

THE TREE-FERNS OF THE GENUS CYATHEA IN AUSTRALASIA AND THE PACIFIC

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The present account of this genus follows the lines of that adopted for Flora Malesiana (ser. II, 1, part 2, 1963). While studying Malesian species, I examined the types of those in neighbouring regions, to discover to what extent Malesian species were distributed further to the East and South-east. I found very few species with such extended distribution, but it was evident that the species of Australasia and the Pacific are closely related to those of Malesia. There has been no attempt at a full comparative survey of all the species of *Cyathea* over this vast area since Hooker and Baker's *Synopsis Filicum* (2nd edition, 1874). Later accounts have been very summary, or confined to limited parts of the region, and there has been inconsistency as between different accounts in the interpretation of some specific names, especially those originating with Forster. I have now examined type material of almost all species, and hope that I have resolved most of the discrepancies of interpretation. A few new species are also here described.

Though the scales of the stipe provide characters by which any species may be placed in its subgenus, other characters are usually necessary for distinguishing individual species. Working from herbarium specimens, I find that the only way to distinguish clearly between species is to examine both indusia (if any) and scales on the lower surface of leaflets with a binocular dissecting microscope at a magnification of 25, and in the descriptions I have attempted to state concisely the distinctive characters of scales and indusia thus seen. The only previous authors who described scales at all carefully were Mettenius and Christensen. The indusia need even more careful examination than the scales. Some which have been described as cup-shaped are in fact hood-shaped, being open on the side towards the margin of the leaflet (e.g. *C. cunninghamii*); at the other extreme are indusia so small that they are covered by the ripe sporangia and so have sometimes been overlooked (e.g. in *C. decurrens*).

In preparing keys to all the species, I have thus been obliged to use, in the main, characters of the small scales and of indusia. It may well be that there are other characters, of which I am ignorant, by which species may be distinguishable in the field. For each islandgroup, in dealing with a small number of species, it should be possible to construct a key based mainly on macroscopic field characters, or at least on characters easily observable with a hand-lens. But it must be emphasized that a large number of species of *Cyathea* are very much alike in general aspect, and that very careful examination is needed to see their distinctive characters.

Under each species I have cited the type, and also numbered collections from islands of the Pacific which occur in several herbaria. The main part of the work has been done at Kew, but I have also examined specimens at the British Museum, Leyden, Paris, Washington, Harvard, University of Michigan, University of California, Lae, Brisbane, Sydney, Melbourne, and Singapore; and I have received on loan specimens from Berlin, Washington, and the Bishop Museum, Honolulu. I wish to express my thanks to the

heads of herbaria for their courtesy in allowing me access to the collections. In all cases where no herbarium is cited after a collector's number, it is to be understood that I have seen a specimen in Kew herbarium.

Full citations of type and other specimens of Australian species are given in Dr M. Tindale's account of the *Cyatheaceae* of Australia (Contr. N. S. W. Nat. Herb. 2, no 4, 1956) and no repetition is here necessary. Similarly I have not attempted to list specimens of New Zealand species.

KEY TO SUBGENERA AND SECTIONS

1. Stipe-scales firm, with fragile edges which are often abraded when old; deeply excavated pneumathodes arranged as V below base of each stipe Subgenus *CYATHEA*
2. Indusia present (sometimes hidden by sporangia) in almost all cases; axes of frond not very dark; little difference in size between fertile and sterile leaflets; larger scales on pinnules often lacking dark median band Section *Cyathea*
2. Indusia lacking; axes of frond very dark; fertile pinnules contracted as compared with sterile; larger scales on pinnules always with dark median band Section *Gymnosphaera*
1. Stipe-scales (at least in their distal part) having cells uniform throughout, their marginal cells, or some of them, bearing thickwalled oblique setae; deeply excavated pneumathodes lacking below stipe-bases
Subgenus *SPHAEROPTERIS*
3. Costules not widely spaced (rarely over 4 mm apart in pinnules 10 cm long); pinnules lobed almost or quite to costa throughout, or fully pinnate; basal basicopic vein of each group usually not springing directly from costa; pinna-rachis usually warty on lower surface Section *Sphaeropteris*
4. Stipe and rachis not very dark, usually glabrescent above base of stipe; sori indusiate or not, in the latter case sometimes bearing narrow scales spreading round base of receptacle
Subsection *Sphaeropteris*
4. Stipe and rachis very dark, bearing many small scales which have dark setae; pinnules mostly fully pinnate; sori protected by overlapping thin scales, not by indusia. Subsection *Fourniera*
3. Costules commonly 5—6 mm apart except on small pinnules; pinnules not lobed to within 1 mm of costa; basal basicopic vein of a group always springing from costa; pinna-rachis smooth.
Section *Schizocaena*

Subg. *CYATHEA* sect. *Cyathea*

This is the largest section of the genus in Malesia, and difficult to subdivide satisfactorily. Malesian species are almost all forest plants, not reproducing spontaneously in the open, in contrast to those of subg. *Sphaeropteris* sect. *Sphaeropteris* which are characteristic of forest clearings, and often establish themselves on bare earth banks.

The main division in the following key is based on the form of the indusium, whether cup-shaped (surrounding the base of the receptacle) or attached only on the costular side. A majority of species have an indusium of the latter kind. Such indusia differ much in size in different species, in some being so small that they are covered by the ripe sporangia, in others so large that they cover sorus to maturity and then often break. In the latter case very careful examination is needed to distinguish them from indusia which surround the bases of receptacles and are ultimately cup-shaped though often broken when old.

KEY TO THE SPECIES

1. Indusium absent.
 2. Pinnae commonly 50 cm long; no very small setiferous scales on costae . . . 1. *C. australis*
 2. Pinnae not over 27 cm long; very small setiferous scales abundant on lower surface of costae. 2. *C. colensoi*
1. Indusium present.
 3. Indusium at first covering the sorus completely, its base completely surrounding the receptacle.

4. Pinna-rachis covered beneath with crisped hairs or hair-like scales which are not setiferous.
 5. Hairs on lower surface of pinna-rachis coarse; indusium a cup of uniform texture with smooth rim, sometimes breaking when old.
 6. Lower surface of lamina conspicuously white 3. *C. dealbata*
 6. Lower surface not conspicuously white 4. *C. milnei*
 5. Hairs or hair-like scales on lower surface of pinna-rachis fine; indusium saucer-shaped with pale edge. 5. *C. macarthurii*
4. Pinna-rachis covered beneath with small scales, many of them bearing dark setae 6. *C. archboldii*
3. Indusium open on side of receptacle remote from costule, its base never forming a complete cup round receptacle.
 7. Lamina-segments, both sterile and fertile, lobed at least half-way to costule; veins often pinnate in the lobes.
 8. Paraphyses thick, pale, much longer than sporangia.
 9. Small appressed hairs abundant on upper surface of lamina between veins. . 7. *C. robertsiana*
 9. Small appressed hairs lacking. 8. *C. howeana*
 8. Paraphyses not longer than sporangia.
 10. Pinnae to 15 cm long; pinnules to 5 cm 9. *C. stokesii*
 10. Pinnae to 50 cm or more long; pinnules commonly 8—10 cm.
 11. Bullate scales present on costae and/or costules.
 12. Indusium distinct, semicircular 10. *C. alata*
 12. Indusium hidden by sporangia 11. *C. decurrens*
 11. Bullate scales lacking *C. decurrens* subsp. *epaleata*
 7. Sterile lamina-segments not deeply lobed; lateral veins in segments not pinnate.
 13. Bullate scales abundant on costules.
 14. No long-rayed stellate hairs or scales on costae and costules 12. *C. alta*
 14. Long-rayed stellate hairs or scales abundant on costae and costules . 13. *C. stelligera*
 13. Bullate scales lacking on costae and costules.
 15. Very small scales bearing long stiff pale hairs or dark setae abundant on lower surface of costae.
 16. Fertile lamina-segments deeply lobed.
 17. Pinnules to 2.5 cm wide; indusium quite covering sorus to maturity, then breaking 14. *C. cunninghamii*
 17. Pinnules to 1.8 cm wide; indusium reflexed at maturity, not splitting 15. *C. smithii*
 16. Fertile lamina-segments not deeply lobed. 16. *C. kermadacensis*
 15. Very small scales of this kind lacking.
 18. Indusium small, hidden by mature sporangia.
 19. Stipe-scales thick at base which is covered with smaller scales; hairs present on lower surface of costae and distal part of pinna-rachis. . 17. *C. woollisiana*
 19. Stipe-scales smooth; no hairs on lower surface of costae and pinna-rachis 18. *C. solomonensis*
18. Indusium conspicuous.
 20. Indusium almost covering sorus, breaking at maturity, not obviously hoodshaped.
 21. Axes of frond very dark; hairs present towards apices of costae and on costules on lower surface 19. *C. aneitensis*
 21. Axes of frond pale; hairs often present on pinna-rachis and bases of costae, rarely on lower surface of costules 20. *C. vieillardii*
 20. Indusium only half covering sorus at maturity, not or little breaking.
 22. Larger costal scales flat, broad, uniformly pale brown, with 1 or more long dark setae. 21. *C. marcescens*
 22. Larger costal scales otherwise.
 23. Pinnules 4—5 cm long; pinna-rachis scales narrow, entire 22. *C. brevipinna*
 23. Pinnules to at least 7.5 cm long; pinna-rachis scales in most cases bearing short dark setae.
 24. Pinnules to 7.5 cm long, veins to 8—9 pairs; no scales on lower surface of veins; indusium firm, reflexed at maturity 23. *C. plagiostegia*
 24. Pinnules commonly 10 cm long, veins 10—14 pairs; small scales present on lower surface of veins; indusium thin, larger, not wholly reflexed at maturity 24. *C. affinis*

1. *Cyathea australis* (R. Br.) Domin, Pterid. (1929) 262; Goy, Queensl. Nat. 12 no 3 (1943) 42; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 349. — *Alsophila australis* R. Br., Prodr. Fl. N. Holl. (1810) 158; Hook., Spec. Fil. 1 (1844) 50, t. 19A. — *Alsophila loddigesii* Kze, Linnæa 20 (1847) 7; *ibid* 23 (1850) 221; Bak., Syn. Fil. ed. 2 (1874) 458. — *C. loddigesii* (Kze) Domin, Pterid. (1929) 262.

Trunk to 20 m tall, massive. *Stipe* to 60 cm, near base bearing conical spines to 3 mm long and densely scaly; scales bright brown, shining, stiff, often twisted, 2—5 cm long, commonly to 3 mm wide, with pale fragile edges. *Pinnae* to 50 cm long, lower ones somewhat reduced; pinna-rachis beneath pale, sparsely warty, glabrescent but usually bearing some very narrow pale crisped hair-like scales. Largest *pinnules* 10—13 × 2—3 cm, lowest 1—2 segments often almost or quite free, then 2 or more pairs separately adnate to costa, rest of pinnule lobed almost to costa; costules 4 mm apart; veins to 12 pairs; lamina-segments more or less crenate-serrate. *Sori* nearer to costule than edge, exindusiate; receptacle bearing some small basal scales; paraphyses many, as long as sporangia, some apical ones flat and scale-like. *Scales on costae* mostly light brown, bullate with dark setiform apex, some basal ones more elongate and almost flat, also very narrow crisped hair-like scales as on pinna-rachis; scales on costules bullate, pale, hair-pointed.

Distribution: South-eastern Queensland southwards to Tasmania.

subsp. *norfolkensis* Holttum, *subsp. nov.*

A species typical differt paleis costarum non bullatis, paleis costularum interdum convexis, vix bullatis.

Type specimen: Metcalf s. n. Feb. 1905 (NSW, P5817), Norfolk Island. The only other specimens seen are *Robinson s. n.* 1884 (MELB); *P. S. Green* 1416, 1417, 1418.

2. *Cyathea colensoi* (Hook. f.) Domin, Pterid. (1929) 262; Crookes & Dobbie, N. Z. Ferns ed. 6 (1963) 130. — *Alsophila colensoi* Hook. f., Fl. N. Z. (1854) 8, t. 73.

Trunk usually prostrate, more or less ascending at apex; fronds 60—150 cm long. *Stipe* to 20 cm long; basal scales to 25 × 1½ mm, pale or partly dark and shining, edges dull and fragile. *Pinnae* to 27 cm long; pinna-rachis beneath persistently scaly, scales shining, dark with pale fragile edges and pale bullate base, also very small stellate scales. *Pinnules* to 4 cm long, 10—14 mm wide, lowest 1—2 segments almost or quite free, rest of pinnule lobed almost to costa; costules 3 mm apart; veins 5—6 pairs, simple or forked; lamina-segments rather strongly crenate-serrate. *Sori* exindusiate; paraphyses longer than sporangia. Larger *costal scales* pale or the largest partly dark, bullate at base, apex acuminate, edges sometimes with several rather long dark setae, also very small dark red stellate scales bearing short dark setae; on costules also pale bullate scales and small dark red stellate scales.

Distribution: New Zealand; in montane forest from southern part of North Island to Stewart Island.

3. *Cyathea dealbata* (Forst.) Sw., Schrad. J. Bot. 1800, ii (1801) 94; Rich., Fl. Nouv. Zél. (1832) 77, t. 10; Hook., Spec. Fil. 1 (1844) 27; Crookes & Dobbie, N. Z. Ferns ed. 6 (1963) 128. — *Polypodium dealbatum* Forst., Prod. (1786) 83. — *C. tricolor* Colenso, Trans. N. Z. Inst. 15 (1883) 304.

Trunk to 10 m tall, upper part covered with withered fronds. *Stipe* covered at base with many dark brown shining twisted scales to 40 × 2 mm. *Pinnae* to 65 cm long;

pinna-rachis more or less persistently covered beneath with rather thick pale crisped hairs, at length pale and almost smooth (warts small and sparse); when young also bearing long narrow pale scales which have a setiform apex and a few rather long marginal setae. *Pinnules* to 12×2 cm, in the largest 1—2 basal segments free, then several pairs separately adnate, rest of pinnule lobed almost to costa; costules $3\frac{1}{2}$ — $4\frac{1}{2}$ mm apart; veins 9—11 pairs; lamina-segments firm, edges crenate-serrate, lower surface almost white. *Sori* nearer to costule than edge; indusium thin, brown, covering young sorus and opening at maturity to form a shallow to deep cup with smooth rim, later often breaking especially when cup is deep. *Costae* covered beneath with crisped hairs like those of pinna-rachis, also some pale elongate scales which may have setiform apices.

Distribution: throughout New Zealand; specimens formerly so named from Lord Howe Island are *C. macarthurii* (F. v. Muell.) Bak.

Note. Colenso stated that his *C. tricolor* had a shallow indusial cup and an observable difference in the blue-white covering of the lower surface of the lamina. It appears to me, however, that there is no sharp distinction between specimens with deep and shallow indusial cups, and herbarium specimens do not indicate any difference in the nature of the white covering of the lower surface of the lamina.

4. *Cyathea milnei* Hook. in Hook. f., Handb. Fl. N. Z. (1864) 349; Oliver, Trans. N. Z. Inst. 42 (1910) 157, pl. XXI; Crookes & Dobbie, N. Z. Ferns ed. 6 (1963) 144.

Trunk 2—8 m tall, clothed at the top with hanging withered fronds; fronds $2\frac{1}{2}$ —4 m long (Oliver). *Pinnae* to 45 cm or more long; pinna-rachis beneath pale, sparsely warty, when young covered with a felt of rather thick pale crisped hairs. *Pinnules* to 12×2 cm, rather long-acuminate, lowest basicopic segment almost free, rest of pinnule lobed to within 1 mm of costa; costules $3\frac{1}{2}$ —4 mm apart; veins 10 pairs; lamina-segments rather rigid, slightly crenate-serrate, pale beneath but not conspicuously white. *Sori* near costules; indusium thin, cup-shaped, opening by a circular aperture to form a complete cup with smooth rim, usually breaking later; paraphyses slender, not longer than sporangia. *Costae* beneath sometimes bearing sparse crisped hairs as pinna-rachis, or minute simple hairs; costal scales sparse, broad, flat, often with a dark apical seta; costules sometimes with smaller flat scales; very short hairs abundant on costules and veins of lower surface, sometimes also on lamina between veins.

KERMADEC ISLANDS. *Milne s. n.* 5 July 1855 (type, K); *MacGillivray 942*; *Cheeseman 85* (part), Sunday Island; *Oliver s. n.* 12 Oct. 1908. 5 Sept. 1908, Sunday Island.

Notes. Very near *C. dealbata*, the only clear distinction I have noticed being the lack of white covering on lower surface of lamina; the collections do not include stipe-scales. As regards colour of the under-surface, Oliver noted only that it is paler than the upper surface. The indusia are perhaps more fragile than in *C. dealbata* and do not so persistently form cups with entire rim.

