

**STUDIES IN THE FERN GENERA ALLIED TO TECTARIA CAV. IV.
THE GENUS CTENITIS IN ASIA, MALESIA AND THE WESTERN PACIFIC**

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SUMMARY

A survey is presented of past treatment of the genus *Ctenitis* C. Chr. in the Old World, with the conclusion that the genus has not hitherto been clearly defined. A new generic description covering the species of Asia, Malesia and the Western Pacific is presented, with a new division of the species into two subgroups of informal status, based on scales and spores, and a key to all species. Seventeen new species are described, one new name proposed and four new combinations made. A list of species in the region which, in the opinion of the author, have been wrongly included in *Ctenitis*, is appended.

INTRODUCTION

When Christensen was preparing his Index Filicum (1905) he realised that the species there listed under *Dryopteris* were an unnatural mixture which needed further study. He subsequently attempted to distinguish natural groups within that mixture by examining the species of tropical America, and in 1911 published a summary of his results, treating his new species-groups as subgenera, though he regarded them as very diverse and stated that some should ultimately have generic rank. He refrained from establishing new genera because he wished to know how a further study of the Old World species might modify his scheme, and he continued to use the name *Dryopteris* in the same broad sense in the third Supplement (1934) to his Index. He published his Monograph of the tropical American species in two parts, in 1913 and 1920. He gave the name *Ctenitis* to one of his subgenera, taking it from *Aspidium ctenitis* Link, a species based on a plant from Brazil cultivated at Berlin. In 1913 he described the group of species within subgenus *Ctenitis* to which *Aspidium ctenitis* belongs; they all have bipinnatifid fronds. In 1920 he described the more diversified species which have more compound fronds and published a conspectus of the whole subgenus, distinguishing five groups of species to which he gave no formal rank. The principal distinguishing character of the subgenus is the presence of short hairs of a peculiar form on all axes of the fronds; he pointed out that these hairs are different from those on all the other subgenera but that they are also characteristic of *Tectaria*.

R.C. Ching, who had begun a study of the ferns of China, spent the years 1929–1932 in Europe under the guidance of Christensen, making a very extensive study of Chinese and Indian fern specimens in European herbaria. During the period 1930–1949 he wrote an important series of papers on the ferns of Asia, clarifying the status of many genera and species, including those belonging to the *Dryopteris* of 1905. In 1938 appeared Christensen's chapter on fern taxonomy in Verdoorn's Manual of Pteridology; in it he accorded generic rank to *Ctenitis* for the first time. In the same year appeared Ching's account of the species of *Ctenitis* in Asia (1938b) and a paper on the species of Indochina by Madame Tardieu-Blot and Christensen. In 1938 also Ching recognized two allied genera which he named *Lastreopsis* (1938a) and *Ctenitopsis* (1938c). In 1939 H. Ito published a new conspectus of *Ctenitis* in Japan; in my judgement this was very confused (see further comment below).

Copeland's Genera Filicum appeared in 1947. In it he assigned many additional Old World species to *Ctenitis*, including all those which Ching had placed in *Lastreopsis* and *Ctenitopsis*, also a few species which belong to other genera. Later Copeland wrote his Fern Flora of the Philippines (1960) in which he described the Philippine species of *Ctenitis*: errors in this have been pointed out by M.G. Price (1972, p. 36). When preparing my book on the ferns of the Malay Peninsula (1955) I based my classification mainly on Christensen's of 1938, transferring Ching's type species of *Ctenitopsis* to *Heterogonium* and recognizing *Lastreopsis* as distinct from *Ctenitis*; a preliminary paper, discussing my system, was published in 1947 simultaneously with Copeland's Genera Filicum. But in the Malay Peninsula there are only two species of *Ctenitis*, so that I did not add much to published knowledge of the genus when my book appeared, and after that I devoted myself to other families over the wider area covered by Flora Malesiana. Subsequently M.D. Tindale (1965) wrote a full monograph of *Lastreopsis* (Ching had dealt with only four species). At least as regards the species of Asia, Malesia and Australasia, I agree that it is a natural genus distinct from *Ctenitis*.

Christensen's book on the Pteridophyta of Madagascar was published in 1932. In it he recognized that the Madagascan species of *Dryopteris* subg. *Ctenitis* (as he then still called them) belonged to groups which he had already distinguished in his study of American species. In 1933 Madame Tardieu-Blot recognized several tropical African species as belonging to *Ctenitis*, and in 1955 published an account of those of the Mascarene Islands which were not dealt with in Christensen's book on Madagascan ferns. In 1959 Alston's work on the ferns of West Tropical Africa added further information; he included species later transferred to *Lastreopsis* by Tindale. In the 1970s three field workers in Réunion and Mauritius collected a large number of specimens (also living plants, cultivated at Kew) which added much new information to that provided by the older collections on which Madame Tardieu-Blot's work of 1955 had been based. I studied this material, together with all the earlier collections in the herbaria of Paris and Kew, and produced a revised account of the Mascarene species of the genus (1983). Most of them belong to the same group as the generic type; the others belong to Christensen's group of *Ctenitis subincisa*. This study was for me a valuable introduction to the species here dealt with.

The species of Asia, Malesia and the Western Pacific — Christensen was the first to comment on some of these species as a distinct group in 1929. Under the name *Dryopteris vilis* (Kunze) C. Chr. he mentioned various specimens he had seen of this and allied species and referred to prior confusions in their nomenclature, but had not seen enough material to enable him to distinguish the species clearly. In 1934 (pp. 252–254), under *Dryopteris* subgenus *Ctenitis*, he published notes on *D. adnata* (Bl.) v. A. v. R., *D. dissecta* (Forst.) O. Ktze and *D. aciculata* (Bak.) C. Chr. of which plants had been found on Mt Kinabalu in North Borneo. He was uncertain whether *D. adnata* belonged properly to *Ctenitis* but noted its close resemblance to *D. apiciflora* (Wall.) C. Chr. and its differences from *D. filix-mas* of which it had previously been regarded as a variety. He was puzzled by *D. dissecta* and thought it indicated a gradual transition between *Tectaria* and *Ctenitis*. He noted resemblances between *D. aciculata* and *Pleocnemia leuzeana*.

When R. C. Ching published his comprehensive account of the species of *Ctenitis* known in Southeast Asia (1938b) he divided *Ctenitis* into two subgenera, *Dryopsis* (a name not validly published) and *Euctenitis*. Under the former he placed the species known to Christensen as *Dryopteris adnata* and *D. apiciflora*, pointing out their differences in scales from *Euctenitis*; but they differ from the type of *Ctenitis* also in the grooved upper surface of their pinna-midribs, the groove lacking hairs within it but bearing on its margins long hairs with thickened bases which are not ctenitoid. I accordingly exclude them from *Ctenitis* and (with P. J. Edwards) am elsewhere treating them as a separate genus *Dryopsis*; in my opinion this group is more nearly related to *Nothoperanema* than to *Ctenitis*.

Evidently Ching had also thought about Christensen's comments on *Dryopteris dissecta*. He found that this and some allied species differ constantly from *Ctenitis* in their venation and their scales; he therefore (1938c) proposed for them a new genus *Ctenitopsis*. As noted above, Copeland later included them (and some others) in *Ctenitis*, not noting the distinctions mentioned by Ching. I now regard these species as belonging to *Tectaria* (Holttum, 1955, p. 501) except the species originally named *Aspidium sagenioides* Mett. which Ching had cited as type of *Ctenitopsis* and the allied *Aspidium subsageniaceum* Christ. The latter two species agree in their frond-form with those which I have assembled in *Heterogonium* Presl (Holttum, 1975) to which I transferred them. It should be noted the species of *Ctenitopsis* and *Heterogonium* examined cytologically have 40 chromosomes as in *Tectaria*, not 41 as in *Ctenitis*. Ching also included in *Ctenitopsis* a species which he had earlier named *Tectaria sinii*. This has the frond-form and venation of free-veined species of *Tectaria* but copious clathrate scales similar to those of *Ctenitis*. I am treating it as a separate genus.

Another aberrant species needs also to be mentioned, namely *Ctenitis dubia* Copel. This has scales and indusia as in *Tectaria* but does not show the typical venation specified for *Ctenitopsis* by Ching; it also differs from *Ctenitis* and agrees with many species of *Tectaria* in having thick hairs between the veins on the upper surface. For it and a few allied species I am proposing another new genus.

The Hawaiian species placed by Copeland in *Ctenitis* are not dealt with here. They

are: *C. latifrons* (Brack.) Copel., *C. honolulensis* (Hook.) Copel. and *C. squamigera* (Hook. & Arn.) Copel. The two former are closely allied and have very peculiar large sporangia, also spores different from others known to me; they perhaps should be regarded as constituting a separate section in the genus. I suggest that *C. squamigera* is allied to Christensen's group of *Ctenitis ampla* in the Americas.

