

A REVIEW OF THE FERN GENUS *HYPOLEPIS* (DENNSTAEDTIACEAE) IN THE MALESIAN AND PACIFIC REGIONS

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SUMMARY

Fourteen species and one subspecies of the fern genus *Hypolepis* Bernh. are recognised in the Malesian and Pacific regions, excluding Australia and New Zealand. Three species, *H. hawaiiensis*, *H. malesiana* and *H. scabristipes*, and one subspecies, *H. elegans* subsp. *carolinensis*, are described for the first time. Two widely misapplied names, *H. punctata* (Thunb.) Mett. and *H. tenuifolia* (Forst. f.) Bernh. are more clearly defined. Descriptions, distributional data and a key for identifying all fourteen species are provided. Five species, *H. alpina*, *H. archboldii*, *H. bamleriana*, *H. malesiana* and *H. scabristipes*, are confined to the Malesian region; four species, *H. brooksiae*, *H. pallida*, *H. polypodioides* and *H. punctata*, extend also to the Asian mainland; three species, *H. dicksonioides*, *H. elegans* and *H. hawaiiensis*, are confined to the Pacific region and two, *H. glandulifera* and *H. tenuifolia*, have a wide distribution from mainland Asia to the Pacific. Four species, *H. dicksonioides*, *H. elegans*, *H. glandulifera* and *H. tenuifolia*, are shared with Australia and New Zealand where a further eight endemic species occur.

INTRODUCTION

The present paper is a continuation of the series of publications on *Hypolepis* which began with a review of the evidence for cytological evolution in the genus (Brownsey, 1983) and continued with taxonomic revisions of the New Zealand and Australian representatives (Brownsey & Chinnock, 1984, 1987). The nomenclatural problems associated with species in the Australasian region necessitated the examination of species in the Indonesian, New Guinea and Pacific regions, which has led to the completion of the present paper. However, it should be stressed from the outset that, whereas the papers on the Australian and New Zealand species were thorough taxonomic revisions based on comparison of herbarium collections backed up by morphological and cytological observations of live material both in the field and in cultivation, the present paper is based only on examination of herbarium specimens from a restricted number of institutions. In particular, I have been unable to examine either the important collections at Bogor and Lae or the type specimens of a number of recently described species from India and China listed here as *incertae sedis*, nor have I had the opportunity to carry out field observations in any part of the area un-

der consideration, or to make cytological investigations of live plants. The range of herbarium material that I have seen of some species is very small, and in many cases it is difficult to get any accurate idea of the overall habit and dimensions of the plants (the general inadequacies of herbarium collections of large ferns have been discussed elsewhere – Brownsey, 1985). Despite these deficiencies, however, the present review is put forward as a starting point for further investigation of the genus, particularly in the Malesian region.

The existing literature is so fragmented and so confused that it is a positive hindrance to progress in understanding the variability and distribution of the different species of *Hypolepis*. Thus, in the Pacific region, authors have either assigned all material somewhat uncritically either to *H. punctata* (e.g. Christensen, 1925) or to *H. tenuifolia* (e.g. Brown & Brown, 1931; Copeland, 1932; Glassman, 1952), or they have attempted to separate off such species as *H. neocaledonica* (Brownlie, 1969) and *H. aspidioides* (Christensen, 1943) which are here regarded as synonyms of *H. tenuifolia*. On the other hand, *H. elegans*, which occurs from the Solomons east to Samoa and Rapa, seems not to have been mentioned by any author since its original description by Carruthers (in Seeman, 1873), until reinstated by Brownlie (1977).

A similar story applies to the Malesian region except that here even greater confusion has resulted from the publication of several *Hypolepis* names which actually belong to species in other genera. Thus, Copeland (1950) listed six species for New Guinea, but of these, *H. papuana* Bailey belongs in *Dennstaedtia*, and *H. grandifolia* Gepp (presumably an error for *H. grandifrons* Gepp) belongs in *Ctenitis*. Amongst the other four species, Copeland listed both *H. punctata* and *H. bamleriana*, but the specimens cited under the former are, in fact, all referable to the latter. He may have realised subsequently that his treatment was unsatisfactory because in his later fern flora of the Philippines (Copeland, 1958) he assigned all material of *Hypolepis* to either *H. tenuifolia* (having the sori protected by a flap) or to *H. punctata* (having the sori unprotected). This treatment has proved to be an oversimplification because at least seven species are now known to occur in the area. Even Holttum (1954) very uncharacteristically failed to come to grips with the genus satisfactorily, recognising only three species in Malaya, including one, *H. bivalvis*, which he later correctly assigned to *Paesia elmeri* (Holttum, 1958), and another, *H. punctata*, which, in direct contradiction to Copeland, he described as having a protective soral flap.

It is not worth recounting in detail all the attempts which have been made to describe the *Hypolepis* species of the Malesian and surrounding regions, since most are incomplete or unsatisfactory, but it is salutary to note that in the very first publication relating to the ferns of Malesia, Blume (1828) described three species from Java as *Cheilanthes alpina*, *C. pallida* and *C. polypodioides*. These were later transferred to *Hypolepis* by Hooker (1858) in the last attempt made at a comprehensive treatment of the genus, but thereafter seem to have been almost totally ignored. Christensen (1906) accepted only one of them, but in fact all three are perfectly good species with extensive distributions.

The widespread misapplication of names and generally confused taxonomy of *Hypolepis* in the Malesian and Pacific regions is exactly comparable to that already found in the New Zealand and Australian regions, and is attributable to polymorphic

variation, inadequate original descriptions and the poor preservation of several important type specimens. The essential taxonomic characters for distinguishing *Hypolepis* from related genera, and for delimiting individual species within the genus, have been described in an earlier paper (Brownsey & Chinnock, 1984). These have been used again here.

In all, some 14 species are recognised, 12 of which occur in the Malesian region and five in the Pacific. Three new species, *H. hawaiiensis*, *H. malesiana* and *H. scabristipes*, and one subspecies, *H. elegans* subsp. *carolinensis*, are described, but at least one more taxon, currently known only from a single collection on Tahiti, may warrant recognition. Five species that occur in the Malesian region extend into the Asian mainland, and two into Australia, but none reach as far south as New Zealand where the *Hypolepis* flora is quite different.

A thorough investigation of the Asian mainland species has not been undertaken. In particular, it is likely that material referred here to *H. punctata* actually comprises an aggregate of more than one species, but recognition of constituent taxa will only be achieved by a combination of field observation, herbarium study and cytological investigation. The type specimens of four species described from China by Ching (1959) and Wang (1961), and those of six more described very recently from India by Biswas (1985), have not been available to me. They may relate to taxa in the *H. glandulifera*, *H. polypodioides* and *H. punctata* aggregates, but their affinities cannot be determined without the opportunity to examine the specimens themselves.

The treatment presented here is essentially conservative. With the exception of the *H. alpina* / *dicksonioides* group, the species described can be recognised in the herbarium with a high degree of confidence. However, I have seen a number of individual collections from different parts of the region which do not fit satisfactorily into any of the species accepted here and which may represent rare or under-collected species not yet clearly recognised or described. Such collections are listed below as a guide to areas where further field work might be profitable. In addition, cytological investigation and field observation may well reveal different cytotypes of taxa within the main groups. This has certainly been the case in the more extensively studied floras of New Zealand and Australia, and can be anticipated also in the much larger and more ecologically diverse Malesian region.

Two species, *H. brooksiae* and *H. scabristipes*, would certainly repay cytological investigation by anyone with access to live material. These two species are morphologically very different to the others, and, as has already been suggested (Brownsey, 1983), they may belong in a separate genus. The extraordinary similarity of *H. brooksiae* to *Dennstaedtia scandens* suggests the possibility of an evolutionary link between the two genera. Two other morphologically unusual species, *Hypolepis distans* from New Zealand and *H. nigrescens* from South America, are aneuploid species with $n = 28$ and $n = 29$ respectively, unlike the majority of other species with $n = 52$ and $n = 104$. Whether *H. brooksiae* and *H. scabristipes* are related to *H. distans* and *H. nigrescens*, or belong to a third group, can only be resolved by further investigation in the field and in the laboratory.

A summary of the critical characters for distinguishing all the different Malesian and Pacific species is given in Table 1.

Table 1. Summary of the most important characters for distinguishing Malaysian and Pacific species of *Hypolepis*.

	<i>H. brooksiae</i>	<i>H. scabrystipes</i>	<i>H. hawaiiensis</i>
Stipe diameter	4–8 mm	5–7 mm	2.5–7 mm
Colour of stipe and rachis	Black-brown or dark red-brown, becoming chestnut-brown towards apex	Chestnut-brown at base, but mostly yellow-brown	Red-brown at base, becoming chestnut-brown or yellow-brown above
Hairs on surface of upper stipe and rachis	Abundant, red-brown, non-glandular hairs (to 3 mm); conical and recurved spines (to 1 mm); prickly	Dense, stiff, stout, recurved, red-brown, non-glandular hairs (to 0.6 mm); bluntly conical hair bases; very rough	Sparse, colourless and chestnut-brown, non-glandular hairs (to 2 mm), or sometimes almost glabrous; smooth and sometimes polished
Lamina	4-pinnate 2(3)–3(4)-pinnate Capable of intermittent, scrambling growth, the apex remaining dormant as successive pairs of pinnae develop Up to 10 m long	4-pinnate 2(3)–3(4)-pinnate Capable of intermittent, scrambling growth, the apex remaining dormant as successive pairs of pinnae develop Up to 8 m long	2–3(4)-pinnate 2–3-pinnate Ovate to broadly ovate (10) 25–70 (100) x (9) 18–80 cm
Hairs on underside of lamina	Variably dense, brown-tinged and red-brown, non-glandular hairs on veins and midribs (to 1 mm); recurved and conical spines on midribs	Dense, brown-tinged and red-brown, non-glandular, often strongly recurved hairs on veins and midribs (to 0.6 mm)	Sometimes almost glabrous, usually sparse, stout, colourless or brown-tinged, non-glandular hairs on veins and midribs (to 1 mm); glandular hairs occasionally present
Soral hairs	Absent	Absent	Absent
Soral protection	Unprotected, or slightly reflexed membranous flap	Unprotected	Unprotected, or slightly reflexed green lamina flap with a few short hairs
Spore size	(30) 32–36 (41) x (18) 20–22 (24) μ m	(28) 31–34 (39) x (17) 18–22 (24) μ m	(30) 33–37 (40) x (21) 22–25 (28) μ m

Table 1 continued

<i>H. polypodioides</i>	<i>H. glandulifera</i>	<i>H. malesiana</i>	<i>H. punctata</i>
2–5 mm	3–10 mm	2–3.5 mm	2–4 mm
Mostly chestnut-brown, becoming yellow-brown near apex	Chestnut-brown at base, but mostly yellow-brown	Dark chestnut-brown at base, becoming paler chestnut- or yellow-brown above	Pale chestnut-brown at base, becoming yellow-brown above
Abundant, colourless and brown-tinged, non-glandular hairs (to 2 mm); \pm smooth	Dense, fine, colourless and brown-tinged, glandular and non-glandular hairs (to 1 mm); slightly rough	Dense, brown-tinged, glandular and non-glandular hairs (to 0.5 mm) and occasional chestnut-brown hairs (to 1 mm); \pm smooth	Sparse, brown-tinged, glandular and non-glandular hairs (to 2 mm); \pm smooth or slightly rough
2–3(4)-pinnate Ovate to broadly ovate (21) 35–125 \times 25–55 (85) cm	2–4-pinnate Broadly ovate or broader than long 45–180 \times 30–150 cm	2(3)–3(4)-pinnate Ovate to elliptic 28–60 \times 13–30 cm	2–3-pinnate Ovate to broadly ovate 22–80 (100) \times 17–70 cm
Abundant, colourless or brown-tinged, non-glandular hairs on veins and midribs (to 1.5 mm), and sometimes on lamina margins (to 0.3 mm)	Dense, fine, colourless and brown-tinged, glandular and non-glandular hairs on all surfaces (to 1 mm)	Dense, colourless and chestnut-brown, glandular and non-glandular hairs on all surfaces (to 1.5 mm)	Variably dense, colourless and brown-tinged, glandular and non-glandular hairs on all surfaces (to 1.5 mm) and sometimes on lamina margins (to 0.2 mm)
Non-glandular hairs present	Glandular hairs occasionally present in very immature sori	Glandular and non-glandular hairs present	Absent
Unprotected, or slightly reflexed green lamina flap with a few short hairs	Unprotected, or slightly reflexed green lamina flap with a few short hairs	Unprotected	Unprotected
(32) 34–38 (40) \times (20) 23–25 (27) μ m	(29) 32–35 (37) \times (17) 18–26 (29) μ m	(34) 37–39 (43) \times (23) 25–28 (32) μ m	(32) 34–39 (43) \times (22) 23–26 (28) μ m

Table 1 continued

	<i>H. archboldii</i>	<i>H. alpina</i>	<i>H. dicksonioides</i>
Stipe diameter	0.5–2 mm	1.5–5 mm	(2) 5–15 mm
Colour of stipe and rachis	Mostly chestnut-brown, becoming yellow-brown near apex	Mostly red-brown or chestnut-brown, sometimes becoming yellow-brown near apex	Dark chestnut-brown below, becoming yellow-brown or green near apex
Hairs on surface of upper stipe and rachis	Dense, conspicuous, chestnut-brown, non-glandular hairs (to 3 mm); rough	Dense, red-brown or chestnut-brown, glandular hairs (to 0.5 mm), and occasional non-glandular hairs (to 2 mm); rough or slightly rough	Abundant, colourless, glandular and non-glandular hairs (to 5 mm); slightly rough
Lamina	1(2)–2(3)-pinnate Narrowly ovate to ovate (5) 20–45 x (3) 6–22 cm	(1)2–(3)4-pinnate Ovate 20–80 (130) x 10–90 cm	2–4(5)-pinnate Broadly ovate to broadly elliptic (20) 35–135 x (15) 35–110 cm
Hairs on underside of lamina	Abundant, chestnut-brown or brown-tinged, non-glandular hairs on veins and midrib (to 2 mm), and sometimes on lamina margins	Dense, stout, ± colourless and red-brown, glandular hairs (to 0.5 mm) and occasional longer chestnut-brown, non-glandular hairs on veins and midribs	Abundant, colourless, glandular and non-glandular hairs on veins and midribs (to 1.5 mm)
Soral hairs	Absent	Absent	Absent
Soral protection	Unprotected, or slightly reflexed green flap with a few short hairs	Reflexed broad green lamina flap	Well-developed reflexed tapering mostly green flap often with a few hairs on the margin
Spore size	(31) 35–36 (40) x (19) 22–23 (26) µm	(32) 34–37 (40) x (20) 21–25 (28) µm	(34) 38–43 (48) x (20) 22–26 (28) µm

Table 1 continued

<i>H. tenuifolia</i>	<i>H. elegans</i>	<i>H. bamleriana</i>	<i>H. pallida</i>
3.5–15 mm	(2) 4–12 mm	2–5 mm	2–6 mm
Dark chestnut-brown below, becoming yellow-brown or green at apex	Dark chestnut-brown below, becoming yellow-brown or green near apex	Red-brown at base, but mostly dark chestnut-brown	Mostly red-brown or dark chestnut-brown, becoming yellow-brown near apex
Abundant, colourless, glandular and non-glandular hairs (to 5 mm); slightly rough	Abundant, colourless and brown-tinged, non-glandular hairs (to 1 mm); slightly rough	Fine, colourless, non-glandular hairs (to 0.3 mm) below, and dense, chestnut-brown, non-glandular hairs (to 0.8 mm) above; slightly rough	Abundant, colourless, and brown-tinged, non-glandular hairs (to 1 mm); \pm smooth
2–4 (5)-pinnate Broadly ovate to broadly elliptic 25–150 x 28–140 cm	2–4 (5)-pinnate Broadly ovate to broader than long (23) 35–100 (350) x (22) 35–80 (150) cm	2 (3)–4 (5)-pinnate Ovate 50–110 (200) x 30–130 cm	2–4-pinnate Broadly ovate to broader than long 25–90 (100) x 30–120 cm
Dense, fine, colourless, glandular and non-glandular hairs on veins and midribs (to 1 mm)	Abundant, colourless and brown-tinged, stiff, curved, sharply pointed, non-glandular hairs on veins and midribs (to 1.2 mm)	Dense, colourless and brown-tinged, non-glandular hairs on all surfaces (to 1 mm)	Dense, colourless or brown-tinged, stiff, often curved, non-glandular hairs on all surfaces (to 1.5 mm)
Absent	Absent	Absent	Absent
Well-developed reflexed broad membranous flap often with a few hairs on upper surface	Well-developed reflexed membranous flap	Well-developed reflexed partially membranous flap	Well-developed reflexed membranous flap
(29) 30–37 (43) x (18) 19–23 (27) μ m	(24) 26–30 (33) x (16) 17–20 (22) μ m	(26) 28–32 (34) x (17) 18–21 (23) μ m	(31) 34–38 (39) x (19) 21–23 (26) μ m

MATERIALS AND METHODS

This review of Malesian and Pacific species of *Hypolepis* is based largely on the investigation of some 1300 specimens from the following herbaria: BISH, BM, CANB, CHR, E, K, KYO, L, NSW and WELT. The personal collections of Dr M.G. Price from the Philippines and selected material (mostly of type status) from B, BRI, GOET, P, S, UPS and US have also been examined. Sheets in the above herbaria have been appropriately annotated, but, for the most part, only specimens with good locality data are listed here. No attempt has been made to produce accurate dot maps for distributions of individual species; rather, the general range is indicated by lines including or excluding the major islands or island groups.

Measurements given for all characters (except spores) indicate the full size range observed in the above material. The figures relating to spores are measurements of the exospore made from spores mounted in gum chloral. The range of mean values (based on a sample of 30 spores) for a specified number of collections is given for each species, the figures in brackets indicating the extreme sizes of individual spores.

Pinnules and hairs are illustrated by camera lucida drawings of lightly pressed specimens.

KEY TO MALESIAN AND PACIFIC SPECIES

- 1 a. Stipes prickly or very rough, bearing distinct spines, projecting conical hair bases or stiff recurved hairs; veins reaching margin at slight sinus or \pm straight edge; lamina capable of \pm indefinite, intermittent growth, often attaining several metres in length 2
- b. Stipes smooth or only slightly rough, lacking spines and obvious conical hair bases, bearing \pm straight unstiffened hairs; veins usually reaching margin at pinnule apex, never at a sinus; lamina of \pm finite growth, rarely > 1.5 m long 3
- 2 a. Stipes mostly dark red-brown, armed with distinct spines 1. *H. brooksiae*
- b. Stipes mostly yellow-brown, lacking distinct spines but very rough due to stiff, recurved hairs, and bluntly conical hair bases 2. *H. scabristipes*
- 3 a. Sori protected by distinct indusia which are entirely membranous and translucent 4
- b. Sori unprotected, or protected only by reflexed laminal flaps that are mostly or entirely green and opaque 7
- 4 a. Lamina bearing glandular and non-glandular hairs 11. *H. tenuifolia*
- b. Lamina bearing only non-glandular hairs 5
- 5 a. Hairs on lamina undersurfaces \pm straight when fresh, crinkly when dry (typical of most *Hypolepis* species); ultimate segments of lamina \pm straight; plants of scrambling habit 13. *H. bamleriana*
- b. Hairs on lamina undersurfaces stiff, curved and sharply-pointed when fresh, unaltered when dry; ultimate segments of lamina \pm sickle-shaped; plants not of scrambling habit 6
- 6 a. Stipes 4–12 mm diameter; pinnae arising at acute angles; spores $26-30 \times 17-20 \mu\text{m}$ 12. *H. elegans*
- b. Stipes 2–6 mm diameter; pinnae arising at wide angles; spores $34-38 \times 21-23 \mu\text{m}$ 14. *H. pallida*
- 7 a. Lamina bearing only non-glandular hairs (glandular hairs sometimes present in Hawaiian plants of *H. hawaiiensis*) 8
- b. Lamina bearing glandular and non-glandular hairs 10
- 8 a. Stipes 0.5–2 mm diameter; stipes and rachises bearing conspicuous chestnut-brown hairs (to 3 mm); plants of moss forest above 3000 m in New Guinea 8. *H. archboldii*

- b. Stipes 2–7 mm diameter; stipes and rachises bearing colourless or brown-tinged hairs, but lacking conspicuous chestnut-brown hairs; plants occurring below 3000 m 9
- 9 a. Hairs usually present in sorus; lamina undersurfaces abundantly covered in hairs up to 1.5 mm long; plants of Asia and western Malesia 4. *H. polypodioides*
- b. Hairs always absent from sorus; lamina undersurfaces sparsely covered in hairs up to 1 mm long, sometimes almost glabrous; plants endemic to Hawaii 3. *H. hawaiiensis*
- 10 a. Sori protected by reflexed, green laminal flaps 11
- b. Sori virtually unprotected 12
- 11 a. Glandular hairs on upper stipe and rachis mostly red-brown or chestnut-brown; long chestnut-brown non-glandular hairs usually present on undersurfaces of lamina midribs; spores 34–37 × 21–25 µm; plants of Southeast Asia and Malesia 9. *H. alpina*
- b. Glandular hairs on upper stipe and rachis mostly colourless; chestnut-brown non-glandular hairs absent from lamina undersurfaces; spores 38–48 × 22–26 µm; plants of Pacific 10. *H. dicksonioides*
- 12 a. Large ferns growing in extensive colonies; stipes 3–10 mm diameter; lamina 45–180 × 30–150 cm, normally 4-pinnate, densely covered in fine glandular hairs ... 5. *H. glandulifera*
- b. Smaller ferns growing in restricted patches; stipes 2–4 mm diameter; lamina 20–100 × 13–70 cm, normally 3-pinnate, sparsely covered in stout glandular hairs 13
- 13 a. Hairs present in sorus; plants found mostly above 1500 m 6. *H. malesiana*
- b. Hairs absent from sorus; plants found mostly below 1500 m 7. *H. punctata*

1. *Hypolepis brooksiae* Alderw. – Figs. 1A, 2.