5. *Cyathea macarthurii* (F. v. Muell.) Bak., J. Bot 12 (1874) 280. — *Hemitelia macarthurii* F. v. Muell., Fragm. Phyt. Austr. 8 (1874) 176 (not *Alsophila macarthurii* Hook. 1866). — *C. moorei* Bak., Syn. Fil. ed. 2 (1874) 453 (not *Alsophila moorei* J. Sm. 1866).

Stipe not seen. *Pinnae* to 50 cm long; pinna-rachis rather persistently covered beneath with a pale felt of fine crisped hairs, or of very narrow hair-like scales, when old pale and finely warty. Largest *pinnules* 9—12 \times 1.4—2.0 cm, 1—2 basal segments almost or quite free, rest of pinnule lobed almost to costa; costules $3\frac{1}{2}$ mm apart; veins 10—12

pairs; lamina-segments crenate-serrate, not deeply lobed. *Sori* nearer to costule than edge; indusium of old *sori* saucer-shaped, almost as wide as base of sorus, dark near receptacle, paler towards the usually rather even edges. *Costae* beneath more or less covered with delicate crisped pale hairs as pinna-rachis, also when young with thin flat pale-brown elongate scales which have short marginal hairs and often end in a dark curved seta; similar scales sometimes on costules.

LORD HOWE ISLAND. *C. Moore*, several specimens (type of *C. moorei* Bak., K); *MacGillivray* 703; *Milne* 26; *Duff* s. n. (NSW); *Watts* s. n. July-Aug. 1911 (several sheets, NSW); *Boorman* s. n. May 1920 (NSW); *Oliver* s. n. Nov. 1913, top of Mt Gower; Erskine valley (NSW).

Note. Some of these specimens were formerly labelled *C. dealbata*. Boorman noted that the underside of the frond is silvery, and a glaucous condition is distinct in several specimens.

6. *Cyathea archboldii* C. Chr., *Brittonia* 2 (1937) 278; *Holttum*, *Fl. Males. II*, 1 (1963) 98. — *C. bidentata* Copel., *Univ. Cal. Publ. Bot.* 18 (1942) 218; *Philip. J. Sc.* 77 (1947) 105, pl. 3.

Stipe c. 50 cm long (not seen in Bougainville specimens), base covered with scales; largest scales 30–40 × 1½–2 mm, very pale to brownish with fragile edges which may be darker than the rest, also present a rather close layer of rusty brown scurf formed by irregular small scales mostly bearing flexuous setae. *Pinnae* to at least 56 cm long; pinna-rachis beneath pale, not conspicuously warty, more or less persistently covered with very small scales as those of stipe, with some residual elongate scales bearing a few dark setae. *Pinnules* to 8.5 × 1.5 cm, lowest 1–2 segments almost or quite free, rest of pinnule lobed nearly to costa; costules 3–3½ mm apart; veins to 10 pairs, dark and not raised on lower surface; lamina-segments firm, where fertile distinctly lobed, each lobule bidentate. *Sori* near costules; indusium at first completely covering sorus, rather firm, breaking irregularly at maturity; receptacle bearing short paraphyses at apex. *Costal scales* as those on pinna-rachis but smaller, some elongate, narrow, pale brown or darker towards base, with some dark marginal setae especially near apex, smallest scales abundant, pale with short concolorous marginal hairs; on costules pale short-fringed scales, larger ones convex or sub-bullate; very small scales occasionally on veins.

Distribution: New Guinea, Bougainville.

BOUGAINVILLE *Kajewski* 1759, Kupei Goldfield, in rain forest, 1000 m, common.

Notes. In New Guinea this species has been collected at altitudes of 1950 to 3000 m. The Bougainville specimen is less rigid than most from New Guinea and the small scales on costules and veins generally are pale-fringed, not setiferous.

7. *Cyathea robertsiana* (F. v. Muell.) Domin, *Pterid.* (1929) 263; *Goy*, *Queensl. Nat.* 12 (1943) 44; *Tindale*, *Contr. N. S. W. Nat. Herb.* 2 (1956) 344. — *Alsophila robertsiana* F. v. Muell., *Fragm. Phyt. Austr.* 5 (1865) 54, 117; *F. M. Bailey*, *Lith. Queensl. Ferns* (1892) t. 39; *Queensl. Fl.* 6 (1902) 1949.

Trunk to 5 m tall, fronds not forming a regular crown (?). *Stipe* minutely scabrous, lower surface covered throughout (and main rachis) with spreading curved pale hairs, near base some rather thin brown scales with paler fragile edges. *Pinnae* to 60 cm long; pinna-rachis hairy on lower surface as main rachis, scales usually all deciduous. *Pinnules*

commonly to 9×2.5 cm (largest 3 cm), segments nearly all constricted at base and joined to a very narrow wing along costa; costules 4—5 mm apart; veins 10 pairs, in many cases pinnately branched; lamina-segments widely spaced, thin, lower ones lobed almost to costule, lobules crenate or lobed. *Sori* one to each lobule of a segment, on basal acroscopic branch of a vein-group; indusium small, on costular side of receptacle, pale and thin; paraphyses pale, longer than sporangia. *Costae and costules*, also veins, covered beneath with rather long spreading hairs; scales few, seen only on a young frond, broad, flat, with rounded apices and no setae; upper surface of lamina bearing many short appressed pale hairs.

Distribution: N. E. Queensland, in mountain forest.

Note. The statement that the fronds do not form a regular crown is taken from Goy and Tindale. However, I saw several plants of this species in forest on hills near Cairns, and did not note anything unusual about their habit. This is the westernmost member of the group of *C. decurrens*.

8. *Cyathea howeana* Domin, Pterid. (1929) 264. — *Hemitelia moorei* Bak., Gard. Chron. (1872) 252; Syn. Fil. ed. 2 (1874) 455 (not *C. moorei* Bak. nor *Alsophila moorei* J. Sm.).

Stipe not seen. Largest *pinna* seen 33 cm long; pinna-rachis beneath rather dark, bearing small, pale, bullate scales; often also pale, slightly crisped, antrorse hairs. *Pinnules* to 8×2.2 cm, lowest 1—2 pairs of segments free, then several pairs contracted on acroscopic side at base but connected by narrowly decurrent bases; costules to 4 mm apart; veins to 9 pairs, forked, or sometimes with acroscopic branch again forked; lamina-segments firm, lobed more than half-way to costule, lobules crenulate at apices. *Sori* one to each lobule; indusium a quadrant of a circle, on costular side, firm, brown, reflexed towards costule at maturity but not reaching costule; paraphyses pale, thick, longer than sporangia. *Costae and costules* beneath bearing small, pale, bullate scales as pinna-rachis, with pale antrorse hairs sometimes also on costae; on upper surface of costules, distally, a few long, pale, thick hairs.

LORD HOWE ISLAND. *C. Moore* 4, 12, 25, 68 (species apparently based on all these, K); *G. King* s. n. Feb. 1892 (NSW); *Watts* s. n. Aug. 1911, top of Mt Gower (NSW); *E. King* s. n. Aug. 1911 (NSW).

9. *Cyathea stokesii* E. Brown, Bishop Mus. Bull. no. 89 (1931) 16, fig. 5.

Stipe 14 cm long, pale, base covered with glossy brown pale-edged scales to 15×5 mm. *Pinnae* to 15 cm long; distal part of lower surface of pinna-rachis bearing pale crisped hairs. *Pinnules* overlapping, lower ones stalked to 5 mm, upper sessile, to 5×1.5 cm, lowest 2 segments free, then several contracted on acroscopic side at base; lamina-segments very oblique, lobed half-way to costule; veins 6 pairs, those in the larger lobes pinnate. *Sori* near costules; indusium small, on costular side, hidden by base of sorus. *Scales* near bases of costae small, pale, not bullate; rather sparse pale crisped hairs present throughout lower surface of costae; costules glabrous beneath, upper surface bearing sparse hairs.

RAPA ISLAND (Austral Group). *Stokes* 361, Pariati, 850 ft (*type*, BISH).

Note. The type (and apparently sole) specimen might be from an immature plant, as it is very small. It is clearly related to *C. decurrens*, but differs in the apparent absence of bullate scales. See also *C. cicatricosa*, p. 274.

10. *Cyathea alata* (Fourn.) Copel., Univ. Cal. Publ. Bot. 12 (1931) 377. — *Alsophila alata* Fourn., Ann. Sci. Nat. V, 18 (1873) 349. — *C. decurrens* [non (Hk.) Copel.] Copel., Univ. Cal. Publ. Bot. 14 (1929) 356, p.p.

Stipe-scales to 15×3 mm, dark, shining, with broad, dull, fragile edges; main rachis pale, smooth and glabrescent beneath, or with small pale scales at bases of pinnae. *Pinnae* to 50 cm long; pinna-rachis pale glabrescent beneath, sometimes with residual small pale scales, larger ones bullate. *Pinnules* to 9×2.5 cm, lowest 1—6 pairs of segments free, rest connected by a narrow wing along costa; costules $3\frac{1}{2}$ — $4\frac{1}{2}$ mm apart; veins 8—10 pairs, forked once or twice in fertile segments, pinnate in sterile ones; lamina-segments lobed $\frac{2}{3}$ — $\frac{3}{4}$ towards costule, lobules crenate at apex. *Sori* near costules; indusium a semicircle, reflexed at maturity and overlapping the costule; paraphyses slender, shorter than sporangia. *Scales on costae* pale, bullate, often very abundant, with some very small, pale, non-bullate scales; on costules many bullate scales near costa also distally some flat, dark, ovate scales; no long hairs on lower surface of costae and costules, a few on upper surface of costules.

NEW CALEDONIA. *Balansa 1589* (type collection; sterile at K, UC), *1589a*, *1589b*, *2738* (BM, NSW); *Vieillard 1611*; *Compton 565* (BM); *McKee 3195* (BM); *Brownlie 15* (BM); *P. S. Green 1778*, Mt. Ignambi, 1200 m.

Note. The specimen of *Balansa 1589b* at Kew is fully fertile; it was distributed as *Alsophila decurrens*, but is certainly *C. alata*, agreeing exactly with *1589* in shape of pinnules and in scales.

11. *Cyathea decurrens* (Hook.) Copel., Univ. Cal. Publ. Bot. 14 (1929) 356; Bishop Mus. Bull. no 93 (1932) 33; C. Chr., Bishop Mus. Bull. no 177 (1943) 31. — *Alsophila decurrens* Hook., Spec. Fil. 1 (1844) 51. — *C. subbullata* Copel., Occ. Pap. Bishop Mus. 15 (1939) 79, fig. 1.

Stipe 30—50 cm long, pale, sparsely warty; basal scales 20×3 —4 mm, dark with paler fragile edges; upper part of stipe sometimes with thin covering of interlacing, very small, pale, fringed scales. *Pinnae* to 55 cm long; pinna-rachis pale, smooth, glabrescent or with minute scales as stipe on lower surface. *Pinnules* commonly to 10×2.5 cm sometimes to 13×3 cm, basal 1—2 pairs of segments free, successive ones gradually more adnate to costa, almost all constricted at base on acroscopic side and separated by rather wide sinuses; costules $4\frac{1}{2}$ —6 mm apart; veins 9—10 (—12) pairs, most of them pinnately branched or forked with acroscopic branch again forked; lamina-segments lobed nearly to costule at base, less deeply distally, lobules crenulate near apices. *Sori* usually on the acroscopic branch of a vein or basal such vein of a pinnate group; indusium on costular side of receptacle, very small, more or less lobed, quite covered by sporangia; paraphyses not longer than sporangia. *Scales on costae* bullate where present (often caducous), often some long pale hairs on lower surface near apex of pinnule; pale bullate scales abundant on lower surface of costules, also thick pale hairs, especially near apex of pinnule, on both surfaces (extent of hairiness very variable on both surfaces).

Distribution. Map 1.

Without locality, *Nightingale* (type, K).

COOK ISLANDS, Rarotonga: *Cheeseman 733*; *Parks 22328*.

SAMOA. *Powell 210*, *246*.

Fiji. *St. John 18304* (type coll. of *C. subbullata*, K, NSW, UC, MICH); *A. C. Smith 8796* (US), *5045*, *5925*, *6145* (distributed as *C. subbullata*).

NEW HEBRIDES. Aneiteum: *Milne 349*; *Herb. Thos Moore 71*.

Var *vaupelii* (Brause) Domin, Acta Bot. Bohem. 9 (1930) 110; C. Chr., l.c. — *Alsophila decurrens* var. *vaupelii* Brause, Notizbl. Bot. Gart. Berlin 8 (1922) 139.

Pinnules to 14 cm long and 4 cm wide; costules to 7 mm apart; lobules of lamina-segments rather deeply lobed.

SAMOA. *Vaupel* 438 (type coll. of var., K); *Christophersen* 3186.

Subsp. *epaleata* Holtum, *subsp. nov.* — *C. decurrens sensu* Copel., Occ. Pap. Bishop Mus. 15 (1939) 80.

A subspecies typica differt: paleis bullatis nullis; indusio majore, velut quadratam circuli efformante.

TAHITI. M. L. Grant 4233, Papenoo, Orofena (type of subsp., K). *Pancher s. n.* 1854 (Herb. Thos Moore, K)

Notes. As in typical *C. decurrens*, there is variation in Tahiti specimens as regards the hairs on lower surfaces; in Grant's specimen there are no such hairs, but in Pancher's they are abundant on costae and costules. Judging by Copeland's remarks, the lack of bullate scales is normal in Tahiti specimens; not having seen the type, he thought this the normal condition of the species, and made the presence of such scales one of the distinguishing characters of his *C. subbullata* from Fiji. It would be possible to regard

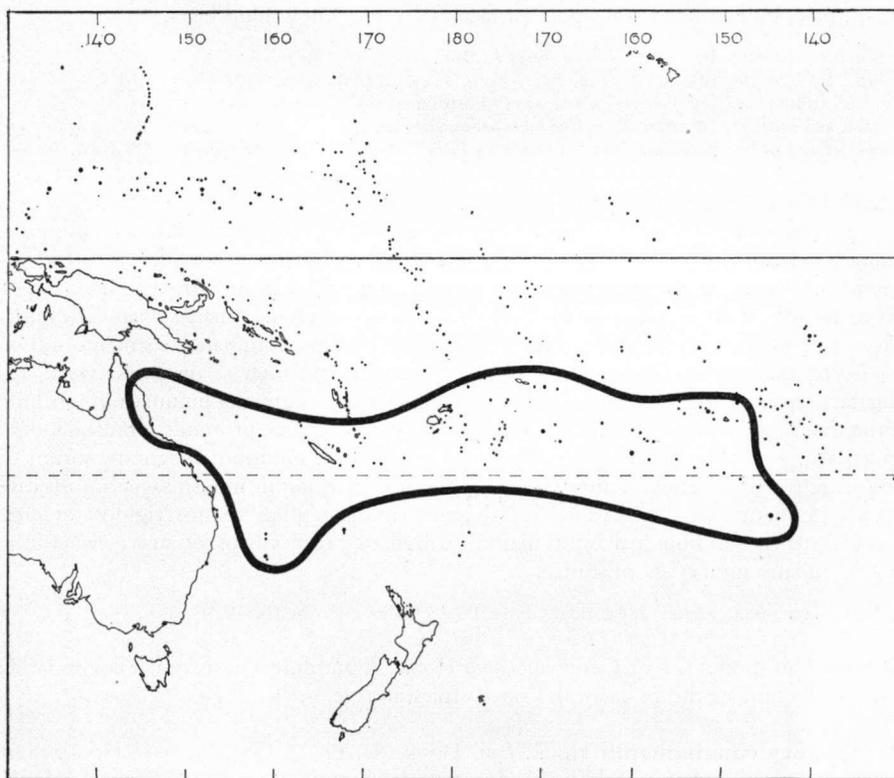


Fig. 1. Distribution of *Cyathea decurrens* and allied species.

C. alata, *C. howeana*, and *C. stokesii* also as subspecies of *C. decurrens*; their relationship to *C. robertsiana* is also obvious.

12. *Cyathea alta* Copel., Philip. J. Sc. 60 (1936) 104, pl. 10. — *Alsophila samoensis* Brack., U. S. Expl. Exp. 16 (1854) pl. 40 f. 1, but no description nor specimen in Herb. US. — *C. plagiostegia* (non Copel.) C. Chr., Bishop Mus. Bull. no 177 (1943) 28.