The present account covers all species of which I have seen specimens from Asia, Malesia and the Western Pacific. It is mainly based on specimens in the herbaria at Kew, the British Museum (Natural History), Paris and Leiden, with the addition of some type and other material sent on loan to Kew from other herbaria which are indicated where specimens are cited. I am grateful for the help received from all the institutions concerned, also to Mr M.G. Price (University of Michigan) who has sent a set of his own Philippine collections which have added significant new information. I am also grateful for the continued hospitality of Kew, and especially to Peter J. Edwards who has made the SEM photographs here reproduced.

THE SUBDIVISION OF CTENITIS

In his Monograph (1913 and 1920) Christensen arranged the American species of *Dryopteris* subgenus *Ctenitis* in informal groups. In 1938 Ching, dealing with the species of Asia, divided them into two subgenera (as above noted); he regarded all American species as belonging to subgenus *Euctenitis*. In 1939 H. Ito proposed a more elaborate subdivision of the species of Asia, making no reference to Ching's work. He wrote Latin diagnoses for two sections, *Eu-Ctenitis* and *Pseudoctenitis*, the former with the same American type as the genus but including some species from Asia, the latter typified by *C. eatonii* (Bak.) Ching of Taiwan; but he included species belonging to subg. *Dryopsis* Ching in both sections, and in sect. *Pseudoctenitis* he included also species which belong to several other genera. I agree that there are two groups of species in Asia, but they are not the groups specified by Ito and neither of them coincides with the species of the Mascarene Islands which are clearly related to the type species of *Ctenitis*.

In the introduction to her monograph of *Lastreopsis* (1965) Tindale discussed the differences between that genus and *Ctenitis* (in which genus Copeland had included it). She wrote Latin diagnoses for Christensen's sections *Hirtae*, *Amplae* and *Subincisae*, including all of them in subgenus *Ctenitis*, but not for his section *Protensae*; the latter has scales like those of *Tectaria* and in my judgement should have separate generic status. Section *Subincisae* differs from sect. *Ctenitis* in lack of cylindrical glands and in the nature of its scales and hairs; the plants are in most cases arborescent, with very large fronds, and in 1875 John Smith suggested for them the generic name *Megalastrum*.

The species here dealt with certainly differ in their frond-form from those of sect. *Ctenitis*. They are clearly divisible into two groups, but whether these groups should each have the formal status of Section cannot well be decided until a new survey of the whole genus is attempted. I therefore treat them as informal groups.

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CTENITIS C. Chr.

Generic description for species of Asia, Malesia and the Western Pacific

Caudex short, erect or suberect or rarely prostrate, its apex and the bases of stipes densely covered with thin flat scales which are not more than 1 mm wide at their bases; stipes scaly throughout, with a \pm abrupt change from the long basal scales to shorter ones of two different types, distinctive for each species. Lamina always bipinnate at the base, the basiscopic pinnules of basal pinnae always longer than the acroscopic ones, the basal ones usually longest and always very deeply lobed, in some species pinnate to bipinnate near their bases; distal pinnae or pinnules \pm adnate to

the rachis and \pm decurrent at their bases but their basal basicopic veins almost always arising from the pinna- or pinnule-midrib; texture of lamina mostly thin with veins distinct on both sides but in some species opaque with the smaller veins indistinct; veins all free, those in each pinna-lobe all arising from the costule of the lobe (not from the costa of the pinna); lower surface of pinna-rachis or pinna-midrib always bearing scales which are progressively smaller distally, similar scales also present on costae of pinnules, some ctenitoid hairs also present and often appressed cylindric unicellular glands, such glands often also present between veins, sometimes with the addition of short hairs of various kinds; upper surface of pinna-rachis or pinna-midrib and of costae of pinnules prominent, always covered with ctenitoid hairs which are thicker than those on the lower surface, similar hairs scattered on veins but not between veins where appressed cylindric glands or short non-ctenitoid hairs may occur. Sori usually medial on the veins, not terminal; indusia usually present, sometimes very small and hidden by the mature sporangia, always unpigmented, thin and fragile, usually bearing marginal cylindric glands when young; spores of two distinct kinds.

Two natural groups of species in this area may be distinguished as follows:

- Pinna-rachis scales with inflexed edges except when very narrow, with isodiametric cells near their thickened bases only; perispore of spores variously developed in broad folds which are translucent and may appear like wings as seen with the light microscope *Group of Ctenitis eatonii*
- Pinna-rachis scales flat or nearly flat, thin and clathrate with isodiametric cells at least in their basal half, bases of scales deeply cordate and point-attached; perispore of spores \pm echinate or spinulose *Group of Ctenitis subglandulosa*

Both groups are represented in Mainland Asia, but the group of *C. eatonii* is much more diversified in Malesia (especially in the Philippines) than the group of *C. subglandulosa*. The latter group however, is represented in Ceylon and also eastwards across the Pacific to Pitcairn Island, whereas the group of *C. eatonii* is absent from Ceylon and extends eastwards only to Fiji. The species of the group of *C. subglandulosa* are difficult to distinguish from each other; those of the group of *C. eatonii* are more diverse. It appears that few of the species are at all common, though some are widely distributed.

The accompanying SEM photographs (fig. 1, 2) illustrate the spores of six species of the group of *C. eatonii* and four of the group of *C. subglandulosa*, also scales of each group (fig. 3).

THE DESCRIPTION OF SPECIES

On a developing plant each successive frond is larger than the preceding one, and the maximum size of frond is a distinctive character of each species, though that size may vary with environmental conditions. A constant character of all species here described is that the basal pinnae are more amply branched than the rest, the basal basicopic pinnules being almost always the largest. The degree of branching of those

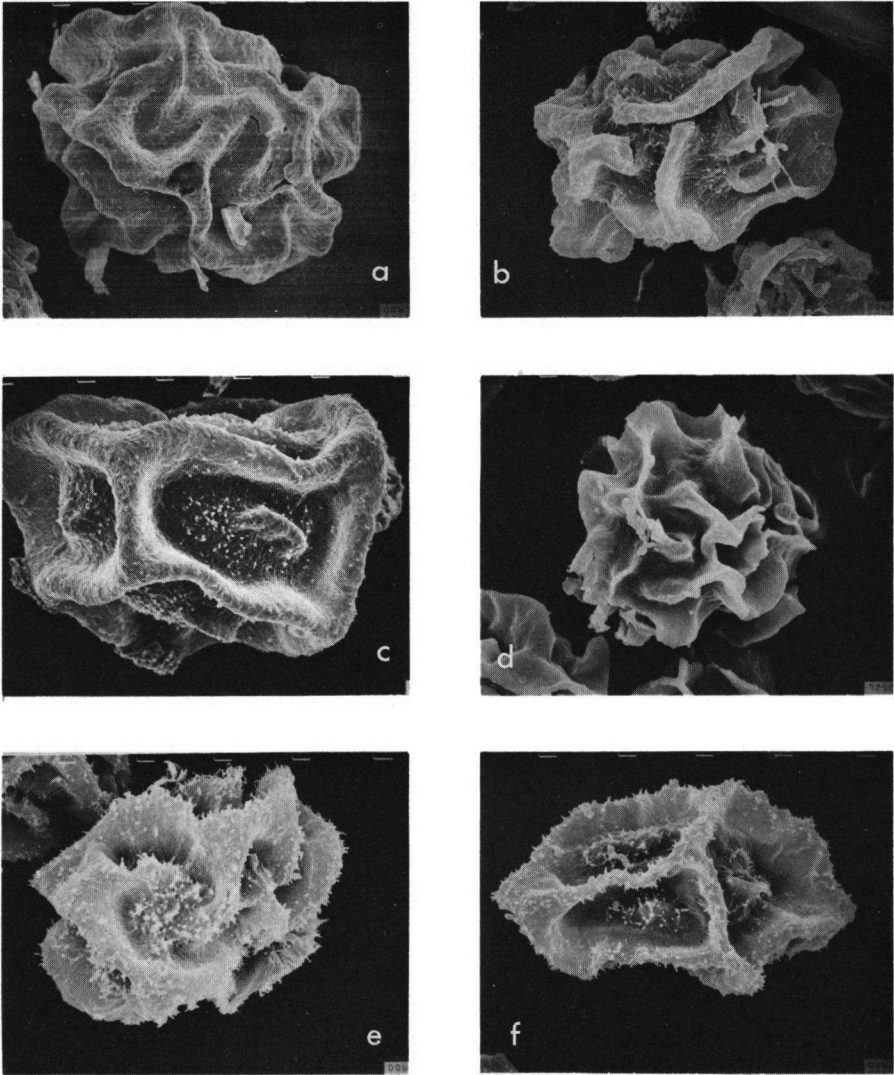


Fig. 1. Spores of the group of *Ctenitis eatonii* (Bak.) Ching, all $\times c.$ 960. — a. *C. pallens* (Jermy 7900, New Ireland, cult. Kew); b. *C. fijiensis* (Milne 159, Fiji); c. *C. alteroblumei* (Hallier, Tjibodas); d. *C. kinabaluensis* var. *crassisquama* (Iwatsuki et al. B.2195, Kalimantan Timor); e. *C. boholensis* (Ramos BS 42983, Bohol); f. *C. propinqua* (Cuming 255, Luzon).

