart. Petioles stramineous to reddish brown, quadrangular, often sulcate. Lamina often lanecolate, with e. 8-15 pinnae to a side, sometimes subbipinnate to fully bipinnate. Pinnae often rather strongly ascending, the major ones c. 5-10 cm by 4-7 mm, 10-15 times as long as wide, the lower ones sometimes subauriculate at base, chartaceous or firmly herbaecous, acute or subacute, not rarely some lower (but not necessarily the lowermost) pinnatifid or pinnate, their segments usually rhombic or obovate, rarely prolongate-rhombic to lanceolate, up to c. 12 to a side, decurrent and often wing-connected, the basal ones often broader. Apices of pinnatifid or pinnate pinnae with a long undivided segment. Upper primary pinnae gradually and strongly reduced, the uppermost ones less than ½ the size of the lower ones, terminal segment confluent with some reduced upper pinnae or lobed at the base. Veins in smaller secondary pinnules irregularly anastomosing; often only one row of areoles present. Sterile margin serrate. Sori continuous except as interrupted by incisions of the pinnae, in small pinnules of bipinnate leaves occupying only their outer margin. Indusium often with an irregular edge, occasionally slightly exceeding the margin. Spores light brown, c. 26 µm."

AUSTRALIA: NORTHERN TERRITORY: Giddy River, 12° 22' S, 136° 42' E, erect and sprawling rhizomatous fern, infrequent in peaty loam, in rain forest fringing creek, *Latz* 2903, 6.1972 (BRI); Darwin, 12° 38' S, 130° 50' E, *Posthumus* 3841 (BO), *Holtze* (BM, US), *Schomburgk* (K).

QUEENSLAND: Cook District: Jardine River, e. long. 142° 21' E, amongst grass in sandy tea-tree savanna-forest, *Brass* 18919, 5.1948 (K); Newcastle Bay, 2.5 miles [4 km] S. of Somersset, Cape York Peninsula, *Brass* 18714 (K, L); Skardon River, Cape York Peninsula, 11° 45' S,

142° 02' E, *Whitehouse* 1943 (BRI 57575); Dulhunty River, W. (Gulf) side of Cape York Peninsula, 12° 00' S, 142° 08' E, *Whitehouse* 3.1943 (BRI 59574), *Whitehouse* 1943 (BRI 59584); Temple Bay, *Young* 38 & 45, 7.1923 (BRI); Brown's Creek, Pascoe River, gregarious in semi-shade on sandy flood banks, alt. 60 m, *Brass* 19605, 7.1948 (BRI, CANB, K); Tozer Gap, Tozer Range, edges of gully fringing rain forest, alt. 100 m, *Brass* 19381, 6.1948 (BRI, CANB); Claudie River, in savannah woodland, 12° 45' S, 143° 15' E, *Dockrill* 499, 10.1972 (BRI); Cape Bedford, 75 km S. of Cooktown, 15° 14' S, 145° 21' E, *Poland* 85 (B); Isabella Falls, 27 miles [43.5 km] from Cooktown, 15° 18' S, 145° 00' E, fringing forest beside creek, *Wrigley & Telford* 1377A, 5.1972 (CBG); Mt Cook, 15° 30' S, 145° 16' E, 15° 30' S, 145° 16' E, along edge of boulder, *L.S. Smith* 10580, 8.1959 (BRI); Rossville, in sandy soil, savannah, *Messmer* NSW P6470, 7.1952 (NSW); Bailcy's Creek area, c. ¼ mile [0.4 km] E. of sawmill (c. 7.5 miles [c. 12 km] ENE. of Daintree), c. 16° 13' S, 145° 28' E, in somewhat swampy lowland rain forest on grey soil, alt. c. 50 ft [c. 15 m], *L.S. Smith* 11517, 10.1962 (BRI); Daintree River, 16° 17' S, 145° 27' E, *Brass* 2178, 2.1938 (BRI), *Pentzke* 1882 (MEL); Kuranda, on hillside near coffee plantation, *Watts* 7-8.1913 (BRI 59543); Black Mountain Road, near Kuranda, sporadic in grass of *Casuarina* open forest, 16° 49' S, 145° 39' E, *Fleeker* 8.1967 (BRI 84890A); Kuranda-Saddle Hill Road, NW. of Cairns, in rain forest margin, *Wrigley & Telford* NQ 52, 5.1972 (CBG); Yarrabah Mission, Cairns district, *Messmer* NSW P2389, 7.1952 (NSW), Mt Bellenden-Ker, 17° 16' S, 145° 51' E, *Podeuzana* (BM); Allumbah (Herberton district), *Waller* NSW P888, 11.1909 (NSW); 1 mile [c. 1.6 km] W. of Crawford's View, Palmerston Highway, c. 40 miles [c. 65 km] W. of Innisfail, in rain forest near creek in sheltered gully, fronds to c. 6 m long and rachis c. 12 cm diam. at base with pale green, swollen base of rachis and base of pinnae, no trunk, broad ± conical base, *Briggs* 1955, 8.1968 (NSW). North Kennedy District: Sugarcane Creek, between Tully and Mission Beach, in *Melaleuca viridiflora* woodland, common ground fern, *Webb & Traeey* 8162, 1962 (BRI); towards mountains S. of Tully, growing amongst grass on a *Casuarina* ridge in open forest, *Vessey* 9.1963 (JCT P253); Rockingham Bay, *Bancroft* (E), *F. Mueller* (K); Kennedy, in poor swampy arcas, 18° 12' S, 145° 58' E, *Percival* 7.1972 (BRI 165006); S. of Cardwell, in poor *Eucalyptus* forest near mangrove swamps, *Vessey* 3.1962 (BRI 35969); Palm Islands (c. 30 miles [c. 48 km] E. of Ingham), 18° 42' S, 146° 36' E, *Bancroft* (BRI 59549); Kelly's Gully, Mt Fox, 18° 49' S, 145° 50' E, *Clemens* 9-12.1949 (BRI 20178, K, MICH); Birthday Creek Falls, Paluma Range, alt. 2600 ft [c. 800 m], in wet sclerophyll (forest) fairly open, *Vessey* 4.1963 (JCT P256). Port Curtis District: Byfield, near Keppel Bay, common in sandy soil in savannah forest, *C.T. White* 8171, 9.1931 (BRI), common in sandy land in mixed xerophytic forest, *C.T. White* 8028, 9.1931 (BRI). Wide Bay District: Inland from Happy Valley on eastern side of Fraser Island, 25° 15' S, 153° 15' E, in sclerophyll forest, *Baxter* 911, 5.1967 (BRI). Moreton District: Wappa Falls, South Maroochy River, NW. of Nambour, 26° 34' S, 152° 57' E, among rocks in the open, *L.S. Smith* 10544, 5.1959 (BRI); Bribie Island, *Clemens* (MICH), *C.T. White* 1.1913 (BRI 59537); Moreton Bay, *F. Mueller* (K); Moreton Island, 27° 10' S, 152° 25' E, *Simuonds* 4.1892 (BRI 59566, K); Stradbroke Island, *Hill* (K); Brisbane River, *Dietrich* (B); Wellington Point, 27° 29' S, 153° 15' E, *Wedd*, 10.1891 (BRI 59570); Eight Mile Plains, 27° 35' S, 153° 06' E, *Williams* (BRI 59571); Nerang Creek, 28° 03' S, 153° 17' E, *Schneider* (BRI 59541).

The following specimens are considered to be intermediates between ssp. *ensifolia* and ssp. *agatii*: Katherine Gorge National Park, N.T., in rock crevices at bottom of cliff, *Byrnes* NB 690, 5.1968 (BRI, NSW); Wide Bay District, Queensland, Double Island Point, near stream, *Clemens* 10.1946 (K); East Coast (of Australia), *R. Brown* (E); Mt Fox, Queensland, *D.A. Smith & L.S. Smith* (BRI, K). A specimen collected at Noosa, Wide Bay District, Queensland, in a swampy area near the sea by *D.A. & L.S. Smith* in July 1943 (BRI 59561) is closer to ssp. *agatii*.

Material with abortive spores collected at Beerburum, Queensland, by *S.T. Blake* 4820 (BRI) is a possible hybrid between *L. ensifolia* and *L. media*.

A possible hybrid between *L. microphylla* and *L. ensifolia* ssp. *agatii* was collected by *L.S. Smith* 324 on 15.ii.1938 at Mt Gravatt, near Brisbane, Queensland, growing in shade at foot of a large boulder in a very shallow gutter (BRI). The spores of this specimen are abortive.

5. *Lindsaea trichomanoides Dryander* in Trans. Linn. Soc. 3: 43, Pl. II (1797); J.D. Hooker, Handb. New Zealand Fl.: 359 (1864); Bentham, Fl. Austral. 7: 720 (1878); F.M. Bailey, Fern World Australia: 40 (1881); Thomson, Ferns & Fern Allies New Zealand: 52, Pl. II a, b (1882); Field, Ferns New Zealand: 78, Pl. 19, 1 (1897); Cheeseman, Man. New Zealand Fl.: 958 (1906); Kramer in Acta Bot. Neerl. 6: 146 (1957), in obs.; Crookes & Dobbie, New Zealand Ferns, ed.



6: 148, photo 149 (1963); Tindale in Beadle, Evans & Carolin, *Handb. Vasc. Pl. Sydney Distr.*: 61 (1963); Tindale in Beadle, Evans & Carolin, *Fl. Sydney Region*: 66 (1972); probably not of *F. Mueller*, *Fragm.* 5: 118 (1865-6).

SYNONYMY: *Adiantum trichomanoides* (Dryander) Poiret in Lamarck, *Encycl. Suppl.* 1: 140 (1810). *Schizoloma trichomanoides* (Dryander) Kuhn, *Chaetopt.*: 346 (1882).

*Adiantum cuneatum* Forster f., *Prodr.*: 84 (1786), non Langsd. & Fischer (1810). *Lindsaea cuneata* (Forster f.) C. Christensen, *Ind. Fil.*: 392 (1906); Ewart, *Fl. Victoria*: 38 (1931); Dobbie & Crookes, *New Zealand Ferns*, ed. 5: 152, photo 153 (1952); Wakefield, *Ferns Victoria & Tasmania*: 28, with fig. (1955); Allan, *Fl. New Zealand* 1: 58 (1961); Willis, *Handb. Fl. Victoria* 1: 23 (1962), *nom. illeg.*, non Willdenow (1810). LECTOTYPE (here designated): New Zealand, *Forster* (GOET). SYNTYPES: New Zealand, *Forster* 298 (BM), *Forster* (UPS).

*Lindsaea lessonii* Bory in Duperrey, *Voy. Bot.* 1: 278, Pl. 37, fig. 2 (1828). *Lindsaea trichomanoides* Dryander var. *lessonii* (Bory) Hooker, *Handb. New Zealand Fl.*: 359 (1864); Thomson, *Ferns & Fern Allies New Zealand*: 52 (1882); Field, *Ferns New Zealand*: 79, Pl. 19, 3 (1890); Cheeseman, *Man. New Zealand Fl.*: 959 (1906); Crookes & Dobbie, ed. 6, *New Zealand Ferns*, ed. 6: 150, photo 151 (1963); Allan, *Fl. New Zealand* 1: 59 (1961). *Lindsaea cuneata* (Forster f.) Christensen var. *lessonii* (Bory) Crookes in Dobbie & Crookes, *New Zealand Ferns*, ed. 5: 154 with plate (1952); Allan, *Fl. New Zealand* 1: 59 (1961). HOLOTYPE: Bay of Islands, New Zealand, *Lesson s.n.* (P). ISOTYPE: (B).

HOLOTYPE: Dusky Bay, New Zealand, *Menzies* (BM). ISOTYPES: (B-WILLD, E).

DISTRIBUTION: Rare and localized in Australia but recorded from New South Wales (Central Coast and Central Tablelands), Victoria (Wilson's Promontory) and Tasmania (Gordon River); reports from Queensland refer to other species. Fairly abundant in the North Island of New Zealand and local in the South Island; sea level to 750 m alt. Incorrectly reported from the Pacific Islands by Dobbie & Crookes (i.e.), Posthumus (1938), and others, probably due to confusion with such species as *L. moorei* and *L. ensifolia* ssp. *agatii*.

HABITATS: In Australia this species is usually found amongst rock crevices in ravines or gorges in rain forests or dense forests above streams or rivers. In New Zealand it is terrestrial on dry shady banks or at the bases of trees in lowland to montane shrubland or in *Nothofagus*, Kauri (*Agathis australis*) or Broadleaf forests, *Dacrydium cupressinum* swamp forests or in podocarp-hardwood forests (*Podocarpus totara*, *Dacrydium kirkii* and *Phyllocladus glauca*).