Trunk to 6 m tall, slender; fronds 2—3 m long. Stipe 15—40 cm long (if short, basal pinnae reduced), rather dark near base with many conical spines 1 mm long; basal scales to 25×1 mm, dark shining, edges dull and fragile; also minute dull scales of irregular shape, not setiferous. Lowest pinnae very short or up to 20 cm long, depending on length of stipe; longest pinnae 50 cm; pinna-rachis rather densely covered beneath with very small, pale, bullate scales, with a few narrow scales 3—4 mm long bearing sparse long dark setae. Pinnules to 9×1.9 cm, basal segment almost free, rest of pinnule lobed almost to costa; costules to $4-4\frac{1}{2}$ mm apart; veins 10—12 pairs, mostly forked, some with acroscopic branch again forked; lamina-segments rather thin, where fertile strongly crenate-serrate but not lobed more than $\frac{1}{4}$ towards costule. Sori near costules; indusium a brown scale attached on costular side, variable in size (in type very small), usually with uneven edge, $\frac{1}{4}-\frac{1}{2}$ circle in shape, hidden, or almost hidden, by sporangia; paraphyses shorter than sporangia. Scales on costae throughout small, pale, bullate; towards bases of costae some flat, elongate, brown scales with a few long setae; on costules many small, pale, bullate scales; on upper surface of costules a few long hairs.

SOLOMON ISLANDS. Isabel: Brass 3330 (type, A, BO).

FIJI. A. C. Smith 7105, 7260, 8139, 8348, 8460, 8933 (all US), 4909, 6788 (distributed as *C. extensa*) 1015 (distributed as *C. plagiostegia*); Parks 20557 (distributed as *C. extensa*).

SAMOA. Vaupel 417 (distributed as *Alsophila samoensis*); Christophersen 3110 (distributed as *C. plagiostegia*); Reehinger 1899 (distributed as *Alsophila lunulata*); Powell 255; Vaughan 3269; McKee 2873 (BM, NSW).

13. *Cyathea stelligera* Holtum, *sp. nov.*

Stipes nigricans, crasse verrucosus, basi paleis vestitus; paleae rigidae, atrobrunneae, supra nitidae, infra hirsutae, ad 35×4 mm. Rhachis primaria pallida, laevis, infra glabrescens. Pinnae ad 70 cm vel ultra longae; rhaches pinnarum infra pallidae, laeves, paleis minutis stellatis pilos rigidos $\frac{1}{2}-\frac{3}{4}$ mm longos ferentibus ornatae. Pinnulae dimorphae; pinnulae steriles ad 12 cm longae, 2 cm latae, longe acuminatae, segmento infimo \pm libero excepto fere ad costam lobatae; costulae 4 mm inter se distantes; venae 12-jugatae; segmenta laminae tenuia, leviter crenato-serrata; segmenta pinnularum fertilium 2 mm lata, sinubus latis separata, ala angustissima costale juncta, profunde lobulata, lobulis bidentatis. Sori paginam inferiorem laminae occupantes; indusium magnum, sorum ex toto tegens sed marginem laminae versus apertum (marginibus indusii saepe imbricatis), tenue, in maturitate rumpens. Paleae costarum minutae, pilos longos rigidos ferentes; costulae paleis similibus paleisque majoribus bullatis breve ciliatis ornatae; venae infra paleis bullatis minoribus praeditae.

NEW CALEDONIA. McKee 9863, ridge above Pouco Valley, 500 m (NSW, type).

Note. This species is near *C. cunninghamii* Hook. f., but differs in its much larger darker stipe-scales and in the bullatescales on costules and veins.

14. *Cyathea cunninghamii* Hook. f. in Hook., Ic. Pl. 10 (1854) t. 985; Hook., Syn. Fil. (1865) 25; Crookes & Dobbie, N. Z. Ferns ed. 6 (1963) 136; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 339.

Stipe 10 cm long, strongly warty; basal scales to 35×2 mm, pale or partly or wholly dark, shining, with dull fragile edges near base, greater part of scale often very narrow, twisted. Lowest *pinnae* 7 cm long, longest to 60 cm; pinna-rachis beneath finely warty, pale, glabrescent, residual scales very small, bearing long stiff marginal hairs or dark setae. Largest *pinnules* $8-12 \times 1.8-2.5$ cm, lowest 1-2 segments free, rest of pinnule lobed almost to costa; costules $3\frac{1}{2}-4$ mm apart; veins 8-10 pairs; lamina-segments rather thin, where fertile lobed more than $\frac{1}{2}$ way to costule. *Sori* one to each lobe of a segment; indusium large, thin, covering sorus to maturity but open at base on side remote from costula (edges often overlapping), breaking at maturity. *Scales on costae* mostly very small, pale, with long stiff marginal hairs, with a few thin flat pale scales which may have 2-3 pale hairs (rarely dark setae) at apices; similar scales on costules, the flat ones somewhat bullate at base.

Distribution: S. E. Australia (Victoria and Tasmania), New Zealand, Chatham Islands.

15. *Cyathea smithii* Hook, f., Fl. New Zeal. 2 (1854) 8, t. 22; Crookes & Dobbie, N. Z. Ferns ed. 6 (1963) 140. — *Hemitelia smithii* Hook., Syn. Fil. (1865) 31.

Stipe short; basal scales to $50 \times 1\frac{1}{2}$ mm, dark, shining, rigid, distally twisted, fragile edges paler, scales on young stipe above base and on main rachis pale, thin, with long terminal seta. Lower *pinnae* gradually reduced, lowest 10 cm, longest 40 cm; pinna-rachis beneath pale, sparsely minutely warty, usually with some very narrow entire scales and very small ones bearing long stiff hairs or dark setae. Largest *pinnules* $6-7 \times 1.3-1.8$ cm, lowest 1-2 segments free, rest of segments joined by a narrow wing on the costa or contiguous; costules $3-3\frac{1}{2}$ mm apart; veins 6-7 pairs; lamina-segments rather thin, where fertile lobed more than half-way to costule. *Sori* near costule; indusium reflexed against the costule at maturity and usually not breaking, when flattened more than a semicircle. *Scales on costae* very small, bearing rather long, stiff, pale hairs or dark setae, larger scales few, very narrow, entire, not setiferous at apex; costular scales similar.

Distribution: New Zealand, throughout; Auckland Islands.

Note. Very near *C. cunninghamii*, but the larger size of indusia and of pinnules in *C. cunninghamii* seems constant, also the broad costal scales which have a few dark setae.

16. *Cyathea kermadacensis* Oliver, Trans. N. Z. Inst. 42 (1910) 158, pl. XXII; Crookes & Dobbie, N. Z. Ferns ed. 6 (1963) 144.

Trunk to 20 m tall; fronds falling and leaving trunk covered with scars throughout (Oliver). *Stipe* not seen, slender, base clothed above and on the sides with copious linear brown scales" (Oliver). *Pinnae* to 45 cm long (lowest not much reduced?); pinna-rachis beneath pale, minutely warty, \pm persistently covered with minute, pale, fringed scales and some elongate, thin, brown, entire scales. *Pinnules* $6-7\frac{1}{2}$ by $1.5-1.8$ cm, basal 1-2 segments almost or quite free, rest of pinnule lobed almost to costa; costules 3 mm apart; veins 9-10 pairs; lamina-segments minutely crenate where sterile, somewhat lobed where fertile. *Sori* near costules; indusium thin, covering mature sorus and splitting when old but open on side remote from costule, its edges sometimes overlapping so as to simulate a true cup; paraphyses short, slender. Very small pale scales with slender rather straight marginal hairs abundant on costae, also much longer thin flat, elongate, light brown scales lacking setae; on costules a few very small scales bearing long marginal hairs and some thin, light brown, entire, flat or convex scales.

KERMADEC ISLANDS. *Oliver s. n.*, 12-10-1908, Sunday Island, in dry forest (*type coll.*, K); *Cheeseman 85* (part), Sunday Island (distributed as *C. milnei*).

17. *Cyathea woollsiana* (F. v. Muell.) Domin, Pterid. (1929) 263; Goy, Queensl. Nat. 12 (1943) 42; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 345. — *Alsophila woollsiana* F. v. Muell., Fragm. Phyt. Austr. 8 (1874) 179.

Stipe to 40 cm or more long; scales near base 15 mm long, 2 mm wide at thickened base which is covered with many small, pale, fringed scales, distally thin, dark and shining with pale fragile edges. Lowest *pinnae* 25—30 cm long; longest to 65 cm; pinna-rachis beneath pale or somewhat reddish, rather sparsely finely warty, glabrescent, residual scales mostly very small, pale, with thick, flexuous, marginal hairs and sometimes a red terminal seta, also when young some large scales with dark median band and pale edges bearing scattered long setae; rather thick flexuous hairs, dark red or paler, scattered on distal part. *Pinnules* commonly to 8 × 1.5 cm, largest 10 × 2.5 cm, lobed to within 1 mm of costa throughout, no free basal segments, sinuses narrow; costules 3—3½ mm apart; veins 10—11 pairs; lamina-segments rather thin, edges crenate-serrate. *Sori* near costules; indusium entirely on costular side of receptacle, brown, semicircular, covered by mature sporangia; paraphyses shorter than sporangia. Lower surface of *costae* bearing few to many flexuous antrorse hairs, also pale, broad, thin, flat, finely fringed scales of varying size, the larger ones having a red seta at apex and sometimes a few marginal setae; costules with similar but smaller non-setiferous scales and sometimes a few flexuous hairs.

Distribution: coastal ranges of N. E. Queensland.

Note. The above description is based partly on a living plant in cultivation at Kew. The thick scale-covered bases of the stipe-scales resemble those of *Cyathea orientalis* (Kze) Moore of Java and the Lesser Sunda Islands.

18. *Cyathea solomonensis* Holttum, *sp. nov.*

Caudex 4 m altus. *Stipes* 90 cm longus, pinnae duas parvas 15 cm supra basin ferens et spinis 2 mm longis praeditus; paleae stipitis ad 25 × 2 mm, pallide brunneae, crassae, nitidae, marginibus fragilibus mox marcescentibus. *Rhachis primaria* infra laevis, glabrescens, rufo-suffusa. *Pinnae* maximae 55 cm longae; rhachis pinnarum infra pallidae, laeves, glabrescentes. *Pinnulae* maximae 10 × 2 cm, segmento infimo ± libero excepto fere ad costam lobatae; costulae 4½ mm inter se distantes; venae 10—12-jugatae; segmenta laminae fertilia profunde crenata, crenis bilobulatis. *Sori* prope costulas siti; indusium perparvulum, hemiteliiforme, soro maturo occultum; paraphyses tenues, quam sporangia breviores. *Paleae costarum* pleraeque perparvae, irregulares, pallide brunneae, tenues, marginibus pilis brevissimis praeditis; paleae costularum multae, ovatae, planae vel convexae, eae apices costularum versus interdum bullatae, raro setas nigras paucas ferentes; venae paleis minutis pallidis conspersis ornatae.

SOLOMON ISLANDS. Guadalcanal: *Whitmore & Womersley BSIP 1035*, foot of Mt Popomanasin, on very steep cliff above stream, 2000 ft (*type*, LAE).

Note. This species appears to be related to *C. affinis*, differing in its much smaller indusia and fewer scales, those on costules ovate and more or less convex to bullate.

19. *Cyathea aneitensis* Hook., Syn. Fil. (1865) 26. — *C. laciniata* Copel., Univ. Cal. Publ. Bot. 12 (1931) 389.

Main rachis and *pinna-rachis* very dark, smooth, glabrescent or with residual very narrow brown scales bearing a few setae; *pinnae* to 35 cm long. *Pinnules* to 3.5×1.5 cm, lowest 1—2 segments free, rest of pinnule lobed almost to costa; costules $3\frac{1}{2}$ mm apart (fertile), 4 mm (sterile); veins 6—7 pairs; lamina-segments distinctly oblique, rather deeply crenately lobed where fertile, slightly crenate near apex where sterile. *Sori* nearer to costule than edge; indusium large, thin and fragile except near the base, almost covering sorus but open on side remote from costule. *Scales on costae* usually few, very narrow, brown, bearing short setae, grading to small, brown, ovate-acute scales with short, rigid, concolorous hairs; long spreading hairs (1— $1\frac{1}{2}$ mm long) rather abundant on costae (especially towards apex) and costules; no scales seen on costules.

NEW HEBRIDES. Aneiteum: *Milne 434*, summit of mountain (type, K); *Kajewski 876*, rain forest, 2000 ft, common (type of *C. laciniata*, UC, US, K); *Quaije s. n.* May 1903 (NSW).

NEW CALEDONIA. *Strange s. n.* 1853. (Herb. Thos Moore, Kew; perhaps wrongly localized; see *C. leucolepis*).

Notes. This species is very near *C. vieillardii*, but seems to differ constantly in darker axes of the frond and in distribution of hairs on lower surface.

The type of *C. laciniata* has young sori almost covered with very thin indusia, but careful observation shows them to be hemitelioid (hoodshaped), not cup-shaped. It has also rather pale-coloured rachises which may also be correlated with its young condition. Copeland adopted his epithet from *Hemitelia laciniata* Spr. (1827), but he did not cite that species as a synonym, and he was in some doubt whether his new species was identical with that described by Sprengel. Sprengel's name was taken from a MS name of Forster's, on a specimen from the New Hebrides. Christensen (Index Filicum) placed *H. laciniata* Spr. with doubt as a synonym of *Aspidium viridans* Mett. Sprengel's description is quite inadequate to fix the genus of his species.

20. *Cyathea vieillardii* Mett., Ann. Sci. Nat. IV, 15 (1861) 82; Hook., Syn. Fil. (1865) 27. — *C. sclerolepis* Bak., Syn. Fil. ed. 2 (1874) 453. — *C. incisocrenata* Bak., Syn. Fil. ed. 2 (1874) 452. — *C. neocaledonica* Compton, J. Linn. Soc. Bot. 45 (1923) 440.

Stipe short, at base covered with rigid, very dark, glossy scales $2.5 \times 1-2$ mm, edges pale and fragile; rest of stipe conspicuously warty near base, less so upwards, bearing minute, dark, short-setiferous scales; main rachis pale, smooth, glabrescent. Lower *pinnae* gradually reduced, lowest 8—12 cm long; longest pinnae 45 cm; pinna-rachis beneath pale, smooth, sometimes with slender, \pm crisped, pale hairs less than 1 mm long, often also near base very small, dark, setiferous scales. *Pinnules* to 7.5×2.0 cm, lowest 1—2 segments free, rest of pinnule lobed almost to costa; costules 4—5 mm apart; veins to 8 pairs (5—6 pairs in small fronds); lamina-segments distinctly oblique, fertile ones more or less deeply lobed (to $\frac{1}{2}$ -way to costule on largest pinnae), sterile crenate. *Sori* almost medial; indusium large, thin, almost covering sorus to maturity but open on side remote from costule, often breaking at maturity. *Costae* sometimes bearing some slender \pm crisped hairs on lower surface, also near base a few very narrow scales bearing very short lateral setae and sometimes small dark scales with short setae; costules usually glabrous on lower surface but in some specimens bearing a few slender hairs.

NEW CALEDONIA. *Vieillard 1629*, Balade (type coll. K, MEL), *1629* (type of *C. sclerolepis*, K); *Balansa 1620, 2739*; *Le Rat*, Jan. 1910; *Richards s. n.* (type of *C. incisoserrata*, K); *Compton 1563* (type of *C. neocaledonica*, BM); *Franz 713*; *Schlechter 1517a* (distributed as *C. propinqua*); *McKee 2318, 3194, 3528, 10024* (all NSW); *Brownlie 135, 224, 239*.

NEW HEBRIDES. Banks Island; *J. Palmer 15*.

Notes. These specimens vary considerably in size of fronds and in the extent of hairiness of lower surface of pinna-rachis and costae. The type of *C. incisocrenata* and several other specimens are quite lacking in hairs on these parts; on the other hand, pinna-rachis and costae of Le Rat's specimen, and of Palmer's from Banks Island, are densely hairy on the lower surface; in this they agree with the type of *C. neocaledonica* which was an unusually small specimen from 4000 ft in the summit cloudforest of Mt Ignambi; possibly the degree of hairiness varies with altitude or some other environmental condition. The type of *C. sclerolepis* is a small frond (or parts of two small fronds), but apart from size there seems no clear distinction from the type of *C. vieillardii*. After his description of *C. sclerolepis*, Baker stated „this may be the *C. funebris* of Linden, which I have only been able to see in a very young state". This must refer to a specimen of a frond of a young plant in Kew herbarium; it does not include base of stipe, but it might be a young state of *C. vieillardii*. The true *C. funebris* was different; for a discussion, see *C. albifrons*.