Hypolepis brooksiae Alderw., Bull. Jard. Bot. Buitenz. II, 28 (1918) 29. – Holotype: C.J. Brooks 328/S (BO, not seen; isotype BM), Benkoelen, Lebong Simpang, Sumatra, Aug. 1917.
Hypolepis celebica C. Chr. in Kjellberg & C. Chr., Bot. Jahrb. Syst. 66 (1933) 58. – Holotype: G. Kjellberg 3549 (BO, not seen; isotypes BM - fragment only, S), B. Poka Pindjang, Celebes, 2500 m, 1929.

Rhizome long-creeping, 3–5 mm diameter, covered in chestnut-brown hairs up to 5 mm long. Stipes of unknown length, 4–8 mm diameter, dark red-brown or almost black, bearing red-brown non-glandular hairs up to 3 mm long and conical spines (hair bases) up to 0.8 mm long, prickly. *Lamina* stiff, coriaceous, capable of ± indefinite intermittent growth, the frond apex ceasing growth as successive pairs of pinnae develop, scrambling up through other vegetation to c. 10 m, 4-pinnate at base; rachises dark red-brown to chestnut-brown, covered in hairs similar to those of stipes and in conical and recurved spines up to 1 mm long, prickly; primary pinnae in subopposite pairs, up to at least 120 × 60 cm; secondary pinnae in subopposite pairs, arising at almost 90° to midrib of primary pinnae, ovate or narrowly ovate, up to at least 35 × 14 cm; tertiary pinnae alternate, narrowly ovate or narrowly triangular, winged, up to 8 × 2.5 cm but the basal acroscopic pinnae greatly reduced in length; quaternary pinnae ± parallel-sided to narrowly triangular, up to 1.3 × 0.6 cm, on largest specimens divided almost to midrib into rounded ultimate segments; veins reaching margin at a slight sinus (emarginate) or at ± straight edge. *Hairs*: brown-tinged and red-brown, non-glandular, up to 1 mm long, of very variable density, covering undersurfaces of lamina veins and pinna midribs, the pinna midribs also bearing curved and conical spines; sparser on upper surfaces; absent from lamina margins. *Sori* round or oval, sometimes slightly protected by small reflexed mem-

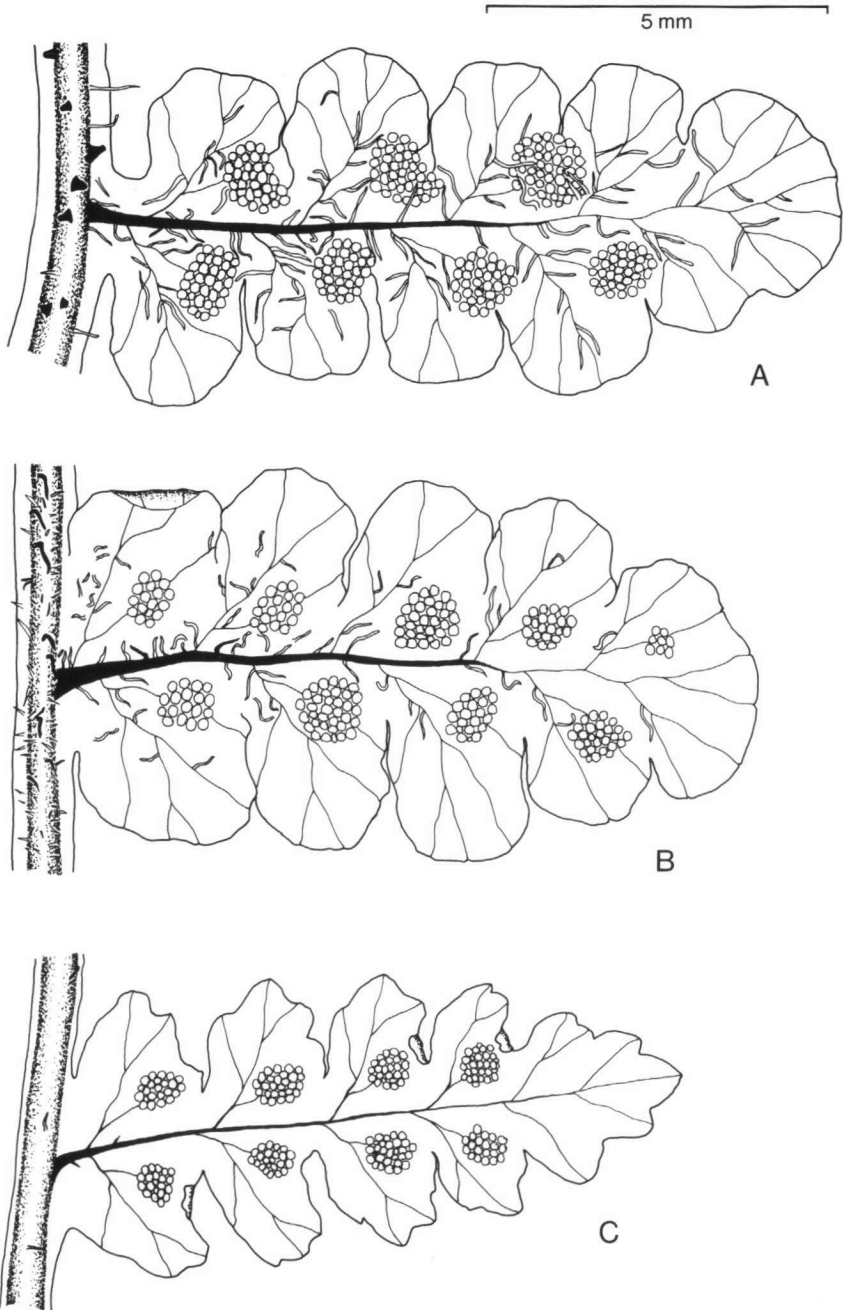


Fig. 1. Camera lucida drawings of pinnules. — A. *Hypolepis brooksiae* Alderw., *Holtum* 20566, Pahang (BM). — B. *H. scabristipes* Brownsey, *Millar & Holtum* NGF 18800, New Guinea (K). — C. *H. hawaiiensis* Brownsey, *Forbes* 1005H, Hawaii (MICH).

branous lamina segments but often unprotected, lacking obvious hairs amongst sporangia. Spores yellow-brown under light microscope, perispores \pm smooth or with very fine projections, $(30-32-36(-41) \times (18-20-22(-24) \mu\text{m}$ (3 populations: Borneo, New Guinea).

Distribution & Ecology. Sumatra (1100–1300 m), Peninsular Malaysia (1050–1500 m), Borneo (1450–1850 m), Sulawesi (2500 m), ?Flores, New Guinea (1700 m).

The distribution cannot be accurately determined from herbarium material alone because a large number of collections are sterile and cannot be distinguished in this state from *Dennstaedtia scandens*. In particular, sterile collections from Flores may be *Hypolepis brooksiae* but fertile collections are required for confirmation.

The species occurs at lower to mid-altitude elevations in open forest, along roadsides, tracksides and in open situations. It is a scrambling species, capable of continued intermittent apical growth according to Holttum (1958), that forms thickets in clearings and climbs to 10 m or more in forest. Holttum noted that most collections in peninsular Malaysia had come from clearings at new hill-stations.

SUMATRA. Mt Sibajak, Lörzing 11698 (L); Benkoelen, Brooks 4155 (BM); between Sidikalang and Pongkolan, Alston 14814 (BM).

PENINSULAR MALAYSIA. Pahang: G. Tahan, Holttum 20566 (BM, K); Fraser Hill, Holttum 11339 (K); G. Jasar, Parris 10957 & Wong (K). Perak: no collector (E).

BORNEO. Mt Kinabalu, Tenompok, Clemens 26809, 27789, 28366, 29485 (BM, K, L, MICH), Holttum 25411 (BM, K), Sinclair *et al.* 9232 (E, K, L); Ranau, Tamura & Hotta 72 (L).

SULAWESI. B. Poka Pindjang, Kjellberg 3549 (BM, S).

?FLORES. Verheijen 4394 (L).

NEW GUINEA. East: Boridi, Carr 14777 (BM, CANB, L); Morobe, Womersley & Millar NGF 8473 (BM, BRI, CANB, L, NSW).

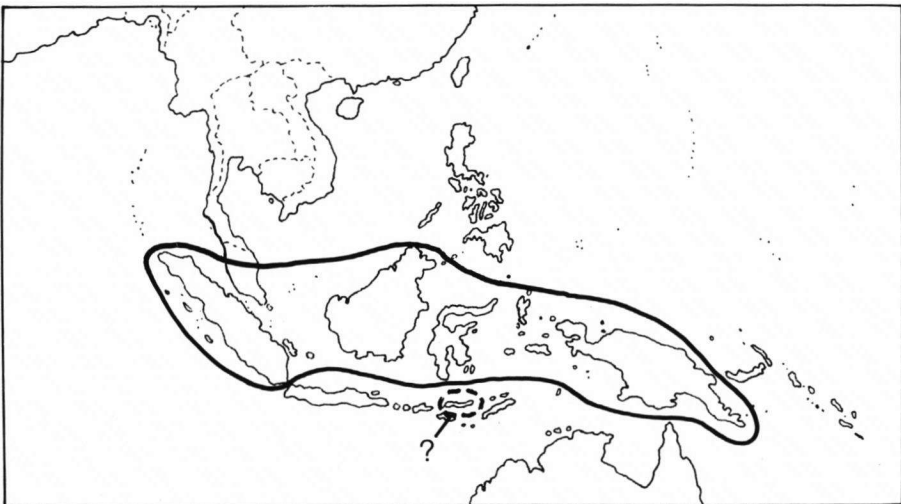


Fig. 2. Distribution of *Hypolepis brooksiae* Alderw. Broken line indicates origin of material of uncertain identity.

Notes. As was noted by Christensen (1943: 33), herbarium material of *Hypolepis brooksiae* bears a quite remarkable similarity to *Dennstaedtia scandens*. In fertile material of *D. scandens*, a careful dissection of the sorus will reveal a small and inconspicuous inner indusium typical of *Dennstaedtia*, whilst the spores are tetrahedral, quite different to the bilateral spores of *Hypolepis*. The two species are therefore fundamentally different, but since herbarium material is often sterile, it is difficult to determine the full extent of the distribution of *H. brooksiae*. It is notable that two species of *Hypolepis* (*H. aculeata* and *H. papuana*) have been proposed based on material of *Dennstaedtia scandens* but are here reduced to synonymy (see p. 272).

Another name, *H. celebica*, is more difficult to place. The only type material I have seen consists of a fragment in BM and a more complete specimen in S. The latter has the stipe and rachis spines typical of *H. brooksiae*, and appears to lack an inner indusium, but the spores do not have such long projections as on other collections of *H. brooksiae*. Christensen (in Kjellberg & Christensen, 1933) noted that *H. celebica* differed from *H. brooksiae* in being 'less divided, tripinnate instead of quadripinnate, and by the total absence of soft articulated hairs on the ribs beneath.' However, in the absence of other material from Sulawesi, I regard the type of *H. celebica* as part of the range of variation in *H. brooksiae*.

Hypolepis brooksiae cannot be confused with any other species of *Hypolepis*, with the possible exception of the newly described *H. scabristipes* (see below). The prickly stipes, scrambling frond, thicket-forming habit, and the cessation of apical growth whilst successive pairs of pinnae develop, are very characteristic. The smooth spores and slightly emarginate vein endings on the ultimate segments are also distinctive. The similarity of *H. brooksiae* to *H. distans* Hook. from New Zealand and *H. nigrescens* Hook. from Central and South America has already been discussed in detail by Brownsey (1983). The unusual chromosome numbers of $n = 28$ and $n = 29$ in the latter two species compared to the more usual base number of $x = 26$ in other species suggests that they belong to a separate evolutionary line and may provide a link between *Dennstaedtia* and *Hypolepis*. It would be very useful to obtain a chromosome number from *H. brooksiae* to see if cytology supports the morphological connection with *H. distans* and *H. nigrescens* on one hand, and *Dennstaedtia scandens* on the other.

Material from New Guinea is slightly different to that from Malaysia and Sumatra in having more or less glabrous, rather than hairy, pinnales, and having more dissected fronds with smaller ultimate segments. Further investigation of all aspects of the distribution, morphology and cytology of this species is highly desirable.

2. *Hypolepis scabristipes* Brownsey, *spec. nov.* — Figs. 1B, 3.

Rhizoma longerepens, 3–5 mm diametro, pilis castaneis usque ad 2 mm longis. Stipes longitudine ignoto 5–7 mm diametro basi castaneus apice fulvus, pilis multis rigidis crassis recurvis rufescentibus non-glanduliferis usque ad 0.6 mm longis basibusque pilorum brevibus conicis atrorufescentibus asperis vestitus. Lamina rigida, coriacea, scandens, usque ad c. 8 m longa, basi quadripinnata. Rhachis subcastanea vel fulva, pilis basibusque pilorum vestita. Pinnae primariae suboppositae, minimae 60 cm longae et 60 cm latae (probabiliter magniores). Pinnae secundariae suboppositae vel alternae, ad angulum fere 90° patentes, anguste ovatae, usque ad 50 cm longae et 19 cm latae.

Pinnae tertiariae alternae, anguste ovatae vel anguste triangulatae, usque ad 11 cm longae et 3.5 cm latae, sed pinnae basales acroscopicae deminutae. Pinnae quaternariae \pm lineares, obtusae, usque ad 1.7 cm longae et 0.8 cm latae, longissimae in segmenta rotundata divisae. Apices segmentorum ultimorum emarginati. Paginae inferiores venarum costarumque pilis multis subfuscis rufescentibusque non-glanduliferis saepe recurvis usque ad 0.6 mm longos, paginae superiores pilis sparsioribus brevioribusque vestitae; margines sine pilis. Sori rotundi vel ovoides, non obiecti, inter sporangia sine pilis, inter costam marginemque laminae positi. Sporae pallidae, perisporae projecturis reticulatis, $(28-31-34(-39) \times (17-18-22(-24)) \mu\text{m}$. – *Holotype*: Millar & Holtum NGF 18800 (L; isotypes BRI, CANB, K), Kauli Creek, near Wau, Morobe District, Papua New Guinea, 3500', 1 Aug. 1963.

Rhizome long-creeping, 3–5 mm diameter, covered in chestnut-brown hairs up to 2 mm long. Stipe of unknown length, 5–7 mm diameter, chestnut-brown at base, yellow-brown above, densely covered in stiff, stout, recurved, red-brown, non-glandular hairs up to 0.6 mm long which break off with age to leave short, projecting, dark red-brown, bluntly conical hair bases that make the stipe very rough. *Lamina* stiff, coriaceous, capable of \pm indefinite, intermittent growth, scrambling up through other vegetation to c. 8 m, 4-pinnate at base; rachises pale chestnut-brown or yellow-brown, covered in hairs and hair bases similar to those of stipe; primary pinnae in subopposite pairs, of unknown size, but at least 60 cm long (probably much more) and 60 cm wide; secondary pinnae in subopposite pairs or alternate, arising at almost 90° to midrib of primary pinnae, narrowly ovate, up to 50×19 cm; tertiary pinnae alternate, narrowly ovate or narrowly triangular, up to 11×3.5 cm but the basal acroscopic pinnae somewhat reduced; quaternary pinnae \pm parallel-sided, obtuse, up to 1.7×0.8 cm, on largest specimens divided half-way to midrib into rounded ultimate segments; veins reaching margin at a slight sinus (emarginate) or at \pm straight edge. *Hairs*: brown-tinged and red-brown, non-glandular (or sometimes glandular in Malaysian specimens), often strongly recurved, up to 0.6 mm long, densely covering undersurfaces of lamina veins and pinna midribs; much shorter and sparser on upper surfaces; absent from lamina margins. *Sori* round or oval, situated about $1/2-2/3$ distance from midrib to lamina margin, unprotected, lacking hairs amongst sporangia. *Spores* pale under light microscope, perisporae with reticulate projections, $(28-31-34(-39) \times (17-18-22(-24)) \mu\text{m}$ (3 populations: New Guinea).

Distribution & Ecology. Sumatra, Peninsular Malaysia (1850–1930 m), New Guinea (1050–2750 m).

This species is known only from a few collections from Sumatra, Malaysia and New Guinea. It is a scrambling or climbing plant which can reach up to 8 m high in forest, on forest margins or in regenerating forest.

SUMATRA. L. Pondom, *Surbeck 1064* (L); Kerintji, *Alston 14104* (BM); Sidikalang-Hariarapitu, *Alston 15173* (BM).

PENINSULAR MALAYSIA. Pahang: G. Ulu Kali, *Piggott* (K); G. Batu Brinchang, *Parris 10940* (K).

NEW GUINEA. Star Mts, Telefomin, *Croft LAE 65710* (L); McAdams Pk, *Gideon 25* (K, L); Kauli Ck, Wau, *Millar & Holtum NGF 18800* (BRI, CANB, K, L); Mt Tafa, *Cheeseman 355* (K).

Notes. *Hypolepis scabrastipes* is closely related to *H. brooksiae* and has the same unusual growth form and scrambling or climbing habit, as well as emarginate vein endings. It differs from *H. brooksiae* in having a stipe which is paler in colour

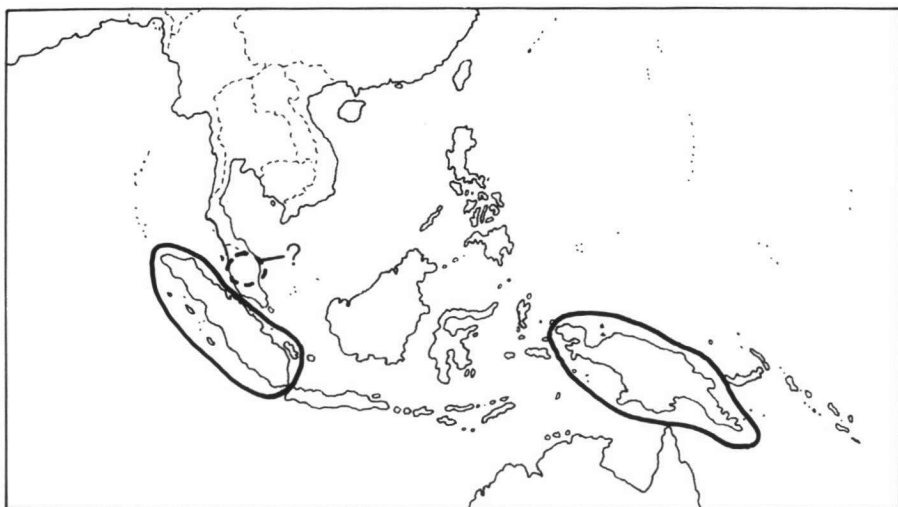


Fig. 3. Distribution of *Hypolepis scabristipes* Brownsey. Broken line indicates origin of material of uncertain identity.

and densely covered in stiff, recurved hairs or hair bases that give it the texture of sandpaper, unlike the darker, prickly stipe of *H. brooksiae*. The hairs on the lamina surfaces of *H. scabristipes* are strongly recurved unlike those in *H. brooksiae* which are straight or only slightly curved. The sori in *H. scabristipes* are situated well away from the margins, and totally unprotected whereas in *H. brooksiae* they are near the margins and sometimes slightly protected by an incurved marginal flap.