*Rhizome* shortly to rather long-creeping, ferruginous or castaneous, c. 0.7-1.5 mm in diam.; scales reddish brown, elongate-triangular or lanceolate, apically very shortly uniseriate, up to c. 14-seriate at or just above the base, up to 2 mm long. *Leaves* clustered to 1.5 cm apart, often irregularly spaced on the same rhizome; petioles (stipes) c. 7-22 cm long,  $\frac{2}{3}$ -1½(-2) × as long as the lamina, slender, reddish brown or more often castaneous, with or without a narrow pale margin, ± lustrous, quadrangular, usually scarcely sulcate except adaxially. *Lamina* herbaceous or less often chartaceous, dark green or olivaceous when dry, oblong or triangular-oblong, c. 10-20 cm long, 2-6 cm wide, 2½-4(-5) × as long as wide, at least at the base pinnate + deeply pinnatifid, not rarely bipinnate, less often at the base bipinnate + more or less deeply cleft or pinnatifid; primary rachis like the petiole (stipe), upward gradually paler. *Major pinnae* c. 5-12, often 6-8, on each side, most or all but the uppermost subopposite, spreading or (especially when fully pinnate) ascending; the basal major pinnae a few cm apart, the upper gradually closer, contiguous or non-contiguous; basal pinnae with a petiolule of 1 to a few mm in length, the upper gradually sessile; lowest pinnae sometimes not larger or even slightly smaller than the pair or pairs just above them. *Secondary rachises*, if any, basally reddish brown, upward gradually stramineous and marginate, abaxially rounded. *Larger pinnae* triangular, deltoid, oblong, or oblong-lanceolate, subobtusate to acuminate, 2-8 cm long, 1-2 cm wide, in the least dissected form at least on the basico-anterior side with one quite free or almost free flabellate pinnule and crenate-serrate-lobate above it, in the more strongly dissected forms with more, up to c. 6 major pinnules to each side, their shape and size depending on the degree of dissection of and their place in the lamina; smaller segments spatulate-cuneate, usually asymmetric, the outer margin rounded, not rarely erose or even minutely apiculate, often 4-5 mm long, 2-3 mm wide at the sorus, 1-1.5 mm wide at the base, the sides nearly straight; coarser segments (pinnules) flabellate-obovate, very obtuse, 5-8 cm long, 3-6 cm wide, widest above the middle, with very convex, usually erose

outer margin; larger pinnules cleft. All possible intermediates found between the extremes, but strongly and relatively slightly incised leaves do not usually occur together on the same rhizome. *Upper segments* gradually confluent into the lobed-crenate pinna-apex; upper (primary) pinnae gradually reduced and of simpler structure, confluent with the lanceolate, lobed, obtuse to acute, well-developed leaf-apex. *Apical parts of less divided pinnae* with an abaxially  $\pm$  elevated stramineous costa, otherwise the ultimate divisions not costate. *Veins* immersed, evident, 1-3  $\times$  forked in the larger divisions, simple in the smallest, subpinnately branched in upper pinnae of scarcely divided leaves, lax, 1-1.5 mm apart, free, ending well within the margin. *Sori* short and approximately straight in smaller divisions, long and basally strongly concave along the outer margin of coarser ultimate divisions, usually on 1-4 (occasionally on up to 8) vein-ends, occurring up to the pinna-apices; receptacle mostly laterally surpassing its supporting veins. *Indusium* pale or brownish, subentire to slightly erose, 0.3-0.5 mm wide, falling short of the margin by less than its width to very nearly reaching it, bulging to  $\pm$  reflexed at maturity. *Spores* hyaline, trilete, c. 25  $\mu$ m (see Harris 1955, 105).  $n = \pm 42$  (Brownlie 1957a).

NEW ZEALAND: NORTH ISLAND: Bay of Islands, *Cunningham* 214, 5.1838, *Cunningham* 212 (K), *Raoul* 1843 (P); near the Keri-Keri, deep woods, *Cunningham* (E); Waipoua Kauri Forest, 500 ft [c. 150 m] alt., in podocarp-hardwood forest (*Phyllocladus glauens*, *Dacrydium kirkii*, *Podocarpus totara*), growing on open track, terrestrial fern, *Varekamp* 80, 12.1953 (L); Trounson Kauri Park, North Auckland, *Sledge* 53 A (K); Kawau, Hauraki Gulf, *Lyll* 12.1848 (E), Hauraki Gulf, *Lyll* (E); Waitakere, *Luerssen* 2403 (P); Birkdale, Auckland, *Hynes* 12.1952 (BM), *Meebold* 5255 (BISH); Auckland, *Mackay* 10.1855 (E), *Hynes* (BM, U), *Kirk* (GH), *Powell* 28 (B), *Schwartz* 385 (B), *Hautain* 36, 37 (BRI 59367), *Dubuc* 1861 (E); University of Auckland property, Swanson, Auckland, *Mason* 1.1950 (L); South Auckland, Bush Reserve, Twilight Road, between Brookby and Clevedon, growing in moss (*Leucobryum*) at base of kauri, *Chinnoek* P114, 11.1971 (Herb. Chinnoek); Titirangi, between Rotorua and Tauranga-Mangarewa Gorge, growing on shaded bank in Broadleaf forest, *Chinnoek* P335, 4.1972 (Herb. Chinnoek); Hunua Ranges, *Moore* (MICH); Pirongia Mt, Waitako, *Cheeseman* 1.1879 (E); Bay of Plenty, *Cunningham* 212 (K); Ngongotaha, *Prince* (GH); Ngongotaha Mountain, near Rotorua, *Chase*, *Leland* & *Tilden* 115, 11.1909 (B, BISH, BM, E, GH, K, US); Waipa-Taupo, *Hochstetter* 28 (W); Rotorua, *Holtum* (SING); Palmerston North, *Zotov* 1931 (BM); Manawatu, Wellington Province, *Craig* (BRI 59368); Wellington District, Akatarawa Range, 3 km below the Akatarawa Road Summit on the Hut Valley side, 40° 58' S, 175° 07' E, growing as base of *Nothofagus* tree, *Chinnoek* P201, 5.1972 (Herb. Chinnoek); in the neighbourhood of Wellington, *Ralph* 5, 1849-52 (BM, E, W), *Ralph* 45, 1849 (B, BM); Wellington, *Houkey* (E), *Logan* (B, K); Butterfly Creek, behind Eastbourne, growing on dry clay slope under *Nothofagus* in open situation, 41° 19' S, 174° 54' S, *Chinnoek* P183, 4.1972 (Herb. Chinnoek); Massacre Bay, *Lyll* 67 (K). SOUTH ISLAND: Queen Charlotte Sound, *Home* (BM); Wahi Punami, *Nelson*, *Ramsf* 1886 (E); Picton, collector? 18/4 (E); in forest round Westport, in deep shade, *Green* 11.1877 (P); *Green* 6, 1878 (BM); *Green* 6.1879 (LE), *Green* 6, 5.1875 (E); Lower Buller Gorge, Westland, 41° 50' E, 171° 40' E, 700 ft [c. 215 m] alt., *Lambrechtsen* 14, 3.1964 (L); Greymouth, *Helms* 1870 (B, HBG, L, P, W); Banks Peninsula, *Raoul* (L); Akaroa, *Comte* 1855 (P); Milford Haven, Milford Sound, *Lyll* 3.1851 (E); Waitaki, *Sinclair* (K); Otago, *Maegregor* 1870 (E), *Dubuc* (E).

AUSTRALIA: NEW SOUTH WALES: North Coast: near Port Macquarie, *Dobson* 1883 (MEL). Central Tablelands: Blue Mts, no collector (K), *Woolfs* 5.1874 (MEL). Central Coast: Kurrajong, *Fletcher* NSW P6071, 9.1886 (NSW); Bulli, *Hamilton* NSW P2700, 1899 (NSW); head of Cordeaux River, W. of Mt Kembla, *Harper* NSW P2968, 2.1911 (NSW); above Minnamurra Falls, alt. 2200 ft [c. 670 m], in rock crevices, in rain forest ravine, above stream, *Judd* NSW P7163, 5.1955 (NSW); above Minnamurra Falls, 3 miles [4.8 km] W. of Jamberoo, 2000 ft [610 m] alt., in moist sheltered gorge in rain forest, in well-drained soil, *Judd* NSW P7994, 11.1956 (NSW); Broger's (Brogher's) Creek, near Illawarra, *Bänerlen* 1883 (MEL).

VICTORIA†: Wilson's Promontory, *Andas & St John* 10.1909 (P).

TASMANIA: Gordon River, *Milligan* 775, 10.1846 (K, W), *Lea* 775, 1886 (BM); Gordon River, Macquarie Harbour, in dense forest, *Gunn* 2057 10.1846 (NSW, HO), *Gunn* 2057 (K).

As it has been our policy to cite a high proportion of the specimens examined, it is obvious that *L. trichomanoides* has a rather limited distribution in Eastern Australia, whereas it is common in New Zealand.

† According to Willis (l.c. 1962) 23, this species may be extinct in Victoria.

The great variability in degree of dissection of the fronds in this species has caused much comment but has had surprisingly few nomenclatural consequences. The less dissected form which was described as *L. lessouii*, has until very recently been upheld as a variety, but we do not consider it separable; nor do we accept the suggestion of Carse (cited by Dobbie & Crookes, l.c.), that there are two forms or varieties with intermediate hybrids.

It is unknown which factor is responsible for the degree of dissection but it is definitely not a matter of the age or size of the plant. If a polypoid series were involved, one would expect differences in the size of the spores but this was not found. In Australia, too, both the coarse and finely dissected forms have been collected.

Although a typical member of section *Schizoloma*, *L. trichomanoides* is somewhat isolated. Its closest relatives may be the New Caledonian *L. nervosa* and *L. rufa*.

6. *Lindsaea incisa* Prentice in J. Bot. 11: 295 (1873); F.M. Bailey, Handb. Ferns Queensland: 19 (1874); Bentham, Fl. Austral. 7: 721 (1878); F.M. Bailey, Fern World Australia: 40 (1881); F.M. Bailey, Lithogr. Queensland: Pl. 55 (1892); F.M. Bailey, Queensland Fl. 6: 1955 (1902); F.M. Bailey, Compr. Cat. Queensland Pl.: 641 (1913); Domin in Biblioth. Bot. 20 (85<sup>1</sup>): 85 (1913).

HOLOTYPE: not cited. A specimen from "near Brisbane" apparently the type (BM, dupl. ?? in K).

DISTRIBUTION: Eastern Australia (uncommon in the North Kennedy and Wide Bay Districts but common in the Moreton Bay District of Queensland; a single record from the North Coast of New South Wales).

HABITATS: Mostly at low elevations in somewhat shaded, moist situations, often growing amongst grasses and sedges, occurring beside streams, in sclerophyll forests and *Melaleuca* swamps.

*Rhizome* somewhat shortly to rather long-creeping, sparingly branched, 0.5–1 mm in diam.; scales lemon-coloured, almost acicular, largely biseriate, to 1 mm long, a short apical portion uniseriate. *Leaves* not clustered, 0.5–1 cm apart; petioles (stipes) stramineous with a darker base, slender, wiry, c. 0.2–0.3 mm in diam., quadrangular with flat or at least adaxially sulcate faces almost to the base, c. 2–8 cm long, very much shorter than the lamina. *Lamina* c. 25–30 cm long when full-grown but apparently slowly developing, usually collected when only basally mature, the apex then lost and the lamina much shorter; 0.5–1.5 cm wide, linear; rhachis stramineous, quadrangular, quadrisulcate. *Pinnules* subopposite or nearly so, c. 30–50 pairs, 0.5–2 cm distant, never touching, spreading, thinly herbaceous, light olivaceous when dry, their laminas presumably not in the same plane as the rachis when growing, sessile or very shortly petiolulate below the cuneate base, in outline suborbicular, semiorbicular, or the smallest upper ones subdimidiate; larger pinnules (pinnae) 5–7 mm long, 5–8 mm wide, very shallowly crenate to deeply cleft or sometimes truly pinnately or palmately compound, the ultimate divisions cuneate-flabellate, with convex, crenate outer margin, sometimes cleft, 2 to 4 per pinnule, 2–5 mm long, 2–6 mm wide; a few pairs of basal pinnules usually  $\pm$  reduced; upper pinnules very gradually reduced and of simpler structure; leaf-apex (usually wanting in herbarium material) with a small cuneate-flabellate terminal segment; sterile leaves often present, not difform but often with broader divisions. *Veins* dichotomous in the pinnules or segments, 1–3  $\times$  forked, often c. 0.5 mm apart. *Sori* on (1–)2–4 vein-ends; indusium whitish, 0.5–0.7 mm wide, with an irregular free edge, reaching or somewhat exceeding the usually crose laminal margin, in short sori almost pouch-shaped, in longer sori usually with a convex base, not reflexed at maturity. *Spores* medium brown, trilete, smooth, c. 43  $\mu$ m. Plate VII.