21. *Cyathea marcescens* N. A. Wakef., Vict. Nat. 59 (1942) 33; *ibid.* 62 (1945) 126; W. Hunter, Vict. Nat. 59 (1942) 118; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 347.

Stipe dark and spiny at base, paler distally; basal scales bright brown, shining, 35—50 × 2—5 mm, apical half very narrow and twisted, edges fragile. *Pinnae* to 75 cm long; pinna-rachis beneath pale, finely warty, glabrescent, residual scales small, pale, often with long red setae. *Pinnules* to 13 × 3 cm, or wider, most segments separately joined to a very narrow costal wing, 1—2 basal ones sometimes free; costules to 5 mm apart; veins 10—12 pairs; lamina-segments where fertile lobed up to $\frac{1}{2}$ -way to costule. *Sori* one to each lobe of a segment; indusium somewhat more than a semicircle when reflexed at maturity. On *costae* beneath many very small pale scales bearing short fine marginal hairs, also some much larger, flat, pale scales which may bear a few long red setae; on costules elongate, flat, pale scales with a few long hairs or setae, some scales ± bullate at base.

Distribution: only known from Cape Otway Ranges, Victoria.

Note. Dr Tindale states that the margin of the indusium occasionally bears a red spinule (seta), but I think she probably observed setiferous scales closely adhering to the outside of the indusium; I have never seen a marginal seta on the indusium of any *Cyathea*.

22. *Cyathea brevipinna* Bak. in Benth., Fl. Austral. 7 (1878) 709.

Stipe 50 cm long, ± scaly throughout, warty after fall of scales; basal scales to 30 × 2 mm, dark, shining, with pale fragile edges, those on upper part of stipe narrower. *Pinnae* to 18 cm long; pinna-rachis beneath finely warty, with a few residual dark pale-edged scales 3—5 mm long. *Pinnules* close, overlapping, to 5.0 × 1.1 cm, basal 1—2 pairs of segments quite free, lowest sometimes stalked, rest all separately adnate; costules 2—2½ mm apart; veins to 8 pairs, hardly raised on either surface, mostly forked; lamina-segments rigid, thick, contiguous, where fertile crenately lobed $\frac{1}{3}$ to costule, basal segment sometimes with one more deeply separated lobe. *Sori* near costules; indusium firm, persistent, covering costular side of mature sorus. *Scales* on costae and costules dull brown, narrow, entire, largest with a dark median band.

LORD HOWE ISLAND. *Lind & Fullagar* (type, K); *King s. n.* Aug. 1911, Febr. 1892 (NSW); *Oliver s. n.* 1913 (NSW); *Watts s. n.* 1911 (NSW).

Note. The type specimen consists of three detached pinnae, none showing costal scales, details of which and of stipe are taken from specimens seen at Sydney.

23. *Cyathea plagiostegia* Copel., Bishop Mus. Bull. no 59 (1929) 9; not of *C. Chr.*, Bishop Mus. Bull. no 177 (1943) 28, which is *C. alta* Copel.

Stipe 35 cm or more long, dark and warty near base; scales pale, to 20 mm long, edges bearing scattered dark setae. Lowest *pinnae* 18 cm long, longest 50 cm; pinna-rachis beneath almost smooth, \pm suffused with dark red, residual scales very small, often with dark setae, and a few very narrow brown scales with sparse setae. *Pinnules* to 7.5×1.5 cm, basal 1—2 segments almost or quite free, rest of pinnule lobed almost to costa; costules $2\frac{1}{2}$ —3 mm apart; veins 8—9 pairs, flat and pale on upper surface, slightly impressed beneath; lamina-segments rigid, edges distinctly crenate, apices rounded. *Sori* near costules; indusium dark, firm, reflexed against costule at maturity, \pm semicircular with even edge; paraphyses short, slender. *Scales on costae* all setiferous, larger ones dark, shining, with pale edges bearing long dark setae, smaller entirely pale; costular scales similar but smaller, none bullate, smallest lacking setae.

Fig. Gillespie 3331, Viti Levu, Natarandamu Mt, 1000 m (*type coll.* UC, MICH, K).

Note. Christensen evidently did not see the type collection of this species which is very different from *C. alta* Copel. *C. plagiostegia* is closely related to the widely-distributed *C. affinis*, but appears to be distinct in its smaller size and smaller indusia.

24. *Cyathea affinis* (Forst.) Sw., Schrad. J. Bot. 1800, ii (1801) 94; Copel., Bishop Mus. Bull. no 59 (1929) 36 (not *C. affinis* of Hook. & Bak., Syn. Fil. 27, which is *C. medullaris*). — *Polypodium affine* Forst., Fl. Ins. Austr. Prodr. (1786) 83. — *Alsophila tahitensis* Brack., Expl. Exp. 16 (1854) 288, t. 40 f. 2. — *Hemitelia tahitensis* (Brack.) Mett., Fil. Lechl. 2 (1859) 31. — *Amphicosmia tahitensis* (Brack.) Moore, Ind. Fil. (1857) 61. — *C. tahitensis* (Brack.) Domin, Pterid. (1929) 264. — *Hemitelia d'urvillei* Mett. in Kuhn, Linnaea 36 (1869) 160. — *C. samoensis* Bak., J. Bot. 14 (1876) 9; *C. Chr.*, Bishop Mus. Bull. no 177 (1943) 27. — *C. thurstonii* Bak., J. Bot. 24 (1886) 182. — *Hemitelia raiateensis* J. W. Moore, Bishop Mus. Bull. no. 102 (1933) 6. — *C. rapaensis* Copel., Occ. Pap. Bishop Mus. 14 (1938) 53, pl. 5.

Stipe to 40 cm or more long, sometimes with 1—2 pairs of small pinnae at base; basal scales sparse, narrow, rigid, pale to dark, with rather broad fragile edges bearing few long dark setae. *Pinnae* to 50 cm, lowest ones 25 cm; pinna-rachis beneath \pm deeply suffused with red, \pm persistently covered with minute scales bearing a short fringe of fine hairs or dark setae; a few residual very narrow, dark, setiferous scales 4—5 mm long sometimes present. *Pinnules* commonly to 10×2 cm, in some cases to 3 cm wide, lowest 1—2 segments almost or quite free, rest of pinnule lobed almost to costa; costules 3—4 (—5) mm apart; veins 10—14 pairs; lamina-segments firm, crenate-serrate or where fertile crenate-lobate. *Sori* near costules; indusium covering half or more of ripe sorus, distinctly open on side remote from costule; paraphyses often abundant near apex of prominent receptacle. *Costae* beneath at first rather densely scaly (when old sometimes glabrescent), a few larger scales with dark shining median band and dull fragile edges, smaller ones of varying size dull medium brown, with short marginal hairs or setae; similar scales on costules, often also on veins.

Distribution. Map 2.

Without locality, *Forster* (*type coll.*, BM, MEL).

ТАИТИ. *Brackenridge* (*type of Alsophila tahitensis*, US); *Pancher s. n.*, 1854; *St John 17269*, Raietea (K, BRJ); *Grant 3760*, Mahina, 4470, Hitiaa; *McKee 3073* (NSW).

MARQUESAS. F. B. H. & E. D. W. Brown 538, Nukuhiva (K, BRJ); *Pacific Entom. Survey* 152, Hivoea, 1100 m, common (BISH).

AUSTRAL ISLANDS. Rapa: Fosberg 11511; St. John & Maireau 15355 (type of *C. rapaensis*, UC, K, BRJ).

COOK ISLANDS. Rarotonga: Wilder 1087, Mt Tukou, (BISH, sterile).

SAMOA. Whitmee s. n. (type of *C. samoensis*, K); Christophersen 805 (BRJ); Christophersen & Hume 2179, 2183.

FIJI. Thurston s. n. (type of *C. thurstonii*, K); A. C. Smith 5165 (K, BRJ).

Notes. This species is variable as regards details of scales on costae, which in some specimens are more freely setiferous than in others. Probably local subspecies may be recognized in different island-groups, but not enough material is now available to characterize these clearly. I have not seen the types of *C. raiateensis* and *Hemitelia d'urvillei*. The Brisbane specimen of the type collection of *C. rapaensis* has pinnules to 15×4 cm, costules to $5\frac{1}{2}$ mm apart, and all segments separated by rather wide sinuses but connected by their decurrent bases. The Marquesas specimen collected by the Pacific Entomological Survey bears the information that young shoots are edible (true of most *Cyatheas*).

Subg. CYATHEA sect. *Gymnosphaera*

KEY TO THE SPECIES

1. Pinnules pinnate at base; fertile leaflets or segments much narrower than sterile 25. *C. hornei*
 1. Pinnules subentire, at most crenate; no great dimorphism between sterile and fertile pinnules.

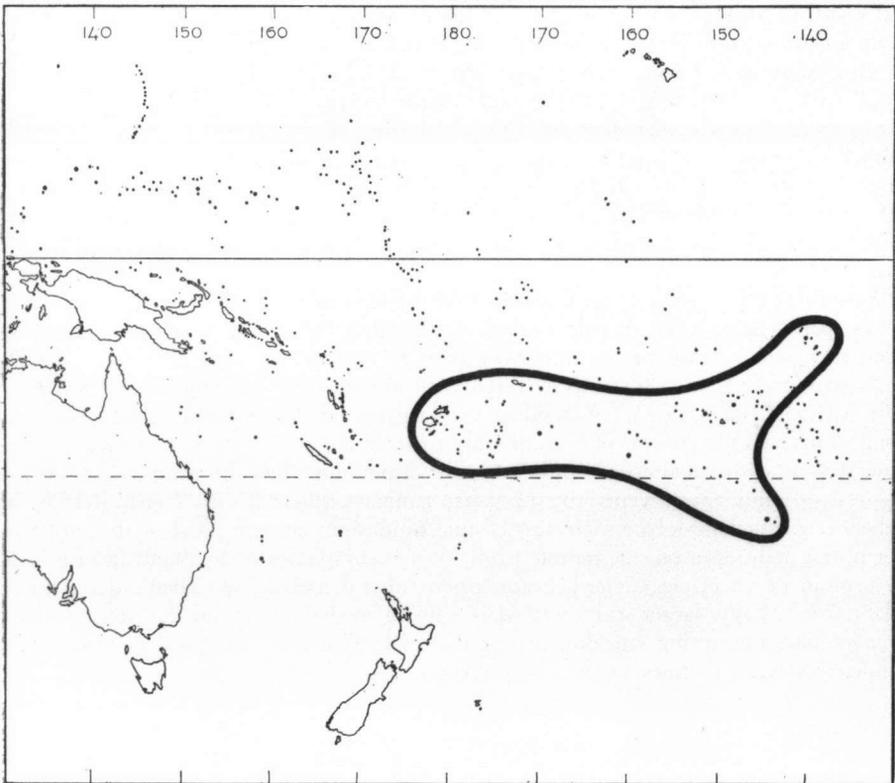


Fig. 2. Distribution of *Cyathea affinis* (Forst.) Sw.

2. Reduced pinnae lacking lamina (restricted to veins) present at base of stipes; pinnules commonly more than 13 mm wide with edges minutely crenate except near apex . . . 26. *C. baileyana*
 2. Lower pinnae gradually reduced, lowest with normal lamina; pinnules commonly not over 13 mm wide, edges rather deeply crenate throughout 27. *C. rebecca*

25. *Cyathea hornei* (Bak.) Copel., Bishop Mus. Bull. no 59 (1929) 38; Philip. J. Sc. 77 (1947) 119. — *Alsophila hornei* Bak., J. Bot. 17 (1879) 293. — *Gymnosphaera hornei* (Bak.) Copel., Gen. Fil. (1947) 99. — *Alsophila dissitifolia* Bak., J. Bot. 24 (1886) 182. — For full synonymy see Holtum, Fl. Males. II, 1 (1963) 120.

Trunk rather slender (4 cm Ø when dry), to 3—4 m tall. *Stipe* to 25 cm long but often much shorter, very dark, basal part covered with dark, shining, pale-edged scales to 15 × 2 mm. Lower *pinnae* gradually reduced, lowest commonly 10 cm long, sometimes with lamina reduced to a narrow wing along veins and costae (sometimes a gap between these and normal pinnae?); largest *pinnae* 40—50 cm long; *pinna-rachis* dark, residual scales narrow, dark, pale-edged. *Pinnules* strongly dimorphous: *sterile* to 10 × 2.5—3.0 cm, lower ones with stalks to 3 mm, basal 2—4 pairs of segments quite free, then several pairs separately adnate to costa; *costules* 5 mm apart; veins to 10 pairs, middle ones in free segments twice forked; *lamina-segments* strongly crenate or the larger free ones somewhat lobed; *fertile pinnules* to 9 × 2 cm, with free basal segments as sterile; *costules* 3½—4 mm apart; veins usually fewer than in sterile pinnules; *lamina-segments* crenate, separated by wide sinuses. *Sori* almost covering lower surface of fertile segments, without indusia. *Scales* near bases of costae elongate, dark with pale edges lacking setae, grading to light brown bullate scales distally and on costules; similar bullate scales also abundant on lower surface of veins of sterile segments.

Distribution: Eastern New Guinea, Louisiade Archipelago, Fiji.

Specimens seen (other than those from New Guinea):

Fiji. J. Horne 620 (type, K); Thurston s. n. 1886 (type of *Alsophila dissitifolia*, K); A. C. Smith 1768, Vanua Levu, 600—700 m, 7570, Ovalau, ridgecrest 600 m (US); Parks 20280, Viti Levu, 400 m (K, BM), 20922; Parham 53, near Suva (BM).

Notes. This species is here broadly interpreted, but I cannot see any clear differences in characters of the larger pinnae which would warrant its subdivision; such pinnae are closely similar in New Guinea and in Fiji, and in both territories there are differences in lobing of pinnules according to size of pinnae. There are differences in small basal pinnae, which in some cases have very narrow ultimate divisions, in others broad divisions. Many specimens, however, lack these basal pinnae, and it is at present impossible to estimate whether differences in basal pinnae are in any way correlated with differences in larger pinnae.

26. *Cyathea baileyana* (Domin) Domin, Pterid. (1929) 262; Goy, Queensl. Nat. 12 (1943) 43, fig. 2; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 333. — *Alsophila baileyana* Domin, Bibl. Bot. 85 (1913) 29. — *Alsophila rebecca* var. *commutata* F. M. Bailey, Syn. Queensl. Fl. Suppl. III (1890) 91; Lith. Ferns Queensl. (1892) t. 33; Queensl. Fl. 6 (1902) 1948.

Trunk to 4 m or more, slender. *Stipe* dark, basal scales to 25 × 2 mm, dark with pale edges, apical part very narrow; near base of stipe reduced pinnae present, to 10 cm long, most or all of their segments lacking any lamina and reduced to the veins. Largest *pinnae* 60 cm long (Tindale); *pinna-rachis* beneath ± suffused with red-brown, smooth, glabrescent. *Pinnules* to 10 × 1.3—2.0 cm, articulate to costae (except distal ones), base

unequal, broadly cuneate on acroscopic side, rounded to auricled on basiscopic side, edges slightly irregularly crenate-serrate, strongly and regularly so towards narrow acuminate apex; veins in groups, lowest in each group separately from costa, remaining vein of the group with c. 4 ultimate branches, all reaching margin; veins pinnate in basal auricle of a pinnule. *Sori* in 1—3 irregular rows parallel to costa of pinnule; no indusium; receptacle much raised, bearing delicate, scale-like, hair-pointed paraphyses. *Scales* on costae sparse, elongate with dark median band ending in a strong dark seta and pale thin edges, smaller ones wholly pale and sometimes slightly bullate; small scales sometimes near bases of veins.

Distribution: North-eastern Queensland, in mountain rain-forest at 3000—4000 ft.

27. *Cyathea rebecca* (F. v. Muell.) Domin, Pterid. (1929) 263; Goy, Queensl. Nat. 12 (1943) 43; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 334; Holttum, Fl. Males. II, 1 (1963) 120. — *Alsophila rebecca* F. v. Muell., Fragm. Phyt. Austr. 5 (1865) 53, 117; Benth., Fl. Austr. 7 (1878) 710; F. M. Bailey, Lith. Ferns Queensl. (1892) t. 32; Queensl. Fl. 6 (1902) 1948. — *Alsophila rebecca* var. *lobulata* Domin, Bibl. Bot. 85 (1913) 29.