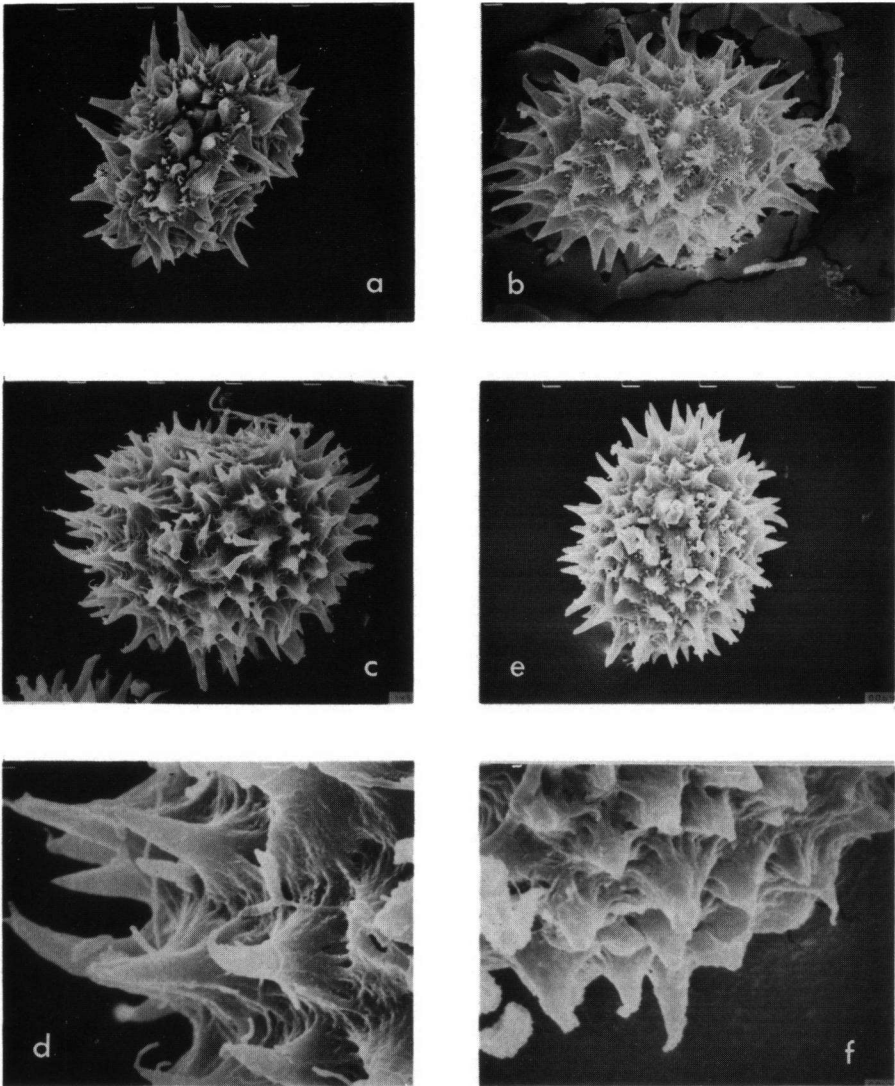
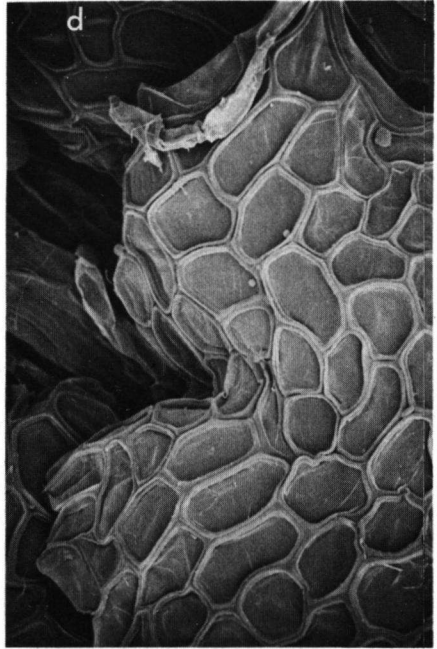


Fig. 2. Spores of the group of *Ctenitis subglandulosa* (Hance) Ching. — a. *C. sciaphila*, \times c. 960 (M. L. Grant 4069); b. *C. cumingii*, \times c. 960 (Cuming 1388); c. *C. subglandulosa*, \times 960 (Griffith, Assam); d. as c, \times 3620; e. *C. samoensis*, \times c. 960 (Whitmee, Samoa); f. as e, \times c. 3620.

Fig. 3. a. *C. alteroblumei*, scales and sori on lower surface of a pinnule, \times c. 25 (Sapien 2793, Tjibodas); b. as a, \times c. 140, base of a scale; c. *C. subglandulosa*, scales on lower surface of a costule, \times c. 70 (Elmer 22162, Luzon); d. as c, \times c. 250, base of a scale.



pinnules on fronds near the maximum size for a species is an important distinctive character and is here in all cases described; it is impossible to describe every earlier stage. The most important characters which are not dependent on the size of fronds are those of the scales, which vary in form from those at the bases of stipes to those on the smaller axes of fronds. The form of these scales has never been critically described for most species in the Old World. I have here tried to describe their essential characters briefly; a still more detailed study is desirable. Fronds which are very similar in general aspect may differ greatly in their scales; e.g. the species here described as *C. alteroblumei* and *C. zeylanica* were not distinguished by Baker, though they belong to different species-groups in the present treatment. To see the small scales clearly a magnification of at least 25 is necessary. The form of indusia is also important. In all species indusia are thin and fragile, and old specimens often do not show them well. At an early stage they bear cylindric glands which in some species are much elongate; such glands are also in some cases attached to the stalks of sporangia. Similar glands are also often present on the surfaces of pinnules, on or between veins; their abundance often varies greatly, even on different parts of the same frond, but in some cases their abundant presence appears to be distinctive.

The term pinnule is used for a leaflet or branch of the second order, the separate parts of a pinnule, where present, being called tertiary and quaternary leaflets.

KEY TO THE SPECIES

- 1a. Scales on pinna-rachis narrow, with inflexed edges or flat, their bases sometimes widened but not cordate nor point-attached, a few isodiametric cells near the base only 2
- b. Scales on pinna-rachis flat or nearly so, point-attached at a deeply cordate base; many isodiametric cells in their basal part 34
- 2a. Basal basisopic pinnules of basal pinnae not longest, less than twice as long as basal acroscopic pinnules 3
- b. Basal basisopic pinnules of basal pinnae distinctly longer than the rest, usually twice as long as acroscopic ones 11
- 3a. Veins thick and prominent on the lower surface 1. *C. kjellbergii*
- b. Veins not prominent on lower surface, the smaller ones in many cases indistinct 4
- 4a. Tertiary leaflets c. 3 × 3 mm, almost entire, their upper surface densely covered with short hairs 2. *C. muluensis*
- b. Tertiary leaflets, if present, differently shaped and not thus covered 5
- 5a. Pinnules or lobes of middle pinnae not lobed nearly to their costae; spreading bristle-like scales present throughout the main rachis 3. *C. aciculata*
- b. Pinnules or lobes of middle pinnae lobed nearly to their costae; such scales not present throughout main rachis 6
- 6a. Scales on pinna-rachis flat or nearly so throughout 7
- b. Scales on pinna-rachis with inflexed edges at least near their bases 9