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LECTOTYPE† (here designated for the first time): Very local . . . in 1 or 2 dry barren places in small quantity under the shade of *Melaleuca* bushes, Brisbane, *Prentice*, received 10.viii.1868 (K). There are also the following specimens: near Brisbane, *Prentice* 7.1872 (BM), *Prentice*, received 5.1874 (K) and *Prentice* (MEL 63714).

DISTRIBUTION: New Caledonia (very rare) and Eastern Australia (North Kennedy, Port Curtis and Moreton Districts of Queensland but rare on the North, Central and South Coast of New South Wales).

HABITATS: In sandy or peaty soil, often under dry grass, usually in heathland or wallum or sometimes on damp hillsides in eucalypt forests.

*Rhizome* very shortly creeping, c. 1 mm in diam.: scales lemon-coloured, almost acicular, largely biseriate with a short, uniseriate apical portion, to 2.5 mm long. *Leaves* clustered, dimorphic (leaves of intermediate size and shape, with sori, seen in Manski (BRI 12666)). *Sterile leaves* narrowly oblong, the petiole (stipe) delicate, stramineous, sulcate and  $\pm$  collapsed when dry, c. 1–3 mm long, half as long as to equalling the lamina: lamina thinly herbaceous, with up to 8 pinnules to each side, c. 1.5–4 cm long, c. 0.7–1.5 cm wide, the pinnules cuneate-flabellate or  $\frac{1}{4}$ -elliptic to submidiate, the lower ones crenate, some incisions deeper, the pinnule bifid or twice bifid, the upper ones similar, or only crenate; leaf-apex consisting of a flabellate, crenate, free or nearly free segment. *Larger sterile pinnules* to c. 8  $\times$  5 mm. *Fertile leaves* rigidly erect, greatly exceeding the sterile ones; petiole (stipe) rather delicate, stramineous, quadrangular, or rounded either abaxially at the base or for the greater part, 6–10 or sometimes 18 cm long, about equalling the lamina or up to approximately twice as long. *Lamina* narrowly oblong to linear, 3.5–8 cm long, c. 1–1.5 cm wide, herbaceous, mostly subbipinnate or bipinnate at the base, simply pinnate above, less often entirely simply pinnate, with c. 6–12 primary divisions to each side, these ascending, at least their width apart, often much more remote. *Rachis* abaxially obtusely bi-angular, upward gradually rounded. *Basal pinnae* usually deeply bifid, with 2 free or almost free divisions (pinnules), sometimes with 3 of the latter; upper primary divisions (or sometimes all) cuneate-flabellate-sublunulate, with a distinct petiolule-like base, asymmetric, the lateral margins often slightly concave, the outer margin faintly concave to convex, sometimes crose; larger (simple) pinnules c. 4  $\times$  5 mm; terminal pinnule (always?) free, flabellate, symmetric, otherwise conform. *Veins* immersed, free, flabellately 1–3  $\times$  dichotomous in sterile and fertile pinnules. *Sori* continuous except when the pinnules are incised; indusium greenish, crose to lacerate, adnate at the narrowed ends,  $\frac{1}{2}$ – $\frac{2}{3}$  mm wide, about equalling the margin. *Spores* light brown, trilete, smooth, c. 28  $\mu$ m. Plate VIII.

AUSTRALIA: QUEENSLAND: North Kennedy District: Wild River Gorge, 5 miles [c. 8 km] from Herberton, on moist bank beside creek in dry sclerophyll forest, *Telford* NQ 728 & *Wrigley*, 6.1972 (CBG); Herberton, *Manski* 9.1958 (BRI 12666). Port Curtis District: Bowen State Forest, Yeppoon district, poor wallum site, *Hinson* 7.1964 (BR1). Moreton District: near top of Glasshouse Mountain(s), unknown collector 7.1964 (BRI 59222); Glasshouse Mountains, *Bailey* (BM, P); Bribe Island, *C.T. White* 9.1914 (BR1 59223), *C.T. White* NSW P2670, 9.1913 (NSW); Moreton Bay, *Leichhardt* NSW P2673, 1857 (NSW); Humpy Bong, *Simmonds* 10.1886 (BR1 113407); Brisbane River, *Bailey* or *F. Mueller* (P); Wellington Point, *Wedd* 9.1891 (BRI 59220); near Cleavland [Cleveland, SE. of Brisbane] *Prentice* (MEL 63715); Cleveland, *Prentice* (P); Eight Mile Plains, *F.M. Bailey* (BM), *Bancroft* (E), *Williams* (BM, BRI 30463), Tallebudgera Creek, *Schneider* (BRI 59268), partim. Cultivated: Wynnum, Brisbane, in damp poor soil under dry grass, collected at Capalaba Dam area, *Percival* (BRI 165094).

NEW SOUTH WALES: North Coast: Bunjlung Reserve, c. 1 mile [1.6 km] S. of Evans Head, 29° 09' S, 153° 26' E, tufted fern in clayey soil on damp hillside in association with *Casuarina linearis*, *Eucalyptus gunnifera*, *Banksia* sp., *Eucalyptus signata* etc., scattered, *Coveny* 4296 & *Armstrong*, 8.1972 (NSW). Central Coast: Dharug National Park, c. 3 miles [4.8 km], E. of Wiseman's Ferry, 33° 23' S, 151° 04' E, in sandy soil in low heath near rock carvings, alt. 240 m, *Coveny* 4618, 9.1970 (NSW, K); Parramatta (correct locality?), *A. Cunningham* 1 or s.n. (K), with an admixture of *L. linearis*; 18 miles [29 km] SE. of Nowra, *E. & L.J. Cady* NSW P9513, 1962 (NSW), sandstone country, open heathland, rather wet, on edge of creeklet, collected near *Drosera spatulata*, *E. & L.J. Cady*, 11.1959 (MEL 63716). South Coast: southern side of the Prince's Highway to Jervis Bay Rd., c. 2.5 miles [4 km] S. of Huskisson, in sandy peaty land at headwaters of creek, in heathland, *Judd* NSW P8072, 3.1960 (NSW).

This curious little species is related to *L. linearis* and probably also to *L. incisa*.

† cf. Kramer in Acta Bot. Neerl. 15: 581 (1967).

8. *Lindsaea linearis* Swartz in J. Bot. (Schrader) (1800)<sup>2</sup>: 78 (1801); F. Mueller, Fragm. 5: 119 (1865-6); J.D. Hooker, Handb. New Zealand Fl.: 359 (1864); F.M. Bailey, Handb. Ferns Queensland: 18 (1874); Bentham, Fl. Austral. 7: 719 (1878); F.M. Bailey, Fern World Australia: 39 (1881); Thomson, Ferns & Fern Allies New Zealand: 51 (1882); Field, Ferns New Zealand: 77, Pl. 19, 4 and 4a (1890); F.M. Bailey, Lithogr. Ferns Queensland: Pl. 51 (right) (1892); F.M. Bailey, Queensl. Fl. 6: 1954 (1902); F.M. Bailey, Compr. Cat. Queensland Pl.: 641 (1913); Cheeseman, Man. New Zealand Fl.: 958 (1906); Domin in Biblioth. Bot. 20 (85<sup>1</sup>): 81 (1913); Wakefield, Ferns Victoria & Tasmania: 26 with fig. (1955); Black, Fl. South Australia 1: 36, fig. 3 (1922), ed. 2, 35, fig. 11 (1960); Ewart, Fl. Victoria: 38 (1931); Dobbie & Crookes, New Zealand Ferns, ed. 5: 150, photo 151 (1952); Allan, Fl. New Zealand 1: 58 (1961); Willis, Handb. Pl. Victoria 1: 23 (1962); Crookes & Dobbie, New Zealand Ferns, ed. 6: 146, photo 147 (1963); Kramer in Acta Bot. Neerl. 15: 581 (1967); Brownlie, Fl. Nouvelle-Calédonie 3: 128, Pl. 14, fig. 1-2 (1969); Tindale in Beadle, Evans & Carolin, Handb. Vasc. Pl. Sydney Distr.: 61 (1963); Tindale in Beadle, Evans & Carolin, Fl. Sydney 66 (1972).

SYNONYMY: *Adiantum lineare* (Swartz) Poiret in Lamarck, Encycl. Suppl. 1: 139 (1810).

*Lindsaea lunata* Willdenow, Sp. Pl. 5: 421 (1810), *nom. superfl.* TYPE: not cited, prob. from Australia; not seen.

*Lindsaea trilobata* Colenso in Trans. & Proc. New Zealand Inst. 16: 345 (1884), non Baker (1891). SYNTYPES?: Great Barrier Island, New Zealand, *Winkelmann NSW P9517*, 1, 1883 (NSW), examined, and Wellington Harbour, New Zealand, *Colenso*, not examined. ISOSYNTYPES?: without indication of provenience, *Colenso* (K), two specimens, seen.

HOLOTYPE: "E n. Hollandia" (Swartz scripsit), (S). The type consists of two fertile fronds but no rhizome nor sterile fronds.

DISTRIBUTION: New Caledonia, Norfolk Island, New Zealand (North, South, Stewart and Chatham Islands) and Australia (southeastern Queensland, New South Wales, Victoria, Tasmania, southern South Australia and southwestern Western Australia).

HABITATS: In Australia terrestrial or more rarely in crevices of boulders, mostly in colonies, in shady situations under trees and shrubs, often associated with sandstone but also on granite and conglomerate, usually in sandy soils, often in open heathland or wallum, near swamps or in boggy ground, otherwise on hillsides in scrub or sclerophyllous forests. In New Zealand it is "common in lowland to lower montane shrubland, open ground and boggy places" according to H.H. Allan, Fl. New Zealand 1: 58 (1961).

This species occurs from sea level to c. 1500 m alt.

*Rhizome* rather shortly to comparatively long-creeping, c. 0.6-1 mm in diam.; scales honey-coloured, flaccid, elongate-triangular, apically rather shortly uniseriate, up to 6-seriate at the base, to 2 mm long. *Leaves* not clustered, a few mm to 1 cm apart; sterile leaves nearly always (perhaps always, but not consistently collected) present beside the fertile ones, as a rule much shorter but not very different. *Petiole* (stipe) atropurpurous, red-brown or black, scarcely or not lustrous, 0.5-1 mm in diam., adaxially flattened or mostly shallowly sulcate, abaxially obtusely bi-angular, downwards gradually rounded, in fertile leaves c. 2-26 cm long, half as long as to equalling the lamina; in sterile leaves often relatively and absolutely shorter. *Lamina* linear, simply pinnate, in fertile leaves c. 5-25 cm long (shorter in sterile leaves), 0.5-1.5 cm wide, with c. 15-40 (in sterile leaves often fewer, 7-12) pinnules to each side; rachis dark reddish brown to atropurpureous, similar to the upper part of the petiole in structure. *Pinnules* for the greater part subopposite, sessile, not or only shortly sclerotic at the base, non-articulate, spreading or markedly deflexed, herbaceous to subcoriaceous (sterile pinnules usually herbaceous), dark green when dry, the lower ones a few times their width apart, the upper closer, or occasionally all subcontiguous or contiguous. *Sterile pinnules*  $\frac{1}{4}$ -elliptic or subtrapezoidal,  $6 \times 3-10 \times 6$  mm,  $1\frac{1}{2}-2 \times$  as long as wide, erenate or bierenate, the deepest incisions reaching almost to the middle in large pinnules; fertile pinnules entire, or the basal ones bifid and incised to  $\frac{1}{3}$ , flabellate-euneate or subdolabriform, usually somewhat asymmetric, when dry often with the outer margin dorsally folded

back over the lower, 3–5 mm long, 4–7 mm wide, usually a little wider than long, the outer margin erose; upper pinnules somewhat reduced, the leaf-apex (very often missing in herbarium specimens) with a flabellate terminal segment. *Veins* closely spaced, immersed c. 0.3–0.5 mm apart, flabellately 2–4 × forked. *Sori* continuous, or once interrupted in the basal pinnules; indusium pale greenish, thin, laterally slightly narrowed and adnate, c. 0.7–1 mm wide, not reaching the edge of the segment by an equal or slightly smaller distance, often strongly reflexed and partly concealed at maturity. *Spores* light brown, trilete, smooth, c. 35 μm. n = 34 (Brownlie 1957b).