Trunk to 6 m, slender. *Stipe* dark, basal scales dark with pale edges; no reduced pinnae at base of stipe. Lower *pinnae* gradually reduced, lowest 4 cm or more long; longest pinnae to 60 cm; pinna-rachis beneath \pm deeply flushed red-brown, smooth, glabrescent. *Pinnules* commonly 6—7 \times 0.8—1.3 cm, jointed to pinna-rachis, basal ones on larger pinnae subcordate and \pm auricled on both sides at base, edges rather broadly crenate throughout, apex acuminate; veins as in *C. baileyana* one group to each crenation. *Sori* in 1 or 2 irregular rows parallel to costa, inner row on outer branches of each vein-group, outer row on inner veins; no indusia; paraphyses as in *C. baileyana*. *Scales* on lower surface of pinnules as in *C. baileyana*.

Distribution: North-eastern Queensland, in forest at low altitudes; Flores.

Subg. SPHAEROPTERIS Sect. *Sphaeropteris*

This section is divided into two subsections, as indicated in the key to the subdivisions of the genus at the beginning of this paper.

Subsection *Sphaeropteris* comprises rather large tree-ferns, most of which grow in open places or on the edge of forest, not in full shade. The most widely distributed are *C. medullaris* (type of the subgenus) and *C. lunulata*, the former indusiate, the latter not. Exindusiate species often have narrow scales attached to the base of the receptacle and spreading beneath the sporangia. In the subsection *Fourniera* such scales are usually large, protecting the sporangia of young sori and so taking on the function of indusia. In some species they cover the sorus to maturity and overlap so closely that they have collectively been described as a single indusium. In other species they are smaller and not very conspicuous in the mature sorus. There are, however, other characters by which the subsection *Fourniera* is distinguished. In almost all species (least so in the Australian *C. leichardiana*) most segments of pinnules are free, often separately stalked, as tertiary leaflets. The dark stipes and rachises, with a close cover of very small scales bearing dark setae, are also distinctive. This subsection has its centre of distribution in New Guinea, extending westwards to Java and Borneo, eastwards to Fiji and to New Caledonia. Though there are not many definite records, I think that members of this subsection are ferns of forest shade. The only such fern I have seen alive was in forest in New Guinea; no young

plants were to be seen on exposed path-sides in the neighbourhood, though in such places young plants of species of subsect. *Sphaeropteris* were abundant.

The setiferous stipe-scale is the common feature of subgenus *Sphaeropteris*. Different species differ in size and texture of scales and in abundance of lateral setae. On the whole, these scales are not well represented in herbarium specimens (often quite lacking from the older collections and thus from many types) and they would repay more study from collectors and field botanists. Two species are remarkable in having scales which are several cells in thickness at the base, one cell thick only near the apex; these are *C. albifrons* and *C. novae-caledoniae* (one from each subsection). The thick part of these scales has no sharply defined edges, and setae are present irregularly on cells near the edges; only near the apex of a scale are setae truly marginal. This condition also occurs in species of the section *Schizocaena* (which see for further discussion), but in that section the thick bases of scales are often soft and fleshy.

KEY TO THE SPECIES OF SUBSECTION SPHAEROPTERIS

1. Sori indusiate.
 2. Lower surface of lamina conspicuously white-waxy 28. *C. albifrons*
 2. Lower surface not conspicuously white.
 3. Bullate scales present on costules; pinna-rachis smooth beneath.
 4. Bullate scales also on veins; no thick hairs on lower surface of costules 29. *C. whitmeei*
 4. Bullate scales lacking on veins; thick hairs present on lower surface of costules 30. *C. nigricans*
 3. Bullate scales lacking; pinna-rachis copiously warty beneath (except on distal pinnae).
 5. Stipe-scales pale; narrow scales with long marginal setae or hairs on lower surface of costae and costules, these scales grading distally to long hairs; a few long pale hairs on upper surface of costules 31. *C. feanii*
 5. Stipe-scales dark brown; costal scales (if present) ovate-acute with long setae or marginal hairs; pale hairs lacking on both surfaces of costules.
 6. Thin appressed hairs abundant on lower surface of veins and often between veins; scales on costae and costules always present; fertile segments of pinnules more or less deeply lobed 32. *C. medullaris*
 6. Hairs and scales lacking or rare on lower surface of veins, costae, and costules; fertile segments at most slightly crenate-serrate 33. *C. parksiaea*
 1. Sori lacking indusia, often with small scales round base of receptacle.
 7. Bullate scales present on costae and/or costules.
 8. Bullate scales abundant on lower surface of veins; stipe-scales to 15 × 3 mm, very thin 34. *C. vittata*
 8. Bullate scales lacking or rare on lower surface of veins; stipe-scales mostly longer and proportionately narrower.
 9. Pale bullate scales always present on costules, rather large; no dark or setiferous scales on costules 35. *C. lunulata*
 9. Pale bullate scales usually present on costules of distal pinnules, abundant and very small; on lower pinnules dark setiferous scales, often abundant, some bullate, basal ones flat; setae on scales very short. *C. lunulata* subsp. *vitiensis*
 7. Bullate scales lacking on costae and costules.
 10. Costular scales (at least larger ones) bearing marginal setae.
 11. Marginal setae short, oblique.
 12. Setiferous costal scales not linear; pinnules to 3 cm wide. *C. lunulata* subsp. *vitiensis*
 12. Setiferous costal scales long, narrow; pinnules to 2 cm wide 36. *C. robusta*
 11. Marginal setae long, spreading 37. *C. cooperi*
 10. Costular scales lacking marginal setae.
 13. Costular scales with long thin marginal hairs; no thick hairs near apex of pinnules on lower surface of costae and costules. 38. *C. brownii*
 13. Costular scales with fringe of short hairs; thick hairs present on lower surface of costae and costules near pinna-apex.
 14. Pinnules to 2.7 cm wide 39. *C. intermedia*
 14. Pinnules to 1.2 cm wide 40. *C. aramaganensis*

28. *Cyathea albifrons* Vieill. ex Fourn., Ann. Sci. Nat. V, 18 (1873) 352. — *C. lenormandii* Vieill. ex Bak., Syn. Fil. ed. 2 (1874) 454. — *C. interjecta* Bak., Syn. Fil. ed. 2 (1874) 453. — *C. funebris* Linden, nom. hort. (1862; fide specimen BR; not *C. funebris* Fourn.).

Stipe dark, warty after fall of scales; scales dark brown to nearly black, largest ones thick near base with several submarginal rows of short concolorous setae, thinner distally. *Pinnae* to 60 cm long; pinna-rachis pale, slightly warty, glabrescent. *Pinnules* to 15 × 3.5 cm, basal 1—2 pairs of segments quite free and stalked, nearly all segments of larger pinnae widely separated and joined by a very narrow wing along costa; costules 5—6 mm apart; veins to 10 pairs; lamina-segments very firm, often very oblique, whitish on lower surface, edges (at least where fertile) lobed up to half-way to costule. *Sori* medial to supramedial, covered with a very firm pale indusium which dehisces by breaking irregularly. Lower surface of *costae* smooth, usually quite glabrescent, sometimes with a few elongate dark scales bearing many short setae; lower surface of costules bearing many very small brown scales which are often contorted and bear many very short slender setae; upper surface of costae and costules glabrous.

NEW CALEDONIA. *Balansa* 2740, 2740a, 1587a (all cited with original description); *Franc* 71; *Schlechter* 14841 (K, BM); *Le Rat* 2881; *Cribs* 1340; *McKee* 4832 (NSW, BM), 9750 (NSW, K); *Compton* 464, Mt Mou, frequent in damp gully forest (B.M); *Lenormand*, Herb. Vieillard 2249 (type of *C. lenormandii*); *Schlechter* 14918 (K, BM, L); *Richards*, Herb. W. S. *Macleay* (type of *C. interjecta*).

Notes. The type of *C. lenormandii* has pinnules only to 9.5 × 2 cm, but in other respects does not differ from larger specimens. The type of *C. interjecta* consists of a single pinna bearing pinnules to 16 × 4 cm, and is thus abnormally large. At Bruxelles is a specimen labelled *C. funebris*, Hort. Linden 1867, of which I have seen a photograph. I do not think there can be any doubt that it belongs to the present species. The name *C. funebris* appears in Linden's catalogues from 1862, but was not described; the first description of a species *C. funebris* was by Fournier in 1876, but the description appears to me incompatible with the Linden specimen above-mentioned, and I have placed the name as a synonym under *C. novae-caledoniae*. See also note on p. 274.

29. *Cyathea whitmeei* Bak., J. Bot. 14 (1876) 343; C. Chr., Bishop Mus. Bull. no. 177 (1943) 27. — *Alsophila samoensis* Brack., U. S. Expl. Exp. 16 (1854) 287 (not pl. 40 f. 1). — *C. betchei* Copel., Philip. J. Sc. 6 (1911) Bot. 360. — *C. Wilkesiana* Domin, Acta Bot. Bohem. 9 (1930) 171 (new name for *Alsophila samoensis* Brack.).

Stipe 120 cm long, basal part covered with pale thin scales to 35 × 1 mm with sparsely dark-setose edges, above base finely warty, covered thinly with minute dull scales, some setiferous; main rachis rather finely warty, glabrescent, suffused dull red. A pair of small *pinnae* sometimes near base of stipe; longest pinnae 70 cm; pinna-rachis beneath smooth or minutely warty, glabrescent. *Pinnules* to 12.5 × 2.5 cm, basal 1—2 pairs of segments almost or quite free, rest of pinnule lobed almost to costa; costules 4—4½ mm apart; veins 10—12 pairs, often twice forked; lamina-segments rather thin, fertile ones strongly crenate, sinuses between them to 1 mm wide, sterile segments crenate towards apices, sinuses narrow. *Sori* nearer to costule than to margin; indusium complete, thin, breaking irregularly, persistent. *Scales* near bases of costae all small and not elongate, some strongly setiferous (setae short, dark in Samoan specimens, paler on those from Solomons), some pale, lacking setae; on costules throughout small pale bullate scales, near bases also scales as costae; small pale bullate scales also on veins beneath.

SAMOA. *Whitmee* 199 *ex parte* (type, K); *Powell* 241; *Brackenridge* (US, sterile, type of *Alsophila samoensis*); *Reinecke* 84, Upolu; *Christophersen* 2247, Savaii, 700 m, open woodland, 219, Upolu, forest (BRJ); *McKee* 2974, Upolu, 600 m (NSW).

SOLOMON ISLANDS. *Whitmore* BSIP 2275, Ysabel; *Van Royen* 16448, Bougainville, 150 m, on hill in open bush (LAE).

Notes. Christensen, l.c., cites further specimens. The above description of stipe-scales is taken from the Bougainville specimen. Samoan specimens seen do not include stipes. Powell, in a MS note, describes the stipe as 3—5 feet long, with deciduous, large, greyish-brown scales near the base and a dust-like covering of small scales above the base, the stipe rather dark in colour and almost smooth after fall of scales. Brackenridge's illustration of *Alsophila samoensis* differs from his specimen and description; I have cited it under *Cyathea alta* Copel.

30. *Cyathea nigricans* Mett., Ann. Mus Bot. Lugd.-Bat. 1 (1863) 56; Hosokawa, Trans. Nat. Hist. Soc. Formosa 26 (1936) 49.

Stipe minutely warty, \pm persistently covered with very small pale fringed scales (not setiferous); larger scales near base of stipe pale, hardly 20 mm long, 1 mm wide, edges bearing short concolorous hairs. *Pinnae* to 60 cm long; pinna-rachis smooth, glabrescent beneath. *Pinnules* to 12 \times 2.3 cm; costules 4½—5 mm apart; veins 10—12 pairs; lamina-segments rather thin, crenate-serrate. *Sori* almost medial, with thin complete indusia breaking irregularly; paraphyses thick, dark. *Costal scales* mostly small, pale, sometimes finely fringed but not setiferous, some (mostly distally) bullate; on costules many pale bullate scales, often with small lateral hairs near their tips; some stout pale hairs also on lower surfaces of costules and costae near apex of pinnules.

CAROLINE ISLANDS. *Mertens*, Ualan (type, B); *Kanehira* 1345, Kusai (MICH), 677, Ponape (MICH); *Takamatsu* 1056, Ponape (K, MICH), 535, Kusaie (MICH); *St John* 21, 441, Kusaie, common in moist forest; *Glassman* 2569, 2322, Ponape (US); *Ledermann* 13193, 13399, 13621, Ponape.

Note. The type is a fragment consisting of two pinnules attached to a short length of rachis. The pinnules are 13 \times 2.8 cm; it is probable that they are not true pinnules but leaflets from near the apex of a frond, as none of the other specimens (from which the above description is mainly drawn) has such large pinnules. The other specimens agree with the type in details of scales.

31. *Cyathea feani* E. Brown, Bishop Mus. Bull. no. 89 (1931) 14, fig. 4.

Trunk to 2 m tall. *Stipe* pale, finely warty; basal scales pale, setiferous; leafy part of frond 130 cm long. *Pinnae* to 50 cm long; pinna-rachis pale with darker warts beneath, \pm persistently covered with narrow pale scales to 10 mm long bearing short, concolorous or dark, oblique setae. *Pinnules* to 12 \times 2½—3 cm (fertile ones seen 1.8 cm wide), basal 1—3 pairs of segments free or separately attached to costa, rest of pinnule lobed almost to costa; costules 3½ mm apart in fertile pinnules seen, to 5 mm in sterile; veins 9—12 pairs, in sterile pinnules often twice forked; lamina-segments firm, almost entire. *Sori* nearer to costule than edge, indusiate as in *C. medullaris* (only young ones seen). *Costal scales* very narrow, pale, bearing long, oblique, pale marginal hairs or dark setae (largest scales have long, dark, setiform apex), grading to long pale hairs distally; similar but smaller scales on costules; scattered long thick hairs on upper surface of costules; very slender, short, appressed hairs abundant on lower surface of veins and sometimes between veins.

MARQUESAS. Brown 1033, Hivaoa, Feani, 1000 m (BISH, cited and labelled as type but sterile), 869, same loc. and date (BISH, fertile); Pacific Entomological Survey 473, Hivaoa (BISH, MICH).

Note. This species is very close to *C. medullaris* which also occurs in the Marquesas Islands, but appears to differ in the abundant very narrow scales on lower surface of pinna-rachis, costae, and costules. It seems possible that these differences are due only to environmental conditions, but this could only be proved by experimental cultivation.

32. *Cyathea medullaris* (Forst.) Sw., Schrad. Journ. Bot. 1800, ii (1801) 94; Schkuhr, Krypt. Gewächse (1809) 128, t. 133; Hook., Spec. Fil. I (1844) 27, p. p.; Crookes & Dobbie, N. Z. Ferns ed. 6 (1963) 132. — *Polypodium medullare* Forst., Pl. Escul. (1786) 74; Prod. (1786) 82. — *Polypodium extensum* Forst. (1786) 83. — *C. extensa* (Forst.) Sw., Schrad. Journ. Bot. 1800, ii (1801) 93; Schkuhr, Krypt. Gewächse (1809) 129, t. 132 a, b. — *Sphaeropteris medullaris* (Forst.) Bernh., Schrad. Journ. Bot. 1800, ii (1801) 122. — *Alsophila extensa* R. Br., Prod. Fl. N. Holl. (1810) 158. — *C. affinis* [non (Forst.) Sw.] auct. plur., incl. Copel., Bishop Mus. Bull. no. 59 (1929) 36; *ibid.* 93 (1932) 31. — *C. societatum* Bak., Syn. Fil. ed. 2 (1874) 453; Drake del Castillo, Fl. Polyn. Fr. (1893) 267. — *C. cumingii* Bak., Syn. Fil. ed. 2 (1874) 453. — *C. polyneuron* Colenso, Trans. N. Z. Inst. 11 (1879) 429. — *C. scabra* Bak., J. Bot. 14 (1876) 343. — *C. deorsilobata* Copel., Philip. J. Sc. 6 (1911) Bot. 359. — *C. grantii* Copel., Bishop Mus. Bull. no 93 (1932) 7, pl. 5.

Trunk to 16 m tall, to 20 cm \varnothing above mantle of roots. *Stipe* closely warty after fall of scales; basal scales dark, shining, to 50 \times 2 mm, edges closely setiferous; very small setiferous scales forming a scurfy covering of young stipe. *Pinnae* to 60 cm long; pinna-rachis pale, glabrescent, conspicuously warty beneath, warts dark, shining. Largest *pinnules* 10—13 \times 2—3 cm, many segments separately adnate to costa but only 1—2 pairs quite free; costules 3—4 mm apart; veins 10—12 pairs; lamina-segments where fertile often deeply lobed, where sterile minutely crenate. *Sori* medial; indusium thin, covering young sorus, breaking and persistent at maturity. *Costae* and costules bearing pale, flat, ovate-acuminate scales, larger ones with long, setiform apex and long dark lateral setae, smaller ones fringed with long, stiff, pale hairs; lower surface of veins bearing more or less abundant short, slender shining brownish hairs, some of them also between veins.