- 7 a. Scales on pinna-rachis not widened at their bases; isodiametric cells at base few; costal scales very narrow 8
 b. Scales on pinna-rachis widened at their bases, the widened part consisting entirely of isodiametric cells; costal scales with broad base 4. *C. pallens*
- 8 a. Scales on pinna-rachis thin and narrow; upper surface of lamina not glandular
 5. *C. kinabaluensis*
 b. Scales on pinna-rachis very firm, wider; upper surface densely glandular
 5. *C. kinabaluensis* var. *crassisquama*
- 9 a. Stipe densely scaly throughout; scales at top of stipe 10 mm long
 6. *C. tabacifera*
 b. Stipe densely scaly near base only; distal scales 3 mm long 10
- 10 a. Scales on pinna-rachis 3 mm long, very narrow, with few isodiametric cells at base 7. *C. subconnexa*
 b. Scales on pinna-rachis 1–1.5 mm long, basal 1/3–1/2 formed of isodiametric cells 7. *C. subconnexa* var. *alstonii*
- 11 a. Lamina opaque; smaller veins not distinct on lower surface . . . 8. *C. propinqua*
 b. Lamina not opaque; smaller veins distinct 12
- 12 a. Scales on pinna-rachis very thin, few cells wide, lacking conspicuous isodiametric cells 9. *C. boholensis*
 b. Scales on pinna-rachis wider with reflexed margins, widened at their bases with some isodiametric cells 13
- 13 a. Indusia lacking or very small, hidden by sporangia at maturity, bearing long slender flexuous glands 14
 b. Indusia distinct but fragile, not long-fringed 18
- 14 a. Basal basicopic tertiary division of basal pinnae lobed 15
 b. Basal basicopic tertiary division of basal pinnae entire 17
- 15 a. Indusia lacking; septate hairs, not glands, present with sporangia
 10. *C. dingnanensis*
 b. Indusia present but small 16
- 16 a. Pinnae narrowly acuminate; appressed glands present on upper surface
 11. *C. seramensis*
 b. Pinnae not narrowly acuminate; short erect capitate hairs present between veins on upper surface 12. *C. bulusanica*
- 17 a. Free pinnae to 8 pairs; basal pinnae of mature plants shorter than suprabasal ones 13. *C. vilis*
 b. Free pinnae to c. 4 pairs; basal pinnae longer than suprabasal ones
 14. *C. silvatica*
- 18 a. Rachis stramineous, bearing stiffly spreading dark bristle-like scales 19
 b. Rachis not stramineous; scales various 20
- 19 a. Fronds to 35 cm long; basal pinnae to 11 cm long 15. *C. eatonii*
 b. Fronds to 12 cm long; basal pinnae 2.5 cm 16. *C. iriomotensis*
- 20 a. Lobes of middle pinnae mostly subentire with rounded apices 21
 b. Lobes of middle pinnae mostly lobulate, their apices not rounded 23

- 21 a. Lamina to 13 cm long, bearing many suberect hairs between veins on upper surface 17. *C. humilis*
 b. Lamina much longer; hairs on upper surface appressed 22
- 22 a. Stipe and rachis densely bristle-scaly; distinct indusia present; isodiametric cells on scales not distinct 18. *C. mannii*
 b. Stipe and rachis not densely scaly; indusia very small; small scales with many isodiametric cells 19. *C. subobscura*
- 23 a. Tertiary leaflets of basal pinnae quite free, lobed to their costules, their basal lobes lobulate 24
 b. Tertiary leaflets of basal pinnae adnate and less deeply lobed, their lobes entire 27
- 24 a. Lobes of tertiary leaflets on basal pinnae deeply lobulate; thick white cylindrical glands copious on upper surface 20. *C. minutiloba*
 b. Lobes of tertiary leaflets on basal pinnae not deeply lobulate; appressed glands on upper surface neither thick nor copious 25
- 25 a. Basal pinnae to 60 cm long 21. *C. elata*
 b. Basal pinnae to 25 cm long 26
- 26 a. Indusia large and persistent 22. *C. fijiensis*
 b. Indusia small and fragile 23. *C. koordersii*
- 27 a. Lobules of lobes of middle pinnae acute 24. *C. sumbawensis*
 b. Lobules of lobes of middle pinnae not acute 28
- 28 a. Basal tertiary leaflets lobed almost to their costules, the lobes to 6 pairs
 25. *C. croftii*
 b. Basal tertiary leaflets lobed less deeply with fewer lobes 29
- 29 a. Fronds to 60 cm long; basal pinnae more than 20 cm 30
 b. Fronds rarely more than 35 cm long; basal pinnae to 15 cm 31
- 30 a. Costules of basal basiscopic lobes of upper pinnae arising from the main rachis
 26. *C. decurrentipinnata*
 b. Costules of basal basiscopic lobes of upper pinnae arising from costae of pinnae
 27. *C. alteroblumei*
- 31 a. Basal basiscopic pinnules of basal pinnae about twice as long as acroscopic ones
 32
 b. Basal basiscopic pinnules of basal pinnae much less than half as long as acroscopic ones 31. *C. angusta*
- 32 a. Tertiary leaflets of basal pinnae deeply lobed at their bases 33
 b. Tertiary leaflets of basal pinnae lobed less than half-way to their costules
 30. *C. erythradenia*
- 33 a. Tertiary leaflets to 18 × 10 mm; scales on rachis very narrow, not stiffly spreading 28. *C. setosa*
 b. Tertiary leaflets to 8 × 4 mm; scales on rachis stiffly spreading
 29. *C. atrorubens*
- 34 a. Tertiary leaflets of basal pinnae and lobes of distal pinnae widely-spaced, narrow, falcate 32. *C. paleolata*
 b. Tertiary leaflets of basal pinnae and lobes of distal pinnae almost contiguous except in *C. rapensis* and there not falcate 35

- 35 a. Largest scales on pinna-rachis rarely more than 0.5 mm wide, gradually attenuate distally; isodiametric cells present near base only 36
- b. Largest scales on pinna-rachis more than 0.5 mm wide, usually abruptly acuminate with all cells almost isodiametric except in the narrow distal part . . . 43
- 36 a. Small scales on costae of pinnules few, narrow, evenly attenuate
33. *C. thwaitesii*
- b. Small scales on costae of pinnules broad at their bases, abruptly acuminate 37
- 37 a. Sori exindusiate, usually covered by scales 34. *C. pseudorhodolepis*
- b. Sori indusiate, rarely covered by scales 38
- 38 a. Scales on pinna-rachis to 3 mm long, very narrow, consisting almost entirely of narrow elongate cells 39
- b. Scales on pinna-rachis 1–2 mm long, narrow cells in distal part only 40
- 39 a. Lobes of larger pinnules crenate, basal scales 20 mm long, stiff . 35. *C. lepigera*
- b. Lobes of larger pinnules deeply lobulate; basal scales 12 mm long, soft
36. *C. microlepigera*
- 40 a. Basal pinnae c. 20 cm long; Yunnan and N. Thailand 37. *C. dumrongii*
- b. Basal pinnae c. 40 cm long; islands of the Pacific 41
- 41 a. Basal scales on stipe 30–40 mm long, gradually decrescent upwards
38. *C. samoensis*
- b. Basal scales on stipe 15–20 mm long, transition upwards to smaller ones rather abrupt 42
- 42 a. No free quaternary leaflets on basal pinnae 39. *C. sciaphila*
- b. Free quaternary leaflets present on basal pinnae
39. *C. sciaphila* var. *raivavensis*
- 43 a. Scales on pinna-rachis consisting of rather small thick-walled cells which are mostly not hexagonal; pinnule-lobes narrow, separated by sinuses as wide as the lobes 40. *C. rapensis*
- b. Scales on pinna-rachis consisting almost wholly of hexagonal and rather thin-walled cells; pinnule-lobes not separated by wide sinuses 44
- 44 a. Many scales on pinna-rachis with almost colourless cell-walls . . 41. *C. cumingii*
- b. All scales on pinna-rachis with firm dark cell-walls 45
- 45 a. Indusia distinct; no short erect hairs between veins on either surface
42. *C. subglandulosa*
- b. Indusia none or very small, not evident on mature sori; erect hairs present between veins on both surfaces 43. *C. membranifolia*

1. *Ctenitis kjellbergii* (C. Chr.) Ching

C. kjellbergii (C. Chr.) Ching, *Sunyatsenia* 5 (1940) 250. — *Dryopteris kjellbergii* C. Chr., Bot. Jahrb. 66 (1933) 45. — Type: *Kjellberg 3260* (S), Celebes, Porema, 1200 m, in 'Regenwald'.

Caudex short, erect, covered with thin castaneous scales 8×0.5 mm. Stipes to 17 cm long, densely scaly, scales above base 3–4 mm long. Lamina to 26×12 cm; pinnae to 8 or 9 pairs; basal pinnae to 7×3.5 cm with 2 pairs of free pinnules, subequal

on the two sides of the pinna-rachis, largest pinnule c. 17×7 mm, deeply lobed, the lobes crenate with rounded apices; distal pinnae little decurrent at their bases; veins distinctly prominent on the lower surface. Rachis densely scaly on lower surface, scales to 2.5×0.3 mm, flat, gradually attenuate, with a few isodiametric cells near the base, rest of cells oblong, all with rather thick walls, margins of scales minutely denticulate. Lower surface of costae of pinnules and pinna-lobes similarly scaly near their bases, distally bearing red glands, red cylindric glands also present on veins, between veins slender pale glands sometimes present. Sori inframedial on the veins; indusia reniform, thin, bearing superficial red glands.