NEW ZEALAND: NORTH ISLAND: Bay of Islands, *Home* 1845 (BM); Baie des Iles, *Raoul* 1843 (P); Whau, *Kirk* 62 (BM); Kawau, Hauraki Gulf, in woods, *Lyall* 12.1848 (E); Waitemata County, *Wood* 8.1950 (BM); Waitakere, Auckland, *Jeffs* 1868 (P); Auckland, *Tenison-Woods* (P), *Cheeseman* 218 (K), *Haultain* 35, 1850 (BRI 59216); vicinity of Auckland city, *Carse* 9.1921 (P); near Auckland, *Dubuc* 1861 (E); Glen Eden, Auckland, *Crookes* (U); Kauri gully, Auckland, *Chase, Leland & Tilden* 218, 12.1909 (BISH, BM, E, GH, K); Swanson, Auckland, *Hynes* (BM, AUCK); Remuera, *Filhol* 1875 (P); Drury, *Jelinek* 325 (W); Manukua, *Maekoy* (E); Manuka, Waiuku, *Hockstetter* 26 (W); Waerenga, Hamilton, in clay soil under *Leptospermum*, *Woods* 165, 7.1962 (K); Taupo Plains (BRI 59212); Wellington, *Haswell* (BRI 59214), *Wedd* (BRI), *Green* (E); Arorere, Bay of Massacres, *Travers* (K). SOUTH ISLAND: Pu Pu Spring, Turaka, *Calder* (K); St. Omer Bay, Kenepura Sound, *Brownlie* (U); Motuaro Totaranui, *Solander* 1769 (BM); Port Nicholson, *Lyall* (K); Muritai, on dry clay hills, *Dobbie NSW* 9578, 11.1928 (NSW); Westport, *Green* 1878 (E).

AUSTRALIA: QUEENSLAND: Moreton District: Caloundra, in wallum, *S.T. Blake* 4090, 8.1932 (BRI), *S.T. Blake* 4876, 8.1933 (BRI); near Brisbane, *Proutice* (BM); Brisbane, *Baucroft* (E); Brisbane River, *F.M. Bailey* 1872 (P); Wellington Point, *Wedd* (BRI 59213); Capalaba, close by creek in poor sandy damp soil in company of *L. incisa*, *Percival* 7.1972 (BRI 165005); Lamington National Park, in open scrub on hillside, c. 3/4 mile [c. 1.2 km] towards Binna Burra from Coomera Falls on the Coomera track, *Schodde* 1152, 1.1960 (BRI); Binna Burra, Dave's Creek country, above Picnic Creek, *R. Jones J* 342 (BRI). Darling Downs District: Stanthorpe, *F.M. Bailey* (BRI 59210); Mt Norman, NE. of Wallangarra, on margin of swampy areas on granite, *Fagg* 586, 5.1970 (CBG).

NEW SOUTH WALES: Northern Tablelands: Wilson's Downfall, *Cambage* 2840, 9.1911 (NSW); Grassy Hill, Gibraltar Range National Park, in a swamp, *Paine NSW* P9444, 12.1966 (NSW); Barrington Tops, on granite, 5000 ft [c. 1500 m] alt., *Fraser & Vickery NSW* P2662, 1.1934 (NSW), c. 5000 ft [c. 1500 m] alt., on open slopes leading down to big swamp, *C.T. White* 11128, 3.1938 (BRI); track to Andrew Laurie Lookout, Barrington Tops National Park, 37 miles [59.6 km] WSW. of Gloucester, in grassy areas in *Eucalyptus pauciflora* forest with *Lepidosperma tortuosum*, common alt. 1140 m, *Covey* 5919, *Hind & Hancock*, 12.1974 (L, NSW, Z). North Coast: The Bald Knob, Angourie, c. 4.5 miles [c. 7.2 km] S. of Yamba, growing in loamy sand on north slope of the Knob, sheltered under *Banksia asplenifolia*, other associated species *Melichrus procumbens*, *Lepidosperma laterale*, *Monotoca scoparia*, occasional. *McGillivray* 2162, 7.1966 (NSW P9067); Hat Head Mountain, 300 ft [c. 90 m] alt., occasional. *Constable NSW* P6330, 1.1953 (NSW); c. 1 mile [c. 1.6 km] S. of "Hut" at Ferny Creek, W. of Wallis Lake, *Salasoo* 3307, 1.1967 (NSW); Port Stephens, *Boorman NSW* P2659, 5.1912 (NSW); Maitland, Hunter River, *Lomont* 361 (BM). Central Coast: Catherine Hill Bay, in scrub on the hill, *Salasoo* 3709, 9.1969 (NSW); near Berowra, *Salasoo* 678, 5.1951 (NSW); St. Ives, on rocky sandstone hillside, *Constable NSW* P5695, 1.1948 (NSW); Gordon, *Kaspiew* 651 (Z); Bampi Place, Castle Cove, 6 miles [c. 10 km] N. of Sydney, occasional at base of cliffs in damp soil in dry sclerophyll forest, sandstone, *Constable* 7359, 3.1967 (BM, NSW, TENN, U); Castle Crag, on sandstone in sandy soil in open eucalypt forest, *Tindale NSW* P6498, 8.1948 (NSW, U); Northbridge, *Helm* 101 (SING); Manly, *Helm* NSW P2664, 7.1900 (NSW); South Head Rd, Sydney, *Stephenson NSW* P2663 (NSW); sandhills near Rose Bay, *Betche NSW* P6076, 6.1893 (NSW); near Sydney, *Eames* (GH), *Wright* (GH), *Docters van Leeuwen-Reijnvaan* 7238 (BO); Port Jackson, *R. Brown* (BM), *Campfield* (GH); Parramatta, *A. Cunningham* 1 (K); Argyle-Parramatta, *Hügel* (W); Kogarah, *Grimson* (W); National Park, in crevices of sandstone. *Constable NSW* P7992, 9.1955 (NSW); near Upper Falls, National Park, in sandstone scrub, terrestrial amongst grasses, *Tindale NSW* P6401 & *Melville*, 4.1953 (NSW); The Barren Grounds, 10 miles [16 km] W. of Kiama, frequent under shrubs and trees on open heathland, sandstone, 2000 ft [600 m] alt., *Constable NSW* P8297, 2.1959 (NSW); Nowra to Sassafras, c. 10 miles [c. 16 km] SW. of Nowra, *Salasoo* 3105, 1.1966 (NSW). Central Tablelands: Lake Medlow, c. 2 miles [c. 3.2 km] SE. of Blackheath, frequent on wet boggy ground, black soil, sandstone, 3350 ft [1020 m] alt., *Constable NSW* P8013, 7.1959 (NSW, U); near Knight's Hill, above Minnamurra Falls, in swampy sand, *Phillips & Judl*, 7.1961 (CBG); Fitzroy Falls, *Rodway* 253 (K); Wingello-Tallong Rd., 1 mile [1.6 km] E. of Tallong, *Constable NSW* P7260, 1.1956 (BM, NSW, U). South Coast: Sassafras, *Gauba* 2.1910 (CBG 1709); Huskisson, Jervis Bay (A.C.T.); *Rodway* 139, 513 (K); Conjola, *Heron NSW* P2658, 11.1898 (NSW); Yadboro State Forest, Kalianna Ridge track towards the Castle, *Cunning* 920, 2.1968 (CBG); Ulladulla, *Cambage* 4125, 11.1914 (NSW); Tiroomba, Twofold Bay, *Mossman* 869, 1850 (E). Southern Tablelands: 5 1/2 miles

[8.8 km] from Mt Clyde summit towards Braidwood, *Canning* 679, 1.1968 (CBG); along Wadbilliga fire-trail 7 km ENE. of Tuross River crossing under *Chloanthes parviflora*, in *Eucalyptus radiata* woodland, *Tindale* 4040 & *Parris*, 1.1975 (NSW).

VICTORIA: Upper Yarra, *Walter NSW P2657*, 11.1881 (BO, NSW); Ringwood, *Morrison* 11.1888 (E) and 11.1890 (E), *Morrison* (BM); *Wakefield* (Pic-Ser); Melbourne, *Adams* 384 (K); Oakleigh, *Morrison* 1794 (E, K, MICH), *Morrison* 10.1893 (BR1 153947); Dandenong, *F. Mueller* (W); Port Phillip, *F. Mueller* (W); near Portland Bay, *Robertson NSW P2656*, 3.1842 (NSW); Otway forest, *Williamson NSW P2654*, 4.1902 (NSW).

TASMANIA: Flinders Island, Bass Strait, *Milligan* 602, 680 (BM, HO); Launceston, *Backhouse* (E); Meander, no collector 11.1961 (HO); Dunn's Creek, *G. Rodway* 170 (CANB); E. of Kingston, *Camber* 13, 79 (E); Blackman's Bay, near Kingston, *Rodway* 2072 (K); Snug, 1000 ft [c. 300 m] alt., on track to Falls in marshland, *Long* 923, 11.1931 (HO); near Lower Snug road to Oyster Cove, moist sandy soil, *Phillips* 1.1962 (CBG 1910); hill above Oyster Cove, *Melville* (K); Roaring Beach, 6 miles [9.7 km] E. of Dover, prostrate fern, in clearing by lagoon near coastal swamp, *T. & J. Whaite* 2320, 1.1961 (NSW); Lunnewanna, *Black* 23A (Z); Melaleuca Inlet, Bathurst Harbour, Port Davey, *Davis* 1181 (A); Recherche Bay, *R.C. Gunn* 1535, 12.1838 (NSW P9519).

SOUTH AUSTRALIA: Mt Lofty Range, swamp beneath Mt Lofty Summit, c. 12 km SE. of Adelaide, *A. Hall* 7.1958 (AD); Mt Lofty Range, Bridgewater (c. 20 km SE. of Adelaide), *Herb. J.M. Black* 1.1904 (AD); Mt Lofty Ranges, Scott's Creek (c. 15 km SE. of Adelaide), *H.B. Womersley* 3.1943 (AD); Southern Mt Lofty Range, Square Waterhole at Mt Compass, c. 50 km S. of Adelaide, *Hj. Eichler* 13887, 6.1957 (AD); Lower Mt Lofty Range, Myponga, *H.H.D. Griffith* 12.1908 (AD); Lower Mt Lofty Range, Springmount, near Myponga, *H. Hunt* 3388, 11.1971 (AD); Fleurieu Peninsula on Tankalilla Rd., Dividing Range (Tankalilla is c. 85 km SSW. of Adelaide), *J.B. Cleland* 1.1925 (AD); Fleurieu Peninsula, Waitpinga Reserve (c. 75 km S. of Adelaide), *G. Gardiner* 12.1968 (AD); Kangaroo Island, Telegraph Line, 20 miles [32 km] E. of Cape Borda (western end of island), *J.B. Cleland* 3.1926 (AD); Kangaroo Island, Rocky River, *J.B. Cleland* 11.1924 (AD); Harriet Station (at southern part of island), clay soil, very wet in winter, *G. Jackson* 937, 11.1972 (AD); near Naracoorte (c. 95 km N. of Mt Gambier), *E.S. Alcock* 2.1922 (AD); Mt Burr Swamps (Mt Burr is c. 35 km NW. of Mt Gambier), *J.R. Dodson* 112, 2.1972 (AD); South East, c. 4 km SW. of Lake Leake (Lake Leake is c. 30 km NW. of Mt Gambier), common under dense shrub cover of *Melaleuca squarrosa* and *Leptospermum* spp. on sandy swampland, *I.B. Wilson* 428, 1.1966 (AD).

WESTERN AUSTRALIA: S. Plantagenet, Mt Clarence, *Diels* 2221 (B); Swan River, *Drummond* 401, 1844 (P), *Drummond* (BM); Lowden, South-West, *Koch* 2069, 10.1910 (E, K, P); Donnybrook, 130 miles [208 km] S. of Perth, in shady places, *Andrews* 1233, 3.1901 (BM, K); Yallingup and Cape Naturaliste, *Darrien Smith* (K); Big Brook, Warren District, perennial, *Koch* 2069 (B, BR1, E, HBG, K, W); 26 miles [c. 42 km] S. of Nannup, in sand on edge of swamp, *Mann & George* 78, 11.1969 (K, NSW); Chester Pass, *Veitch* 2.1893 (BM); Mt Barker, *Helms NSW P5311* (NSW); 3 miles [4.8 km] from Mt Barker towards Albany, *Canning* (CBG); Porongorup, *Knight* (P); Augusta, in sandy soil in eucalypt woodland, *G.G. Smith* 8.1966 (JCT P628); between Irwins Inlet and Brookes Inlet, Bow River, within 20 miles [c. 32 km] of the sea, *Jackson NSW P2666*, 12.1912 (NSW); 4 miles [6.4 km] W. of Albany towards Denmark, prostrate fern on moist sandy soil, *Phillips NSW P8691*, 10.1962 (CBG 16744, NSW); Albany, *Morrison* 11.1896 (E); woods at Mt Melville, Albany, *Morrison* 4.1904 (BM, K); Mt Melville, Albany, on black sand over granite under *Eucalyptus calophylla*, *Souster* 663, 4.1947 (K, NSW); north side of Mt Le Grand, in sand, near damp drainage depression, *George* 2243, 12.1960 (PERTH); 8 km E. of Cape Le Grand (c. 30 km ESE. of Esperance), *P.G. Wilson* 5638, 10.1966 (PERTH); Eucla Division, Shire of Neridup, Howick Hall, c. 100 km E. of Esperance just N. of Fisheries Road, *Orchard* 1302, 10.1968 (PERTH).