Sumatran material of *H. scabristipes* has longer (up to 1.3 mm), less strongly recurved hairs on the lamina undersurfaces compared to New Guinea specimens which have hairs to 0.6 mm long. Such a distinction could reflect a more fundamental difference between populations on these two islands. Cytological investigation is desirable.

Populations from peninsular Malaysia have glandular hairs and are, in this respect, quite different to both Sumatran and New Guinea material. Specimens are in cultivation at Kew and should be investigated further.

3. *Hypolepis hawaiiensis* Brownsey, *spec. nov.* — Figs. 1C, 13.

Phegopteris punctata var. *glabra* Hillebrand, Fl. Hawaiian Isl. (1888) 562. — Lectotype: herb. W. Hillebrand (B 74643), Mt Kaala, Oahu, no collector or date.

Phegopteris punctata var. *mauiensis* Hillebrand, Fl. Hawaiian Isl. (1888) 563. — Lectotype: herb. W. Hillebrand (B 74679), Maui, 1870, no collector.

Rhizoma longerepens, 2–4 mm diametro, pilis subcastaneis usque ad 2 mm longis vestita. Stipes 15–95 cm longus, 2.5–7 mm diametro, basi rufescente, leviter aspero, pilis sparsis hyalinis vel castaneis non-glanduliferis usque ad 2 mm longis vestita, apice castaneo, saepe laevi vel polito,

glabro. Lamina ovata, late ovata vel late triangulata, (10–)25–75(–100) cm longa et (9–)18–80 cm lata, apice 2-pinnato, basi 3–4-pinnata. Rhachis subcastanea vel fulva, pilis sparsis subfuscis vel hyalinis non-glanduliferis usque ad 1 mm longis vestita, interdum praeter sulcum glabra in pagina superiore. Pinnae primariae 15–25-jugatae, oppositae vel suboppositae, praeter infimas late angulatae, prope basin longissimae repertae (6–)13–48 × (4.5–)8–27 cm, superiores anguste ovatae, inferiores ovatae. Pinnae secundariae ± lineares, anguste ovatae, anguste triangulatae vel ovatae, late angulatae, longissimae (2.5–)4.5–16 × (1.5–)2–7 cm. Pinnae tertiariae ± lineares, anguste ovatae vel anguste triangulatae, late angulatae, (0.7–)1–3.5 × (0.3–)0.4–1.5 cm, obtusae, dentatae vel in pinnas quaternarias usque ad 0.8 × 0.4 cm divisae. Venae ad marginem in apicibus dentium attingentes. Paginae inferiores venae costaeque interdum glabrae, plerumque pilis sparsis crassis fuscis vel hyalinis non-glanduliferis usque ad 1 mm longos, raro pilis glanduliferis vestitae; margines sine pilis. Sori rotundi vel ovoides, procul a margine exorientes, non obtecti vel pinnularum marginibus reflexis viridibus partim obtecti. Sporae pallidae, perisporae projecturis complanatis interconnexis, (30–)33–37(–40) × (21–)22–25(–28) μm. – Holotype: *D. Herbst & S. Ishikawa 5451* (BISH 410211, 2 sheets), Puu Waa Waa Ranch, North Kona, Hawaii, 27 Aug. 1975.

Rhizome long-creeping, 2–4 mm diameter, covered in pale chestnut-brown hairs up to 2 mm long. Stipes 15–95 cm long, 2.5–7 mm diameter, red-brown, slightly rough and bearing scattered colourless or chestnut-brown non-glandular hairs up to 2 mm long below, chestnut-brown and often almost glabrous, smooth or polished above, producing roots at very base. *Lamina* ovate, broadly ovate or rhombic, (10–)25–75(–100) × (9–)18–80 cm, 2-pinnate at apex, 3–4-pinnate at base; rachises pale chestnut-brown or yellow-brown, bearing scattered pale brown or colourless non-glandular hairs up to 1 mm long, sometimes almost glabrous except along upper groove; primary pinnae in 15–25 pairs, opposite or subopposite, all except the lowest arising at wide angles to the rachis, the longest at or near the base (6–)13–48 × (4.5–)8–27 cm, the upper ones narrowly ovate, the lower ovate; secondary pinnae ± parallel-sided, narrowly ovate, narrowly triangular or ovate, arising at wide angles, the longest (2.5–)4.5–16 × (1.5–)2–7 cm; tertiary pinnae ± parallel-sided, narrowly ovate or narrowly triangular, arising at wide angles, (0.7–)1–3.5 × (0.3–)0.4–1.5 cm, obtuse, those on smaller fronds toothed, those on larger fronds divided into quaternary pinnae up to 0.8 × 0.4 cm; veins reaching margins at tooth apices. *Hairs*: sometimes almost lacking, usually sparse, stout, brown or colourless, non-glandular or occasionally glandular, up to 1 mm long, on undersurfaces of pinna midribs and lamina veins; similar non-glandular hairs on upper surfaces of pinna midribs; absent from lamina margins. *Sori* round or oval, originating away from margins, unprotected or only slightly protected by partially reflexed green lamina segments. *Spores* pale under light microscope, perispores with interconnecting flattened projections, (30–)33–37(–40) × (21–)22–25(–28) μm (5 populations: Hawaii, Maui, Oahu, Laumaia, Kauai).

Distribution & Ecology. Hawaiian Islands: Hawaii, Maui, Oahu, Laumaia, Kauai (800–2000 m). In forest, along tracksides, around bogs and in pastureland.

HAWAIIAN ISLANDS. Hawaii: Kalua, *Faurie 405* (MICH); Palakea, *Forbes 1005H* (BISH, MICH); N. Kona, *Herbst & Ishikawa 5451* (BISH). – Maui: Puu Kukui, *Cranwell & Skottsberg* (BISH), *Wagner 65379 & Tessene* (MICH); Haleakala, *Forbes 2608M* (BISH); Kipahulu, *Forbes 1732M* (BISH, WELT); Makawao Forest, *Wagner 5156, Wagner et al. 9524* (MICH); Haleakala, *Skottsberg s.n.* (BM). – Oahu: Mt Kaala, *Wagner 65311* (MICH); Mt Konahuanui, *Garber 317* (BISH). –

Laumaia: Neal & Hartt 826 (BISH). — Kauai: Kaholuamanoa, Heller s.n. (BISH, BM); Kauhao, Faurie 407 (MICH); Alakai swamp, Wagner 5496 (MICH).

Notes. *Hypolepis hawaiiensis* has a smooth stipe, often entirely lacks glandular hairs and sometimes has an almost glabrous lamina. It lacks hairs in the sorus, and it has virtually no protective marginal flap covering the sorus. Thus, it is identified by its lack of distinctive features rather than by any positive characteristic.

Earlier authorities (Hillebrand, 1888; Robinson, 1912; Christensen, 1925) have referred most Hawaiian material to *Hypolepis punctata*, or combinations based on this type. However, as noted below (p. 252), *H. punctata* is here regarded as a species confined to Southeast Asia. It is closely related to *H. hawaiiensis* but is distinguished by its rather less divided and less coriaceous frond, and by its abundance of glandular hairs which are always present on the frond. In my opinion, the Hawaiian plant is sufficiently distinct, both morphologically and geographically, to warrant recognition at the species level, and is accordingly described here as a new species. It has been deemed prudent to give the species a new name, rather than raise one or other of Hillebrand's varietal names to specific rank, because of the uncertainty surrounding their exact identity.

Previous attempts to recognise separate taxa within this species have served only to obscure the characteristic endemic nature of the Hawaiian plants. Hillebrand (1888) referred Hawaiian material to four varieties of *Phegopteris punctata*: var. *glabra*, var. *mauiensis*, var. *rugosula*, and var. *flaccida*. Var. *glabra* was considered to be the typical form on most of the islands whilst var. *mauiensis* was distinguished by its viscid hairs. Var. *rugosula* and var. *flaccida* were described from single unlocalised collections, the latter presenting a special problem which is considered further below. I doubt that Hillebrand's varieties are otherwise worthy of recognition, although further investigation in the field may prove me wrong. The presence of viscid hairs, supposedly characteristic of var. *mauiensis*, is probably determined by the habitat of the plant and is a variable feature in this species that is of little taxonomic significance; New Zealand plants of *H. ambigua* are similarly variable. Var. *flaccida* is described from a fragment of a pinna and may not even be from Hawaii. Var. *rugosula* I have not seen, but Hillebrand's specimen was unlocalised and he himself implied that it was close to Australian material of *H. rugosula*. Christensen (1925: 17) states that it '.... is doubtfully indigenous in the islands.'

Robinson (1912) considered that two species were present on the Hawaiian islands: *H. punctata*, including Hillebrand's var. *glabra*, with quadripinnate fronds and brown or pale stipes, and *H. flaccida*, a new combination based on Hillebrand's var. *flaccida*, with bipinnate fronds and purplish red stipes. Her description of *H. flaccida* fits Hillebrand's specimen in B, but although she stated that the type locality for the species was the Hawaiian islands, Hillebrand's specimen is unlocalised and, in my opinion, unlikely to be of Hawaiian origin. Moreover, Robinson does not actually cite this specimen, but gives only 'Baldwin 80' in her list of material examined. Specimens so numbered (in E, NY) are entirely typical of the plant Robinson called *H. punctata*, suggesting that her concept of *H. flaccida* was somewhat confused. Not only the origin, but also the identity of Hillebrand's specimen in B is uncertain. Hillebrand himself considered it very similar to *H. poeppigii* from South America or *H.*

rugosula from Australia, and with this I would agree. Whatever its true identity, it is quite different to the typical Hawaiian plant, and is therefore not a valid name for this species. It is listed here as *incertae sedis* (p. 271).

4. *Hypolepis polypodioides* (Blume) Hook. – Figs. 4A, 5.

Hypolepis polypodioides (Blume) Hook., Sp. Fil. (1852) 63. – *Cheilanthes polypodioides* Blume, Enum. Pl. Javae (1828) 139. – Lectotype: C.L. Blume (L, 2 sheets), Tjiruk tjipannas, Java, May 1823.

Rhizome long-creeping, 1.5–4 mm diameter, covered in chestnut-brown hairs up to 2 mm long. Stipes 20–90(–110) cm long, 2–5 mm diameter, chestnut-brown at base, yellow-brown or chestnut-brown above, covered in brown-tinged non-glandular hairs up to 2 mm long, \pm smooth. *Lamina* ovate or broadly ovate, (21–)35–125 \times 25–55(–85) cm, 2-pinnate at apex, 3–4-pinnate at base; rachises chestnut-brown or yellow-brown at base, yellow-brown at apex, covered in colourless or brown-tinged non-glandular hairs up to 1 mm long; primary pinnae in 18–25 pairs, opposite or subopposite, the longest at or near the base (13–)15–55 \times 7.5–35 cm, the upper ones narrowly ovate or narrowly triangular, the lower ones ovate or triangular; secondary pinnae \pm parallel-sided to narrowly ovate or narrowly triangular, the longest 4.5–18 \times 1.6–7.5 cm; tertiary pinnae \pm parallel-sided, obtuse, the longest 0.8–4 \times 0.4–1.5 cm, divided into quaternary pinnae up to 0.8 cm long on largest fronds; veins reaching margins at tooth apices. *Hairs*: colourless or brown-tinged, non-glandular, up to 1.5 mm long, on undersurfaces of lamina veins and pinna midribs; similar but generally shorter on upper surfaces; sometimes present on lamina margins, up to 0.3 mm long. *Sori* round or oval, originating away from margin, unprotected or only partially protected by slightly reflexed green lamina segments, non-glandular hairs up to 0.4 mm amongst sporangia. *Spores* very pale under light microscope, perispores with interconnecting flattened projections, (32–)34–38(–40) \times (20–)23–25(–27) μ m (10 populations: Nepal, India, China, Taiwan, 'Indochina', Thailand, Philippines, Java, Flores).

Distribution & Ecology. Northwest India (1250–2300 m), Nepal (1250–2350 m), southern China (100–2600 m), Taiwan (800 m), Burma (1550 m), mainland Southeast Asia (1200–1700 m), Peninsular Malaysia, Java (1200–2200 m), Flores (1000–1200 m), Philippines (Luzon) (2750 m).

This is a widespread species extending from the Himalayas through southern China to mainland Southeast Asia. It also occurs in Taiwan, Luzon, Java and Flores but no specimens from Sumatra have been seen.

Almost nothing about its habitat preferences in the Malesian region can be gleaned from herbarium labels, but in the Himalayan region the plant occurs mostly in open situations, along roadsides, amongst boulders or by streams, and only occasionally in forests.

PENINSULAR MALAYSIA. Pahang, G. Ulu Kali, Piggott 2421 (K).

JAVA. G. Gedeh, Blume (L); Baerangrang, Blume (L); Jang Plateau, van Steenis 11042 (L), Hoogerwerf 440 (L); Tengger Mts, Mousset s.n. (L); Priangan, G. Perbakti, Bakhuizen van den Brink 7309 (L).

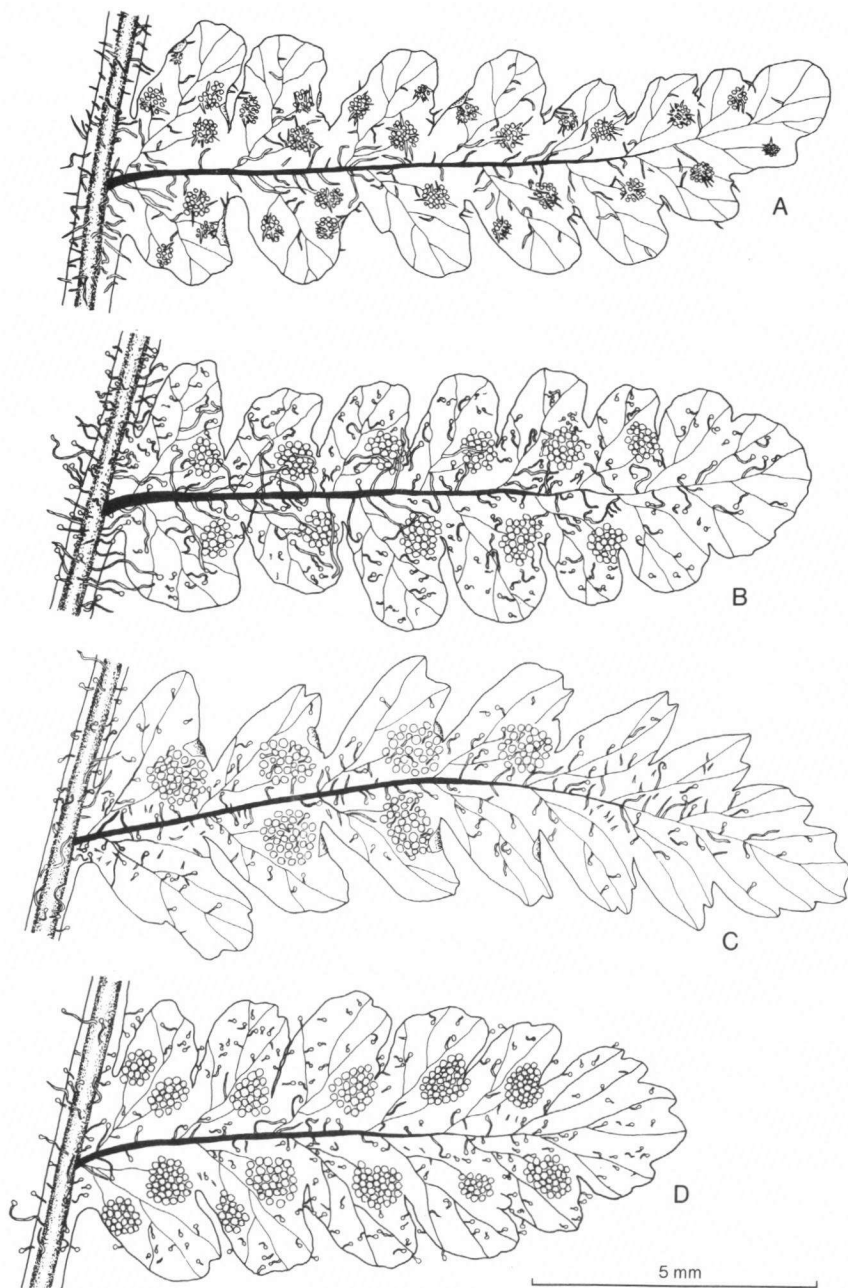


Fig. 4. Camera lucida drawings of pinnules. A. *Hypolepis polypodioides* (Blume) Hook., *Kostermans & Wirawan* 793, Flores (L). – B. *H. glandulifera* Brownsey & Chinnock, *Chinnock* 5646 & *Brownsey*, Australia (WELT). – C. *H. malesiana* Brownsey, *Walker* ANU 717, New Guinea (CANB). – D. *H. punctata* (Thunb.) Mett. ex Kuhn, *Matthew* s.n., Perak (K).

FLORES. Bealaing-Rana Messe, 1200 m, *Kostermans & Wirawan* 793 (K, L), *Jaag* 1638 (L).

PHILIPPINES. Luzon: Mt Pulog, *Copeland* (MICH); Baguio, *LeRoy Topping* 290, 291 (BISH); Bontoc-Baguio, *Price* 1144, 1145 (Price, pers. herb.).

Notes. This species is recognisable by its generally light-coloured stipe and rachis, the covering of non-glandular hairs on the lamina, the absence of well-defined membranous flaps protecting the sori, and the presence of hairs in the sori. In the Malesian region, the only other species with the latter character are *H. malesiana* and occasionally *H. glandulifera*, both of which are immediately distinguished by the presence of glandular hairs on the lamina.

Chromosome counts of $n = c.102$ and $n = 104$ have been reported for plants referred to *H. punctata* from Darjeeling, Mussoorie and the Kathmandu Valley in the Himalayan region (Mehra & Khanna, 1959; Mehra & Verma, 1960; Roy et al., 1971). However, *H. polypodioides* is a much more common fern in these areas than *H. punctata* (as defined here) and it is likely that the counts actually originated from plants of the former species, although this obviously requires confirmation.

Four new species, *H. coerulescens*, *H. indica*, *H. sikkimensis* and *H. viridula*, have recently been described from Sikkim and West Bengal by Biswas (1985). Their descriptions suggest that they are similar to both *H. polypodioides* and *H. punctata*, but determining their exact relationships requires examination of the type specimens. They are listed here as *incertae sedis*.