Distribution. Apart from the type, known only from Japen Island, W. New Guinea, *L. E. Cheesman 1421* (BM), 'on the face of limestone rocks, leaves flat, forming a rosette', Mt Oudia, 1100 m.

Cheesman's specimen is larger than the type, but agrees in all details; the dimensions in the above description are taken from it. Kjellberg does not mention limestone; his locality is in the southeastern part of Central Celebes.

2. *Ctenitis muluensis* Holttum

C. muluensis Holttum, Fern Gaz. 12 (1984) 320. – Type: *A. C. Jermy 14156* (BM; BO, K, KON, SAR, TNS), Sarawak, G. Mulu National Park, G. Api at 1000–1700 m, montane limestone forest.

Stipe to 15 cm long, slender, dark brown, minutely hairy throughout; basal scales 7 mm long, little over 0.5 mm wide at their bases, filiform distally, medium brown, thin; scales above base gradually shorter and darker, very narrow with widened bases. Lamina to 23 cm long, to 10 cm wide at the base, texture firm and opaque; pinnae to 10 pairs; basal pinnae to 7 cm long including a stalk of 5 mm, bearing several pairs of pinnules; basal pinnules on the two sides about equal, to 16×7 mm with obtuse apex, bearing 1–2 pairs of tertiary leaflets which are 3 mm long, not quite 3 mm wide, with truncate base and broadly rounded slightly crenate apex, other pinnules gradually smaller, the middle ones deeply lobed near their bases only. Lower surface of pinna-rachis and costae of pinnules bearing very short hairs and copious scales, the largest 3 mm long, 0.2–0.3 mm wide at their bases, flat, very narrow distally, cells near the base isodiametric; lower surface of leaflets, on and between veins, bearing many appressed pallid cylindric glands 0.1 mm long. Upper surface of pinna-rachis bearing scales as lower, also abundant thicker short hairs; upper surface of leaflets densely covered with very short erect hairs and pale appressed glands. Sori about medial on the veins; indusia very small, fugacious, bearing minute hairs.

Distribution. Known only from the type collection.

3. *Ctenitis aciculata* (Bak.) Ching

C. aciculata (Bak.) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 292. – *Nephrodium aciculatum* Bak., J. Linn. Soc. Bot. 22 (1886) 226. – *Dryopteris aciculata* (Bak.) C. Chr., Ind. Fil. (1905) 250; v. A.v.R., Handb. (1908) 200. – Type: *G. F. Hose 86* (K; P), Sarawak, G. Matang.

Caudex erect, to 50 cm tall (Brooks); stipes to more than 40 cm long, basal scales to 25 mm long and 1 mm wide, dull brown, thin, decrescent upwards, scales on upper part and on rachis 5–7 mm long, copious, very narrow, stiffly spreading with edges inrolled. Lamina to 75 cm long, firm, opaque; free pinnae to 5 pairs and 5 pairs adnate; basal pinnae to 28 cm long, basal pinnules free, then a few pairs increasingly adnate, basal basisopic pinnule to 9.5×2 cm, not or little longer than the next one, deeply lobed, the lobes entire, basal acroscopic pinnule to 4×1.2 cm; pinnules and lobes of middle pinnae not deeply lobed. Lower surface of pinna-rachis bearing very narrow spreading scales 3–4 mm long; some cylindric glands present on lower surface of pinna-lobes, smaller veins not evident on either surface. Sori mostly on both branches of a forked vein; indusia very small, bearing when young elongate glands.

Distribution. Sumatra, Borneo (several widely separated localities), Java, Mindanao, SE. New Guinea, in forest at altitudes up to 1000 m, sometimes on boulders or tree-trunks.

Extra-Bornean collections. Sumatra: *Lörzing 14049*, G. Sibayak; *Korthals*. — Java: *Backer & Posthumus 546*, G. Smeroe; *Mousset 208* p.p., Wonosari; *Winckel 1486*, Tjadas Malang. — Mindanao: *Copeland s.n.*, 2 April 1905, San Ramon. — New Guinea: *B.S. & J.P. Croxall 4308*, Port Moresby Dist., Musgrave River.

4. *Ctenitis pallens* (Brack.) M.G. Price — Fig. 1a.

C. pallens (Brack.) M.G. Price, *Kalikasan* 12 (1983) 155. — *Lastrea pallens* Brack. in Wilkes, *Expl. Bot.* (1854) 197. — Type: *U.S. Expl. Exp. 1838–1842 s.n.* (US), Luzon, forest near Banos.

Dryopteris rizalensis Christ, *Philip. J. Sc.* 2 (1907) Bot. 216, nom. illegit., non Christ 1906. — *C. rizalensis* Copel., *Gen. Fil.* (1947) 125; *Fern Fl. Philip.* (1960) 290, nom. illegit. (Specimen cited as type: *Copeland 1659*, Mindanao.)

Stipe to more than 50 cm long; basal scales 20 mm long, narrow, thin; scales for 15 cm above base gradually shorter, those on distal part and on rachis 4–5 mm long, not stiffly spreading, flat, very narrow with widened bases. Lamina to 75 cm long, firm and opaque; pinnae to c. 10 pairs; basal pinnae to 30 cm long (stalk 2 cm) with free pinnules to 4 pairs and 3–4 pairs adnate, basal basisopic pinnule to 13 cm long with 1 pair free tertiary leaflets and 2–3 pairs adnate, basal tertiary leaflet 3.5×1.4 cm, obtuse, lobed nearly to its costa at the base, second basisopic pinnule not longer than the first, basal acroscopic pinnule to 8.5 cm long with a pair of tertiary leaflets; largest pinnules on second pair of pinnae to 7.5×1.9 cm, deeply lobed, costules of lobes to 7 mm apart; costules of pinna-lobes distinct on the lower surface but not the veins. Lower surface of pinna-rachis bearing copious scales like those on the main rachis but smaller, clathrate at their bases; on both surfaces between veins a variable number of appressed pale glands. Sori about medial on each side of costules of pinnule-lobes; indusia very small, fringed with many pale cylindric glands.

Distribution. Luzon, Samar, Negros, Mindanao, New Ireland, in forest at altitudes up to 600 m.

Additional specimens. Luzon: *Elmer 16321*; *M. G. Price 683*. – Samar: *Price & Hernaez 782*. – Negros: *Elmer 10166*. – Mindanao: *Copeland 1649*. – New Ireland: *A. C. Jermy 7870*; *7900* (cult. Kew).

5. *Ctenitis kinabaluensis* Holttum, *spec. nov.*

var. *kinabaluensis*

Stipes usque 70 cm longus, basi paleis pallide brunneis 15–25 mm longis, vix 1 mm latis, medio paleis 5–6 mm longis 0.3 mm latis tenuibus vestitus. Lamina usque 70 cm longa, subcoriacea, opaca; pinnae infimae usque 30 cm longae pinnulis 6-paribus dissitis praeditae, pinnula basiscopica infima 10 × 3 cm, foliolo tertiaro adnato 2/3 versus medium lobato instructa; pinnulae pinnarum suprabasaliū profunde lobatae; venae utrinque haud distinctae. Rhachides pinnarum subtus paleis angustissimis planis sparsis praeditae, supra pilis brevibus ctenoideis dense vestitae, pagina laminae inter venas subtus pilis tenuibus adpressis varie instructa, supra nuda. Sori in medium venarum lobulorum loborum pinnarum siti; indusia minuta, tenuia, primo glandulis gracilibus ornata. – *T y p u s*: *Holttum SFN 25253* (K), Mt Kinabalu, near Dallas, 1000 m.

Distribution. Northeastern Borneo, several localities, in forest at 1000–1500 m.

Additional specimens. Sabah: *W. L. Chew et al. 1212*; *Clemens 26846*; *Parris & Croxall 8942*. – Brunei: *T. Lobb s.n.*, 1857. – Sarawak: *Mjöberg 5*, Baram River. – Kalimantan: *Endert 3456a*, *3481*, W. Kutai.

var. *crassisquama* Holttum, *var. nov.* – Fig. 1d.

A varietate typica differt: lamina tenuiore, paleis rhachidum latioribus et crassioribus, pagina pinnarum supra inter venas glandulis adpressis multis instructa. – *T y p u s*: *K. Iwatsuki et al. B2195* (K), Kalimantan Timor, G. Nyapa.

More collections are needed to establish the distinctness of this variety. Owing to the thinner lamina, the veins are more distinct on the lower surface than those of the type variety.