*L. linearis* is the most widespread Australian species ranging across the southern portion of the continent. In addition there is a possible record from the Northern Territory, viz. Dämel (HBG) which is rather dubious. Crookes & Dobbie (1952) stated that this species is frequent in the North Island of New Zealand but rare in the South Island. They also reported *L. linearis* from Norfolk Island, although no material has been examined by the authors.

The leaves in this species seem to develop quite slowly and the immature apex is usually lost in herbarium specimens.

### 9. *Lindsaea brachypoda* (Baker) Salomon, Nomencl. Gefässcrypt.: 212 (1883).

SYNONYMY: *Davallia brachypoda* Baker, Syn. Fil., ed. 2: 468 (1874). *Lindsaea cultrata* (Willd.) Swartz var. *brachypoda* (Baker) Domin in Biblioth. Bot. 20 (85<sup>1</sup>): 82 (1913).

HOLOTYPE: Ranges on the Gilbert (River), Queensland. *Daintree* s.n. (K), juvenile plant, examined by both authors.



MISAPPLIED NAMES: *Lindsaea cultrata* auct. non (Willd.) Swartz as to Australian specimens, e.g. Bentham, Fl. Austral. 7: 719 (1878); F.M. Bailey, Fern World Australia: 39 (1881); F.M. Bailey, Lithogr. Ferns Queensland: Pl. 52 (left), (1892); F.M. Bailey, Queensland Fl. 6: 1954 (1902); F.M. Bailey, Compr. Cat. Queensland Ferns: 641 (1913). *L. concinna* (or *L. cultrata* var. *concinna*) auct. non J. Smith as to Australian specimens, e.g. F.M. Bailey, Handb. Ferns Queensland: 18, fig. 12a, b (1874); Domin in Biblioth. Bot. 20 (85): 82 (1913).

DISTRIBUTION: Eastern Australia (Cook, North Kennedy, Wide Bay and Moreton Districts of Queensland, also 3 records from the North Coast of New South Wales). Fig. 3 (p. 116).

HABITATS: Terrestrial or usually on mossy rocks, in rain forests, mesophyll palm forests or mesophyll vine forests, often on the banks of creeks, on steep rocky slopes or under rock ledges, frequently on soils derived from granite or metamorphics, at lower elevations up to 850 m alt.

*Rhizome* very shortly creeping, 0.6–1 mm in diam.; scales pale brown, minute, subacicular, at least  $\frac{1}{2}$  uniseriate, biseriate at the base, sometimes entirely uniseriate, rarely up to 0.5 mm long. *Leaves* clustered; petiole (stipe) stramineous or slightly darker with age, dull, quadrangular almost to the base, adaxially and often also laterally sulcate, slender, in fertile leaves c. 5–13 cm long, about half as long as the lamina or in the largest leaves equalling it. *Lamina* mostly linear, herbaceous, usually dark green when dry, dimorphic. *Fertile lamina* c. 10–20 cm long, 1.2–2 cm wide, simply pinnate, or occasionally subbipinnate, or bipinnate with a single pair of strongly ascending pinnae, truncate or slightly narrowed at the base, scarcely or not acuminate at the apex, with c. 15–30 pinnules on each side, these spreading, subcontiguous, or more often  $\frac{1}{2}$ –1  $\times$  their width apart; rachis quadrangular, quadrisulcate or abaxially only flattened. *Sterile leaves* (apparently invariably present in carefully collected specimens) with the lamina c. 7–14 cm long, 1.2–1.5 cm wide, the petiole (stipe) 1–2.5 cm long,  $\frac{1}{3}$ – $\frac{1}{10}$  the length of the lamina; lamina basally and apically long-tapering, the pinnules usually contiguous to slightly imbricate, c. 10–25 on each side. *Fertile pinnules* subsessile,  $\frac{1}{4}$ -elliptic or subligulate, the largest sometimes touching or overlying the rachis with their anterior base, the larger 5  $\times$  3–10  $\times$  5 mm, slightly longer than wide to twice as long as wide in the largest, subacute on the outer-posterior side, the outer margin not distinct or broadly rounded into the upper; lower margin straight or nearly so. *Fertile pinnules* entire, or especially in the larger ones on the upper/outer margin minutely erose and with 1–4 very shallow incisions at the most c. 0.5 mm deep yet interrupting the sorus; sterile pinnules in outline like the fertile but mostly smaller, 4  $\times$  2–7  $\times$  4 mm,  $\pm$  regularly crenato-lobate on the outer upper margin. *Basal pinnules of fertile leaves* not rarely more remote and then sometimes slightly reduced; upper pinnules more strongly reduced, few or none denticuliform, the terminal pinnule (segment) free or nearly so, rhombic-cuneate-flabellate, 2  $\times$  2 mm or larger, sometimes lobed, seriferous. *Upper sterile pinnules* scarcely reduced, the terminal relatively large, cuneate-flabellate, free or nearly so; basal pinnules reduced, usually remote and  $\pm$  decurved. *Intermediates* between sterile and fertile leaves sometimes found, basally sterile, apically fertile, with intermediate measurements. *Veins* immersed or slightly elevated, quite free, c. 0.5–0.8 mm apart, simple or once forked or in the innermost twice forked. *Sori* continuous or interrupted by (even very shallow) incisions of the margin, indusium greenish or pale brownish, entire to slightly erose, narrowed-rounded at the partly adnate ends, 0.3–0.5 mm wide, reaching the margin or almost so, not or slightly reflexed at maturity. *Spores* very pale brownish, trilete, smooth, c. 25  $\mu$ m. Plate IX.

AUSTRALIA: QUEENSLAND: Cook District: Leo Creek, Upper Nesbit River, alt. 420 m, Brass 19849, 8.1948 (CANB, K, L); Endeavour River, F. Mueller (P); fringing forest W. of Cooktown, on clay bank of creek, very moist, Vessey 3.1963 (JCT); Shiptons Flat, alt. 275 m, Brass 20015, 9.1948 (CANB, K, L); Upper Parrot Creek, Annan River, gregarious on shady banks of a stream in rain forest, 350 m alt., Brass 20029, 9.1948 (BRI, CANB, K, L), Brass 20030, 9.1948 (BRI); 1 mile [1.6 km] NW. of Stuckies Gap, Bloomfield River area, 15° 50' S, 145° 19' E, in complex mesophyll vine forest on coarse sandy clay derived from granite, Webb & Tracey 8396 (BRI); Mt Hemmani, c. 48 km NE. of Mossman, 16° 08' S, 145° 28' E, Tracey 549 (BRI); Bailey's Creek c. 7  $\frac{1}{2}$  mls [11.7 km] ENE. of Daintree, L.S. Smith 11676, 10.1962 (BRI); Daintree River, on damp rocks in rain forest gullies, Messmer NSW P9504, 7.1954 (NSW); Stewart Creek gorge, bank beside creek, in rain forest, 16° 23' S, 145° 16' E, Wrigley



Fig. 3. Map of Queensland and extreme northeast of New South Wales showing the distribution of *L. brachypoda*.

& Telford NQ 1055, 6.1972 (CBG); Whyanbell Creek, c. 16° 24' S, 145° 25' E, 7 miles [11.3 km] N. of Mossman, terrestrial in rain forest on bank of creek with *Selaginella*, Tindale NSW 9505-6, 7.1957 (NSW); Mossman River Gorge, alt. 100 m, Brass 18188, 3.1948 (BRI, K, L); Intake, Mossman, 16° 27' S, 145° 22' E, L.S. Smith 3978, 9.1948 (BRI, L); Mt Lewis, 15 km NNW. of Julatten P.O., 16° 35' E, 145° 17' S, terrestrial fern, common in rain forest, growing with *Lindsaea obtusa*, Coveny 7196 & Hind, 9.1975 (AD, BRI, K, MEL, NSW, Pic.-Ser., Z); Kuranda, alt. 1100 ft [340 m] Goy 425, 8.1938 (BRI), Copland King NSW P1173 (NSW); Street's Gully, Kuranda, Wats 7-8.1913 (BRI, NSW, P); Cairns-Kuranda, terrestrial in rain forest, Messmer NSW P9507, 8.1952 (NSW); Smithfield, Edgar's Plot, Webb & Tracey 5948, 3.1962 (BRI); Whitfield Range, W. of Cairns, 8 miles [12.9 km] up forestry road, in rain forest, 16° 53' S, 145° 44' E, Wrigley & Telford NQ 1201 (CBG); West Cairns Range, in rain forest on creek banks, Messmer NSW P9508, 7.1954 (NSW); between Cairns and Herberton, Wild 1891 (BRI 59235-6); Danbulla, Webb & Tracey, 6453, 12.1962 (BRI); Harvey's Creek, Manski 9.1958 (BRI 12658); Bellenden Ker, below summit, 17° 15' S, 145° 50' E, L.S. Smith 4249, 6.1949 (BRI 142706); Babinda Creek, c. 17° 19' S, 145° 57' E, 300 ft [92 m] alt., in rain forest, Messmer NSW P6869, 8.1954 (NSW); Herberton, Waller NSW P858, 1908 (NSW); Malanda on banks of rain forest, 2400 ft [c. 730 m] alt., S.T. Blake 15170, 8.1943 (BRI); 12 miles [19.3 km] SE. of Millaa Millaa on Palmerston Highway, on bank in rain forest, c. 2400 ft [c. 730 m] alt., 17° 36' S, 145° 43' E, Wrigley & Telford NQ 783, 6.1972 (CBG). North Kennedy District: Tully Falls, growing by track to Falls in rain forest, 17° 47' S, 145° 34' E, Vessey 4.1962 (JCT 246); Dunk Island, on hill behind Brammo Bay, approx. 17° 55' S, 146° 09' E, in mixed mesophyll vineforest on lower slopes in soils derived from metamorphics, Webb & Tracey 10666, 9.1970 (BRI); Mt. Fox, Wallaman Falls area, NW. of Ingham, 18° 51' S, 145° 49' E, Vessey & Fox 9.1963 (JCT 247); Mt Spee—summit, at edge of rain forest, 18° 57' S, 146° 11' E, Boyland 9.1964 (JCT), at edge of rain forest half-way, Craddock 9.1964 (JCT), Bardsley 9.1964 (JCT). South Kennedy District: Finch Halton Gorge, foot of Eungella Range, W. of Mackay, moist bank in rain forest, c. 1500 ft [c. 460 m] alt., 21° 06' S, 148° 38' E, Fagg 670, 5.1970 (CBG). Moreton District: Eumundi, Simmonds (BRI 59248); Yandina, Shirley 3.1891 (BRI 59246-7). Simmonds (BRI 59256); Maroochie, F.M. Bailey 7.1879 (BRI 59238); Mt. Coolum, W. of Maroochydore, 26° 34' S, 153° 05' E, grows in rock crevices of cliffs, Percival 5.1973 (BRI 165018); Nambour, Shirley (BRI 59246); Eudlo Creek, F.N.C. BRI 59250, 11.1891 (BRI); Brisbane district, Bancroft 1875-8 (E); Brisbane, Simmonds (MICH).

NEW SOUTH WALES: North Coast: Tumbulgum, R.T. Baker 8.1897 (K, BM); Brunswick River, Bänerlen (MICH); Mullumbimby, Bänerlen NSW P6069, 7.1896 (NSW).

There are also two specimens from Queensland with generalized distributions at Kew Herbarium in the type folder, viz. York Peninsula, North Australia, Norman Taylor, ex Herb. Mueller, 7.1877 and Cape York Peninsula Expedition, W. Hann 292, 12.1873.

Two collections from Fraser Island, Wide Bay District, Queensland, viz. S.T. Blake 14368a (BRI) and Epps (BRI 59224) are distinguished by comparatively large leaves and pinnules as well as crispate-erose pinnule-margins and indusia. They may represent a distinct local form.