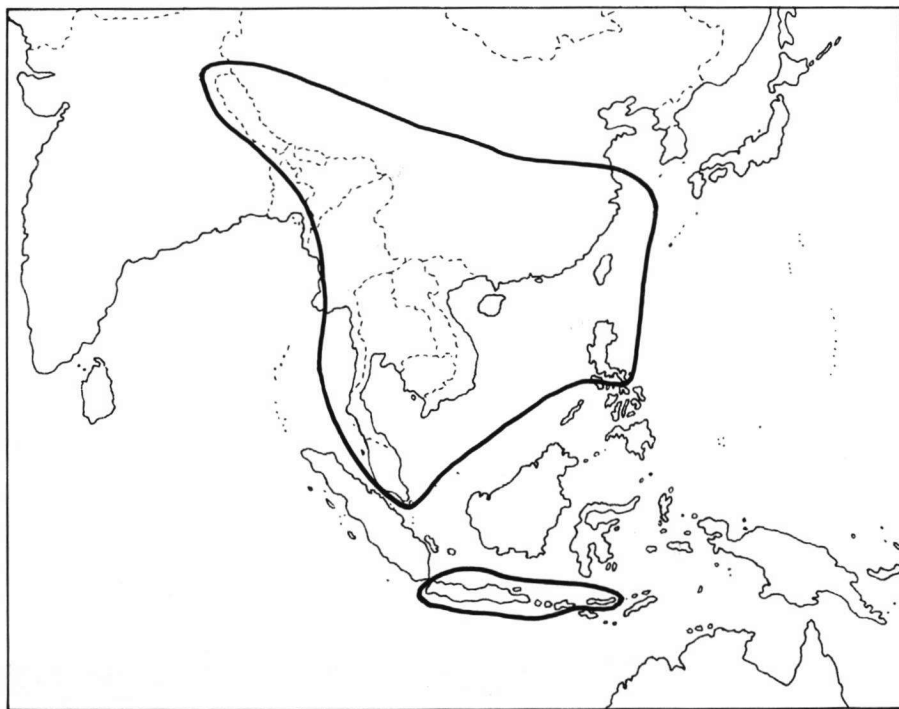


Fig. 5. Distribution of *Hypolepis polypodioides* (Blume) Hook.

5. *Hypolepis glandulifera* Brownsey et Chinnock — Figs. 4B, 6.

Hypolepis glandulifera Brownsey et Chinnock, J. Adelaide Bot. Gard. 10 (1987) 16. — Holotype: R.J. Chinnock 5646 & P.J. Brownsey (WELT P11585; isotypes AD, CBG, NT), Millaa Millaa Falls, Queensland, Australia, 10 Oct. 1982.

Cheilanthes dicksonioides var. *phyllochlaena* Kunze, Linnaea 24 (1851) 275. — Lectotype: R.F. Hohenacker 909 (B 74774-5; isoelectotypes BM, K), in montibus Nilagiri.

Rhizome subterranean, long-creeping, 4–8 mm diameter, densely covered in soft red-brown hairs up to 0.5 mm long. Stipes 28–120 cm long, 3–10 mm diameter, chestnut-brown at base, yellow-brown above, densely covered in hairs similar to those of rhizome at base, sparsely hairy above, slightly rough, often producing roots at the very base. *Lamina* broadly ovate or slightly broader than long, 45–180 × 30–150 cm, 2-pinnate at apex, 4-pinnate at base; rachises yellow-brown throughout, densely covered in fine colourless or brown-tinged glandular and non-glandular hairs up to 1 mm long; primary pinnae in 20–30 pairs, opposite or subopposite, the longest at or near the base 21–65 × 10–48 cm, upper ones narrowly ovate or narrowly triangular, the lower ones ovate; secondary pinnae ± parallel-sided to narrowly ovate or narrowly triangular, the longest 6–25 × 2–11 cm; tertiary pinnae ± parallel-sided, 1–6 × 0.4–2 cm; quaternary pinnae obtuse to acute, 1–10 mm long, themselves deeply divided in largest fronds. Veins reaching margin at tooth apices. *Hairs*: fine, colourless, glandular and non-glandular, densely covering undersurface of lamina, lamina veins and pinna midribs, with some brown-tinged hairs mostly on the midribs, 0.1–1 mm long; similar hairs on upper surfaces but less dense except on the midribs; rare on the lamina margins. *Sori* round, originating away from margin, unprotected, or protected only by partially reflexed green lamina segments, lacking hairs amongst mature sporangia but sometimes with fine glandular hairs when very young. *Spores* very pale under light microscope, perispore with interconnecting flattened projections, (29–)32–35(–37) × (17–)18–26(–29) μm (13 populations: India, Sri Lanka, Java, Borneo, New Guinea, Australia, New Caledonia).

Distribution & Ecology. Southern India (1300–2300 m), Sri Lanka (1850 m), China (Hainan) (900 m), Sumatra (1000–1800 m), Java (900–2000 m), Bali, Lombok (2000–3000 m), Borneo (900–1650 m), Philippines (1000–1200 m), Moluccas, New Guinea; eastern Australia (100–1600 m); New Caledonia (500 m).

Hypolepis glandulifera has a very wide distribution from southern India throughout the Malesian region to Australia and New Caledonia. It occurs in lower to mid-altitude areas and is primarily a fern of disturbed ground, dominant in the early stages of succession after clearance of forest or abandonment of cultivated land. It is found also along forest trails, in clearings, in regenerating forest and on forest margins.

SUMATRA. Takegeun, Iwatsuki *et al.* 1436 (KYO); Lake Tawar, Jochems 284 (L); S. Sibreatan, Surbeck 1138 (L); Mt Luste, Surbeck 979 (L); L. Pandom, Surbeck 713 (L).

JAVA. Tjitere, Holstvoogd 709 (NSW); G. Pangerango, Buse *s.n.* (L); Preanger Pengalengan, Hochreutiner *s.n.* (L); Teloga Bodas, Brooks J17 (BM); Tjibodas, Priangan, Sapiin 2852 (K, L); G. Boerangrang, Matthew *s.n.* (K), Dieng Plateau, 2000 m, Murata *et al.* J1179 (L); Tengger Mts, Mousset *s.n.* (L); Tengger, Lawang, Mousset 4 (MICH).

BALI. Kintamani, Holstvoogd 829 (L).

LOMBOK. G. Rindjani, *Tengwall s.n.* (K, L).

BORNEO. Mt Kinabalu, Kundasang, *Clemens 29110, 29239* (BM, CANB, K, L), Tenompok, *Clemens 26980, 29497* (BM, CANB, K, L), *Holttum 25299* (BRI, K).

PHILIPPINES. Luzon: Hights Place, *Quisumbing & Sulit s.n.* (MICH); Pauai, *Merrill 8381* (NSW). – Mindanao: Mt Apo, *ANU 1527, 1672* (CANB, L).

NEW GUINEA. Daimandi, *Walker 7972* (BM); Wagau, *Jermy 4552* (BM); Mt Albert Edward, *Croft & Marsh 1520* (NSW).

NEW CALEDONIA. Haute Diahot, *McKee 19969* (CHR).

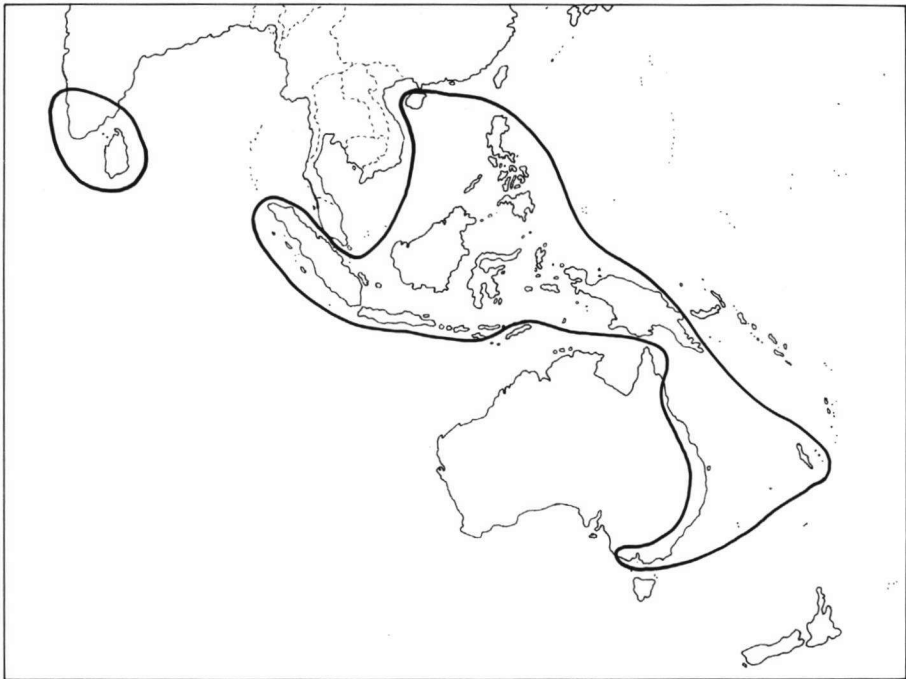


Fig. 6. Distributon of *Hypolepis glandulifera* Brownsey & Chinnock.

Notes. *Hypolepis glandulifera* is recognisable by its large and quadripinnate fronds, yellow-brown stipes, abundant fine glandular hairs on the lamina, and the absence of well-developed indusia. Hairs are normally absent from mature sori, but fine glandular hairs can sometimes be detected in very young sori. Its habit of growing in extensive colonies in disturbed areas is also characteristic. Herbarium material can be confused with *H. alpina*, but the latter has red-brown stipes, at least partially reflexed membranous flaps over the sori, and a sparser covering of stout hairs. Some specimens of *H. punctata* are also similar to *H. glandulifera*, but the fronds are smaller (22–100 × 17–70 cm cf. 45–180 × 30–150 cm), generally only tripinnate at the base, have a sparser covering of hairs on the lamina undersurface, and often have some hairs on the lamina margins.

A chromosome number of $n = 52$ has been reported for *H. glandulifera* from Australia (Brownsey & Chinnock, 1987). This same number has also been recorded for Sri Lanka (Manton & Sledge, 1954) and southern Indian plants (Ghatak, 1977; Bir & Vasudeva, in Löve, 1978) identified as *H. punctata* by these authors, but almost certainly belonging to *H. glandulifera*. The latter species is therefore cytologically distinct from at least the Japanese populations of *H. punctata* which have $n = 98$ (see Brownsey, 1983, for original references). The chromosomal difference is reflected in the spore size of the two species, *H. glandulifera* having rather smaller spores than *H. punctata* ($32-35 \times 18-26 \mu\text{m}$ cf. $34-39 \times 23-26 \mu\text{m}$). However, Ghatak (1977) reports a chromosome number of $n = 104$ in another population of southern Indian *Hypolepis*, the identity of which is unclear.

Biswas (1984, 1985) recognises two species of *Hypolepis* from southern India which he refers to *H. rugosula* (Labill.) J. Smith and a new species, *H. longa* Biswas. Without access to his material, his concept of these species is unclear, but, in my opinion, *H. rugosula* is endemic to southern Australia (Brownsey & Chinnock, 1987). The relationship of *H. glandulifera* to *H. longa*, which is listed here as *incertae sedis*, requires further investigation, particularly in view of Ghatak's report of two cytotypes in southern Indian populations of *Hypolepis*.

Hypolepis glandulifera has only recently been described as a new species based on Australian material (Brownsey & Chinnock, 1987). Previously, most authors had included it in *H. punctata* which is here interpreted more narrowly. However, the taxon was probably first recognised as distinct by Kunze (1851) who described material from the Nilghiri Hills in southern India as *Cheilanthes dicksonioides* var. *phyllochlaena*. Although the description is inadequate, several specimens from the cited collections are still extant and all are *H. glandulifera*.

Unfortunately on the same page as he described *Cheilanthes dicksonioides* var. *phyllochlaena*, Kunze also described another new species, *Cheilanthes resistens*, from the same locality. Although longer, the description is still inadequate to identify the taxon — even Hooker (1858: 65) was moved to write 'instead of the copious specific character occupying just half a page of the Linnaea, we wish the able author could have given us a figure, which would have been far more intelligible.' Kunze likened it to the American *Hypolepis repens* Presl, but it is most unlikely to be that species. Indeed, only one, or possibly two, species, are known today from southern India, but neither some aspects of the description of *Cheilanthes resistens*, such as purple-brown stipes, nor Kunze's recognition of *Cheilanthes dicksonioides* var. *phyllochlaena*, which is undoubtedly synonymous with *Hypolepis glandulifera*, as a distinct taxon, encourage the idea that *Cheilanthes resistens* is also an earlier name for *Hypolepis glandulifera*. Unfortunately no authentic specimen of *Cheilanthes resistens* has been found in any of the herbaria where the remains of Kunze's specimens are located. The name is therefore treated here as *incertae sedis* (p. 271).

6. *Hypolepis malesiana* Brownsey, *spec. nov.* — Figs 4C, 7.

Rhizoma longerepens, 2–3 mm diametro, pilis rufescentibus usque ad 1.5 mm longos vestita. Stipes (7–)25–50 cm longus, 2–3.5 mm diametro, \pm laevis, basi atrocastanea, pilis sparsis rufes-

centibus vestita, apice subcastaneo vel fulvo, pilis sparsis subfuscis glanduliferis non-glanduliferisque usque ad 0.5 mm longis vestito. Lamina ovata vel elliptica, 28–60 cm longa et 13–30 cm lata, apice 2–3-pinnata, basi 3–4-pinnata, rhachis subcastanea vel fulva, pilis multis subfuscis, glanduliferis non-glanduliferisque usque ad 0.5 mm longis et pilis sparsis castaneis usque ad 1 mm longos vestita. Pinnae primariae 15–25-jugatae, oppositae vel suboppositae, longissimae basim versus 10–37 cm longae et 5–13 cm latae, superiores anguste ovatae, inferiores ovatae. Pinnae secundariae anguste ovatae vel anguste triangulatae, longissimae 3–9 cm longae et 1.3–3 cm latae. Pinnae tertiae \pm lineares, obtusae, 0.7–1.5 cm longae et 0.2–0.7 cm latae, dentatae vel in pinnas quaternarias divisa. Venae ad marginem in apicibus dentium attingentes. Paginae inferiores laminarum, venarum costarumque pilis multis castaneis subfuscis hyalinisque glanduliferis non-glanduliferisque vestitae, pili non-glanduliferi usque ad 1.5 mm longi, pili glanduliferi breviores; paginae superiores praeter costas minus piliferae; margines sine pilis. Sori rotundi vel ovals, a margine procul exorientes, non-obtecti, inter sporangia pilis glanduliferis non-glanduliferisque usque ad 0.3 mm longis. Sporae pallidissimae, perisporae projecturis complanatis interconnexis, $(34-37-39(-43) \times (23-25-28(-32) \mu\text{m})$. – *Holotype*: Walker ANU 637 (CANB 119761-3; isotypes L, LAE), L. Iviva, Sirunki, Western Highlands, Papua New Guinea, 29 Aug. 1962.

Rhizome long-creeping, 2–3 mm diameter, covered in red-brown hairs up to 1.5 mm long. Stipes (7-)25–50 cm long, 2–3.5 mm diameter, dark chestnut-brown at base, pale chestnut-brown or yellow-brown above, bearing a few red-brown hairs similar to those of rhizome at very base, sparsely covered in brown-tinged glandular and non-glandular hairs up to 0.5 mm long elsewhere, \pm smooth. *Lamina* ovate or elliptic, 28–60 \times 13–30 cm, 2–3-pinnate at apex, 3–4-pinnate at base; rachis pale chestnut-brown or yellow-brown, densely covered in brown-tinged, glandular and non-glandular hairs up to 1 mm long; primary pinnae in 15–25 pairs, opposite or subopposite, the longest at or near the base 10–37 \times 5–13 cm, the upper ones narrowly ovate, the lower ones ovate; secondary pinnae narrowly ovate or narrowly triangular, the longest 3–9 \times 1.3–3 cm; tertiary pinnae \pm parallel-sided, obtuse, 0.7–1.5 \times 0.2–0.7 cm, those on smaller fronds toothed, those on larger fronds divided almost to midrib into quaternary pinnae; veins reaching margins at tooth apices. *Hairs*: variable mixture of chestnut-brown, pale brown and colourless, glandular and non-glandular hairs densely covering undersurface of lamina, lamina veins and pinna midribs, the non-glandular hairs up to 1.5 mm long, the glandular generally rather shorter; the upper surfaces much less hairy except on the pinna midribs; generally absent from the lamina margins. *Sori* round or oval, originating away from margin, unprotected, bearing both glandular and non-glandular hairs up to 0.3 mm long amongst sporangia. *Spores* very pale under light microscope, perispores with interconnecting flattened projections, $(34-37-39(-43) \times (23-25-28(-32) \mu\text{m})$ (3 populations: Sumatra, Philippines, New Guinea).

Distribution & Ecology. ?Sumatra, Philippines (Luzon) (1400–2150 m), New Guinea (2000–2600 m).

This species is based on four collections from the Western Highlands of Papua New Guinea where it grows in *Miscanthus* grassland and in marsh vegetation. Specimens from the mountains of Luzon in the Philippines are very similar and appear to be conspecific, although further collections would be desirable to confirm this. A single collection from Lake Pandom in Sumatra may also belong to this species.

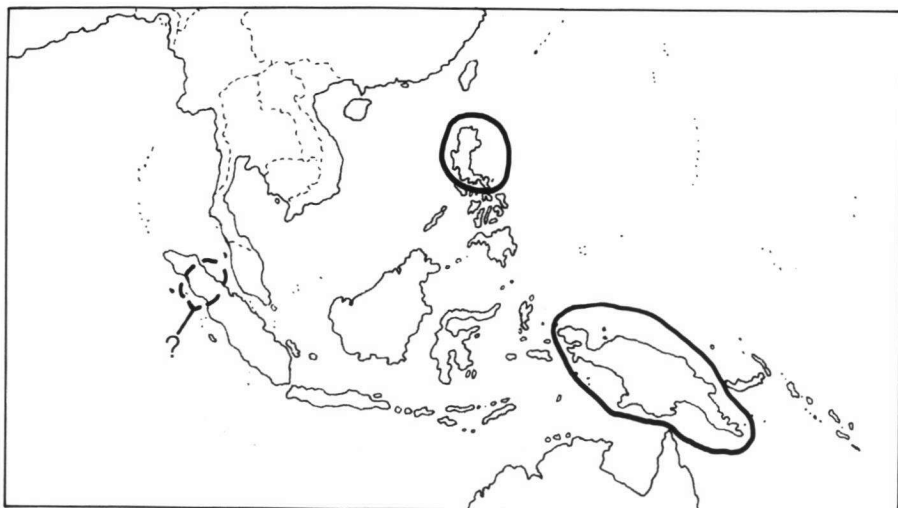


Fig. 7. Distribution of *Hypolepis malesiana* Brownsey. Broken line indicates origin of material of uncertain identity.

?SUMATRA. L. Pondom, *Surbeck* 630 (L).

PHILIPPINES. Luzon: Zambales, nr Palauig, *Price* 2849 (*Price* pers. herb.), *Ramos* s.n. (MICH); Mt Data, *Copeland* s.n. (MICH).

NEW GUINEA. Sirunki, L. Iviva, *Walker* ANU 637, 717 (CANB, L); L. Inim, *Flenley* ANU 2155 (CANB, K, L, NSW); L. Myola, Kokoda, *Croft* LAE 61926 (E, K).

Notes. *Hypolepis malesiana* is similar to *H. glandulifera* but has a smaller frond (28–60 × 13–30 cm cf. 45–180 × 30–150 cm), a sparser covering of rather stouter glandular hairs on the lamina, and, very characteristically, hairs in the sorus. The latter character distinguishes it from all other species except *H. muelleri* from Australia and *H. polypodioides* (p. 243), neither of which have glandular hairs on the frond. Occasional glandular hairs may be found in the very young sori of *H. glandulifera*, but this species can be further distinguished by its smaller spores (32–35 × 18–26 μm) compared to those of *H. malesiana* (37–39 × 25–28 μm) suggesting that the latter has a higher chromosome number. Further investigation of this species is required to determine its cytological characteristics, range of habitats and distribution.

7. *Hypolepis punctata* (Thunb.) Mett. ex Kuhn – Figs 4D, 8.

Hypolepis punctata (Thunb.) Mett. ex Kuhn, *Filic. Afr.* (1868) 120. – *Polypodium punctatum* Thunb., *Fl. Japonica* (1784) 337. – *Phegopteris punctata* (Thunb.) Mett., *Ann. Mus. Bot. Lugd.-Bat.* 1 (1864) 222. – *Nephrodium punctatum* (Thunb.) Diels in E. & P., *Nat. Pflanzenfam.* 1, 4 (1899) 177. – *Dryopteris punctata* (Thunb.) C. Chr., *Index Filic.* (1905) 287. – Holotype: *Thunberg* (UPS), Japan.