6. *Ctenitis tabacifera* (v.A.v.R.) Ching

C. tabacifera (v.A.v.R.) Ching, *Sunyatsenia* 5 (1940) 250. – *Dryopteris tabacifera* v.A.v.R., Bull. Jard. Bot. Btzg III, 2 (1920) 147. – Type: *Kornassi 1543* (BO; L), Mid-Ceram, Kampong Hatuoto, 600 m.

Stipe to 63 cm long, very densely scaly throughout; basal scales to 15 × 1 mm, thin, medium brown, those above base gradually shorter but without change of colour, largest on upper part of stipe 8–9 mm long, very narrow, rather weakly spreading, almost flat, their bases a little widened with a few isodiametric cells; rachis scales similar, on distal part 3–4 mm long. Lamina to 70 cm long, texture very firm, opaque; free pinnae c. 12 pairs; basal pinnae to 28 cm long with 7 pairs free or ad-

nate pinnules; basal basicopic pinnule to 10×3.5 cm (second a little shorter) bearing 1 pair free deeply lobed tertiary leaflets to 12×7 mm; largest acroscopic pinnule to 7.5×2.3 cm, also with a free tertiary leaflet. middle pinnae bearing c. 6 pairs of deeply lobed pinnules, their lobes entire or the basal ones crenate; veins in pinnule-lobes mostly forked, only the part below the fork visible on the lower surface. Scales on lower surface of pinna-rachis flat except near the base, to 8 cells wide, cells all elongate except a few near the base, many short hairs also present, no glands on surface between veins; upper surface of pinna-rachis densely covered with short thick hairs and some scales, surface of pinnules between veins bearing a variable number of appressed glands. Sori at forks of veins in pinnule-lobes; indusia small and very thin, bearing many slender glands.

Distribution. Apart from the type collection, known only from one from Amboina: *C. J. Brooks 17761* (BM), Telaga Radja at 600 m.

The Brooks specimen is larger than the type; maximum size of parts of the frond specified above are taken from it.

7. *Ctenitis subconnexa* (Christ) Holttum, *comb. nov.*

Phegopteris subconnexa Christ in Warburg, *Monsunia* 1 (1900) 83; v.A.v.R., *Handb.* (1908) 496.
— *Dryopteris subconnexa* (Christ) C. Chr., *Ind. Fil.* (1905) 295. — Type: *Warburg 17864* (B), Batjan, Mt Sibella, 760 m.

var. *subconnexa*

Stipe to 52 cm long; basal scales in a tuft, thin and crinkled, to 20 mm long, 1 mm wide at the base, apex filiform; scales above base gradually shorter for 10 cm, on distal part of stipe and on rachis 2–3 mm long, very narrow, flat with \pm widened base. Lamina to 70 cm long, texture firm; pinnae widely spaced, 6 pairs free and 3–4 pairs increasingly adnate; basal pinnae c. 27 cm long bearing 4 pairs of free pinnules; basal basicopic pinnule 8.5×3 cm with one pair of almost free tertiary leaflets 20×7 mm deeply lobed at their bases, costules of the lobes 3 mm apart; basal acroscopic pinnule 7×3 cm, also with tertiary leaflets. Lower surface of pinna-rachis bearing scales 3 mm long, very narrow with widened bases in which are a few isodiametric cells, also copious short hairs, lower surface of pinnae between veins (which are not distinct) bearing variably appressed glands and short erect hairs, glands also present on the upper surface. Sori medial on veins; indusia thin and very small, bearing slender flexuous marginal glands, similar glands attached to sporangium-stalks.

Distribution. Known only from the type and *Warburg 17877* from 1370 m on Mt Sibella.

var. *alstonii* Holttum, *var. nov.*

A varietate typica differt: paleis basalibus stipitis 10 mm longis, paleis rhachidum 1–1.5 mm longis base dilatatis cellulis pluribus isodiametricis constitutis. — T y p u s : *Alston 16937* (BM), Batjan, N. slope of Mt Sibella at 1500 m.

8. *Ctenitis propinqua* (Presl) Copel. – Fig. 1f.

C. propinqua (Presl) Copel., Fern Fl. Philip. (1960) 289; Holttum, Novit. Bot. Univ. Carol. Prag. 1968 (1969) 37. – *Lastrea propinqua* Presl, Epim. Bot. (1851) 38, excl. *Cuming* 80, 151. – *Nephrodium preslii* Bak., Syn. Fil. (1867) 272, nom. nov. (not *N. propinquum* R. Br.). – Lectotype (Baker): *Cuming* 255 (PRC; BM, K, L), Luzon, N. Ilocos.

Stipe incomplete on all specimens seen, basal scales not known, scales on distal part and on rachis to 3 mm long, narrow, their margins inrolled above the widened base which consists of isodiametric cells. Lamina to 28 cm long, texture firm; pinnae well spaced, 3–4 pairs free and 2–3 pairs adnate; basal pinnae to 8.7 cm long bearing 1 pair of free pinnules and one pair adnate; basal basisopic pinnule 3.5×1.7 cm, distinctly longer than the next one, very deeply lobed at its base, the lobes entire, basal acroscopic pinnule to 2.2×1.4 cm; second pair of pinnae 8 cm long with 2 pairs of adnate pinnules; veins in pinnule-lobes mostly simple, their distal parts not distinct on the lower surface; appressed red cylindrical glands present on lower surface of costules of lobes and on veins, also sometimes between veins. Sori medial or inframedial on pinnule-lobes; indusia distinct, persistent, bearing red glands.

Distribution. Known only from the type collection and *M. G. Price* 2977, also from Ilocos Norte, Solsona, at 1300 m.

The name *Lastrea propinqua* was first published, without description, by John Smith in 1841. He cited four Cuming numbers: 80, 151, 252, 255. When validating the name by his description of 1851 Presl also cited the same four numbers. *Nephrodium preslii* Baker was a new name for part of Presl's concept of the species; he cited *Cuming* 255 only. I regard this as designating a lectotype for *Lastrea propinqua* Presl; it has been so accepted by Copeland. In my judgement, the three other Cuming numbers represent three distinct species of *Ctenitis*: *setosa*, *silvatica* and *decurrenti-pinnata*.

9. *Ctenitis boholensis* Holttum, *spec. nov.* – Fig. 1e.

Stipes usque 53 cm longus, pallide castaneus, basin versus paleis tenuibus 12 mm longis 0.5 mm latis, supra basin paleis 4 mm longis angustissimis non patentibus vestitus. Lamina 36 cm longa, herbacea; pinnae liberae 3-jugatae, adnatae 6-jugatae, pinnae infimae a sequentes 7 cm dissitae, 14 cm longae, pinnulis infimis basisopicis 6.2×2.6 cm, fere ad costam lobatis, lobis maximis 14×6 mm dimidium costulam versus lobatis, pinnulis infimis acroscopicis 3.7×1.4 cm lobis crenatis; pinnae suprabasales 12.5 cm longae, pinnulis adnatis profunde lobatis plurijugis praeditae, lobis pinnularum plerisque integris; venae graciles infra leviter prominentes, rhachides pinnarum infra paleis 1–2 mm longis angustis fere planis etiam pilis gracilibus adpressis praeditae. Sori in lobis pinnularum inframediales; indusia tenuia sed persistentes, pilosa. – Typus: *M. Ramos* BS 42983 (K; UC), Bohol, Aug.–Oct. 1923.

Distribution. Known only from the type collection and *Ramos* BS 43023 (UC) from the same locality.

10. *Ctenitis dingnanensis* R.C. Ching

C. dingnanensis R.C. Ching, Acta Phytotax. Sinica 19 (1981) 122. — Type: *J.F. Cheng 63142* (PE, not seen), Jiangxi, Dingnan.

Caudex short, erect, its apex covered with thin narrow scales more than 10 mm long; stipe of sterile frond 23 cm long, of fertile more than 30 cm, light castaneous, above base bearing very narrow scales to 3 mm long with inflexed margins, not stiffly spreading. Lamina to 34 cm long with 4 pairs of free pinnae and several adnate; basal pinnae to 14 cm long with almost free basal pinnules, basal basisopic pinnule 7.5×2 cm (sterile) with one adnate lobed tertiary leaflet; basal acroscopic pinnule 2.8×1.4 cm, lobed almost to its costa, almost all lobes entire; lobes of middle pinnae almost all deeply lobed with obtuse apices; lower surface of pinna-rachis bearing very narrow scales 2 mm long with edges inrolled at their bases which consist of isodiametric cells; hairs on upper surface of pinna-rachis more than 0.5 mm long. Sori exindusiate.

Distribution. Jiangxi, Guangdong.

The above description is based on *C.M. Wu 1772* (PE), Jiangxi, Xunwu, cited with the original description. *W. T. Tsang 20974* (K), Guangdong, Loh Chiang District, 'in thicket on dry sandy soil' agrees in frond-form and scales with the type; it was distributed from Lingnan University as *Athyrium* sp.