Hardly any collections of this species have been correctly named, which is not surprising, considering that Baker described it very briefly on the basis of a juvenile plant and placed it in the wrong genus. Material of this species has been usually identified as *L. cultrata*, *L. concinna*, *L. gracilis* or *L. orbiculata*. It is readily distinguished from what has been called *L. cultrata* (i.e. *L. odorata*) by the abaxially angular axes, the presence of sterile leaves, and trilte spores. The similarity of *L. lucida* ("L. concinna, L. gracilis") is more pronounced but in section *Stenolindsaea* (where *L. lucida* was placed by the senior author) there is no leaf dimorphism, and the lamina is never bipinnate as is sometimes the case in *L. brachypoda*. Because of the presence of sterile leaves, and some resemblance to *L. cubensis* and *L. linearis*, *L. brachypoda* is placed with them in section *Paralindsaea* but some affinity to section *Stenolindsaea* seems likely.

### 3. SECTION CHLOROLINDSAEA

#### Section *Chlorolindsaea* Kramer & Tindale, sect. nov.

Rhizoma breviter repens, squamis subclathratis; petioli aggregati, obscuri, abaxialiter carinati; lamina pinnata et pinnatifida vel magis dissecta, pinnis superioribus sensim reductis; venae liberae; sporaе monoletae. Species typica (unica): *Lindsaea viridis* Colenso.

10. *Lindsaea viridis* Colenso in Tasm. J. 2: 174 (1844); Baker in J. Bot. 13: 110 (1875); Kirk in Trans. & Proc. New Zealand Inst. 10: 396, 1877 (1878); Thomson, Ferns & Fern Allies New Zealand: 51, Pl. 11, 2 (1882); Field, Ferns New Zealand: 79, Pl. 19, 2 (1890); Cheeseman, Man. New Zealand Fl.: 959 (1906); Cheeseman, Ill. New Zealand Pl. 2: Pl. 238 (1914); Crookes & Dobbie, ed. 5, New Zealand Ferns: 156, photo 157 (1963); Allan, Fl. New Zealand 1: 59 (1961).

SYNONYMY: *Odontosoria viridis* (Colenso) Kuhn, Chactopt.: 346 (1882). *Stenoloma viride* (Colenso) C. Christensen, Ind. Fil., Suppl. 3: 174 (1934). *Sphenomeris viridis* (Colenso) Brownlie in Trans. Roy. Soc. New Zealand 87: 197 (1961).

TYPE: A specimen without data, probably collected by Colenso, marked "holotype" (K).

DISTRIBUTION: New Zealand (North and South Islands).

HABITATS: In deep ravines under rocks or in damp situations along streams, in lowland or montane forest.

*Rhizome* shortly creeping, c. 1 mm in diam., dark, the apex densely clothed with spreading, ferruginous scales; scales golden brown in transmitted light, slightly clathrate, especially towards the apex, elongate-triangular, basally bordered by short, oblique, sometimes latero-apically, slightly protruding cells, the apical  $\frac{1}{3}$  or  $\frac{1}{4}$  uniseriate, up to 6-seriate at the base, to c. 4 mm long. *Leaves* close to clustered; petioles (stipes) dark reddish brown to atropurpureous or blackish, not pale-margined,  $\pm$  lustrous, adaxially sulcate, abaxially obtusely unicarinate, 2.5–10 cm long, not over half as long as the lamina. *Lamina* narrowly lanceolate-oblong, bipinnate + pinnatifid, pinnate + bipinnatifid, or in small leaves the greater part only pinnate + pinnatifid, medium to dark green when dry, herbaceous or thinly herbaceous, 9–30 cm long,  $2-4\frac{1}{2} \times$  as long as the petiole (stipe), 1.5–4 cm wide, strongly and gradually narrowed to the apex, somewhat narrowed to the base. *Primary rachis* at the base similar to the petiole, upward gradually paler, with a green wing near the apex. *Primary pinnae* ascending (usually strongly so), with an abruptly pale petiolule of 1–1.5 mm long or subsessile, ovate-lanceolate, obtuse to acute, all or all except the lowest alternate, the lower ones 1 to a few cm apart, the upper closer, often all  $\pm$  contiguous by being ascending; major pinnae c. 7–18 on each side, the largest in each lamina (0.7–)1.5–4 cm long, (0.4–)1–1.5 cm wide,  $2-4 \times$  as long as wide, strongly anadromous, with (1–)2–6 secondary divisions on each side and a terminal one, the secondary rachis wiry, pale, largely or entirely green-winged: basal secondary divisions cleft, pinnatifid or the largest pinnate, with up to 4 tertiary divisions, the largest of which may be bifid; upper primary and secondary pinnae gradually reduced, confluent; leaf-apex with a pinnatifid apical portion. *Basal pinnae* mostly somewhat remote and slightly reduced. *Primary and pinnate secondary pinnae* with a small but distinct cuneate terminal segment. *Larger ultimate divisions* spatulate-cuneate or cuneate (not unlike those of *Sphenomeris clavata*), often 4–5 mm long, c. 0.3–0.7 mm wide at the base, c. 1.5–2.5 mm wide at the sorus (if broader incised), often asymmetric, the sides  $\pm$  convex at least at the sorus. *Apical margin of ultimate divisions* truncate or slightly convex, especially in larger ones erose or lobulate or laterally corniculate. *Veins* immersed, evident in transmitted light, simple or forked and then geminate in the segments. *Sori* uni- or binerval in all segments and even in small plants (sterile leaves apparently quite rare), on the apical margin of the ultimate divisions; indusium pale, basally straight or convex at least near the ends (not concave as in larger sori of *L. trichomanoides*), laterally for the greater part free, c. 0.7–2.3 mm long, 0.6–0.8 mm wide, with erose, gashed or sometimes lobulate outer margin, almost or quite reaching the margin, not reflexed at maturity. *Spores* medium brown, ellipsoid, monoletic, smooth, c.  $48 \times 35 \mu\text{m}$  (see Harris (1955) 106, Pl. 6, fig. 14–16).  $n = \pm 88$  (Brownlie 1961).

NEW ZEALAND: NORTH ISLAND: Auckland Province, *Craig* (BRI 59476); Manukau, *Kirk* (P); Great Barrier (Island), *no collector* (L); Waitakere, *Pruce* (GH); Auckland, *Hay* 382 (B), *Crookes* (U); Manukau Harbour, *Hector* 2.1876 (E); Tiirangi Ranges, *Colenso* 2.1891

(E), ex Herb. Cheeseman; Waitakere Range, Auckland, *Cheeseman 13* or *s.n.* (BRI 59489, GH); Hendersons Creek, Waitakere Range, *Cheeseman 238* (K); The Huia, Manukau, *Tenison-Woods* (P); Huia, *Hector* (E); Mt Ngongotaha, *Prince* (GH); Mangarewa Gorge, between Rotorua and Tauranga, *Chinnoek P334*, 4.1972 (Herb. Chinnoek); Manutahi, New Plymouth, *H. Tryon* (BO, BRI 59493-4, SING); Waikato, *Attwood* (MICH); Wellington, *Logan 5.1867* (K), *Field*, received 3.1875 (K); near Massaere Bay, in deep shady ravine, *Lyll 9.1850* (E); Massaere Bay, Cook's Straits of New Zealand, under high rocks in a deep ravine, rare, *Lyll* (K); without specific localities in North Island, *Sinclair* (E), *Kirk* (BM). SOUTH ISLAND: Nelson, *Dall* (BRI 59371); Westport, *Green 1.1878* (E); Greymouth, *Helms 1875-1885* (L), 1870 (P); Prov. Canterbury, *Sinclair & Haast 1860* (K).

WITHOUT SPECIFIC LOCALITIES: *Craig* (BISH, GH, HBG); *Jessie Heywood 40* (GH); *Kirk 161* (BM, GH).

This species has often been confused with *L. trichomanoides* but the differences stated in the key are quite obvious. The leaf pattern of *L. viridis* would place it in section *Schizoloma*, although the shape of the petioles, the sublathrate scales as well as the monoete spores exclude it from that section and show its affinity to section *Tropidolindsaea*, as stipulated previously (Kramer 1957, p. 136). Its leaf-architecture is, however, so different from the latter homogeneous and closely-knit group of species, that it seems preferable to place it in a section of its own.

#### 4. SECTION SYNAPHLEBIUM

Section *Synaphlebiium* (*J. Smith*) *Diels* in Engler & Prantl, Nat. Pflanzenf. 1 (4): 221 (1902); Kramer in *Blumea* 15: 559 (1968).

11. *Lindsaea obtusa* *J. Smith* in Hooker, Sp. Fil. 1: 224 (1846); Kramer in *Blumea* 15: 565 (1968); Kramer in *Blumea* 18 (1): 171 (1970), Kramer in *Fl. Males.*, Ser. 2, 1 (3): 218-219, fig. 31 (1971).

SYNONYMY: *Lindsaea decomposita* Willdenow var. *contigua* Domin†, l.c. 84. HOLOTYPE: Bellenden-Ker Mountains, above Harveys Creek, Queensland, *Domin 182*, 12.1909 (PR). *L. decomposita* Willdenow var. *davallioides* (Blume) Domin f. *simplex* Domin l.c. 84. HOLOTYPE: Harveys Creek, Queensland, *Domin 181*, 1910 (PR), doubtfully described as a new taxon.

HOLOTYPE: Malacca, *Cuming 394* (K). ISOTYPES: B, E, GH, P, W.

MISAPPLIED NAMES: *Lindsaea lobata* auct. non Poiret in Lamarek; Bentham, *Fl. Austral.* 7: 720 (1878); F.M. Bailey, *Fern World of Australia*: 40 (1881); F.M. Bailey, *Lithogr. Ferns Queensland*: Pl. 52 (right) (1892); F.M. Bailey, *Compr. Cat. Queensl. Pl.*: 641 (1913). *L. decomposita* auct. non Willd.; Domin in *Biblioth. Bot.* 20 (85): 83 (1913).

DISTRIBUTION: Taiwan and Thailand to eastern Malesia; Australia (eastern Queensland), Admiralty Islands and New Caledonia. Fig. 4 (p. 120).

HABITATS: On the banks of streams or on rocks in rain forests (simple meso-notophyll vine-forests with sclerophyll emergents, complex mesophyll vine-forests etc.), usually in gullies or ravines, often in fringing forest.

The following description by the senior author is cited from *Fl. Males.*, l.c. 218:

"*Rhizome* short-creeping, 1-2½ mm, usually 1½ mm  $\phi$ , scales medium brown, narrowly triangular, to 1½ mm long, to 4-seriate at base, with a rather short uniseriate apex. Leaves close (less so in epiphytic plants); *petioles* stramineous or in mature specimens mostly medium to dark brown or blackish, sometimes pale-margined or mottled,  $\pm$  sharply quadrangular and mostly somewhat sulcate, c. 10-30 cm long,  $\frac{1}{2}$  as long as to equalling the lamina. *Lamina* simply pinnate or in full-grown plants mostly bipinnate, with 1 or 2, less often 3 pairs of pinnae (very rarely the basal pinnae forked) and a conform terminal one; primary rachis like the petiole. *Pinnae* mostly subopposite, obliquely ascending, 10-20 cm long, 1½-3 cm wide (simply pinnate

† Probably *L. obtusa* (aberrant by small, very shallowly incised pinnules; bipinnate).



Fig. 4. Map of Queensland showing the distribution of *Lindsaea obtusa*.

laminae may be wider), widest in the lower half, gradually and strongly narrowed to the usually long-acuminate apex; secondary rachises abaxially bi-angular, mostly distinctly sulcate, usually pale. *Pinnules* herbaceous to chartaceous, mostly rather dark when dry, c. 20–35 to a side, mostly distinctly ascending, close but hardly contiguous, the basal ones of simply pinnate leaves often more remote, ligulate to subtrapeziform, the larger ones 10–16 mm long and 5–7 mm wide, nearly always slightly over twice as long as wide, narrowed from the base to the broadly rounded or subtruncate apex, less often of almost equal width from base to apex, the upper margin straight at the base, outward convex. *Upper pinnules* gradually and strongly reduced, mostly some denticuliform ones present below the crenate-pinnatifid pinna-apex. Upper and outer margins of pinnules incised, mostly with 3–5 narrow, oblique incisions usually less than 1 mm (but in extreme cases to 2 mm) deep; margin otherwise minutely but distinctly crispate and/or crose. Lobes of fertile pinnules, especially the inner ones, flat, truncate, not convex. Veins immersed and often obscure, mostly twice forked, regularly anastomosing, forming one or sometimes towards the apex of the pinnule two series of areoles; larger areoles to 1 mm wide. *Sori* interrupted by the incisions, variable in size, the innermost ones often quadrinerval, the outer ones bi- or trinerval, but often on more or fewer vein-ends. Indusium subentire or, if broader, often crose, very variable in width, 0.2–0.7 mm wide, not reaching the margin by  $\frac{1}{2}$ –1 times its width, bulging but hardly reflexed at maturity. Spores pale yellowish, trilete, smooth, c. 24  $\mu\text{m}$ .” Plate X.