Rhizome long-creeping, 1.5–4 mm diameter, covered in pale brown hairs up to 2 mm long. Stipes 15–75 cm long, 2–4 mm diameter, pale chestnut-brown, sometimes becoming yellow-brown above, sparsely covered in brown-tinged glandular and non-glandular hairs up to 2 mm long, smooth or slightly rough. *Lamina* ovate to broadly ovate, 22–80(–100) × 17–70 cm, 2-pinnate at apex, 3-pinnate at base; rachises pale chestnut-brown or yellow-brown throughout, sparsely covered in similar hairs to those of stipe; primary pinnae in 15–25 pairs, opposite or subopposite, the longest at or near the base 9–50 × 3.5–20 cm, upper ones narrowly triangular, the lower ones narrowly triangular, triangular or ovate; secondary pinnae ± parallel-sided or narrowly triangular, the longest 2–11 × 1–4 cm; tertiary pinnae ± parallel-sided, obtuse, 0.4–1.9 × 0.2–0.8 cm, ± entire on smaller fronds, divided to c. 2/3 way to midrib on larger fronds; veins reaching margin at tooth apices. *Hairs* rather variable in length and density; brown-tinged and colourless, glandular and non-glandular, up to 1.5 mm long on undersurface of lamina, lamina veins and pinna midribs; similar but generally shorter and sparser on upper surfaces; occasional on lamina margins, glandular or non-glandular, up to 0.2 mm long. *Sori* round or oval, originating away from margin, unprotected, hairs lacking amongst sporangia. *Spores*

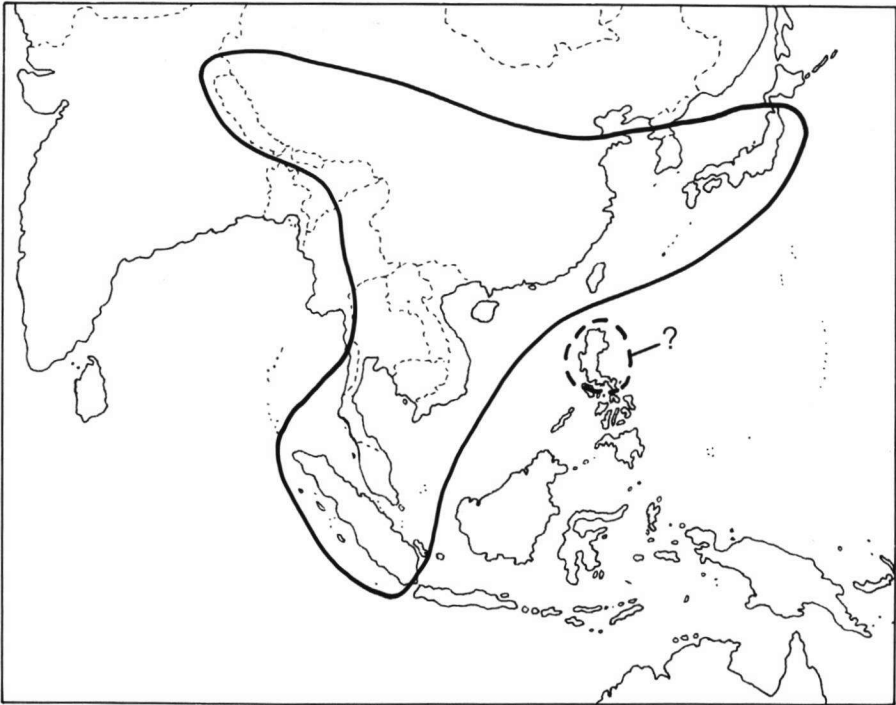


Fig. 8. Distribution of *Hypolepis punctata* (Thunb.) Mett. ex Kuhn. Broken line indicates origin of material of uncertain identity.

very pale under light microscope, perispores with interconnecting flattened projections, $(32-34-39(-43) \times (22-23-26(-28) \mu\text{m}$ (9 populations: Japan, Ryukyu Is., Korea, India, Taiwan, China, Thailand, Perak, Sumatra).

Distribution & Ecology. Northwest India (1000–1550 m), Japan (300–750 m), Ryukyu Islands (500 m), Korea, southern China (600–750 m), Taiwan (1350–1500 m), Thailand (1200–1550 m), Sumatra (750 m), Peninsular Malaysia (1050–1440 m), ?Philippines (Luzon) (900 m).

Plants referred to *Hypolepis punctata* occur widely in the Himalayas and in South-east Asia from Japan south to Thailand. Single collections only are known from Perak, Pahang, Sumatra and possibly Luzon in the Malesian region. Habitats include rather open forest, forest margins, streambanks and open situations.

SUMATRA. Padang Panjang, *Matthew s.n.* (E).

PENINSULAR MALAYSIA. Perak: G. Hijau, *Matthew* (K). Pahang: Tanah Rata, *Parris 10944* (K).

?PHILIPPINES. Luzon: Ilocos Norte, Mt Bubungkayo, *Iwatsuki et al. P375* (L).

Notes. *Hypolepis punctata* was first described by Thunberg (1784) as *Polypodium punctatum* from Japan. It has since been credited with a very wide distribution extending from that country as far as the Himalayas in the west, to New Zealand in the south, and to Hawaii and many other islands of the South Pacific in the east. In common with *H. tenuifolia*, the name has been very widely misapplied. In part, this problem derives from an inadequate original description and a fragmentary and over-mature type specimen (see Brownsey & Chinnock, 1984: fig. 21). In my opinion, the species is primarily confined to Japan, Taiwan, Korea, southern China, the Himalayas and mainland Southeast Asia, with occasional specimens having been collected from Sumatra and possibly Luzon. However, I am by no means certain that even the more restricted circumscription defined here represents a single taxon, and further investigation in the northern part of its range with emphasis on field observation and cytological study is required. In particular, four new species, *H. coerulescens*, *H. indica*, *H. sikkimensis* and *H. viridula*, described by Biswas (1985) from Sikkim and West Bengal require further investigation. They are listed here as *incertae sedis*.

As defined here, *H. punctata* includes plants with a pale stipe, a relatively small tripinnate lamina ($22-100 \times 17-70 \text{ cm}$), a covering of both glandular and non-glandular hairs on the lamina surfaces and occasionally on the lamina margins, no hairs in the sorus and no protective membranous flap covering the sorus. These characters will distinguish *H. punctata* from all other species in the Malesian region, but there is a considerable range of variation in the size, colour and distribution of the hairs on the lamina suggesting that further subdivision is possible. Spore size is fairly uniform but plants from Thailand have rather smaller spores than those from other areas. Chromosome counts from Japan indicate a range of numbers including $n = c. 92$, $n = 98$ and $n = c. 104$ (Kurita, 1962, 1967, 1972; Mitui, 1968, 1975, 1976) although the more recent counts suggest that $n = 98$ is the correct number. That this is a probable aneuploid derivative of the octoploid number ($n = 104$) in the genus is interesting in itself and has been discussed elsewhere (Brownsey, 1983), but there is



Fig. 9. Camera lucida drawings of pinnules. A. *Hypolepis archboldii* Copel., Brass 4235, New Guinea (BM). – B. *H. alpina* (Blume) Hook., Matthew s.n., Sumatra (K). – C. *H. dicksonioides* (Endl.) Hook., Brownsey NZ 1379, New Zealand (WELT). – D. *H. tenuifolia* (Forst. f.) Bernh. ex C. Presl, Chinnock 5793 & Brownsey, Queensland (WELT).

an obvious possibility that other cytotypes may exist and bear some relationship to the observed range of morphological variability. Other chromosome counts for material identified as *H. punctata* have been reported, but they almost certainly refer to different species; some are discussed here under *H. glandulifera* (p. 248), *H. pallida* (p. 271) and *H. polydodioides* (p.245), but the reports of $n = 104$ from populations in Sichuan, China (Wang, Xia & Zhang, 1984) and $n = 52$ from Taiwan (Tsai, 1973; Tsai & Shieh, 1983) cannot be accurately attributed to any particular species without reference to voucher material.

8. *Hypolepis archboldii* Copel. — Figs 9A, 10.

Hypolepis archboldii Copel, Univ. Calif. Publ. Bot. 18 (1942) 218; Philipp. J. Sci. 78 (1950) 27, t. 5. — Holotype: L.J. Brass & E. Meijer Drees 9852 (MICH; isotypes BM, L), 7 km NE of Wilhelmina Top, West New Guinea, 3560 m, Sept. 1938.

Rhizome long-creeping, 1–2 mm diameter, covered in chestnut-brown hairs up to 3 mm long. Stipes (5–)10–20 cm long, (0.5–)1–2 mm diameter, chestnut-brown, rough, covered in conspicuous chestnut-brown non-glandular hairs up to 3 mm long. *Lamina* narrowly ovate to ovate, (5–)20–45 × (3–)6–22 cm, 1–2-pinnate at apex, 2–3-pinnate at base; rachises chestnut-brown at base, becoming-yellow brown above, densely covered in conspicuous chestnut-brown non-glandular hairs up to 2.5 mm long; primary pinnae in 25–30 pairs, opposite or subopposite, the longest at or near the base (1.5–)5–15 × (1–)2–5 cm, the upper ones ± oblong and toothed, the lower narrowly triangular; secondary pinnae ± oblong and toothed to narrowly triangular, the longest (0.5–)0.8–2.5 × (0.3–)0.5–1 cm, divided into tertiary pinnae up to 0.6 cm long on largest fronds; veins reaching margin at tooth apices. *Hairs*:

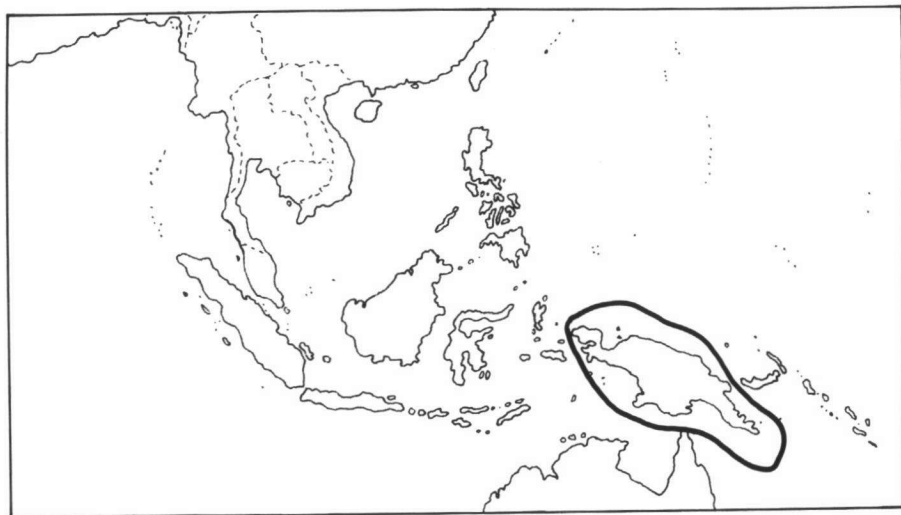


Fig. 10. Distribution of *Hypolepis archboldii* Copel.

abundant, chestnut-brown or brown-tinged, non-glandular, up to 2 mm long, on both surfaces of lamina veins and pinna midribs, sometimes also on lamina margins. *Sori* round or oval, originating away from margin, unprotected or protected only by slightly reflexed lamina segments, lacking hairs amongst sporangia. *Spores* very pale under light microscope, perispores with interconnecting flattened projections (31–) 35–36(–40) \times (19–) 22–23(–26) μ m (2 populations: New Guinea).

Distribution & Ecology. New Guinea (3300–3680 m). This species is known only from the highest mountains of New Guinea where it grows in sub-alpine forest on moss-covered tree trunks and on the forest floor.

NEW GUINEA. Mt Ambua, *Kalkman 5090* (L, NSW); Mt Sarawaket, *Clemens s.n.* (MICH); Mt Albert Edward, *Brass 4235, 4389* (BM, BRI).

Notes. *Hypolepis archboldii* is a very distinctive species, easily recognised by its small size, thin rhizome, covering of conspicuous chestnut-brown, non-glandular hairs and isolated habitat. It cannot easily be confused with any other species.

9. *Hypolepis alpina* (Blume) Hook. – Figs 9B, 11.

Hypolepis alpina (Blume) Hook., Sp. Fil. 2 (1852) 63. – *Cheilanthes alpina* Blume, Enum. Pl. Javae (1828) 138. – Lectotype: C.L. Blume (L, 2 sheets), 'van de grote muur van de Krater Gedé', Java.

Hypolepis alte-gracillima Hayata, Icon. Pl. Formos. 5 (1915) 295, t. 118. – Holotype: T. Ito & B. Hayata (TI), Nimandaira, Formosa, April 1914.

Rhizome long-creeping, 2–5 mm diameter, densely covered in red-brown hairs up to 3 mm long. Stipes 12–70 cm long, 1.5–5 mm diameter, usually red-brown, sometimes chestnut-brown, becoming paler upwards, rough or slightly rough, covered in red-brown non-glandular hairs up to 2 mm long and shorter glandular hairs. *Lamina* ovate, 20–80(–130) \times 10–90 cm, 1–2-pinnate at apex, 3–4-pinnate at base; rachis red-brown or chestnut-brown at base, becoming chestnut-brown or yellow-brown at apex, densely covered in red-brown or chestnut-brown glandular hairs up to 0.5 mm long with occasional much longer non-glandular hairs; primary pinnae in 20–30 pairs, opposite or subopposite, the longest at or near the base, 10–52 \times 3–28 cm, upper ones narrowly ovate or narrowly triangular, lower ones narrowly ovate to ovate; secondary pinnae narrowly ovate to ovate, the longest 2–14 \times 0.8–5 cm; tertiary pinnae narrowly ovate to ovate, the longest 0.5–3.5 \times 0.3–1.9 cm, those on largest fronds divided into toothed quaternary pinnae up to 1 \times 0.5 cm; veins reaching margin at tooth apices. *Hairs*: stout, often rather rigid, red-brown, brown-tinged or \pm colourless, glandular, up to 0.5 mm long, densely covering undersurfaces of lamina veins and pinna midribs with occasional longer non-glandular chestnut-brown hairs; on upper surfaces generally shorter and less dense; usually absent from lamina margins. *Sori* round or oval, originating away from margins, protected by reflexed broad green lamina segments, lacking hairs amongst sporangia. *Spores* very pale under light microscope, perispores with interconnecting flattened projections, (32–) 34–37(–40) \times (20–) 21–25(–28) μ m (10 populations: Japan, Taiwan, Sumatra, Java, Borneo, Philippines, New Guinea).

Distribution & Ecology. Japan (Yakushima Is.), Taiwan (1350–1500 m), Sumatra (1700–2750 m), Java (1450–2600 m), Borneo (1100–3100 m), Philippines (1850–2150 m), Moluccas, New Guinea (1800–3500 m).

In general, as its name suggests, this species occurs at higher altitudes in the Malesian region, from about 1500–3500 m. On Mt Kinabalu in Borneo, however, it has been collected as low as 1100 m. It occurs in open forest at lower altitudes, sub-alpine rainforest, scrub, tussock grassland and in disturbed habitats, especially in damper situations.

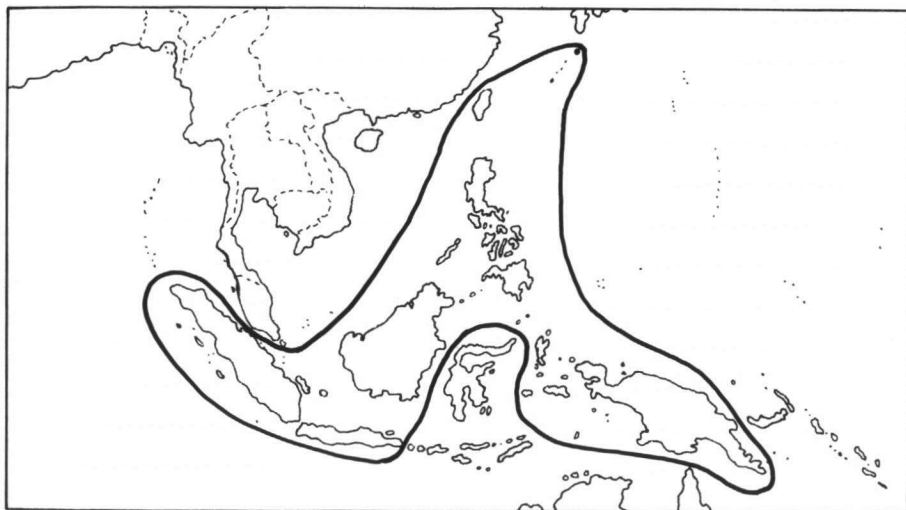


Fig. 11. Distribution of *Hypolepis alpina* (Blume) Hook.

SUMATRA. Mt Sibajak, *Lörzing* 15765 (L); Deleng Si Naboen, Karoland, *Bartlett* 8633 (L, MICH); G. Singgalan, *Matthew* s.n. (K).

JAVA. G. Patuha, S. of Bandung, *Lörzing* 2553 (L); Tjibodas, Kandang Badak, G. Gedeh–G. Pangrango, *Adelbert* 188 (L), *van Slooten* 194 (L), *Hochreutiner* s.n. (L); Tjibodas, Tjibeureum, *Kostermans* s.n. (L), *Alston* 12543 (BM); G. Karrah, *Raciborski* s.n. (K, L); Tjibodas, Priangan, *Sapiin* 2665 (L), G. Tengger, Lawang, *Mousset* 184 (BISH, L, MICH), *Koorders* 37485 (L).

BORNEO. Mt Kinabalu: Tahubang R., *Clemens* 30702 (L, MICH); Colombon basin, *Clemens* 34397 (L), *Chew et al.* 923 (CANB, K, L); Paka Cave, *LeRoy Topping* 1671 (MICH).

PHILIPPINES. Luzon: Mt Bulusan, *Copeland* 1932 (MICH). Mindanao: Mt Apo, *Copeland* s.n. (MICH).

MOLUCCAS. *Teijsmann* 11 (K, L).

NEW GUINEA. Mt Capella, Telefomin, *Barker LAE* 67209 (BM, K, L); Mt Wilhelm, *Nakaike* 283 (K); S. Kandep valley, Wabag, *Robbins* 3267 (CANB); Sarawaket Range, Huon Peninsula, *Hoogland* 9935 (CANB, L); Wau, Edie Ck, *Broome* 5 (K, L); Mt Victoria Range, *Croft LAE* 61699 (BRI, L); Mt Manurep, Rabaraba, *Stevens & Veldkamp LAE* 54490 (BRI, L); Mt Lamington, *Mitchell* 211 (CHR).

Notes. *Hypolepis alpina*, *H. dicksonioides* and *H. tenuifolia* belong to a species aggregate in which morphological and geographical limits are not yet clearly

defined. The three species have in common a combination of glandular hairs on the lamina, and sori that lack hairs amongst the sporangia but are protected by well-developed indusia.

Hypolepis alpina is distinguished by its reddish-brown stipe, fronds covered in stout, often rather rigid red-brown glandular hairs and a variable number of longer, chestnut-brown, non-glandular hairs, and sori protected by broad, green (not membranous) reflexed marginal flaps. In the Malesian region *H. alpina* occurs mostly above 1500 m, reaching 3500 m in New Guinea, well above the altitudinal range of the other two species. There is, however, a considerable range of variation between plants from the highest elevations in New Guinea, which have rather smaller fronds and a dense covering of chestnut-brown non-glandular hairs, to those at lower altitudes in the northern part of its range (notably Taiwan and North Borneo), which have large fronds and very few chestnut hairs. Amongst the latter is included the type specimen of *H. alte-gracillima* from Taiwan, a name which is here reduced to synonymy with *H. alpina*. However, the possibility remains that the polymorphic *H. alpina*, as defined here, actually includes more than one taxon.