Distribution: New Zealand to Pitcairn (as indicated by specimens). Map 3.

Specimens seen (other than from New Zealand):

Without locality, Forster (type coll. of *P. extensum*, BM).

SAMOA. Whitmee 1919 (type of *C. scabra* Bak.); Vaupel 471 (type of *C. deorsilobata* Copel., MICH, K); Christophersen 2176, 804, 2182.

FIJI. A. C. Smith 4856, 6123.

TAHITI. Bidwill s. n. (type of *C. societatum* Bak.); M. L. Grant 3526 (distr. as *C. affinis*), 4245 (type of *C. grantii* Copel., MICH), 4471; St. John & Fosberg 14151, 14145.

MARQUESAS. Quayle 1215; F. B. H. Brown 461, 869.

PITCAIRN. Cuming 1393 (type of *C. cumingii* Bak.); Mathews 7; Fosberg & Christian 11241; St. John 14978. „CORAL ISLES” (between Pitcairn and Tahiti) Beechy.

AUSTRAL ISLANDS. St John 16361, Tubuai, 16659, Rurutu; St John & Maireau 15397, Rapa (distr. as *C. rapensis*); Stokes 86, Rapa.

Note. The apparent absence of this widely-distributed species from the Kermadec Islands is surprising.

33. *Cyathea parksiae* Copel., Univ. Cal. Publ. Bot. 12 (1931) 377.

Very closely related to *C. medullaris*, differing as follows: fertile segments not lobed,

at most slightly crenate-serrate; lower surface of costae and costules quite lacking scales; lower surface of veins rarely with fine short hairs.

COOK ISLANDS. Rarotonga: H. E. & S. T. Parks 22330 (UC, type; dupl. at MICH, K), 22232; Wilder 1089; Cheeseman 731.

Note. I am very doubtful of separating this from *C. medullaris*, but the specimens, so far as they go, appear to be distinct in the characters stated above.

34. *Cyathea vittata* Copel., Philip. J. Sc. 60 (1936) 102, pl. 7. — *C. barotu* Copel., l.c. 103, pl. 8.

Base of *stipe* covered with thin pale scales to $15 \times 1-3$ mm, edges sparsely setiferous; *stipe* and main *rachis* warty beneath. *Pinnae* to 75 cm long; *pinna-rachis* pale, glabrescent, conspicuously warty beneath *Pinnules* to 16×3 cm, lowest 1-2 segments of largest ones free, rest of *pinnule* lobed almost to *costa*; *costules* to 5 mm apart; *veins* to 16 pairs; *lamina-segments* minutely crenate. *Sori* nearer to *costules* than edge, base of *receptacle* surrounded by spreading scales. *Scales on costae* small, shining, medium brown, with many short marginal *setae*; similar scales at base of *costules*; distally on *costules* and on

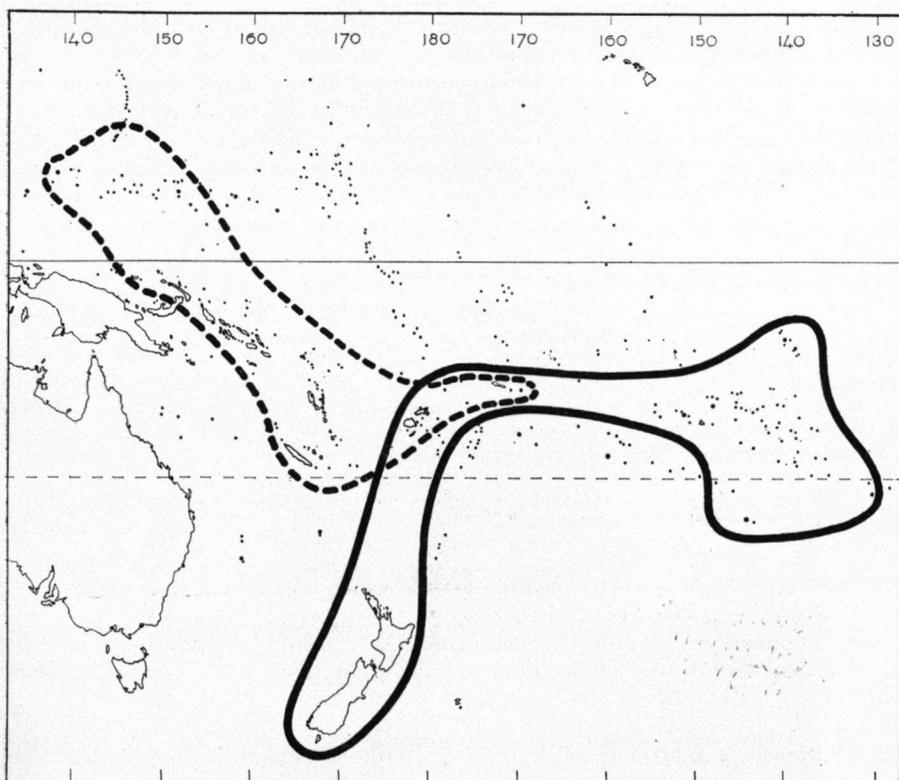


Fig. 3. Distribution of *Cyathea medullaris* (Forst.) Sw. (continuous line) and *C. lunulata* (Forst.) Copel. (broken line).

lower surface of veins small, entire, pale, bullate scales; some thick pale hairs near apices of pinnules on costae and costules, lower surface.

SOLOMON ISLANDS. *Brass* 3313, Ysabel (*type*; original at Manila lost; dupl. at A), 2822, San Cristoval (*type coll.* of *C. barotti*, BO, MICH, A); *C. T. White* 55, Guadalcanal (K, BRI, A); *Wakefield* 1157, Bougainville (BM); *Whitmore & Womersley* 693, Guadalcanal (LAE, L); *Stone* 2416, Malaita, 2100 ft, in rain forest, common, to 65 ft tall (BISH).

35. *Cyathea lunulata* (Forst.) Copel., Bull. Bish. Mus. no. 59 (1929) 37; *C. Chr.*, *ibid.* no. 177 (1943) 29; Holttum, Fl. Males. II, 1 (1963) 131. — *Polypodium lunulatum* Forst., Prod. (1786) 83. — *Alsophila lunulata* (Forst.) R. Br., Prod. Fl. N. Holl. (1810) 158; Hook., Spec. Fil. 1 (1844) 51; Syn. Fil. (1865) 41, p.p.; Carr. in Seem., Fl. Vit. (1873) 333. — *Alsophila haenkei* Presl. Rel. Haenk. 1 (1825) 68. — *C. haenkei* (Presl.) Merr., Philip. J. Sc. 15 (1919) 540. — *Alsophila veitchii* Bak., Syn. Fil. ed. 2 (1874) 41. — *C. veitchii* (Bak.) Domin, Pterid. (1929) 263. — *Alsophila naumannii* Kuhn, Forschungsr. Gazelle 4 (1889) 13; v. A. v. R., Handb. Mal. Ferns Suppl. (1917) 59. — *C. naumannii* (Kuhn) Domin, Pterid. (1929) 263. — *C. rugosula* Copel., Univ. Cal. Publ. Bot. 12 (1931) 390. — *Alsophila ponapeana* Hosokawa Trans. Nat. Hist. Soc. Formosa 26 (1936) 51. — *C. ponapeana* (Hosok.) Glassm., Bishop Mus. Bull. no. 209 (1952) 40.

Stipe smooth or finely warty, more than 50 cm long; scales 30–40 × 2 mm, pale, thin, with short dark marginal setae. *Pinnae* to 70 cm long; pinna-rachis beneath pale, ± warty, glabrescent. *Pinnules* commonly 10 × 2 cm, largest seen 15 × 3 cm; costules 3½–4½ mm apart; veins to 15 pairs; lamina-segments distinctly serrate. *Sori* exindusiate; paraphyses shorter than sporangia; narrow scales present round base of receptacle. *Costae* bearing thick pale hairs distally on lower surface (especially near apices of pinnae), scales mostly caducous except a few small ones which may be setiferous; costules bearing similar hairs, also scales which are bullate and ± fringed or on lower pinnae setiferous; minute hairs sometimes visible on lower surface of veins; hairs on upper surface of costules rare.

Distribution: Marianas, Carolines, Bismarck Archipelago, Solomons, New Hebrides, New Caledonia, Tonga, Samoa (subsp. *vitiensis* in Fiji). Map 3.

No locality, *Forster* (*type collection*, GOET, BM).

MARIANAS. *Rodin* 754, Guam; *Gilbert & Wagner* 3742, Guam.

CAROLINES. *Kanehira* 2100, Palau; *Takamatsu* 1543, Palau; *Duff*, Ponape (NSW, P 6301).

BISMARCK ARCHIPELAGO. *Naumann*, Neu-Pommern (*type* of *A. naumannii*, B).

SOLOMONS. San Cristoval: *Richards* s. n. Santa Cruz group, *Whitmore* 1803 (L).

NEW HEBRIDES, *Kajewski* 857; *McGillivray* 907; *Kajewski* 54, Tanna, 545, Vanikoro.

NEW CALEDONIA. *Germain* s. n. 1874–76.

TONGA. *Parks* 16032, 16226, 16016 (*type* of *C. rugosula*, UC; K).

SAMOA. *Powell* 257, 262, 85, "the largest Samoan tree-fern"; *Whitmee* 5; *Christophersen* 1910, 1947 (BRJ), 2076, 2536, 2995, 3208 (BRJ); *Yuncker* 5475, 9424 (BRJ); *McKee* 3000 (NSW).

Note. Specimens from Palau, Caroline Islands, have veins to 10 pairs, and very few thick hairs on lower surface of costae and costules. I have not seen the *type* of *Alsophila ponapeana*.

subsp. *vitiensis* (Carr.) Holttum, *stat. nov.* — *Alsophila vitiensis* Carr. in Seem., Fl. Vitiensis (1873) 334. — *C. vitiensis* (Carr.) Domin, Pterid. (1929) 263. — *Alsophila lunulata sensu* Brack., U.S. Expl. Exp. 16 (1854) 285, p.p., pl. 39.

Differs from typical *C. lunulata* in costular scales on lower pinnules (sometimes on all

pinnules), especially near base of frond, being dark and strongly setiferous, largest ones more or less ovate and flat, but most usually \pm bullate; costular scales towards apex of a pinna or frond often all pale and bullate but smaller and more numerous than in typical *C. lunulata*. In characters other than costular scales this is not distinguishable from *C. lunulata* from Samoa, so far as can be judged from herbarium material.

Fiji. Sir E. Home (type, BM); A. C. Smith 8569, 9080, 4367 (BRJ), 6724 (BRJ); St John 18098 (NSW); Degener & Ordóñez 14146 (NSW).

36. *Cyathea robusta* (C. Moore) Holttum, *comb. nov.* — *Alsophila robusta* C. Moore ex Watts, Proc. Linn. Soc. N. S. Wales 39 (1914) 261. — *Alsophila australis* var.? *nigricans* Benth., Fl. Austral. 7 (1878) 711.

Trunk to 3 m tall, with distinct scars. *Stipe* 30—50 cm, subglaucous; basal scales to 4 cm long, pale brown, setiferous; frond 100—150 cm long. *Pinnae* to 50 cm long; pinna-rachis closely warty beneath. Largest *pinnules* 10—12 \times 1.5—2.0 cm, lowest 1—2 pairs of segments almost or quite free; costules 3 mm apart; veins to 12 pairs; lamina-segments crenulate, 'subcaeruleous' on lower surface. *Sori* exindusiate; narrow scales spreading round base of receptacle. *Scales on costae* often caducous, elongate, pale with dark setiferous edges; scales on costules many, flat, pale, ovate-acute, larger ones with dark setae, smaller with short pale marginal hairs; short slender hairs abundant on lower surface of veins.

LORD HOWE ISLAND. C. Moore no 1 (dupl. of type?, K), 65 (sterile); Fullagar s. n. (K. NSW); Watts s. n., July 1911 (NSW); Oliver, Nov. 1913 (NSW, P5819); Boorman, May 1920 (NSW, P5818).

37. *Cyathea cooperi* (Hook. ex F. v. Muell.) Domin, Pterid. (1929) 262; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 357. — *Alsophila cooperi* Hook. ex F. v. Muell., Fragm. Phyt. Austr. 5 (1866) 117; Bak., Syn. Fil. ed. 2 (1874) 459. — *Alsophila excelsa* var. *cooperi* Domin, Bibl. Bot. 85 (1914) 31. — *Alsophila hilleana* F. v. Muell., Fragm. Phyt. Austr. 5 (1866) 53, 116; *ibid.* 8 (1874) 179. — *Alsophila australis* var. *cervicalis* F. M. Bailey, Queensl. Dep. Agr. Bull. 7 (1891) 22; Lith. Ferns Queensl. (1892) t. 33. — *Alsophila australis* var. *pallida* F. M. Bailey, l.c. 23, t. 36. — *Alsophila australis* var. *excelsa* F. M. Bailey, l.c. 22.

Trunk to 10 m, mostly covered with scars. *Stipe* to at least 50 cm, warty, basal scales pale, thin, 20—50 \times 1—5 mm, with close dark red marginal setae, smaller scales red-brown, setiferous; lower surface of main rachis pale, warty, glabrescent. *Fronde*s to 4 m long; *pinnae* to 65 cm; pinna-rachis beneath \pm covered with pale to red-brown scales which are mostly setiferous, larger ones very narrow. *Pinnules* commonly to 12 \times 2.3 cm, largest seen 16 \times 3 cm, a few basal segments free or nearly so, rest of pinnule lobed almost to costa; costules 4—4½ mm apart, or on largest pinnules to 6 mm; veins 11—15 pairs; lamina-segments serrate-crenate or crenately lobed, sometimes subglaucous on lower surface. *Sori* exindusiate; paraphyses about as long as sporangia; narrow scales spreading round base of receptacle. *Costae* beneath minutely warty, near base bearing narrow scales with long dark setae, also smaller pale scales with stiff pale marginal hairs; costules bearing small brown or pale scales with long marginal setae or hairs, and near apex of pinnule a few thick hairs.

Distribution: Queensland, New South Wales.

38. *Cyathea brownii* Domin, Pterid. (1929) 262. — *Alsophila excelsa* R. Br. ex Endl., Prodr. Fl. Norf. (1833) 16; Hook., Spec. Fil. 1 (1844) 49, t. 18A (not *C. excelsa* Sw. 1801). — *Alsophila robusta* var. *norfolkiana* Laing, Trans. N. Z. Inst. 47 (1915) 9.

Trunk 5—16 m tall; fronds 3 m long (Endl.). *Stipe* finely warty; scales near base to 20 × 2 mm, firm, medium brown, shining, edges with close, short, oblique, concolorous or darker setae. *Pinnae* to 60 cm long; pinna-rachis beneath pale, finely warty (warts dark-tipped), glabrescent or with residual very small pale scales with pale marginal hairs. *Pinnules* to 12 × 2.5—3 cm (sterile), to 10 × 2.2 cm (fertile), 1—2 pairs basal segments sometimes free; costules commonly 3½—4½ mm apart, on a sterile pinna 5 mm; veins 10—12 (—15) pairs, often 2-forked on sterile pinnules; lamina-segments crenate, most deeply so where fertile. *Sori* exindusiate; paraphyses slender, as long as sporangia; narrow spreading scales round base of receptacle. A few basal *costal scales* sometimes with dark setiform apices and a few short lateral setae, rest (usually all) pale and lax, with lax marginal hairs which are sometimes tangled; costular scales same, usually few; no thick pale hairs on lower surface of costae and costules near apex of pinna, nor on upper surface.

NORFOLK ISLAND. *Bauer* (type, BM); *Cunningham* 48, 65; *P. S. Green* 1419.

39. *Cyathea intermedia* (Mett.) Copel., Univ. Cal. Publ. Bot. 14 (1929) 357. — *Alsophila intermedia* Mett., Ann. Sci. Nat. IV, 15 (1861) 83. — *Alsophila francii* Rosenst. in Fedde, Repert. 10 (1911) 158. — *C. francii* Domin, Pterid. (1929) 263.

Stipe not seen. *Pinnae* to 65 cm long; pinna-rachis pale, glabrescent and warty beneath. *Pinnules* to 11 × 2.7 cm, abruptly short-acuminate, 1—2 pairs of basal segments almost or quite free, then c. 6 pairs constricted at base; costules 4—4½ mm apart; veins 11—13 pairs; lamina-segments crenately lobed where fertile. *Sori* nearer to costule than edge, exindusiate; many long, narrow, fringed scales spreading from base of receptacle beneath sorus. *Costa* beneath usually almost glabrous, at base sometimes a few scales bearing short dark setae, and very small pale non-setiferous scales; scales on costules narrow (some very narrow), pale, with short pale marginal hairs; towards apex of pinna some thick pale hairs near ends of costae and costules on lower surface.