In his original description R.C. Ching compared this species with *C. calcarea* Ching & Wang, but the type of the latter has scales like those of *C. subglandulosa*.

11. *Ctenitis seramensis* Holttum, *spec. nov.*

Paleae basis stipitis ignotae, sursum 4–5 mm longae marginibus inflexis, cellulis prope basin isodiametricis, paleae rhachidum similes. Lamina usque 45 cm longa; pinnae liberae usque 9-jugatae, anguste acuminatae; pinnae infimae usque 16 cm longae, pinnulis 4-jugatis infimis stipitulatis; pinnula infima basisopica 7×2.8 cm, acuminata, profunde lobata, lobo infimo fere libero 19×7 mm profunde lobulato; pinnula infima acroscopica 2.5×0.9 cm, obtusa; pinnulae pinnarum suprabasialium obtusae, profunde lobatae, costulis loborum 3.5 mm dissitis. Sori fere mediales in lobis pinnularum; indusia perparva glandulis gracilibus ornata, pedicellis sporangiorum etiam glandulis gracilibus instructis. — Type: *de Vriese & Teijsmann 324* (L 908.294-175; K), Seram.

Additional specimens from Amboina: *C.B. Robinson 1956* (BO); *Warburg 17583* (P). Van Alderwerelt gave the name *Dryopteris intermedia* to the Robinson collection (Philip. J. Sc. 11, 1916, Bot. 106).

12. *Ctenitis bulusanica* Holttum, *spec. nov.*

Stipes usque 28 cm longus, basi paleis 8×0.5 mm, sursum paleis atrobrunneis usque 5 mm longis angustissimis praeditus. Lamina usque 23 cm longa, firma, in sicco

brunneo-olivacea; pinnae liberae 2–3-jugatae; pinnae infimae usque 10 cm longae stipitulo 7 mm longo incluso, pinnulis infimis basicopicis sessilibus usque 5 cm longis, basi 2.5 cm latis, lobis infimis subliberis, 18 × 7 mm, 2/3 costulas versus lobulatis, lobulis usque 4-jugatis; pinnae suprabasales sessiles, pinnulis adnatis unijugis praeditae; rhachides pinnarum subtus paleis 2–3 mm longis, angustis, marginibus basin versus inflexis praeditae; pagina pinnularum supra inter venas pilis brevibus capitatis instructa. Sori ad venulas inframediales; indusia minuta glandulis gracilibus ornata. — *T y p u s*: *Elmer 16681* (K; BM, BO, L, UC), Luzon, Mt Bulusan, July 1916.

The specimens were distributed as *Dryopteris sarawakensis*. No other collections are known.

13. *Ctenitis vilis* (Kunze) Ching

C. vilis (Kunze) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 290; Holttum, Rev. Fl. Malaya 2 (1955) 496, f. 293. — *Aspidium vile* Kunze, Bot. Zeit. 4 (1846) 474; v.A.v.R., Handb. (1908) 199; C. Chr., Gard. Bull. Str. Settl. 4 (1929) 391. — *T y p e*: *Zollinger 1602* (L; BO, K, P), Java, 'im nassen Gebusch am Bachufer der Pantar Pete'.

Polypodium asplenioides Bory in Bél. Voy. Bot. 2 (1833) 33, non Sw. 1801. — *T y p e*: *Bory s.n.* (P), Java.

Lastrea blumei Moore, Ind. Fil. (1858) 94, nom. nov. for *Aspidium intermedium* Bl., Enum. Pl. Jav. (1828) 161, non Willd. 1810, p.p. — *Nephrodium blumei* Hook., Spec. Fil. 4 (1862) 135, p.p. — *T y p e*: *Blume* (L), Java.

Nephrodium sarawakense Bak., J. Linn. Soc. Bot. 22 (1886) 225. — *T y p e*: *G. F. Hose 95* (K), Sarawak.

Lastrea padangensis Bedd., Handb. Ferns Br. India Suppl. (1892) 60. — *T y p e*: *Kunstler 8038* (K; BM, L, P), Perak.

Nephrodium setosum Bak., Syn. Fil. (1867) 274. — *Dryopteris millettii* C. Chr., Ind. Fil. (1905) 278, nom. nov. (not *D. setosa* (Pr.) C. Chr.). — *T y p e*: *Millett* (K), Java.

Stipe to 20 cm long; basal scales c. 10 mm long, light brown; scales above base darker, 3–5 mm long, very narrow with inflexed margins, widened near the base. Lamina commonly 20 cm long, to 35 cm; free pinnae to 8 pairs and 5–6 pairs adnate; basal pinnae of mature plants a little shorter than the next pair, commonly 7 cm long with basal basicopic pinnule 3.5 × 1.4 cm, deeply lobed; middle pinnae with 1 pair free deeply lobed pinnules, the rest lobed almost to the costa, lobes oblique, acute, middle ones entire; lower surface of costae of pinnae bearing very narrow scales widened with some isodiametric cells at their bases. Sori medial on pinna-lobes; indusia very small, often hidden by sporangia, bearing many very slender flexuous pale glands.

Distribution. Malay Peninsula and Peninsular Thailand, Sumatra, Java, Borneo, Amboina; growing most commonly among rocks by streams, often in the flood zone, less common in rock crevices away from streams, at low and medium altitudes.

14. *Ctenitis silvatica* Holttum, *spec. nov.*

C. vilis sensu Copel., Fern Fl. Philip. (1960) 288.

Ctenitidi vili affinis, ab ea differt: frondibus maximis 26 cm longis, pinnis liberis usque 4-jugatis praeditis, pinnis infimis a sequentibus longioribus, vulgo 9 cm longis. — Typus: *M. G. Price 2042* (K), Luzon, Mt Makiling, 350 m.

Distribution. Luzon, Negros, Leyte, Samar, Mindanao, 'common in drier woods at middle altitudes' (Copeland).

This species has broader and shorter fronds than *C. vilis*, with longer basal pinnae; it is terrestrial in the forest, not confined to rocks nor occurring in the flood zone of streams. I have seen no plants of *C. vilis* from the Philippines. *Cuming 151* (BM, K), cited by Presl as *Lastrea propinqua*, is this species; I formerly wrongly identified it with *Lastrea setosa* Presl (Novit. Bot. Univ. Carol. Prag. 1968 (1969), 20).

15. *Ctenitis eatonii* (Bak.) Ching

C. eatonii (Bak.) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 291; DeVol, Fl. Taiwan 1 (1975) 326. — *Nephrodium eatonii* Bak., Syn. Fil. (1867) 276. — *Dryopteris eatonii* (Bak.) O. Ktze, Rev. Gen. Pl. 2 (1891) 812; Hayata, Ic. Pl. Formos. 4 (1914) 90, f. 150. — Type: *C. Wright* (K), 'Kakeah and Loochoo Isles'.

Nephrodium leucostipes Bak., J. Bot. 23 (1885) 105. — Type: *Hancock 17* (K), Taiwan.

C. confusa Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 290. — Type: *C. G. Matthew* (K), Kwangtung, Lienchow River, on limestone.

Stipe to 32 cm long, stramineous except at base, bearing throughout copious dark spreading very narrow scales which have inflexed edges, basal ones to 12 mm long, distal to 5 mm; rachis stramineous with similar scales. Lamina to 35 cm (rarely to 50 cm) long, texture thin; free pinnae c. 10 pairs; basal pinnae 11.5 cm long (stalk 5 mm), basal basisopic pinnule 5 × 1.5 cm bearing one almost free lobed tertiary leaflet, distal lobes and those of other pinnules entire; suprabasal pinnae with obtuse deeply lobed pinnules and pinna-lobes. Lower surface of pinna-rachis bearing narrow scales 2–3 mm long, their basal cells isodiametric, also spreading hairs up to 1 mm long, very slender erect hairs variably present between veins, appressed cylindrical glands also variably present on both surfaces. Sori about medial on pinnule-lobes; indusia very thin but usually conspicuous, bearing superficial glands and also very short hairs of 2–3 cells.

Distribution. Taiwan, Ryukyu Islands, Kwangtung, Tonkin; in rock crevices (sometimes on limestone) and steep banks.

Ching distinguished *Ctenitis confusa* by its smaller fronds with much shorter hairs on the lower surface of smaller axes of the frond, but I do not find the latter character constant.

16. *Ctenitis iriomotensis* (H. Ito) Nakaike

C. iriomotensis (H. Ito) Nakaike, Enum. Pterid. Japan Filicales (1975) 195; New Fl. Japan Pterid. (1982) 329 with photograph. — *C. eatonii* var. *iriomotensis* H. Ito, J. Jap. Bot. 46 (1971) 305. — Type: *Shimabukuro s.n.*, 9 July 1969 (TI, not seen), Ryukyu, Iriomote Island, Mt Komidake.