Hypolepis alpina is very closely related to *H. dicksonioides* from New Zealand, Norfolk Island, the Kermadec Islands, Samoa, Tahiti and the Marquesas Islands. Whilst populations of *H. alpina* from higher elevations can be readily recognised by their smaller fronds with reddish-brown stipes, the presence of abundant chestnut-brown non-glandular hairs on the lamina, and by the generally stouter, more rigid, red-brown glandular hairs, populations from Taiwan and Borneo are not so readily distinguished. However, *H. dicksonioides* has rather larger spores ($38-43 \times 21-26 \mu\text{m}$) than *H. alpina* ($34-37 \times 21-25 \mu\text{m}$) suggesting the possibility of a cytological difference between the two (see p. 259). Taken together with the ecological and geographical differences, there is enough evidence to suggest that two separate species should be recognised, at least until a more detailed investigation can be carried out.

Hypolepis alpina is more easily distinguished from *H. tenuifolia* which has thicker stipes (3.5–15 mm cf. 1.5–5 mm), larger fronds (25–150 \times 28–140 cm cf. 20–130 \times 10–90 cm), rather fine glandular hairs, and sori protected by membranous (not green) marginal flaps.

10. *Hypolepis dicksonioides* (Endl.) Hook. – Figs 9C, 12.

Hypolepis dicksonioides (Endl.) Hook., Sp. Fil. 2 (1852) 61. – *Cheilanthes dicksonioides* Endl., Prodr. Fl. Norfolk. (1833) 15. – *Hypolepis endlicheriana* C. Presl, Tent. Pterid. (1836) 162, nom. nov. pro *Cheilanthes dicksonioides* Endl. – Lectotype: *F. Bauer* (W, on 4 sheets, chosen by Brownsey & Chinnock, 1984), Norfolk Island.

Cheilanthes pellucida Colenso, Tasmanian J. Nat. Sci. 1 (1845) 173. – *Hypolepis tenuifolia* (Forst f.) Bernh. var. *pellucida* (Colenso) Hook., Sp. Fil. 2 (1851) 60, t. 90. – Lectotype: *W. Colenso* (WELT P3224, chosen by Brownsey & Chinnock, 1984), E. coast, New Zealand.

Rhizome long-creeping, (3–)4–8 mm diameter, densely covered in pale brown hairs near growing apex, more scattered hairs becoming red-brown elsewhere. Stipes (15–)20–100 cm long, (2–)5–15 mm diameter, dark chestnut-brown at base, pale chestnut-brown or yellow-brown above, bearing red-brown hairs at very base,

replaced by colourless glandular and non-glandular hairs above (up to 5 mm long on uncoiling fronds); two dark, prominent, vertical bands on opposite sides of stipe. *Lamina* broadly ovate or broadly elliptic, (20–)35–135 × (15–)35–110 cm, 2-pinnate at apex, 4–5-pinnate at base; rachis yellow-brown at base, green at apex, bearing colourless glandular and non-glandular hairs (up to 3 mm long); primary pinnae in 15–30 pairs, opposite or subopposite, the longest at or near the base (11–)20–70 × (7–)14–45 cm, upper ones narrowly ovate, lower ones ovate; secondary pinnae ovate, (4.5–)7–30 × 3–15 cm, those on the lower pinnae decreasing markedly in length along the pinnae; tertiary pinnae ovate, (1.6–)2–8 × (0.7–)1–3.5 cm, midrib winged; quaternary pinnae narrowly ovate, 0.7–1.6 × 0.2–0.6 cm, shallowly incised on smaller specimens, divided into 4–5 pairs of ultimate segments on larger specimens; veins reaching margin at tooth apices, or sometimes ending just short of margin. *Hairs*: stout, colourless, glandular and non-glandular, on midribs and veins of both lamina surfaces but absent from margins, 0.2–1 mm long on lamina surfaces, up to 1.5 mm on midribs. *Sori* round or ovate, protected by reflexed incised tapering flaps 0.3–0.5 mm wide that are green at base and membranous at apex, often bearing a few glandular hairs on the margin, lacking hairs amongst sporangia. *Spores* very pale under light microscope, perispores with interconnecting flattened projections, (34–)38–43(–48) × (20–)22–26(–28) μm (10 populations: Norfolk Is., Kermadec Islands, New Zealand, Tahiti, Marquesas Islands).

Distribution & Ecology. Norfolk Island; Kermadec Islands (0–250 m); New Zealand (North and South Islands) (0–600 m); Samoa (Savaii, Mangaloa) (1200–1700 m); Society Islands (Tahiti) (785–1560 m); Marquesas Islands (Hivaoa, Niki Hiva) (1020 m).

Hypolepis dicksonioides has a disjunct distribution with lowland populations occurring on the temperate and subtropical islands of New Zealand, the Kermadecs and Norfolk Island, and higher altitude populations on the tropical islands of Samoa, Tahiti and the Marquesas group. In the temperate part of its range it is largely confined to coastal regions preferring sandy soils or disturbed ground on forest margins. In both New Zealand and the Kermadecs it occurs away from coastal areas only on thermally heated ground where it grows well in pumice soils, whilst on the more northerly Norfolk Island it grows up to 200–300 m on Mt Bates.

In the tropical Pacific *H. dicksonioides* grows mostly above about 1000 m, usually on tracksides and in open situations, although sometimes in forest. On Savaii it has been recorded from lava fields. The absence of high ground above 1000 m on many tropical Pacific islands is an obvious factor limiting the distribution of this species.

SAMOA. Savaii, *Christopherson* 795, 900 (BISH, BRI); Mangaloa, *Vampal* 280 (MICH).

SOCIETY ISLANDS. Tahiti: *Lépine s.n.* (P); Mt Marau, *Florence* 2527, 3275 (P); Taravoa, *Florence* 2894 (P); Mahina, *Florence* 5412 (P).

MARQUESAS ISLANDS. Hivaoa, *Brown & Brown* 810 (BISH); Nuku Hiva, *Florence* 4375 (P).

Notes. One collection, from the south side of Orohena at 1350 m on Tahiti (*MacDaniels* 1551, BISH), is worthy of further note. The specimen consists of two basal pinnae about 45 cm long and is immediately distinct because of an abundance

of bristly hairs on the margins of the lamina as well as a dense covering of glandular and non-glandular hairs on the lamina surfaces. Few other species of *Hypolepis* have hairs on the margins, but this specimen fits none of them. It appears to belong to the *H. tenuifolia/dicksonioides* aggregate in being a large fern, and having both glandular hairs and reflexed flaps protecting the sori, but is very different in having hairs on the margins. No other similar collections have been located and until more complete specimens are collected it must remain *incertae sedis*.

Hypolepis dicksonioides is most closely related to *H. alpina* and *H. tenuifolia*, and the characteristics for distinguishing the three species are discussed elsewhere (pp. 256 and 262).

Brownsey & Chinnock (1984) reported chromosome counts of $n = 104$ in New Zealand populations of *H. dicksonioides* indicating that it is an octoploid species in contrast to *H. tenuifolia* which is tetraploid (p. 262). This cytological difference is reflected in the greater spore size in most populations of *H. dicksonioides* compared to those of *H. tenuifolia*. However, Samoan plants from the mountains of Mangaloa and Savaii which, in gross morphology, closely match other populations of *H. dicksonioides* have rather smaller spores ($32-33 \times 20-21 \mu\text{m}$ cf. $38-43 \times 22-26 \mu\text{m}$)

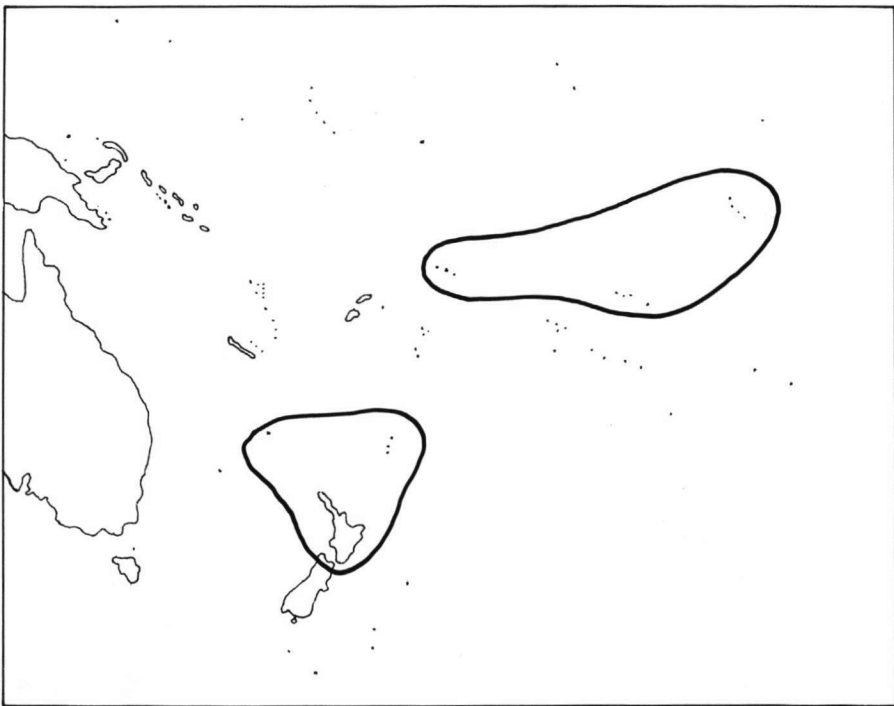


Fig. 12. Distribution of *Hypolepis dicksonioides* (Endl.) Hook.

suggesting a lower chromosome number. Clearly, cytological investigation of Samoan populations would be desirable.

The distributions of *H. dicksonioides* and *H. tenuifolia* are contiguous throughout much of the Pacific region (Figs 12, 13), *H. tenuifolia* being a lowland species of the tropical islands, and *H. dicksonioides* largely confined to more temperate latitudes. They overlap only on Norfolk Island in the southwest Pacific and on Samoa and Tahiti in the eastern Pacific. In Samoa and Tahiti, however, the two species are still ecologically separated, *H. tenuifolia* being a lowland species, and *H. dicksonioides* confined to the mountains. On Norfolk Island, *H. tenuifolia* is a rare species and the ecological preferences of the two species not well known.

In the Malesian region *H. tenuifolia* is still typically a lowland species, but at higher altitudes *H. dicksonioides* is replaced by the closely related *H. alpina* (p. 257).

11. *Hypolepis tenuifolia* (Forst. f.) Bernh. ex C. Presl – Figs 9D, 13.

Hypolepis tenuifolia (Forst. f.) Bernh. ex C. Presl, Tent. Pterid. (1836) 162. – *Lonchitis tenuifolia* Forst. f., Fl. Ins. Austr. (1786) 80. – *Phegopteris tenuifolia* (Forst. f.) Keys., Polyp. Herb. Bunge. (1873) 51. – *Cheilanthes arborescens* Sw., Syn. Filic. (1806) 129, 336, nom. nov. pro *Lonchitis tenuifolia* Forst. f. – Lectotype: Forster (BM, chosen by Brownsey & Chinnock, 1987), Insulae Oceani Pacifici.

Cheilanthes dissecta Hook. & Arn., Bot. Beechey Voy. (1841) 75. – *Hypolepis dissecta* (Hook. & Arn.) Brackenr., U.S. Expl. Exp., Filic. (1854) 89. – Holotype: Beechey (K), Coral Is.

? *Hypolepis aspidioides* Christ, Bot. Jahrb. Syst. 23 (1896) 343. – Lectotype: Reinecke 132 (K; isoelectotypes B, BM, E), West Savaii, Samoa, 300 m.

Hypolepis neocaledonica Rosenstock, Feddes Repert. Spec. Nov. Regni Veg. 10 (1911) 159. – Lectotype: Franc 143 (B 74705; isoelectotypes BISH, BM, K), Yahoué, New Caledonia, 12 Jan. 1911.

Hypolepis gigantea Ching in Ching & C. H. Wang, Acta Phytotax. Sinica 8 (1959) 165. – Type: *H. Fung* 20220 (BM, E, K), Chim Shan, Fan Maan Ts'uen, Ling-shiu district, Hainan, China, May 1932.

Hypolepis nausoriensis Brownlie, Pterid. Fl. Fiji (1977) 125, t. 12. – Holotype: C. Veitch (CHR 340628), Nausori Highlands, Viti Levu, Fiji, 2000', Aug. 1970.

Rhizome long-creeping, 3–10 mm diameter, densely covered in pale brown hairs near growing apex with more scattered hairs becoming red-brown elsewhere. Stipes 35–150 cm long, 3.5–15 mm diameter, dark chestnut-brown at base, chestnut or yellow-brown above, bearing red-brown hairs at very base, replaced by colourless glandular and non-glandular hairs (up to 5 mm long on uncoiling fronds); two dark, prominent, vertical bands on opposite sides of stipe. *Lamina* broadly ovate or broadly elliptic, 25–150 × 28–140 cm, 2-pinnate at apex, 4–5-pinnate at base; rachis yellow-brown at base, green at apex, bearing colourless glandular and non-glandular hairs up to 2 mm long; primary pinnae in 10–30 pairs, opposite or subopposite, longest pair at or near base 16–90 × 11–50 cm, upper ones narrowly ovate to ovate, lower ones ovate; secondary pinnae ovate, 7–30 × 3.5–15 cm, those on the lower pinnae decreasing markedly in length along the pinnae; tertiary pinnae ovate, 2–8 × 1–3.5 cm, midrib winged; quaternary pinnae narrowly ovate, 0.5–2.0 × 0.2–0.8 cm, shallowly incised on smaller specimens, divided into 4–5 pairs of ultimate segments on larger specimens; veins reaching margin at tooth apices. *Hairs*: fine, col-

ourless, glandular and non-glandular, on midribs and veins of both lamina surfaces, absent from margins, 0.1–0.8 mm long on lamina surfaces, up to 1 mm on midribs. *Sori* round or ovate, protected by reflexed incised broad membranous flaps 0.5–1.2 mm wide that sometimes bear a few glandular hairs on the upper surfaces, lacking hairs amongst sporangia. *Spores* very pale under light microscope, perispores with interconnecting flattened projections, $(29-30-37(-43) \times (18-19-23(-27) \mu\text{m}$ (24 populations: Hainan, Philippines, New Guinea, Australia, New Caledonia, Norfolk Is., Fiji, Samoa, Tonga, Tahiti, Rapa, Tubuai, Mangareva, Pitcairn).

Distribution & Ecology. Taiwan, China (Hainan), Philippines (350–550 m), Flores (700 m), New Guinea (450–1400 m), Australia (Queensland) (150–1000 m); New Caledonia (0–400 m), Norfolk Is., Vanuatu (Tanna), Fiji (Viti Levu) (600 m), Tonga (Eua, Vava'u), Tongatapu (0–100 m), Samoa (Savaii, Upolu) (300–600 m), Cook Islands (Rarotonga), Society Islands (Tahiti, Moorea, Raiaitea) (0–350 m), Austral Islands (Raivavae, Tubuai, Rurutu) (300–400 m), Rapa (100 m), Mangareva (350 m), Pitcairn Island.

Hypolepis tenuifolia has an extensive distribution around the western edge of the Pacific from Taiwan to Queensland and across the South Pacific as far as Pitcairn Island. The species occurs from sea-level on many of the islands up to 1400 m in New Guinea. Plants are found in rather open woodland, around forest margins, along streambanks, on disturbed ground, in open grassy areas, on lava fields and in swampy ground.

PHILIPPINES. Luzon: Mt Balusan, *Elmer 16449* (BISH, L, MICH, NSW); Quezon, Real, *Price 1491* (Price pers. herb.); Mt Makiling, *Price 899, 1697* (MICH, Price pers. herb.); Linao R., Bataan, *Copeland 233* (MICH); Mt Mariveles, *LeRoy Topping 420* (BISH). – Mindanao: L. Lanao, *Clemens 593* (MICH).

FLORES. Nunang, *Schmutz 3071* (L).

NEW GUINEA. Kulolo R., Morobe, *Streimann NGF 39481* (BRI, CANB, L); Laloki R., Wakefield 1346 (BM).

NEW CALEDONIA. Bogen R.-Unio, *Buchholz 1285* (BISH, K, L); Isle of Pines, *McGillivray 736*, *Milne s.n.* (BM, K); Oubatch, *McKee 4746* (E, NSW); Voh-Katé, *McKee 30585* (CHR).

VANUATU. Tanna, no collector (NSW).

FJI. Cairns s.n. (K).

TONGA. Eua, *Yuncker 15461, 15514* (BISH), *Parks 16275* (BISH); Vava'u, *Yuncker 16036* (BISH), *Crosby s.n.* (K); Tongatapu, Moseley Challenger Exped. (BM, K).

SAMOA. Savaii, *Reinecke 132* (B, BM, E, K); Upolu, *Sledge 1633* (K), *Christophersen 218* (BISH, BM), *Graeffe s.n.* (BM), *Betche 13* (NSW).

COOK ISLANDS. Rarotonga, *Parks & Parks 22028, 22572* (BISH, MICH), *Cheeseman s.n.* (AK).

SOCIETY ISLANDS. Tahiti, *Oliver s.n.* (WELT), *Savatié s.n.* (K, P), *Barclay 3345*, *Andersson s.n.* (BM), *Seitchell & Parks 236* (B, BISH, E), *Copeland 4001* (BISH), *Vieillard s.n.* (B); Moorea, *Copeland 5390* (BISH); Raiaitea, *Moore 307* (BISH, BRI, NSW).

AUSTRAL ISLANDS. Raivavae, *St John 16171* (BISH, BRI); Tubuai, *St John 16342* (BISH, WELT); Rurutu, *St John 16668* (BISH, BRI, WELT); Rapa, *St John 15300 & Fosberg* (BISH, BRI, US, WELT).

MANGAREVA ISLAND. Mt Mokoto, *St John 14899* (BISH, BRI, MICH, WELT).

PITCAIRN ISLAND. Belt s.n. (BM).

Notes. Like *H. punctata*, *H. tenuifolia* is a name which has been widely misapplied since its description by Forster (1786) as *Lonchitis tenuifolia*. The problem

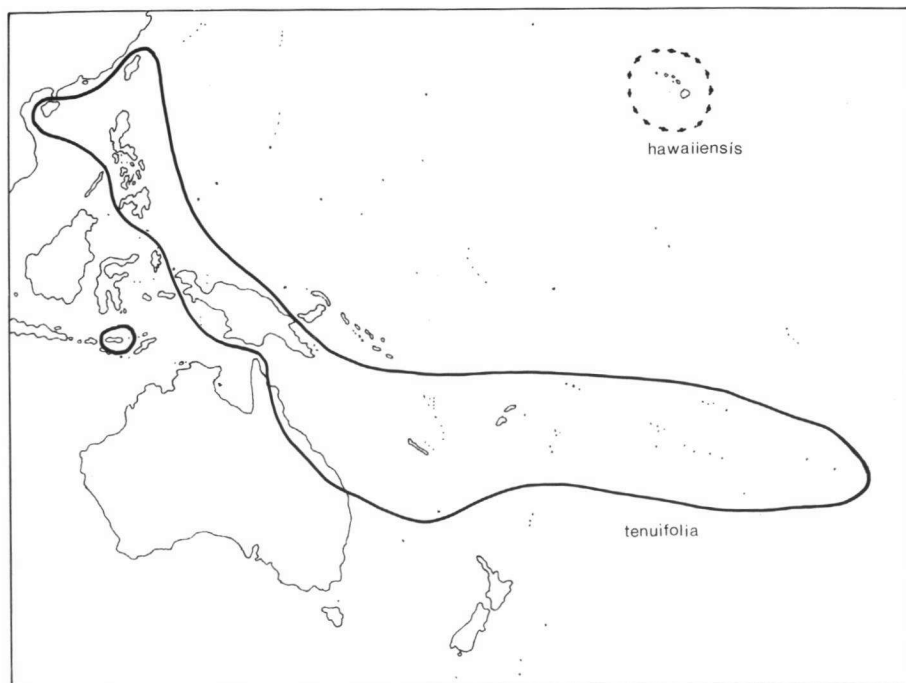


Fig. 13. Distributions of *Hypolepis hawaiiensis* Brownsey and *H. tenuifolia* (Forst. f.) Bernh. ex C. Presl.

of accurately defining *H. tenuifolia*, and its relationship to the closely related *H. dicksonioides*, have been discussed in detail by Brownsey & Chinnock (1984, 1987). The problem is compounded by a large number of published names which are almost certainly synonyms.