NEW CALEDONIA. *Vieillard* 1631, 1632 (both cited by Mettenius, B; dupl. of 1632 at K, MEL); *Schlechter* 14777; *Franc* 583 (distr. as *Fourniera lepidotricha*), 553 (type coll. of *Alsophila francii*), 469.

Notes. Another specimen labelled *Franc* 553, with same place and date as the type of *Alsophila francii*, is *C. novae-caledoniae*; also a third specimen with the same number but collected in 1907 (type of *Alsophila francii* in 1905). Rosenstock described *Alsophila francii* as differing from *C. novae-caledoniae* in the pale glabrous lower surface of pinna-rachis.

40. *Cyathea aramaganensis* Kanehira, Bot. Mag. Tokyo 48 (1934) 731. — *Alsophila aramaganensis* (Kanehira) Hosokawa, Trans. Nat. Hist. Soc. Formosa 26 (1936) 50. — *Alsophila kanehirae* Hosokawa, Bull. Biogeogr. Soc. Japan 5 (1934) 129; Trans. Nat. Hist. Soc. Formosa 26 (1936) 50.

Trunk 5—10 m tall. *Stipe* 60—100 cm long; basal scales not seen; main rachis pale, lower surface glabrescent, closely warty. *Pinnae* to 45 cm long; pinna-rachis warty on lower surface, glabrescent. *Pinnules* 8—10 × 1.2 cm, basal 1—2 segments almost or quite free, then several pairs separated by a narrow wing along costa, rest of pinnule lobed almost to costa; costules to 3 mm apart; veins to 8 pairs; lamina-segments firm, almost entire. *Sori* exindusiate; paraphyses many, as long as sporangia; many narrow scales spreading from base of receptacle. *Scales on costae* minute, pale, of irregular shape; scales on costules small, pale, short-fringed, not bullate, a few long hairs near apices of pinnules on lower surface of costae and costules.

MARIANAS. *Kanehira* 7123 (type coll., K, MICH).

KEY TO THE SPECIES OF SUBSECTION FOURNIERA

- 1. Scales on costules bullate.
 - 2. Soral scales small, not covering sorus to maturity 41. *C. truncata*
 - 2. Soral scales large, covering sorus to maturity 42. *C. aciculosa*
- 1. Scales on costules not bullate.
 - 3. Lower surface of veins bearing finely-fringed interlacing scales which cover lower surface of leaflets 43. *C. celebica*
 - 3. Lower surface of veins bearing at most scattered small scales.
 - 4. Costules 3—3½ mm apart; pinnules to 17 mm wide; up to half of the tertiary segments quite free 44. *C. novae-caledoniae*
 - 4. Costules 3½—4½ mm apart; pinnules commonly 25 mm wide; usually only one basal pair of tertiary segments quite free 45. *C. leichardtiana*

41. *Cyathea truncata* (Brack.) Copel., Philip. J. Sc. 4 (1909) Bot. 39; C. Chr., Bishop Mus. Bull. no. 177 (1943) 30. — *Alsophila truncata* Brack., U. S. Expl. Exp. 16 (1854) 289, t. 41. — *Hemitelia truncata* (Brack.) Chr., Ann. Jard. Bot. Btzg 15 (1897) 81, *nomen tantum*.

Stipe 25—40 cm long, finely warty after fall of scales, dark; basal scales thin, pale, to 30 × 1 mm with sparse dark marginal setae; rest of stipe ± covered with small scales bearing dark setae. *Pinnae* commonly to 45 cm long, lowest somewhat reduced; pinna-

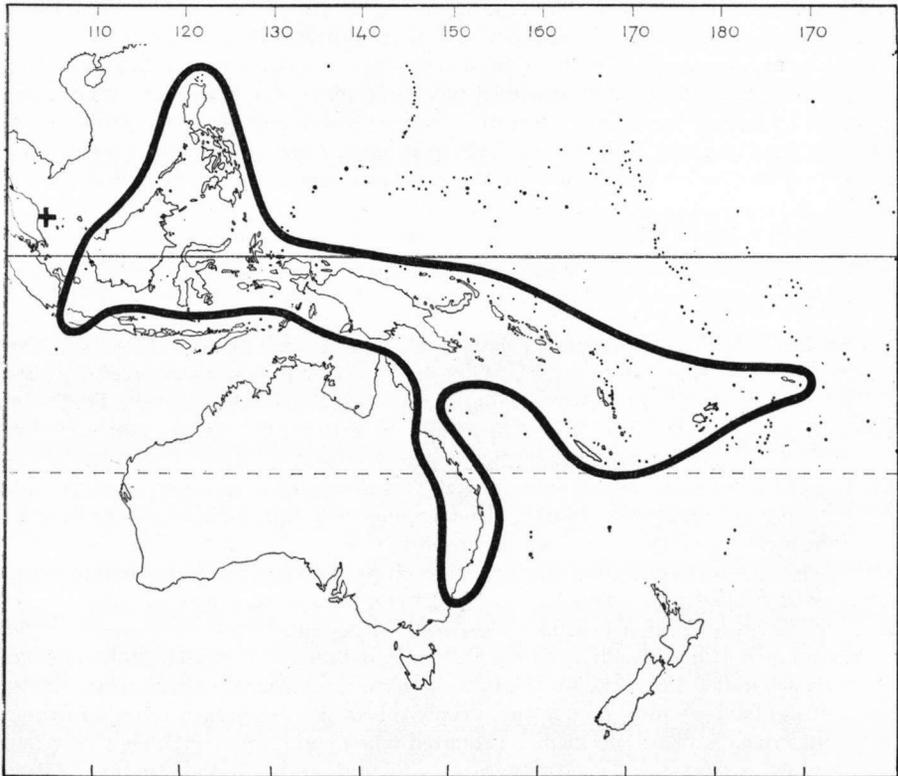


Fig. 4. Distribution of *Cyathea* subg. *Sphaeropteris* subsect. *Fourniera* (Bommer) Holtt. (all species of the subsection, including 5 in New Guinea).

rachis beneath dark, closely and finely warty, \pm densely covered with small scales, smallest pale and lacking setae, larger ones brown, setiferous, residual long narrow setiferous scales also sometimes present. *Pinnules* 6—8.5 \times 1.2—1.8 cm, pinnate almost throughout; costules 2½—3½ mm apart. *Tertiary leaflets* unequal at base (acroscopic side wider and truncate, basicopic side rounded), edges \pm crenate, apex bluntly pointed; veins 8—9 pairs, mostly forked, basal acroscopic one often twice forked. *Sori* near costules, receptacle surrounded at base by spreading, rather narrow, pale scales which are almost covered by the ripe sporangia. Larger scales on costae elongate and wholly or partly dark with setiferous edges, rarely wholly pale, with smaller irregular scales; scales on costules, except near base, always bullate, usually pale but sometimes dark; pale bullate scales, or very small fringed scales, also sometimes present on lower surface of veins.

FIJI. *Brackenridge* (US, type; dupl. at K, P); A. C. Smith 5904, Viti Levu, 1290—1323 m, dense mossy forest; Milne 265; Parks 20953.

SAMOA. Powell 119, Matafao, 2100 ft; Vaupel 430, Maugaloa, 800 m; Christophersen 2180, 1300 m, 3531, wet scrub-forest, 500 m.

SOLOMON ISLANDS. New Georgia group, Kolombangara, Whitmore & Grubb 2153.

Note. Specimens recorded from Celebes and New Guinea belong to various allied species.

42. *Cyathea aciculosa* Copel., Philip. J. Sc. 60 (1936) 104, pl. 9. — *C. arachnoidea* (non Hook.) Greth. & Wagn., Univ. Cal. Publ. Bot. 23 (1948) 43.

Stipe 18 cm long, dark, smooth, covered with minute scales, also near base with pale scales 25 \times 1 mm bearing dark marginal setae near apices. Lowest *pinnae* 10 cm long, longest 50 cm; pinna-rachis beneath warty, shining, with many very small, pale, short-fringed scales and a few long, narrow, setiferous ones. *Pinnules* to 6.5 \times 1.6 cm, fully pinnate. *Tertiary leaflets* to 20 pairs, to 7 \times 2 mm, larger ones crenate; veins 7 pairs. *Sori* covered with overlapping pale scales. Scales on costae near base narrow, setiferous; also throughout costae pale bullate scales and some very small pale scales.

SOLOMON ISLANDS. Brass 2887, San Cristoval, 900 m (MICH, type; dupl. at L. BRI).

ADMIRALTY ISLANDS. Grether & Wagner 4163, Manus Island.

43. *Cyathea celebica* Bl., Enum. Pl. Jav. (1828) 245; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 338, p.p.; Holttum, Fl. Males. II, 1 (1963) 140. — *Alsophila celebica* (Bl.) Mett., Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 53. — *C. arachnoidea* Hook., Syn. Fil. (1865) 24. — *Alsophila truncata* var. *sagittata* Chr., Bull. Herb. Boiss. II, 1 (1901) 458; var. *nivea* Chr. in K. Schum. & Laut., Fl. Deuts. Schutzgeb. Nachtr. (1905) 36. — *C. quadripinnatifida* Copel., Univ. Cal. Publ. Bot. 18 (1942) 213; Philip. J. Sc. 77 (1947) 108, pl. 6.

Stipe to 100 cm long, dark, bearing slender spines to 3 mm long, near base covered with light brown scales 2—4 cm long, mostly not over 1 mm wide, firm, shining, edges bearing close concolorous setae, rest of stipe covered closely with small interlacing setiferous or fringed scales. Small *pinnae* sometimes present near base of stipe; largest *pinnae* to 70 cm long; pinna-rachis almost covered beneath with small, irregular, pale scales bearing short marginal hairs or setae. *Pinnules* 9—14 \times 1.7—2.8 cm, fully pinnate, lower tertiary leaflets stalked; costules (stalks of tertiary leaflets) 3—5 mm apart; tertiary leaflets to 15 \times 2½—5 mm, largest ones deeply lobed near base, basal lobes sometimes free as quaternary leaflets. *Sori* medial, protected when young by overlapping very thin fringed scales. *Costae* covered beneath with scales as pinna-rachis; costules at first bearing small, ovate, setiferous scales; costules and veins covered persistently with small pale fringed scales which interlace and completely cover lower surface of lamina.

Distribution: Celebes (doubtfully), Ternate, Amboyna, New Guinea, Queensland.

Note. The above description is prepared from Malesian specimens; the only one from Queensland at Kew is sterile. Some New Guinea specimens formerly referred to this species appear to me distinct; see treatment of subsect. *Fourniera* in Flora Malesiana. The type specimen of *C. celebica* came from Ternate.

44. *Cyathea novae-caledoniae* (Mett.) Copel., Univ. Cal. Publ. Bot. 14 (1929) 356. — *Alsophila novae-caledoniae* Mett., Ann. Sci. Nat. IV. 15 (1861) 82. — *Fourniera lepidotricha* Fourn., Ann. Sci. Nat. V, 18 (1873) 349. — *Alsophila lepidotricha* (Fourn.) Diels in Engl. & Prantl. Nat. Pfl. Fam. 1, Abt. 4 (1899) 138. — (?) *Fourniera funebris* Fourn., Ill. Hort. 23 (1876) 99.

Stipe to at least 40 cm long, not spiny, dark near base and paler upwards, covered throughout with small brown scales having setiform apices; longer scales near base pale, thick, with short dark setae on surface near edges (complete large scales not seen). *Pinnae* to 50 cm or more, lowest not much reduced; pinna-rachis dark, or paler distally, minutely warty beneath, \pm closely covered with small scales, smallest with pale marginal hairs, larger ones with close short dark setae, also sometimes long narrow scales. Largest *pinnules* 7—8.5 \times 1—1.7 cm, up to half the segments free as tertiary leaflets, basal ones stalked, middle ones adnate on basisopic side, upper ones on both sides; costules 3—3½ mm apart. *Tertiary leaflets* firm, unequally cordate at base, edges crenately lobed, on largest fronds lowest lobes almost free; veins 8—9 pairs. *Sori* nearer to costule than to edge, almost filling lower surface of leaflets at maturity; base of receptacle surrounded by many pale, narrow, fringed scales which spread a little beyond base of ripe sorus. *Scales on costae* very small, mostly with many short dark setae; on costules similar and smaller scales; on lower surface of veins scattered small pale scales.

NEW CALEDONIA. *Vieillard* 1633 (type coll.; dupl. at K, MEL); *Franc* 572; *Cribs* 1099; *McKee* 6542; *Balansa* 1592 (type coll. of *Fourniera lepidotricha*, K); *Brownlie* 202, 203, 237, 238.

Note. The Kew specimen of the type collection of *Fourniera lepidotricha* is a small pinna, with pinnules to 5 \times 1.4 cm; in scaliness it agrees exactly with larger specimens. For a note on *Fourniera funebris*, see *C. albifrons*.

45. *Cyathea leichardtiana* (F. v. Muell.) Copel., Philip. J. Sc. 6 (1911) Bot. 360; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 353. — *Alsophila leichardtiana* F. v. Muell., Fragm. Phyt. Austr. 5 (1865) 53, (1866) 117. — *Hemitelia australis* Pr., Epim. Bot. (1851) 33; Tindale, Contr. N. S. W. Nat. Herb. 2 (1953) 8 (not *C. australis* (R. Br.) Domin). — *Amphicosmia australis* (Pr.) Moore, Ind. Fil. 2 (1857) 59. — *Alsophila macarthurii* Hook., Syn. Fil. (1866) 40. — *Alsophila moorei* J. Sm., Ferns Brit. & For. (1866) 245. — *C. australiensis* Domin, Pterid. (1929) 263, new name for *Hemitelia australis* Pr.

Trunk to 7 m tall, 5—10 cm \varnothing ; stipe-bases mostly persistent. *Stipe* dark, spiny (spines to 4 mm long), shining when scales are removed; near base covered with pale scales to 60 \times 1 mm with sparsely dark-setiferous edges, throughout covered with small setiferous and smaller nonsetiferous scales. *Pinnae* to 65 cm long; pinna-rachis dark beneath (or paler distally), minutely spiny, bearing many very small, appressed, pale, finely fringed scales and larger ones having short dark setae. *Pinnules* commonly to 10 \times 2.5 cm, largest to 13 \times 3 cm; costules 3½—4½ mm apart. *Tertiary segments* \pm adnate to costa, only 1 basal pair free and shortly stalked, edges rather sharply serrate to crenately lobed; veins

10 pairs. *Sori* near costule; scales surrounding base of receptacle \pm covered by mature sorus. *Scales on costae* small, ovate-acute, very dark throughout with short dark marginal setae; most costular scales pale with dark setae or fine marginal hairs.

Distribution: Central eastern Queensland and southwards to eastern Victoria.

Note. In shape of pinnules this species hardly differs from many species of subsect. *Sphaeropteris*, most of which have also scales round base of sorus; but it agrees with other species of subsect. *Fourniera* in dark stipe and rachis and in the very abundant small strongly setiferous scales.

Subg. SPHAEROPTERIS sect. *Schizocaena*

As interpreted in *Flora Malesiana* II, I (1963) 141—157, this section is confined to Malesia and the islands of the Pacific which are less than 20° S of the equator, as far as Samoa and Fiji (the species of Ceylon included in his genus *Schizocaena* by Copeland are excluded). The section appears to be distinct from sect. *Sphaeropteris* in its less deeply lobed pinnules with more widely-spaced costules and in the basal basicopic vein of each group being attached directly to the costa; it appears also that species of sect. *Schizocaena* are all ferns of moist shady forest, not tolerating exposure to sun as do those of sect. *Sphaeropteris* subsect. *Sphaeropteris*. In the exindusiate species of sect. *Schizocaena* in Malesia I have not seen any scales round the base of the receptacle, such as are common in exindusiate species of sect. *Sphaeropteris*. All species of sect. *Schizocaena* here dealt with are indusiate; indusia always cover the sorus to maturity and then break irregularly, usually persisting. In most cases there are rather thick paraphyses which are dark when old.

The large scales at the bases of the stipes of species of sect. *Schizocaena* in New Guinea and the Pacific are more or less thickened near their bases, some being very fleshy; towards their apices at least they are flat and thin, with marginal setae. I have not seen the base of the stipe of *C. leucolepis*. Because of these fleshy scales, I separated the species of New Guinea (to which those of the Pacific are closely related) as a subsection *Sarcopholis*, but I am not sure how sharply this subsection is distinct from the species of Western Malesia which include the type of the section. A careful morphological and developmental study of the fleshy type of scale (especially well developed in *C. propinqua*) is needed; for this purpose dried herbarium specimens are not suitable. These fleshy scales look comparable to the thick but very rigid scales of *C. albifrons* and *C. novae-caledoniae*, both of which carry short setae on the surface of their thickened parts, not only near the edges distally; and the curious New Guinea species *C. procera* Brause and *C. pulcherrima* Copel. need also to be brought into the comparison.