AUSTRALIA: QUEENSLAND: Cook District: Iron Range, grouped in dense shade in bottom of ravine in rain forest, alt. 40 m, *Brass* 19213, 6.1948 (CANB, K, L); Leo Creek, Upper Nesbit River, Cape York Peninsula, 13° 33' S, 143° 28' E, on rocky creek banks in rain forest, alt. 420 m, *Brass* 19855, 8.1948 (BRI, CANB, L); headwaters of Massey Creek near old mining site, Mellwraith Range, approx. 13° 50' S, 143° 20' E, in simple meso-notophyll vineforest with sclerophyll (*Acaecia polystachya*) emergents on soils derived from metamorphic and granite with large quartzite rocks on the surface, permanent running stream nearby, *Webb & Tracey* 9096A, 10.1969 (BRI); Mellwraith Range, c. 11 miles [17.7 km] NE. by E. of Coen, along gully with small waterholes, in rain forest on damp banks, alt. 2000 ft [600 m], *L.S. Smith* 14728, 8.1969 (BRI); Endeavour River, *Taylor* (K, P); Cooktown, *Harris*, 1888 (BRI 59270); near Cooktown, on clay bank by stream fringing forest, c. 15° 28' S, 145° 15' E, *Vessey* 3.1963 (JCT P463); Helenvale, on muddy bank of creek in rain forest, *Messmer NSW* P6433, 7.1952 (NSW); 11 miles [c. 18 km] S. of Helenvale on road to Bloomfield River, frequent on stones also roots in damp forest floor, level ground not far above large fast-flowing creek, complex mesophyll vine forest, *A. Rodd* 243, 12.1915 (NSW); Thornton Peak, alt. 4000 ft [1200 m], on a rock in forest, *Brass & C.T. White* 299, 9.1937 (BRI); Daintree River, in rain forest gully, *Brass & C.T. White* 323, 9.1937 (BRI); Kuranda, *Watts* 7–8.1913 (BRI 59271); Cairns, *Warburg* 19270 (B, P); Cairns district, *Watts NSW* P855, 7–8.1913 (NSW); between Cairns and Herberton, *Wild* 1891 (BRI 59263, 59266 & 59272); Mt Edith, c. 6.5 km N. of Danbulla, near Kairi, in rain forest, *L.S. Smith* 3415, 8.1947 (BRI); Mt Bellenden Ker, c.  $\frac{3}{4}$  mile [1.4 km] SE. of centre peak, in gully in rain forest, *L.S. Smith* 14728, 6.1969 (BRI); The Boulders, Babinda Creek, 17° 21' E, 145° 55' S, c. 6.5 km W. of Babinda, *L.S. Smith* 10215, 9.1957 (BRI); Junction Creek, Russell River, *Brass* 18258, 4.1948 (BRI); Herberton, *Waller* (P). North Kennedy District: towards mountains S. of Tully, in rain forest growing on bank of creek, *Vessey & Fox* 9.1963 (JCT P260); Rockingham Bay, *Dallachy?* (P); Paluma Range, in more open forest, c. 19° 05' S, 146° 20' E, *Chapman* 6.1962 (JCT P752), on clay bank in rain forest clearing, *Vessey* 6.1962 (JCT P250); Cleveland Bay to Rockingham, *Hill* 41 (K). Moreton District: Eumundi, *Simmonds* 153 (BRI); Eudlo?, *Simmonds* 1891 (BRI 113409); Brisbane, *Simmonds* (MICH); Tallebudgera Creek, *Schneider* (BRI).

“This widespread, variable and probably still too broadly circumscribed species is mainly distributed in Malesia and occurs only in the western Pacific” (see Kramer in *Blumea* 18 (1): 171 (1970)). It is closely allied to *L. harveyi* Carruthers ex Seemann and small plants of the latter cannot be distinguished from *L. obtusa* with certainty.

Most Australian specimens of *L. obtusa* are smaller than those from Malesia but fall within the variability of this broadly circumscribed and perhaps still too inclusive species. The width of the indusium and its distance from the margin are quite as variable in Australia as elsewhere.

A collection from North Eastern Queensland, namely *C.T. White* No. 10533, Mt Spurgeon, Cook District, 9.1937 (BRI, GH) is similar to some simply pinnate forms of *L. obtusa* but diverges in its entire, subfalcately decurved pinnules and less elongate areoles of the veins. It may represent an undescribed relative of *L. obtusa* but in view of the difficulties in distinguishing species in Section *Synaphlebium*, a new species is preferably not described on the basis of a single collection. Perhaps Domin's var. *contigua* (cited on p. 119) applies to this taxon.

## 5. SECTION PSAMMOLINDSAEA

Section *Psammolindsaea* *Kramer* in *Blumea* 15: 560 (1968); *Fl. Males.*, Ser. 2, 1 (3): 229 (1971).

The type and only species in this section is the following taxon which has been placed in both *Schizoloma* and *Isoloma*, but is not closely allied to either.

12. *Lindsaea walkerae* *Hooker*, *Sp. Fil.* 1: 20, Pl. 69A (1846); *Kramer* in *Blumea* 15: 560 (1968); *Kramer* in *Fl. Males.* l.c. 229–230.

SYNONYMY: *Isoloma walkerae* (*Hooker*) *Presl*, *Epimel. Bot.*: 101 (1851). *Schizoloma walkerae* (*Hooker*) *Kuhn*, *Chactopt.*: 346 (1882); *Diels* in *Engler & Prantl, Nat. Pflanzenf.* 1 (4): 218 (1902); *Holtum*, *Rev. Fl. Malaya* 2: 344 (1954). *Schizolegnia walkerae* (*Hooker*) *Alston* in *Bol. Soc. Brot.*, 2<sup>a</sup> ser., 30: 25 (1956).

HOLOTYPE: Ceylon, (*Mrs*) *Walker* (K). ISOTYPE: (B).

DISTRIBUTION: Ceylon and Indo-China to Micronesia. This species has been recorded from W. New Guinea but not previously from Australia (Cook District, Queensland). *Fig. 1* (p. 97).

HABITATS: In localities outside Australia it occurs in moist, open situations, frequently on poor acid soil as well as by streams and in swamps mostly at low elevations but in Malaya at altitudes of 1000–1200 m.

The following description of *L. walkerae* by the senior author is cited from *Fl. Males.*, l.c. 229:—

“*Rhizome* rather short- to long-creeping, 1½–2 mm  $\phi$ ; scales reddish brown to castaneous, almost linear, to 2 mm, to 4-seriate at base, there usually with laterally projecting cell partitions, the apex uniseriate, paler. Leaves rather close to 4 cm apart; petioles dark castaneous to black, lustrous, abaxially rounded, adaxially flattened or broadly sulcate, c. 10–45 cm long, much shorter to longer than the lamina. Lamina narrowly oblong, 15–70 cm long, 1½–20 cm wide, simply pinnate, with 3–17 pinnules to a side and a free terminal one; rachis like the upper part of the petiole. Pinnules chartaceous to rigidly coriaceous, mostly olivaceous to dark brown when dry, paler beneath, subsessile, obliquely to very strongly ascending, a few cm apart, opposite or subopposite throughout, linear, 2½–15 cm long, 4–8 mm wide, 6–20 times as long as wide; lower pinnules often more remote and sometimes slightly shortened; upper pinnules little or not reduced. Base of pinnules slightly unequally cuneate, the basiscopic side narrower, the dark colour of the rachis ending rather abruptly in the stalk-like base, but without an articulation; margin entire, somewhat revolute; upper half of pinnule narrowed, obtuse, if acuminate the tip still obtuse. Terminal pinnule conform, symmetric, occasionally joined to an upper lateral one or lobed at base, usually soriferous. Costa distinct, abaxially elevated, almost percurrent. Veins elevated on both sides, very oblique, less so towards their apices, 2–3 times forked, close, ¼–½ mm apart, free. Sori continuous, extending around the apices of the pinnules, the vein-ends below the receptacle thickened; indusium rigid, yellow or brown, entire, 0.4 mm wide, reaching the margin, somewhat reflexed at maturity. Spores dark brown, trilete, smooth, 25–30  $\mu\text{m}$ .”

AUSTRALIA: QUEENSLAND: Cook District: Cockatoo Creek, Cape York Peninsula, *Whitehouse* 1943 (BR1 59589, K); Browns Creek on Iron Range road, NNE. of Coen, 12° 44' S, 143° 06' E, terrestrial fern 30 cm high with creeping rhizome, in *Sinoga* swamp with *Lycopodium cernuum* etc., very localized, *Coveny* 7119 & *Hind*, 9.1975 (NSW, BR1, K, L, Z).

## B. SUBGENUS ODONTOLOMA

Subgenus *Odontoloma* (*Hooker*) *Kramer* in *Blumea* 15: 561 (1968).

## 1. SECTION ODONTOLOMA

Section *Odontoloma* see *Kramer*, l.c. 562 (1968).

13. *Lindsaea repens* (*Bory*) *Thwaites*, *Enum. Pl. Zeylanicae*: 388 (1864); *Domin* in *Biblioth. Bot.* 20 (851): 85, 87, fig. 16 (1913); *Kramer* in *Blumea* 15: 568 (1968), 18: 180 (1970); *Kramer* in *Fl. Males.* l.c. 237 (1971).



SYNONYMY: *Dicksonia repens* Bory, Voy. 2: 323 (1804).

TYPE: Bourbon (= Réunion), *Bory s.n.* (P; dupl. in B, BM).

For further synonymy of this widespread and variable species, see Fl. Males., ser. 2, 1 (3): 237 (1971).

DISTRIBUTION: From the Mascarenes to Hawaii and Eastern Polynesia with several, mostly geographically exclusive, local forms which are treated here as varieties. So far 3 varieties have been recorded from Tropical Australia.

*Rhizome* long-creeping, castaneous; scales triangular, up to 5 mm long, narrowly triangular or lanceolate with a very short uniseriate apex. *Petiole* short in the Australian varieties, usually 1–5 cm long. *Leaves* one to several cm apart, borne at a narrow angle on the rhizome; petioles stramineous to pale brown with a dark base, quadrangular, the faces non-sulcate. *Lamina* linear, simply pinnate, gradually and strongly narrowed at the base in the Australian varieties; rachis stramineous, quadrangular, adaxially at the base  $\pm$  convex, the pinnules inserted below the edges, upwards sulcate, bearing the pinnules at its edges. *Pinnules* numerous, herbaceous, elongate-triangular, ligulate or  $\frac{1}{4}$ -elliptic, the upper ones gradually and strongly reduced, a few confluent into a pinnatifid leaf-apex; upper margin of the pinnules shallowly incised. *Juvenile plants* with deeply (bi)pinnatifid, thin pinnules, sterile; but in transitional cases leaves may be fertile in the upper part and bear sterile pinnules of the juvenile shape in the basal part. *Veins* immersed, free, once or twice forked. *Sori* interrupted. *Spores* pale brown, trilete, smooth, c. 22–26  $\mu$ m.

#### KEY TO THE VARIETIES

1. Indusium with strongly concave base, subhippocrepiform. Most sori uninerval and round, occasionally some binerval, crescent-shaped. Margin of the pinnules very regularly incised to somewhat beyond the level of the receptacle. Most lobes of the pinnules rounded. Sporangia at full maturity strongly spreading laterally. . var. *sessilis* 1.
- 1.\* Indusium with weakly concave, straight, or somewhat convex base. Sori uninerval to plurinerval.
  2. Most inner incisions of the pinnules reaching the level of the receptacle or slightly beyond. Lobes of the pinnules (except sometimes the innermost 1 or 2) rounded, narrowed from base to apex, sometimes apically crose; outer lobes very oblique. Sori short, often with basally somewhat concave receptacle ..... var. *marquesensis* 2.
  - 2.\* Many inner incisions of the pinnules reaching considerably beyond the level of the receptacle. At least the broader lobes of the pinnules ligulate, scarcely narrowed to the shallow rounded or truncate, not rarely in addition emarginate or sinuate-crose outer margin; outer lobes usually not very oblique. Sori short, without basally concave receptacle; binerval sori transversely elongate ..... var. *lingulata* 3.