The concept of *H. tenuifolia* sens. lat. that has emerged from this study is of a plant with a very thick, dark-coloured stipe, a large 5-pinnate frond, a covering of fine glandular hairs on the lamina undersurface, and sori protected by well developed membranous flaps, but lacking soral hairs. It is a tetraploid species, $n = 52$ having been reported from Australian material (Brownsey & Chinnock, 1987) and $2n = 104$ from Samoan plants (Manton & Vida, 1968). It is very closely related to *H. dicksonioides* from Norfolk Island, the Kermadec Islands and New Zealand, but is distinguished by its lower chromosome number, smaller spores ($30-37 \times 19-23 \mu\text{m}$ cf. $38-43 \times 22-26 \mu\text{m}$), shorter hairs and broader, more truly membranous indusia compared to the tapering, largely green indusia of *H. dicksonioides*. The only other species with which it can be confused are *H. alpina* in the Malesian region and *H. elegans* in the Pacific. Characters for separating these species are discussed above (pp. 257 and 263 respectively).

Of the five names here reduced to synonymy, there is no doubt about the identities of *Cheilanthes dissecta*, *Hypolepis neocaledonica*, *H. gigantea* and *H. nausoriensis*. *Hypolepis aspidioides* from Samoa is more equivocal in that, although the frond characters are indistinguishable from those of *H. tenuifolia*, the original description states that the plant has an erect rhizome. Such a character is, of course, alien to *Hypolepis* which has long-creeping, terrestrial rhizomes, but earlier authors, as quoted by Christensen (1943: 36) all refer to erect or climbing rootstocks in one form or another. The type specimen of *H. aspidioides* and almost all other collections from Samoa do not include any portion of rhizome. However, I have seen one collection from Upolu (*Christophersen 218*, BISH, BM) which has roots emerging from a point a little way up the stipe, thus giving the impression that the lower part belonged to the rhizome. The effect in the field would be of a stipe with buttress-roots, which could be interpreted as an 'erect rhizome'. However, this collection also includes a detached piece of rhizome with lateral roots which appears to have run horizontally or, at best, climbed. Without the benefit of field observation or adequate herbarium specimens, it is impossible to know how significant or consistent the rhizome character really is. It is possible that Samoan plants have developed a different growth-form in isolation from populations of *H. tenuifolia* on other islands, and that they should perhaps be regarded as constituting a geographical subspecies. However, until the nature of the rhizome in wild Samoan populations can be more thoroughly investigated, the name *H. aspidioides* is tentatively reduced to synonymy with *H. tenuifolia*.

12. *Hypolepis elegans* Carruth. in Seemann – Figs 14A, B, 15.

Hypolepis elegans Carruth. in Seemann, Fl. Vitiensis (1873) 347. – Lectotype: *J. McGillivray 108* (BM; isoelectotype E, chosen by Brownsey & Chinnock, 1987), Aneiteum, New Hebrides, Feb. 1860.

Notes. The distinction between *H. elegans* and the closely related *H. bamleriana* and *H. pallida* from the Malesian region is discussed below (p. 268). In the Pacific regions the only two common species are *H. elegans* and *H. tenuifolia*, both of them occurring together on several of the islands. Despite some similarity in size and growth form, *H. elegans* is easily distinguished by its stiff, curved, non-glandular hairs compared to the fine, glandular hairs found on *H. tenuifolia*.

a. subsp. *elegans*

Rhizome long-creeping, up to 6 mm diameter, covered in pale-brown hairs. Stipes 30–125(–150) cm long, 4–12 mm diameter, dark chestnut-brown at base, lighter above, densely covered at base in fine colourless non-glandular hairs up to 0.5 mm long, sparsely hairy above, slightly rough, producing roots at base. *Lamina* broadly ovate or broader than long, 35–100(–350) × 35–80(–150) cm, 2-pinnate at apex, 4–5-pinnate at base; rachises either chestnut-brown throughout or becoming yellow-brown or green at apex, covered in colourless and brown-tinged non-glandular hairs up to 1 mm long, densely so on upper surface; primary pinnae in 20–25

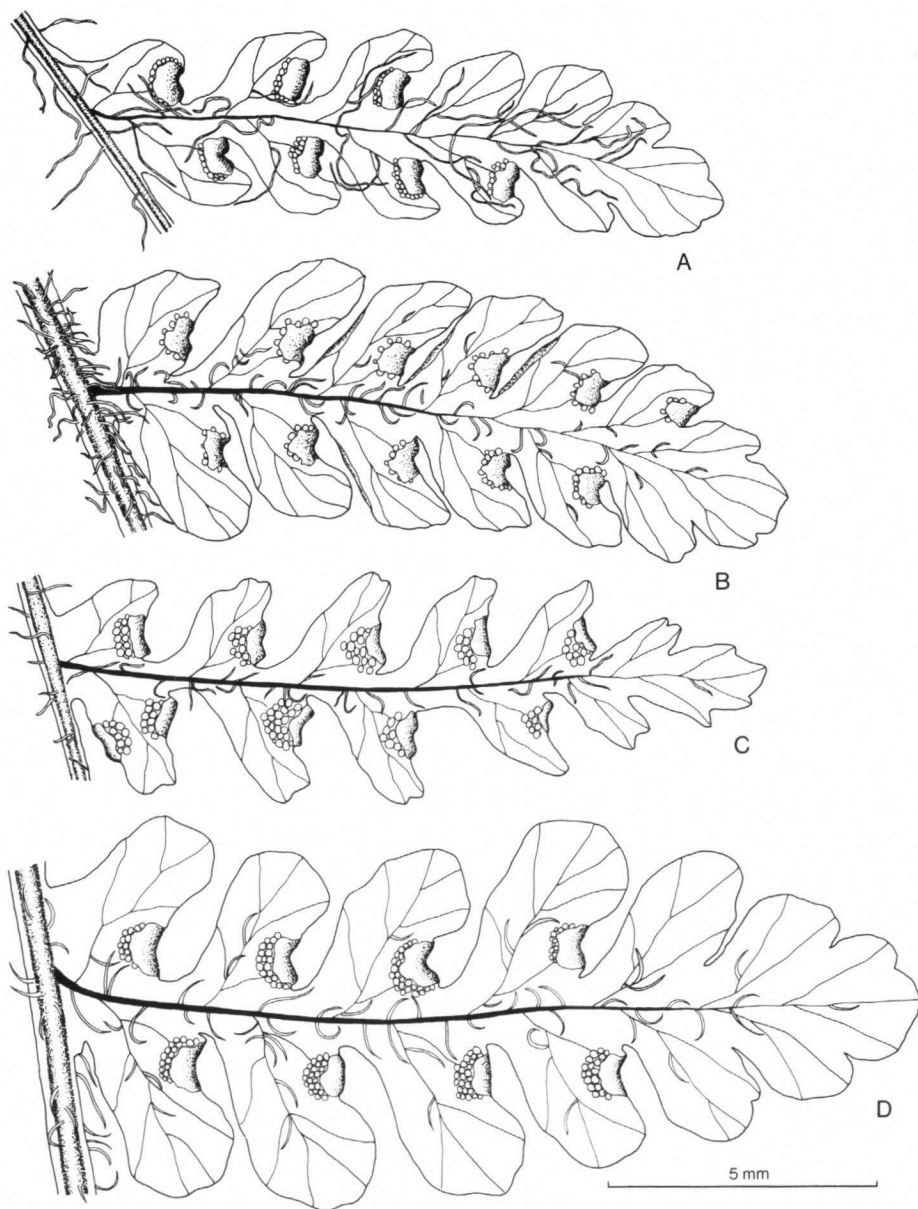


Fig. 14. Camera lucida drawings of pinnules. A. *Hypolepis elegans* subsp. *carolinensis* Brownsey, Ledermann 13769a, Ponape (B). — B. *Hypolepis elegans* subsp. *elegans*, Beever 78139, Lord Howe Is. (WELT). — C. *H. bamleriana* Rosenstock, Pullen 7936, New Guinea (L). — D. *H. pallida* (Blume) Hook., Matthew s.n., Java (K).

pairs, opposite or subopposite, the longest at or near the base, $21-92 \times 14-50$ cm, upper ones narrowly ovate or narrowly triangular, the lower broadly ovate; secondary pinnae narrowly triangular or narrowly ovate to ovate, the longest $10-34 \times 4-20$ cm; tertiary pinnae \pm parallel-sided, narrowly ovate, narrowly triangular, or ovate, the longest $2.5-11 \times 0.8-6$ cm; quaternary pinnae obtuse or acute, $0.4-3 \times 0.2-0.5$ cm, divided to midrib in largest specimens to form segments up to 0.5 cm long, the ultimate segments regardless of degree of dissection often sickle-shaped; veins reaching margin at tooth apices. *Hairs*: colourless or brown-tinged, stiff, curved, sharply pointed, non-glandular, up to 1 mm long, on both surfaces of lamina veins and pinna midribs; absent from margins. *Sori* round or oval, originating at margin, protected by obvious reflexed membranous flaps, lacking hairs amongst sporangia. *Spores* very pale under light microscope, perispores with long interconnecting flattened projections, $(24-26-30(-33) \times (16-17-20(-22) \mu\text{m}$ (10 populations: New Guinea, New Ireland, Vanuatu, New Caledonia, Lord Howe Is., Fiji, Samoa, Rapa).

Distribution & Ecology. ?Eastern New Guinea (1200 m), eastern Australia; New Ireland (650 m), Solomons (Guadalcanal, Malaita, Bougainville) (300-1200 m), Vanuatu (Tanna, Espiritu Santo, Aneiteum) (350-1150 m), New Caledonia (50-1150 m), Lord Howe Island (50-300 m), Fiji (Viti Levu, Vanua Levu) (100-1300 m), Samoa (Savaii, Upolu) (700-800 m), Rapa (250-350 m).

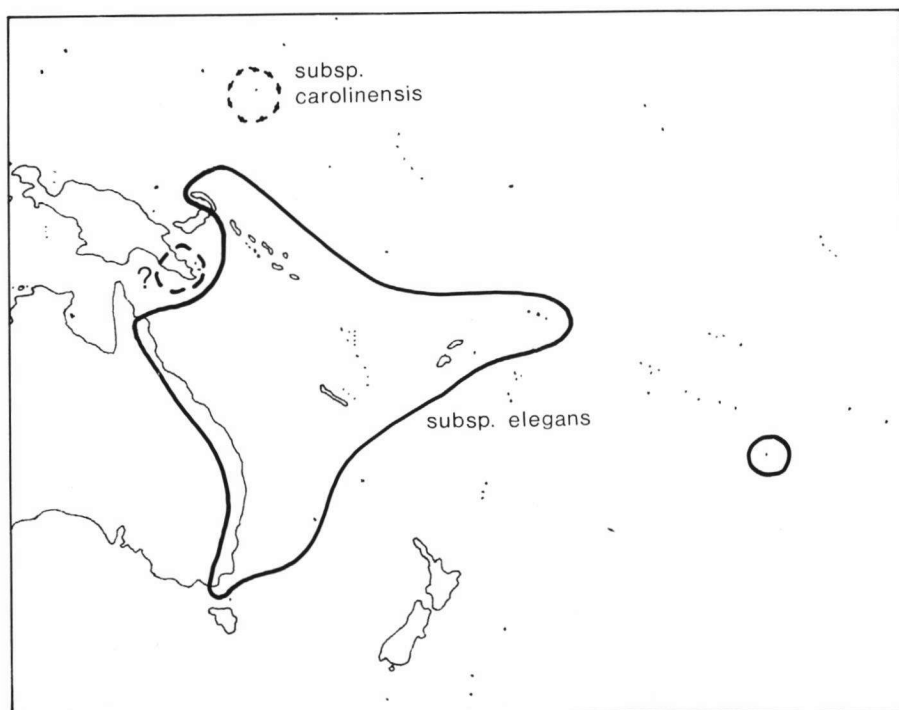


Fig. 15. Distributions of *Hypolepis elegans* subsp. *elegans* Brownsey and subsp. *carolinensis*. The broken line indicates origin of material of uncertain identity.

Primarily a plant of the islands in the southwest Pacific. It is known only from three collections on mainland Australia (Brownsey & Chinnock, 1987), and perhaps from a single collection of uncertain identity in eastern New Guinea. There is an outlying population on Rapa, well to the east of the main distribution, but the plants are morphologically indistinguishable from *H. elegans* subsp. *elegans* and clearly belong to this species despite the apparent gap in distribution between Rapa and the nearest populations in Samoa.

The subspecies occurs in lowland and hill forests from near sea-level to 1200 m. It grows in damp forests, in canopy gaps, along water courses and in open cleared areas in full sun.

?NEW GUINEA. Baniara, Pullen 8066 (CANB, L).

NEW IRELAND L. Mandiuh, nr Taron, Croft LAE 68277, Croft 204 (BM, BRI, K, L, NSW).

SOLOMONS. Bougainville, Wakefield 1047 (BM); Malaita, Braithwaite RSS 4875 (K); Guadalcanal, Kajewski 2664 (BISH, BRI, MICH, NSW).

VANUATA. Tanna, Braithwaite RSNH 2180, 2437 (BISH, CHR, K, NSW), Braggins T27 (WELT); Espiritu Santo, Braithwaite s.n. (K); Aneiteum, McGillivray 97 (E).

NEW CALEDONIA. Col d'Amieu, McKee 8069 (NSW, WELT); Mt Mou, McKee 3808 (E, NSW, WELT); Hermitage, McKee 7811 (NSW); Yahoué, Franc 50b (BM), McKee 3258 (E, NSW); Mt Koghis, McKee 3197 (E, NSW, WELT), Brownlie 286, 294 (CHR), Braggins NC 111 (CHR); Païta, Schlechter 14883, 15000 (BM, E, K, NSW); Isle of Pines, Milne s.n. (BM).

FIL. Viti Levu: Naitasiri, Vondonaivalu s.n. (CHR); Ba, Brownlie 1716, 1750 (CHR), Brownlie 1825 (CHR); Mt Victoria, Brownlie 1774 (CHR). Vanua Levu: Bua, Vondonaivalu s.n. (CHR).

SAMOA. Upolu, Christophersen 189 (BISH), Teraoka & Kennedy 76 (BISH), Graeffe s.n. (BM), Betche s.n. (NSW); Savaii, Christophersen & Hume 2310 (BISH, BM, K, WELT), Powell 209 (K).

AUSTRAL ISLANDS. Rapa, Fosberg 11617 (BISH), Stokes 114, 376 (BISH), Quayle 355, 364, 376 (BISH); Anaura Bay, Florence 6372 (P).

b. subsp. *carolinensis* Brownsey, subsp. nov.

A subsp. *eleganti* frondibus fertilibus parvioribus et pilis longioribus differt. Stipes ultra 15 cm longus et 2 mm diametrus; lamina ultra 23 cm longa et 22 cm lata, apice bipinnata, basi tripinnata; pinnae primariae ultra 12 cm longae et 4.5 cm latae; pinnae secundariae ultra 3 cm longae et 1.2 cm latae; pinnae tertiae ultra 0.5 cm longae et 0.2 cm latae. Pili in paginis laminarum usque ad 2 mm longis. Sporae (27–)29–32(–37) × (16–)17–19(–20) μm. – Holotype: C. Ledermann 13769a (B 75199; isotype K), Ponape, Caroline Islands, 1913.

Differs from subsp. *elegans* in having smaller fertile fronds and much longer hairs on the laminae. Stipes from 15 cm long and 2 mm diameter; laminae from 23 × 22 cm, 2-pinnate at apex to 3-pinnate at base; primary pinnae 12 × 4.5 cm; secondary pinnae 3 × 1.2 cm; tertiary pinnae 0.5 × 0.2 cm. Hairs on lamina surfaces up to 2 mm long. Spores (27–)29–32(–37) × (16–)17–19(–20) μm (3 populations).

Distribution & Ecology. Known only from the collections of Ledermann on Ponape in the Caroline Islands, made at 700–800 m in thick woodland containing many palms and tree ferns.

CAROLINE ISLANDS. Ponape, Paue, Ledermann 13694, 13706, 13769a, 13817 (B, K).

Notes. *Hypolepis elegans* subsp. *carolinensis* is immediately recognisable by its extremely long lamina hairs which are significantly longer (up to 2 mm) than in

any other species of *Hypolepis* and about twice as long as in subsp. *elegans*. The spores of subsp. *carolinensis* are slightly longer ($29\text{--}32 \times 17\text{--}19\ \mu\text{m}$) than those of subsp. *elegans* ($26\text{--}30 \times 17\text{--}20\ \mu\text{m}$) but the difference is not great enough to suggest any variation in chromosome number. The only other discernible morphological difference between the two subspecies is in the overall size of the fronds – the smallest fertile fronds of subsp. *carolinensis* being somewhat smaller than those of subsp. *elegans*. These differences are insufficient to warrant recognition at the specific level, but are indicative of minor variation in an outlying population away from the main range of *H. elegans*.

13. *Hypolepis bamleriana* Rosenstock – Figs 14C, 16.

Hypolepis bamleriana Rosenstock, Feddes Repert. Spec. Nov. Regni Veg. 10 (1912) 325. – Type: I.G. Bamler (B 74546, single pinnule only), New Guinea.

Hypolepis punctata var. *obscura* Brause, Bot. Jahrb. Syst. 56 (1921) 161. – Holotype: C. Ledermann 11839, Kaiserin Augusta Fluss Expedition (B 74868-70), Schraderberg, NE. New Guinea, 2070 m, 31 May 1913.

Rhizome long-creeping, up to 3 mm diameter, covered in pale brown hairs. Stipes 20–75(–95) cm long, 2–5 mm diameter, red-brown at base, dark chestnut-brown above, slightly rough, covered in short fine colourless non-glandular hairs 0.1–0.3 mm long, and sparser longer brown-tinged non-glandular hairs up to 0.8 mm long. *Lamina* ovate, 50–100(–200) \times 30–130 cm, 2–3-pinnate at apex, 4–5-pinnate at base; rachises dark chestnut-brown for most of length, usually becoming paler only near apex, densely covered in chestnut-brown non-glandular hairs up to 0.8 mm long; primary pinnae in 20–30 pairs, opposite or subopposite, widely spaced and arising at wide angles to rachis, the longest at or near the base 20–75 \times 7–35 cm, upper ones narrowly ovate or narrowly triangular, lower ones ovate or triangular; secondary pinnae \pm parallel-sided to narrowly ovate or narrowly triangular, the longest 4–22 \times 1–10 cm; tertiary pinnae \pm parallel-sided, the longest 0.6–6 \times 0.3–1.3 cm; quaternary pinnae obtuse, \pm straight-sided, up to 0.7 cm long, divided almost to midrib in largest fronds; veins reaching margin at tooth apices. *Hairs*: colourless or brown-tinged, non-glandular, up to 1 mm long, densely covering undersurface of lamina and both surfaces of lamina veins and pinna midribs, absent from margins. *Sori* round or oval, originating near margin, protected from earliest stages by obvious reflexed and at least partially membranous flaps, lacking hairs amongst sporangia. *Spores* very pale under light microscope, perispores with long interconnecting flattened projections ($26\text{--}28\text{--}32\text{--}34$) \times ($17\text{--}18\text{--}21\text{--}23$) μm (9 populations: Borneo, Philippines, New Guinea).

Distribution & Ecology. Borneo (1650–2150 m), Philippines (1700–2000 m), New Guinea (1250–2900 m).