The species of this section are difficult to discriminate, and I am not sure that I have been able to characterize them clearly.

KEY TO THE SPECIES OF SECTION SCHIZOCAENA

1. Pinnules 3—4 cm long; veins 3—5 pairs. 46. *C. subsessilis*
1. Pinnules commonly to 10 cm long; veins 8—10 pairs.
 2. Stipe to 60 cm long; lower pinnae not greatly reduced; scales on costae mostly bearing close short marginal setae; no bullate scales 47. *C. microlepidota*
 2. Stipe 10—25 cm long; basal pinnae 10 cm or less; scales on costae with sparse lateral setae or none; bullate scales usually present.
 3. All costal and costular scales entire 48. *C. leucolepis*

3. Costal and costular scales mostly with some marginal hairs or setae.
4. Long scales, not greatly thickened at base, abundant throughout length of stipe
49. *C. brackenridgei*
4. Long scales only near base of stipe, considerably thickened near their bases.
5. Stipe-scales thick almost throughout and persistent; small scales on stipe often with dark setae; bullate scales on costules few or lacking. 50. *C. propinqua*
5. Stipe-scales thick near base only, ultimately caducous; small scales on stipe not setiferous; hair-pointed bullate scales abundant on costules and often on costae 51. *C. vaupelii*

46. *Cyathea subsessilis* Copel., Philip. J. Sc. 6 (1911) Bot. 359; C. Chr., Bishop Mus. Bull. no. 177 (1943) 25.

Frond to c. 100 cm long. *Stipe* 5 cm long, covered with dull brown scales to 20 × 2 mm, thick at base, thin, paler, and setiferous distally. Lowest *pinna* 3 cm long; longest 22 cm; *pinna-rachis* smooth beneath. *Pinnules* 3—4 × 1.0—1.2 cm, lobed to about 1 mm from costa, no free segments; costules 4 mm apart; veins 3—4 pairs; lamina-segments almost entire, apices rounded. *Sori* medial or infra-medial; indusium complete, breaking and persistent. *Scales on costae* near base elongate, dull brown with scattered long marginal hairs, grading to hair-pointed bullate scales distally and on costules; a few thick spreading hairs on upper surface of costules.

SAMOA. *Vaupe*l, Savaii, 1200 m (US, *type*; dupl. at K, MICH); *Betche* 136, Upolu, 3000 ft (NSW); *Christophersen* 2064, Savaii, medium wet forest, 900 m.

FIGI. A. C. *Smith* 1902, Vanua Levu, dense forest.

Note. As noted by Christensen this species differs only in size (of all parts of the plant) from *C. vaupelii*.

47. *Cyathea microlepidota* Copel., Journ. Arn. Arb. 30 (1949) 435.

Stipe to 60 cm long, dark, warty, ± covered by a thin felt of minute, pale, fringed scales and a few with dark setae; near base of stipe some fleshy upcurved outgrowths which appear to be scale-bases (imperfect in specimens seen) and to bear small scales on their outer surfaces. Lowest *pinnae* (*vide* Copeland) 23—30 cm long; longest 50 cm; *pinna-rachis* beneath pale, smooth, glabrescent. *Pinnules* to 10 × 2.3 cm, lowest distinctly stalked, acuminate, basal basiscopic segment small and almost free, rest of pinnule lobed to 1—1½ mm from costa; costules 6—7 mm apart (more widely spaced in sterile than in fertile pinnules); veins 8 pairs; lamina-segments almost entire to distinctly crenate. *Sori* medial; indusium complete, breaking and persistent. *Scales on costae* abundant, small, mostly with close, short dark marginal setae, some with a long, shining, dark apical seta; smaller but similar scales on costules.

FIGI. A. C. *Smith* 6654, Vanua Levu, 100—200 m, in forest (UC, *type*; dupl. at A, K, BRI), 1529; *Gillespie* 3018, Viti Levu.

48. *Cyathea leucolepis* Mett., Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 56.

Stipe not seen. Longest *pinna* seen 40 cm long; *pinna-rachis* beneath pale, smooth, glabrescent. *Pinnules* to 10 × 2.5 cm, short-acuminate, lobed to 1—1½ mm from costa, basal basiscopic segment never quite free; costules 5—6 mm apart; veins to 8 pairs; lamina-segments thin, slightly to rather strongly crenate, tips rounded. *Sori* medial; indusium complete, breaking and persisting. *Scales on costae* few, small, not fringed nor setiferous, sometimes bullate; pale entire bullate scales abundant on costules; a stout hair often present on upper surface of each costule.

NEW HEBRIDES. Aneiteum: "Sheage" = *Strange* (B, type; dupl. at Kew); *Milne 343*, woods, frequent; *Kajewski 861*, fronds to 9 ft long, forest, common.

Note. The *Strange* specimen at Kew matches the *Mettenius* type at Berlin exactly, but the label bears the locality New Caledonia. However, this specimen is from Thomas Moore's herbarium, and the original label appears to have been discarded. It seems probable that New Caledonia is an error. See also note under *C. aneitensis* Hook.

49. *Cyathea brackenridgei* Mett., Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 56.

Stipe pale, to at least 25 cm long, scaly throughout; larger scales $20 \times 1\frac{1}{2}$ mm, dark and slightly thickened in a median band with pale edges bearing short oblique dark setae, also copious very small irregular dull scales, mostly not setiferous. Lowest *pinna* c. 10 cm long, largest 60 cm; *pinna-rachis* beneath pale, smooth glabrescent. *Pinnules* to 12×2.4 cm, lobed to within 1 mm of costa; costules 5—6 mm apart; veins to 10 pairs; lamina-segments distinctly falcate, edges crenate, apices blunt. *Sori* medial; indusium complete, breaking and persisting. *Costal scales* some narrow, dark, setiferous, some very small, pale, and fringed, sometimes also pale bullate scales; on costules pale acuminate bullate scales, often with a few pale marginal hairs near their apices; similar scales sometimes on lower surface of veins; near apex of a pinnule a few stout erect hairs on both upper and lower surfaces of costae and costules.

SOLOMON ISLANDS. *Brackenridge* (B, type); *Milne 586*, Guadalcanal; *Waterhouse 325*; *B. C. Stone 2531*, Florida Group, beside streams, rather common, to 30 ft tall (K, BISH); *Guppy 300, 301, 302* (BM); *Brass 3192*, Ysabel (MICH), *3065*, San Cristoval (MICH); *Whitmore BSIP 1981*, New Georgia.

Note. The only specimen which shows a lower *pinna* is *Brass 3065*; in this specimen the length of the *stipe* is uncertain.

50. *Cyathea propinqua* Mett., Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 56. — *C. affinis?* [non (Forst.) Sw.] Brack., U. S. Expl. Exp. 16 (1854) 283.

Stipe 15—20 cm long, dull and dark, \pm covered with minute dull brown scales many of which have setiform apices, near base bearing thick fleshy ascending scales to $25 \times 2\frac{1}{2}$ —4 mm, tapering to a thin pale apex bearing marginal setae. Lower *pinnae* gradually reduced, lowest 5—8 cm long; longest *pinnae* to 50 cm; *pinna-rachis* pale, smooth, glabrescent beneath. Largest *pinnules* commonly 10×2.3 cm, lobed to within $1\frac{1}{2}$ mm of costa, lowest basiscopic segment smallest and sometimes almost free; costules 6—7 mm apart; veins to 8 or 9 pairs; lamina-segments \pm distinctly crenate, costules distinctly falcate. *Sori* medial; indusium complete, breaking and persistent. *Scales on costae* very narrow, ending in dark setiform apex, largest with thickened base and some dark lateral setae, some reduced to a dark hair, also small irregular pale scales; scales on costules few, small, not (or rarely) bullate.

Fiji. Com. Sir Wm Hooker (type, B); *Brackenridge* (US); *A. C. Smith 1322, 999, 229, 1933, 5603, 5805, 2002, 9272, 9017, 5934, 7031, 7290, 7740, 7540* (all US); *Degener 15234, 15511, 14613*; *Degener & Ordoñez 13857*; *Gillespie 3459, 4368* (US); *Horne 548*; *H. E. Parks 20064*; *Setchell & Parks 15051* (US).

Notes. *A. C. Smith 5934, 5805*, both have bullate scales on costules of sterile basal *pinnae*; no other specimens have such scales except as noted below.

The type specimen at Berlin has no collector's name, and presumably was not collected by *Brackenridge*; but it seems probable that *Mettenius* saw a *Brackenridge* specimen. One *Brackenridge* specimen (labelled by him *C. affinis*) has some bullate scales on costules;

this is the upper part of a frond. The other specimen (a larger pinna) has no bullate scales.

51. *Cyathea vaupelii* Copel., Philip. J. Sc. 6 (1911) Bot. 260; C. Chr., Bishop Mus. Bull. no. 177 (1943) 25. — *C. setchellii* Copel., Univ. Cal. Publ. Bot. 12 (1931) 389, pl. 50.

Trunk slender, to $3\frac{1}{2}$ m tall (Powell). *Stipe* c. 10 cm long, when young covered with scales to 25×1 mm, thick near base and in a median band, with setiferous adges which extend nearly to the base, ultimately caducous and leaving irregular warty bases, also a \pm caducous covering of very small dull brown scales which are not setiferous. Lowest *pinna* 5 cm long; largest 45 cm; pinna-rachis beneath pale, smooth, glabrescent. *Pinnules* to 10×2.2 —3 cm, basal basicopic segment smallest and sometimes almost free, rest of pinna lobed to 1 — $1\frac{1}{2}$ mm costa; costules 6—7 mm apart; veins 8—10 pairs; lamina-segments rather thin, slightly crenate, apex blunt. *Sori* medial; indusium complete, breaking and persistent. *Scales on costae* near base narrow, long, pale, sometimes ending in a dark seta, grading to hair-pointed bullate scales distally; hair-pointed bullate scales abundant on costules; a few thick spreading hairs on upper surface of costules.

SAMOA. *Vaupel* 184 (UC, type; dupl. at K); *Setchell* 2 (UC, type of *C. setchellii*); *T. Powell* 20; *Christophersen* 563, top of Fao, open, 680 m; 3546, top of Pioa (BR); *Yuncker* 9430, Tutuila, in moist shady forest; *Reinecke* 89b; *Whitmee* 4, 93; *McKee* 2975 (distr. as *C. subsessilis*, BM); *Betche* 147, Upolu (NSW); *Rechinger* 613, 1867 (BM).

LISTS OF SPECIES IN THE VARIOUS ISLAND-GROUPS

The number of species in an island-group depends on two factors: the size of islands, and their distance from New Guinea. Thus, though Tahiti has mountainous islands of size comparable with those of Fiji, it has fewer species. The smaller islands which have not developed a complex shady forest, bear mostly species of sect. *Sphaeropteris*. It is to be expected that more species will be found in the Solomon Islands and the New Hebrides, especially in mountain forest.

There is much need for more local study of this group of ferns, so that their characteristics may be more clearly described. Information here recorded about length of stipe and of lower pinnae is often uncertain, and in some cases also information about stipe-scales.

In the following lists, the species are given their serial numbers for convenience of reference.

AUSTRAL ISLANDS. *C. affinis* (24), *C. medullaris* (32), *C. stokesii* (9).

AUSTRALIA. *C. australis* (1), *C. baileyana* (26), *C. celebica* (43), *C. cooperi* (37), *C. cunningghamii* (14), *C. leichardtiana* (45), *C. marcescens* (21), *C. rebecca* (27), *C. robertsiana* (7), *C. woolliana* (17).

CAROLINE ISLANDS. *C. lunulata* (35), *C. nigricans* (30).

COOK ISLANDS. *C. affinis* (24), *C. decurrens* (11), *C. parksiae* (33).

FIJI. *C. affinis* (24), *C. alia* (12), *C. decurrens* (11), *C. hornei* (25), *C. lunulata* (35), *C. medullaris* (32), *C. microlepidota* (47), *C. plagiostegia* (23), *C. propinqua* (50), *C. subsessilis* (46), *C. truncata* (41).

KERMADEC ISLANDS. *C. kermadacensis* (16), *C. milnei* (4).

LORD HOWE ISLAND. *C. brevipinna* (22), *C. howeana* (8), *C. macarthurii* (5), *C. robusta* (36).

MARIANAS. *C. aramaganensis* (40), *C. lunulata* (35).

MARQUESAS. *C. affinis* (24), *C. feani* (31), *C. medullaris* (32).

NEW CALEDONIA. *C. alata* (10), *C. albifrons* (28), *C. intermedia* (39), *C. lunulata* (35), *C. novae-caledoniae* (44), *C. stelligera* (13), *C. vieillardii* (20).

NEW HEBRIDES. *C. aneitensis* (19), *C. decurrens* (11), *C. leucolepis* (48), *C. lunulata* (35), *C. vieillardii* (20).

NEW ZEALAND. *C. colensoi* (2), *C. cunninghamii* (14), *C. dealbata* (3), *C. medullaris* (32), *C. smithii* (15).

NORFOLK ISLAND. *C. australis* (1), *C. brownii* (38)

PITCAIRN. *C. medullaris* (32).

SAMOA. *C. affinis* (24), *C. alta* (12), *C. decurrens* (11), *C. lunulata* (35), *C. medullaris* (32), *C. subsessilis* (46), *C. truncata* (41), *C. vaupelii* (51), *C. whitmeei* (29).

SOLOMON ISLANDS. *C. aciculosa* (42), *C. alta* (12), *C. archboldii* (6), *C. brackenridgei* (49), *C. lunulata* (35), *C. solomonensis* (18), *C. vittata* (34), *C. whitmeei* (29).

TAHITI. *C. affinis* (24), *C. decurrens* (11), *C. medullaris* (32).

TONGA. *C. lunulata* (35).

EXCLUDED SPECIES

Cyathea grevilleana Mart., Ic. Pl. Crypt. (1834) 78; Tindale, Contr. N. S. W. Nat. Herb. 2 (1956) 342. — *C. lindsayana* Hook., Syn. Fil. (1865) 25.

The type of *C. grevilleana* came from Jamaica; the specimens on which *C. lindsayana* were based, said to have been found on Mt Lindsay in Queensland, were probably mis-labelled as to locality.

Hemitelia denticulata Hook., Syn. Fil. (1865) 31.

The type is *Cuming 1360* from Elizabeth Island which I cannot locate. Also on the sheet is the name *Hemitelia servitensis* Karst., a species of tropical America. The specimen certainly belongs to the group of species which Maxon has included in *Hemitelia* in tropical America.

Hemitelia laciniata Spr., Syst. 4 (1827) 126.

This was based on a Forster specimen from New Hebrides which I have not seen. The description does not indicate the genus clearly. In his Index Filicum, Christensen referred this species with doubt to *Tectaria*.

ADDENDUM

The following additional information is based on specimens received from Mr P. S. Green after the present paper had been sent for printing.

Cyathea cicatricosa Holttum, *sp. nov.*

C. alata (Fourn.) Copel. affinis, differt: caudice graciliore (c. 3 cm diametente) frondes quatuor late patentes ferente; stipitibus 15 cm longis; pinnis 20 cm longis; pinnulis maximis 3.5 × 0.8 cm; costulis 2 mm inter se distantibus; venulis 5–6-paribus.

P. S. Green 1778, New Caledonia, near top of Mt Ignambi, in humid montane forest, 1200 m, on metamorphic rocks.

This species is closely similar to *C. alata* in scaliness of all parts and in sori, also in the somewhat swollen stipe-bases which fall immediately and leave the trunk with scars right up to the living fronds; but the new species differs in its very much smaller size, and the way in which the few fronds spread widely from the apex of the trunk, whereas the more numerous fronds of *C. alata* spread very little from the vertical near their bases (photographs of both species seen). In size, *C. cicatricosa* is near to *C. stokesii*, but the two differ in scaliness.

Cyathea albifrons (no 28, p. 260).

Mr Green has collected a specimen (no 1807) with pinnae very like the type of *C. lenormandii*; its stipe-scales (to 40 × 2 mm) are not at all thickened and have close uniseriate setae along their edges throughout. It may be that there are two species, *C. albifrons* with larger fronds and dark thick stipe-scales, and *C. lenormandii* with smaller fronds and thin brown stipe-scales; but, apart from stipe-scales (lacking from most specimens) I cannot see a clear distinction between them.