1. *L. repens* var. *sessilis* (Copeland) Kramer in *Blumea* 15: 568 (1968), 18: 180 (1970).

SYNONYMY: *L. sessilis* Copland in *Philipp. J. Sci. Bot.* 6: 82 (1911), 60: 115 (1936).

For further synonymy see Kramer in *Fl. Males.*, l.c. 239.

HOLOTYPE: Papua, *Copland King 244* (MICH). ISOTYPE: Ambasi, Papua, *Copland King 244* (NSW).

DISTRIBUTION: Borneo to New Guinea, the Admiralty Is and Australia (Queensland), also Western Polynesia.

HABITATS: In moist forests, mostly epiphytic, rarely epilithic.

The following description of *L. repens* var. *sessilis* by the senior author is cited from Fl. Males., l.c. 239:

“*Rhizome* c. 2 mm  $\phi$ ; scales honey-coloured to medium brown, to over 20-seriate at the broadened base but usually narrower, to  $3\frac{1}{2}$  by 1 mm. *Petioles* to 5 cm long but usually much shorter, less than 1 cm. *Lamina* 20 by 2 to 70 by 6 cm, with c. 40–80 pinnules to a side, rather suddenly, shortly, and strongly narrowed at both ends. *Pinnules* sessile, spreading, or slightly ascending or the basal ones somewhat falcately decurved, 15 by 4 to 28 by 8 mm, 3–4 times as long as wide, rarely less. Margins little convex except if pinnules falcate, the outer margin rounded, subtruncate, or virtually absent. Colour mostly dark green when dry. Incisions of upper/outer margin  $\frac{1}{2}$  to  $1\frac{1}{2}$  mm deep, occasionally deeper, mostly progressively deeper from base to apex, reaching almost to the level of the receptacle to considerably beyond; lobes regular, rounded or narrowed-rounded, often 1 mm wide. *Basal pinnules* reduced, often decurved, sterile, not rarely deeply pinnatifid. Veins single or rarely paired in the lobes. *Sori* on one, or on two connivent vein-ends (rarely a few on two more divergent vein-ends, then more elongate and the lobe subtruncate), roundish, distinctly intramarginal even in more deeply incised pinnules; indusium with concave base, reniform or subhippoepiform, pale, entire, 0.4–0.8 mm long, 0.2–0.3 mm wide, not reaching the extremity of its lobe by its own width or more.”

Domin's plate in *Biblioth. Bot.* 20 (85<sup>1</sup>): fig. 16 (1913) depicts this variety from East Malesia, being based on material from Harveys Creek, Cook District, north-eastern Queensland, *Domin 185 and 186* (PR), both of which were examined by the senior author.

Sterile material of *L. repens* var. *sessilis* and var. *marquesensis* cannot be distinguished with certainty.

2. *L. repens* var. *marquesensis* E. Brown in *Bull. Bish. Mus.* 89: 51, Pl. 9 (1931), (err. “*marquesense*” with the description); Kramer in *Blumea*, 18 (1): 182, fig. 14 (1970).

For synonymy see Kramer, l.c. 182.

HOLOTYPE: Fatuhiva, Marquesas, *Brown 1083* (BISH).

DISTRIBUTION: Fiji to the Marquesas Is. A single collection from Australia (Queensland) probably belongs to this variety.

HABITATS: See only cited specimen.

The following description of var. *marquesensis* by the senior author is cited from *Blumea*, l.c. 182:

“Scales of the rhizome to 5 mm long. Base of lamina gradually and strongly reduced, the petiole not over a few cm long. Pinnules spreading or slightly ascending, the upper margin straight or towards the apex weakly concave, the lower margin faintly but distinctly S-shaped, i.e. basally concave, apically convex, a distinct outer margin not developed, the apex narrowed-rounded to subacute. Larger pinnules ligulate, almost evenly narrowed from base to apex, 16–24(–33) mm long, 5–7 mm wide,  $3\frac{1}{2}$ –4(–4 $\frac{1}{2}$ )  $\times$  as long as wide; upper margin of fully fertile pinnules with 4–7 acute incisions, the inner ones  $\frac{1}{2}$  mm deep, less often to 1 mm deep, reaching to or slightly surpassing the level of the receptacle, or shallower; outer incisions very oblique, sometimes deeper; lobes narrowed from the base to the broadly rounded, sometimes in addition erose, apex, with convex, convergent sides, only the basal 1 or 2 sometimes ligulate-subtruncate; outer lobes very oblique. Sori on 1 or 2 vein-ends, 0.4–1 mm long; short sori with basally straight or somewhat concave (much less so than in var. *sessilis*) indusium; indusium pale, entire to erose, 0.3–0.5 mm wide, narrowed at the sides, not reaching the margin by a distance equal to its width to almost reaching it, not rarely reflexed and concealed at maturity.”

AUSTRALIA: QUEENSLAND: Cook District: Iron Rangc, Cape York Peninsula, terrestrial and climbing to  $\pm$  1 m in rain forest of a wet ravine, alt. 40 m, *Brass 19212*, 6.1948 (K, L, NSW).

3. *L. repens* var. *lingulata* Kramer in *Blumea* 18: 181–182, fig. 13 (1970).

HOLOTYPE: Kusaia, Caroline Is, *Stone 1911* (U).

DISTRIBUTION: Marianas, Caroline Is, Solomon Is and Australia (Queensland). So far this variety has not been found in New Guinea.

HABITATS: Mostly epiphytic on the trunks of palms or other trees but sometimes terrestrial, usually at low altitudes.

The following description of *L. repens* var. *lingulata* by the senior author is cited from Blumea, l.c. 182:

"Petiole short, up to a few cm; pinnules usually rather close, not rarely contiguous; larger pinnules  $\frac{1}{2}$ -elliptic to falcate-ligulate, mostly slightly ascending or spreading but often subfalcately downcurved, 16-30 mm long, 5-9 mm wide,  $2\frac{1}{2}$ -3  $\times$  as long as wide, the lower edge straight or somewhat concave, rarely outward convex, the upper edge outward increasingly convex, a distinct outer margin not or scarcely developed. Upper/outer margin incised, with ca. 10 incisions, these acute, narrow, at least some of the inner ones 1 mm deep or more and reaching twice the distance from the receptacle to the margin, some, especially outer incisions, often to 2 or even  $2\frac{1}{2}$  mm deep, the outer ones more oblique; lobes ligulate, 1-2 mm wide, parallel-sided, with straight lateral edges, the outer edge shallowly convex or truncate, not rarely in addition sinuate-erose. Sori on 1 or 2, exceptionally on 3 or 4 vein-ends,  $\frac{1}{2}$ - $1\frac{1}{2}$ (-3) mm long, distinctly intramarginal; receptacle straight or in short, outer sori somewhat concave; indusium greenish, entire to sinuate, 0.3-0.4 mm wide, not reaching the margin by an equal or larger (up to twice its width) distance, often strongly bulging or reflexed and  $\pm$  concealed at maturity."

AUSTRALIA: QUEENSLAND: Without specific locality, *Amalia Dietrich* (B, two sheets), typical.†

## 2. SECTION PENNA-ARBOREA

Section *Penna-arborea* Kramer in Blumea 15: 563 (1968).

14. *Lindsaea pulchella* (*J. Smith*) *Mettenius ex Kuhn* in *Linnaea* 36: 81 (1869); Kramer in Blumea 15: 570 (1968), 18: 92 (1970).

For further synonymy, key to and descriptions of the varieties see Kramer in Fl. Males., Ser. 2, 1 (3): 249-252 (1971).

The single collection from Australia belongs to:

var. *blanda* (*Mettenius ex Kuhn*) Kramer in Blumea 15: 571 (1968), Kramer in Fl. Males. l.c. 251.

HOLOTYPE: Java, *Wichura* (B).

DISTRIBUTION: Sumatra, Java, Philippines, Celebes, ? Ternate, New Guinea, Solomon Is and Australia (Queensland).

The following description of *L. pulchella* var. *blanda* by the senior author is cited from Fl. Males., l.c. 251:

"*Rhizome* ( $\frac{1}{2}$ )- $\frac{3}{4}$ - $1\frac{1}{4}$  mm  $\phi$ ; scales often a little longer and broader than in var. *pulchella*. *Petioles* 1-10 cm long,  $\frac{1}{2}$ - $\frac{3}{4}$  mm  $\phi$ , dark reddish brown or upward paler, hardly pale-margined, adaxially flattened, upward sulcate, abaxially bi-angular except at the rounded base. *Lanina* 5-30 cm long, 1-2 $\frac{1}{2}$  cm wide; rachis quadrangular, at least adaxially sulcate, stramineous or with darker base, wiry. *Pinnules* herbaceous, mostly olivaceous-brown when dry, c. 20-50 to a side, usually a little ascending, mostly not contiguous, asymmetrically ovate to  $\frac{1}{2}$ -elliptic, 7-12 mm long, 3 $\frac{1}{2}$ -6 mm wide, twice as long as wide or slightly less; margins not or little sclerotic, a distinct outer margin usually not or scarcely developed, the upper margin with 1-3 oblique major incisions 1-3 mm deep, reaching  $\frac{1}{2}$  to  $\frac{1}{2}$  (rarely to  $\frac{3}{4}$ ) down, sometimes with some shallower additional incisions; lobes convex, not rarely erose,  $\pm$  divergent. Basal pinnules further apart but scarcely reduced; upper pinnules gradually reduced, as in var. *pulchella*. *Veins* immersed, not evident, simple or once forked, free, ending well within the margin,  $\frac{1}{2}$ -1 mm apart. *Sori* uni- or binerval or less often to 5-nerval,  $\frac{1}{2}$ -2(-4) mm long, in longer sori the base  $\pm$  concave. Indusium pale to brownish, delicate, subentire, with a  $\pm$  convex free edge, narrowed at the free sides, 0.3-0.5 mm wide, nearly always strongly intramarginal."

AUSTRALIA: QUEENSLAND: Rockingham, 4000 ft alt., gullies, *A.W. Castle*, *A. McCastle*, *A. McCaskill* or *A. McArdle*, March, 1926, (US 1378303).

† It is unfortunate that the only record of var. *lingulata* from Australia lacks a specific locality but a description is provided in the hope that collectors will search for this variety especially in the north-eastern region of Queensland.

It is unfortunate that the writing on the label of the only known Australian specimen of this taxon is not very legible. Dr D. Lellinger (Smithsonian Institution) very kindly forwarded a xerocopy of the specimen and its label to Sydney but the collector was unknown to him. However Mr B. Andrews (Queensland Herbarium) has suggested that the collector may have been A. MacCaskill (mis-spelled as A. McCaskill on the label), a country member of the Field Naturalists Club of Victoria in 1927, whose interests were Algae and ferns. The locality "Rockingham, 4000 ft alt." is also puzzling but probably refers to mountains near Rockingham Bay in north-eastern Queensland. According to Mr S.L. Everist (pers. comm.) "There is the Rockingham Bay Range, latitude 18° 20' S, a short spur extending westward from the Seaview Range. According to the topographic maps it does not rise much above 3000 ft and is slightly lower than some of the peaks in the Seaview Range to the east of it".

In Malesia *L. pulchella* var. *blanda* is mostly epiphytic on trees or tree-ferns, often growing amongst mosses but more rarely terrestrial, usually at elevations of c. 1500–2750 m.

#### EXCLUDED

*L. concinna* J. Smith—see under *L. brachypoda*.

*L. cultrata* (Willd.) Swartz—see under *L. brachypoda*.

*L. decomposita* Willd.—see under *L. obtusa*.

*L. flabellulata* Dryander—see under *L. media*.

*L. lamginosa* Hooker, Sp. Fil. 1: 210, Pl. 69A (1846); F. Mueller, Fragm. 5: 118 (1865–66); F.M. Bailey, Handb. Ferns Queensland: 18 (1874); Bentham, Fl. Austral. 7: 722 (1878); F.M. Bailey, Queensl. Fl. 6: 1956 (1902); F.M. Bailey, Compr. Cat. Queensland Pl.: 641 (1913).—*Nephrolepis acutifolia* (Desvaux) Christ.

*L. lobata* Poirlet in Lamarck—see under *L. obtusa*.

*L. orbiculata* (Lamarek) Mettenius ex Kuhn—see under *L. media*.

*L. tenera* Dryander—see under *L. media*.

*Sphenomeris chinensis* (L.) Maxon. Four specimens in the Berlin Herbarium are labelled "Amalia Dietrich, Queensland". They belong to the narrow form of this species from the Eastern Pacific and were almost certainly collected elsewhere, presumably not even by Amalia Dietrich.

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