Most abundant in New Guinea where it occurs in rain forest, *Nothofagus* forest, montane forest, secondary forest, clearings, more open situations such as tracksides and thickets of *Gleichenia* or on grassy slopes and banks. It is a rampant, scrambling

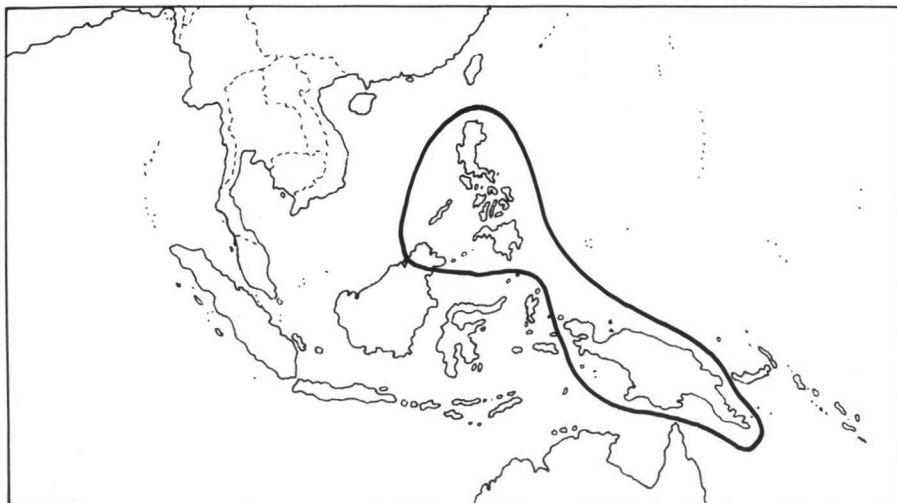


Fig. 16. Distribution of *Hypolepis bamleriana* Rosenstock.

species often forming tangled brakes. It has been collected also from the islands of Mindanao and Luzon in the Philippines and from Mt Kinabalu in Borneo.

BORNEO. Mt Kinabalu, Gurulau, *Clemens* 50708 (L), *Tamura & Hotta* 74 (L); Kamborangah, *Holtum* 25535 (BM, K).

PHILIPPINES. Luzon: Ilocos Norte, Mt Burnay, *Iwatsuki et al.* P768 (L); Benguet, *Merrill* 968 (MICH). — Negros: Canlaon volcano, *Merrill* 655 (MICH). — Mindanao: Mt Apo, *Edaño s.n.* (MICH, WELT), *Elmer* 11532, 11579 (BISH, BM, E, L, MICH, NSW); Mt McKinley, *Edaño s.n.* (MICH); Mt Katanglad, *Sulit s.n.* (MICH).

NEW GUINEA. Lake Habbema, *Brass* 10288, 10717 (BM, BRI, L, MICH); Kaisenik, *Croft* 77 (L, NSW); Sugarloaf, Wapu R., *Hoogland & Schodde* 7070 (CANB, L); Mt Hagen, *Millar & Holtum* NGF 18583 (BRI, L); Mt Tafa, *Brass* 4970 (BM, BRI, MICH); Iloilo, Howick R., *Wakefield* 1345 (BM); Okapa-Waisa, *Jermy* 5085 (BM), *Walker* 9907 (BM); Wau, Edie Creek, *Walker* 7424, 7843, 7845 (BM), *Womersley & van Royen* 5918 (BRI, K, L, NSW); *Millar & Holtum* NGF 15720 (BRI, L), *Gawi* 2 (K, L); Wau, Mt Kaindi, *Croft* LAE 60595 (L); Mt Kenive, Kokoda, *Croft* LAE 65148 (L); Baniara, *Pullen* 7936 (CANB, CHR, L, NSW); Rabaraba, *Stevens & Veldkamp* LAE 54393 (BRI, L); Oroh R., *Pulle* 1141 (BM, L); Mt Albert Edward, *Croft & Marsh* 1516 (NSW).

Notes. *Hypolepis bamleriana* is closely related to both *H. pallida* and *H. elegans*, and herbarium material of these taxa is not always easy to identify. All three species have reddish-brown stipes, large highly divided fronds that are at least quadripinnate, non-glandular hairs only, and sori that lack hairs and are protected by distinct membranous reflexed laminal flaps. However the three species can be distinguished by the following characters. The stipe of both *H. bamleriana* and *H. pallida* is relatively thin (2–6 mm) compared to that of *H. elegans* (4–12 mm), and the stipe and rachis in the first two species are generally darker in colour than in *H. elegans*. The pinnae and pinnules of *H. bamleriana* and *H. pallida* arise from the midribs at

wider angles (approaching 90°) compared with those of *H. elegans* which arise at more acute angles. *Hypolepis bamleriana* is distinguished from the other two species in having hairs on the lamina undersurfaces which are typical of most *Hypolepis* species in being somewhat crinkled when dry, whereas *H. elegans* and *H. pallida* have stiff, slightly curled, sharp-pointed hairs. In the latter two species the ultimate segments are often slightly sickle-shaped, whereas in *H. bamleriana* they are more straight. Finally, *H. pallida* can be distinguished from the other two species by its larger spores ($34\text{--}38 \times 21\text{--}23\ \mu\text{m}$) compared to those of both *H. bamleriana* ($28\text{--}32 \times 18\text{--}21\ \mu\text{m}$) and *H. elegans* ($26\text{--}30 \times 17\text{--}20\ \mu\text{m}$). In the field, *H. bamleriana* is a distinctive scrambling species that tends to become tangled with other vegetation, whereas *H. elegans* is much tidier in appearance. *Hypolepis bamleriana* occurs mostly above 1300 m and does not extend east of New Guinea, whereas *H. elegans* occurs below this altitude and is primarily a Pacific island species. *Hypolepis pallida* generally occurs at slightly lower elevations than *H. bamleriana* and has a more westerly distribution, although the two species may occur together in the Philippines.

14. *Hypolepis pallida* (Blume) Hook. – Figs 14D, 17.

Hypolepis pallida (Blume) Hook., Sp. Fil. (1852) 64. – *Cheilanthes pallida* Blume, Enum. Pl. Javae (1828) 139. – Lectotype: *C.L. Blume* (L, 3 sheets), Java.

Hypolepis punctata Beddome, Suppl. Ferns Brit. India (1892) 19, non Mett. ex Kuhn (1869). – *Hypolepis beddomei* Nair & Ghosh, J. Jap. Bot. 50 (1975) 93, nom. nov. pro *Hypolepis punctata* Beddome. – Holotype: *King's collector 5015* (K), Larut, Perak, 4400–5000'.

Rhizome long-creeping, 2–3.5 mm diameter, covered in pale-brown hairs up to 2.5 mm long. Stipes 20–100 cm long, 2–6 mm diameter, red-brown or dark chestnut-brown at base, chestnut-brown above, covered in brown-tinged non-glandular hairs up to 0.6 mm long, \pm smooth. *Lamina* broadly ovate, deltoid, or broader than long, 25–90(–100) \times 30–120 cm, 2-pinnate at apex, 4-pinnate at base; rachises chestnut-brown at base, yellow-brown above, covered in colourless and brown-tinged non-glandular hairs up to 1 mm long; primary pinnae in 20–30 pairs, opposite or subopposite, the longest at or near the base 18–95 \times 13–50 cm, ovate or triangular; secondary pinnae narrowly ovate, narrowly triangular or ovate, the longest 8–30 \times 4–13 cm; tertiary pinnae \pm parallel-sided, narrowly ovate or narrowly triangular, the longest 0.6–1.3 \times 0.2–0.5 cm, those on the largest fronds divided again almost to the midribs; the ultimate segments often slightly sickle-shaped; veins reaching margins at tooth apices. *Hairs*: colourless or brown-tinged, non-glandular, stiff, often curved, up to 1.5 mm long, densely covering undersurface of lamina, lamina veins and pinna midribs, longest ones on the midribs; similar but generally shorter and sparser on upper surfaces; absent from lamina margins. *Sori* round or oval, protected by well-developed reflexed membranous flaps, lacking hairs amongst sporangia. *Spores* very pale under light microscope, perispores with long interconnecting flattened projections, (31–)34–38(–39) \times (19–)21–23(–26) μm (6 populations: Taiwan, Perak, Sumatra, Java).

Distribution & Ecology. Taiwan, 'Indochina', Sumatra (1300 m), Peninsular Malaysia (1050–1550 m), Java (1550 m), ?Borneo, ?Philippines (Negros), ?Sulawesi.

Hypolepis pallida occurs at low to mid-altitude elevations in the western part of the Malesian region. Almost nothing about the ecology can be deduced from herbarium labels other than the fact that one or two collections originated from forest.

Single, rather inadequate, collections from Sulawesi and from Luzon suggest that the species may occur in these areas, but the specimens are sterile and cannot be distinguished with certainty from *H. bamleriana*. A single collection from Mt Kinabalu is reminiscent of *H. pallida* but has a much thicker stipe than usual for this species and originated from a locality at 1750 m, well above its known altitudinal range. The specimen is rather similar to *H. elegans* from the Pacific. Another enigmatic collection that may be related to *H. pallida* originated from 3050 m on Kerinci Peak, Sumatra. Further collections from these areas are obviously desirable.

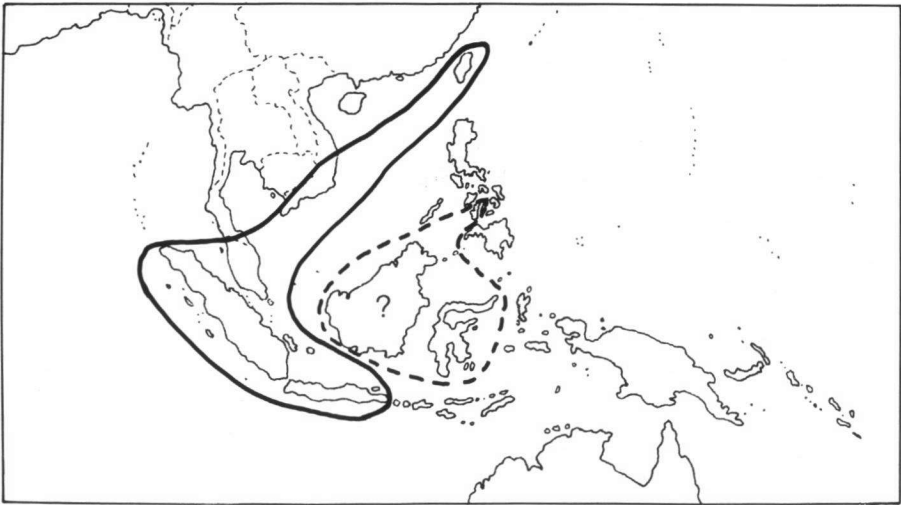


Fig. 17. Distribution of *Hypolepis pallida* (Blume) Hook. Broken line indicates origin of material of uncertain identity.

SUMATRA. Lae Pondom, E. of Sidikalang, *Alston 14963* (BM); Lebong Simpang, Benkoelen, *Brooks 353/S* (BM, CANB); ?G. Kerinci, *Robinson & Kloss* (BM).

PENINSULAR MALAYSIA. Perak: Cawfield's Hill, *Scortechini* (L); Birch's Hill, *Burkill 12732* (BM); G. Hijau, *Matthew s.n.*, *Holtum s.n.* (E). Selangor: Bawang, *Ridley s.n.* (K).

JAVA. Tjibodas, Rawa Tjipanggong, *Alston 12539* (BM); Huistenbosch, *Alston 12843* (BM); Salole Suid, *Raciborski* (L); G. Gedeh, *Matthew s.n.* (K).

?BORNEO. Mt Kinabalu, *Chew et al. 952* (K, L).

?SULAWESI. Kelelonde, *Alston 15813* (BM).

?PHILIPPINES. Negros, Amlan, *Price 2479* (Price pers. herb.).

Notes. *Hypolepis pallida* is known from relatively few collections and is not easily distinguished from *H. bamleriana* and *H. elegans* (see p. 268), except by its larger spores. This difference suggests that *H. pallida* may have a higher chromosome number. Manton & Sledge (1954) and Manton (in Holttum, 1954) reported $n = c.100$ and $n = c.104$ for material from the Taiping Hills and Fraser Hills in Peninsular Malaysia which they referred to *H. punctata*. However, Holttum's (1954) description of *H. punctata* suggests that the material may actually have been *H. pallida*. Clearly, further cytological observations on newly identified material would be desirable.

INCERTAE SEDIS

Cheilanthes resistens Kunze, Linnaea 24 (1851) 14. – *Hypolepis resistens* (Kunze) Hook., Sp. Fil. 2 (1852) 64. – Type: not located. Original collection stated as 'Schmid.-Koch. 93, 149, 150, Nilghiri Hills, southern India'.

As noted above (p. 248), the correct application of this name is in doubt until a type specimen is located.

Hypolepis apicularis Wang, Acta Sci. Nat. Univ. Sunyatsenis 2 (1961) 41. – Type not seen.

Hypolepis coerulescens Biswas, J. Econ. Tax. Bot. 7 (1985) 121, t. 5. – Type: CAL (not seen). Holotype stated as 'Sikkim - Gangtok, 20.9.1982, S.R. Ghosh 56543A'.

Possibly related to *H. polypodioides* or *H. punctata* (see pp. 245 & 252).

Hypolepis flaccida (Hillebrand) Robinson, Bull. Torrey Bot. Club 39 (1912) 579. – *Phegopteris punctata* var. *flaccida* Hillebrand, Fl. Hawaiian Isl. (1888) 563. – Holotype: Baldwin s.n., no locality or date (B 74635).

As noted under *H. hawaiiensis* (p. 242), Robinson's *H. flaccida* is based on Hillebrand's variety which in turn is based on a single, unlocalised collection comprising two small portions of a frond of unknown identity. It is unlikely that the specimen originated from the Hawaiian Islands, and more likely that it belongs to *H. rugosula* from Australia or *H. poeppigii* from South America.

Hypolepis gamblei Biswas, J. Econ. Tax. Bot. 7 (1985) 124, t. 8 – Type: CAL (not seen). Holotype stated as 'West Bengal - Lebung, 1834 m, 4.9.1875, J.S. Gamble 6357A'.

Hypolepis glabrescens Ching, Fl. Reipublicae Popularis Sinicae 2 (1959) 371. – Type: not seen. Type collection stated as 'Yunnan occid., Yen-kiang, south of Teng-chung, 1100 m alt., leg. R.C. Ching 50766, xi 1952'.

Hypolepis indica Biswas, J. Econ. Tax. Bot. 7 (1985) 112, t. 1. — Type: CAL (not seen). Holotype stated as 'Sikkim, Gangtok, 21.9.1982, S.R. Ghosh 56579'. Possibly related to *H. polypodioides* or *H. punctata* (see pp. 245 & 252).

Hypolepis longa Biswas, J. Econ. Tax. Bot. 7 (1985) 112, t. 4. — Type: CAL (not seen). Holotype stated as 'Tamilnadu - Salem Sheveroy hills - Cannery peak, Yercaud 1280 m, 13.6.1963, Ghatak G.476'. Possibly related to *H. glandulifera* (see p. 248).

Hypolepis sikkimensis Biswas, J. Econ. Tax. Bot. 7 (1985) 122, t. 6. — Type: CAL (not seen). Holotype stated as 'Sikkim - Gangtok, 1834 m, 26.5.1959 S.K. Mukherjee 490B'. Possibly related to *H. polypodioides* or *H. punctata* (see pp. 245 & 252).

Hypolepis tenera Ching, Fl. Reipublicae Popularis Sinicae 2 (1959) 370. — Type: not seen. Type collection stated as 'Yunnan austr.-orient., Ping-pien Hsien, Ta-wei Shan, 1200 m alt., leg. R.C. Ching, 21 vii 1952'.

Hypolepis viridula Biswas, J. Econ. Tax. Bot. 7 (1985) 123, t. 7. — Type: CAL (not seen). Holotype stated as 'Sikkim-Lachen, 23.9.1982, S.R. Ghosh 56597A'. Possibly related to *H. polypodioides* or *H. punctata* (see pp. 245 & 252).

Hypolepis yunnanensis Ching, Fl. Reipublicae Popularis Sinicae 2 (1959) 370. — Type: not seen. Type collection stated as 'Yunnan austr.-orient., Ping-pien Hsien, Ta-wei Shan, leg. R.C. Ching, 17 vii 1952'.

EXCLUDED SPECIES

Hypolepis aculeata Gepp, J. Bot. 61 (Suppl.) (1923) 59 = *Dennstaedtia scandens* (Blume) T. Moore. — Holotype: *H.O. Forbes* (BM), Otomionumu Hill, New Guinea Expedition 555.

Hypolepis bivalvis Alderw., Bull. Jard. Bot. Buitenzorg II, 16 (1914) 19, t. 5 = *Paesia elmeri* Copel. — Holotype: *C.G. Matthew* 700 (BO, not seen; isotype BM), Mt Sago, Sumatra. See Holttum (1958).

Hypolepis grandifrons Gepp in Gibbs, Fl. Arfak Mts (1917) 197 = *Dennstaedtia delicata* (F. Muell.) Alston. — Holotype: *L.S. Gibbs* 6258 (BM; isotype CANB), Humboldt Bay, Dutch New Guinea, Jan. 1914. See Alston (1939: 289).

Hypolepis papuana F.M. Bailey, Queensland Agric. J. 23 (1909) 158 = *Dennstaedtia scandens* (Blume) T. Moore. — Lectotype: *Rev. C. King* (BRI 173974-5), British New Guinea, 1909.

Hypolepis tenerifrons Christ, Philipp. J. Sci. 3 (1908) Bot. 274 = *Ctenitis tenerifrons* (Christ) Copel. — Isotype: *E.D. Merrill* 6103 (MICH), Mt Halcon, Mindoro, Philippines, Nov. 1906. See Copeland (1960).

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INDEX TO COLLECTION NUMBERS

The collection numbers of the different collectors are followed by the numbers given to the taxa in this treatment. Unnumbered collections are not included.

- Adelbert 188: 9 – Alston 12539: 14; 12543: 9; 12843: 14; 14104: 2; 14814: 1; 14963: 14; 15173: 2; 15813: 14 – ANU 1527: 5; 1672: 5.
- Bakhuizen van den Brink 7309: 4 – Bamler 74546 B (T): 13 – Barclay 3345: 11 – Barker LAE 67209: 9 – Bartlett 8633: 9 – Betche 13: 11 – Braggins NC 111: 12a; T27: 12a – Braithwaite RSNH 2180: 12a; 2437: 12a; RSS 4875: 12a – Brass 4235: 8; 4389: 8; 4970: 13; 10288: 13; 10717: 13 – Brass & Meijer Drees 9852: 8 – Brooks 17/J: 5; 328/S: 1; 353/S: 14; 415/S: 1 – Broome 5: 9 – Brown & Brown 810: 10 – Brownlie 286: 12a; 294: 12a; 1716: 12a; 1750: 12a; 1774: 12a; 1825: 12a – Buchholz 1285: 11 – Burkill 12732: 14.
- Carr 14777: 1 – Cheeseman 355: 2 – Chew c.s. 923: 9; 952: 14 – Chinnock & Brownsey 5646 (T): 5 – Christopherson 189: 12a; 218: 11; 795: 10; 900: 10 – Christopherson & Hume 2310: 12a – Clemens 593: 11; 2939: 13; 26809: 1; 26980: 5; 27789: 1; 28366: 1; 29110: 5; 29239: 5; 29485: 1; 29497: 5; 30702: 9; 34397: 9; 50708: 13 – Copeland 233: 11; 1932: 9; 4001: 11; 5390: 11 – Croft 77: 13; 204: 12a – Croft LAE 60595: 13; 61699: 9; 61926: 6; 65148: 13; 65710: 2; 68277: 12a – Croft & Marsh 1516: 13; 1520: 5 – Cuming 118: 11; 233: 11.
- Degener 17550: 3.
- Elmer 11532: 13; 11579: 13; 16449: 11.
- Faurie 405: 3; 407: 3 – Flenley ANU 2155: 6 – Florence 2527: 10; 2894: 10; 3275: 10; 4375: 10; 5412: 10; 6372: 12a – Forbes 917M: 3; 1005H: 3; 1047K: 3; 1161M: 3; 1732M: 3; 2166M: 3; 2608M: 3 – Fosberg 11617: 12a – Franc 143 (T): 11; 649: 12a – Fung 20220 (T): 11.
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 dicksonioides Endl. = 10
 var. *phyllochaena* Kunze = 5
 dissecta Hook. et Arn. = 11
 pallida Blume = 14
 pellucida Colenso = 10
 polypodioides Blume = 4
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