Closely allied to *C. eatonii*, but fronds much smaller and narrower; stipe to 9.5 cm long, lamina 11–12 cm long with basal pinnae to 2.5 cm long, 1.2 cm wide, with one pair of adnate shallowly lobed pinnules, rest of frond gradually attenuate with many free or adnate pinnae, the lower ones lobed but most of them crenate to entire; sori as in *C. eatonii*.

Distribution. Known only from the type collection.

17. *Ctenitis humilis* Holttum, *spec. nov.*

Ctenitide boholense affinis, ab ea differt: frondibus multo minoribus, paleis stipitis 3 mm longis valde patentibus, rachidibus pinnarum subtus pilis patentibus, pagina pinnularum supra inter venas pilis multis suberectis praedita. Stipes c. 5 cm longus basi paleis 3 mm longis vestitus, paleis supra basin patentibus, marginibus inflexis; lamina usque 11 cm longa; pinnae infimae 2.8 cm longae, pinnulis unijugatis, pinnulae basiscopica 13 × 4 mm basi profunde lobata; pinnae mediae obtusae, fere ad costam lobatae, lobis falcatis obtusis plerisque integris; sori ut eis *C. boholensis*. — *Typus*: *M. Ramos BS 43032* (SING; MICH, P, UC), Bohol, Valencia, 600 m, 'on rocks in damp forest'.

Distribution. Bohol, Mindoro.

Additional specimen. *H.H. Bartlett 13626* (MICH), Mindoro, Puerto Galera, on a steep cliff.

The specimens from Bohol presumably grew on limestone, but Bartlett's from Mindoro probably on granite. More specimens are needed to show whether the dwarf habit is constant for this species.

18. *Ctenitis mannii* (Hope) Ching

C. mannii (Hope) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 289. — *Nephrodium mannii* Hope, J. Bot. 28 (1893) 145. — *Dryopteris intermedia* var. *mannii* Christ, Philip. J. Sc. 7 (1907) Bot. 215, nom. tant. — *Typus*: *G. Mann s.n.*, March 1889 (BM; K, P), Assam, Digbai, Lakhimpur, Makum Forest.

C. fulgens Ching & Wang, Acta Phytotax. Sinica 19 (1981) 120. — *Typus*: *Yunnan Univ. 2503* (PE), Yunnan, Hekou, 150 m.

Lastrea intermedia sensu Bedd., Handb. Ferns Br. India, Suppl. (1892) 61, p.p. — *Dryopteris rhodolepis* sensu C. Chr., Ind. Fil. (1905) 288, p.p.

Stipe 30–40 cm long, densely scaly throughout, basal scales to 10 mm long, flat, scales above base 5–6 mm long, bristle-like with inflexed margins; rachis-scales gradually shorter, most cells near their bases narrow and elongate. Lamina to 50 cm long, texture thin with veins slightly prominent on the lower surface; free pinnae c. 15 pairs; basal pinnae to 13 cm long with 3 pairs of free pinnules; basal basiscopical pinnule to 6 × 1.5 cm, acuminate, deeply lobed; basal acrosopic pinnule 1.5 cm long, apex rounded, shallowly lobed; middle pinnae to 12 × 2.5 cm, lobed almost to their costae throughout, lobes distinctly oblique, their margins slightly sinuate, apices rounded to obtuse, costules 6–7 mm apart; veins 6–7 pairs, mostly simple. Lower

surface of pinna-midrib bearing narrow dark scales in which very few basal cells are isodiametric, very slender appressed hairs present on and between veins on both surfaces. Sori medial; indusia distinct but small and thin, bearing a few slender short hairs.

Distribution. NE. Assam, Yunnan. (The type specimen of *C. fulgens* looks like a frond of a young plant of *C. mannii*.)

19. *Ctenitis subobscura* (Christ) Holttum

C. subobscura (Christ) Holttum, Fern Gaz. 12 (1984) 320. — *Phegopteris subobscura* Christ, Bull. Herb. Boiss. 6 (1898) 836. — Type: *G. Schneider* 35 (P), Sumatra, near river bank on vertical rocks.

Dryopteris squamulifera v.A.v.R., Bull. Jard. Bot. Btzg II, 16 (1914) 9. — Type: *C. G. Matthew* 669 (BO; K), Sumatra, Padang Panjang.

C. mannii sensu Holttum, Rev. Fl. Malaya 2 (1955) 497, quoad pl. males.

Closely related to *C. mannii*, differing in much less scaly stipe and rachis, the scales very narrow and not stiffly spreading, and more widely spaced pinnae, scales on smaller axes much thinner, distinctly clathrate with many isodiametric cells, indusia very small with short slender marginal glands. Largest fronds have stipe and lamina both 50–60 cm long; as with *C. mannii*, basal basisopic pinnules of basal pinnae are very deeply lobed but have no free tertiary leaflets; most lobes of middle pinnae are crenate to entire with rounded apices.

Distribution. Most specimens from Borneo, others widely in Western Malesia, also Mindanao (*Copeland 1588*). Almost all habitat notes indicate that plants grow on rocks, especially near streams. The type is a small specimen.

20. *Ctenitis minutiloba* Holttum, *spec. nov.*

Caudex brevis, erectus, crassus; stipites arcte fasciculati, basi solum paleis planis castaneis, supra basin paleis atrocastaneis setiformibus 10 mm longis sursum gradatim brevioribus vestiti. Lamina c. 35 cm longa, deltoidea; pinnae infimae usque 23 cm longae, pinnulis 10-jugatis praeditae; pinnulae infimae basisopicae 12 × 5 cm, foliolis tertiariis acutis 7-jugatis infimis 20 × 8 mm profunde oblique lobatis, lobis usque 4 × 1.5 mm lobulatis praeditam; pinnulae infimae acroscopicae 5 × 1.8 cm, foliolis tertiariis usque 10 × 6 mm profunde lobatis praeditae; pinnae mediales pinnulis multijugatis dissitis oblique lobatis, lobis usque 5 × 3 mm profunde lobulatis praeditae; rhachides pinnarum subtus paleis angustis 2 mm longis marginibus inflexis basi clathratis sparsim vestitae; foliola omnia supra omnino glandulis crassis pallidis multis adpressis 0.1 mm longis ornata; sori ad apices venarum siti; indusia reniformia, firma, interdum glandulifera. — Typus: *W. Meijer SAN 20267* (K), Sabah, Ranau District, Bukit Minitolob Kechil, 600 m, in hillside forest.

Distribution. Known only from the type collection.

21. *Ctenitis elata* Holttum, *spec. nov.*

Dryopteris subarborea var. *glabrior* v.A.v.R., Bull. Jard. Bot. Btzg II, 16 (1914) 57.

Stipes ultra 60 cm longus, castaneus, basi paleis 12×1 mm planis sursum paleis 5 mm longis marginibus inflexis basi clathratis vestitus. Lamina ut videtur ultra 100 cm longa; pinnae suprabasales usque 60 cm longae, pinnulis dissitis 12-jugatis plerisque stipitulatis praeditae; pinnulae maximae 15×5.5 cm, foliolis tertiariis 5-jugatis profunde lobatis maximis 3.2×1 cm, lobis infimis crenatis, costulis loborum 4 mm inter se distantibus instructae; rhachides pinnarum subtus paleis usque 2 mm longis basi dilatata fere 1 mm lata valde clathrata marginibus supra basin inflexis, etiam pilis multis brevibus vestitae; sori in lobis pinnularum prope costulas siti; indusia tenuia, parva, glandulis ornata. — *T y p u s*: *C. G. Matthew 653* (BO; K), Sumatra, Korinchi Peak, 1800–2100 m.

Distribution. See the type collection.

The Bogor specimen, briefly described by Van Alderwerelt, has basal pinnae 33 cm long with basal basiscopic pinnules 13 cm long (acrosopic ones 7.3 cm); a specimen collected by Holttum (*SFN 26211*) on the same mountain is of similar size. The duplicate specimen retained by Matthew in his own herbarium, now at Kew, above described, consists of two parts of a much larger frond: the apical 50 cm and a complete pinna 60 cm long which is probably one of a pair immediately above the basal ones (its basal basiscopic pinnules are not greatly elongate). More specimens are desirable.

This species is nearest to *C. alteroblumei* but has much larger fronds with scales broader and more clathrate in their basal part on the smaller axes of the frond.

22. *Ctenitis fijiensis* (Hook.) Copel. — Fig. 1b.

C. fijiensis (Hook.) Copel., Gen. Fil. (1947) 124; Brownlie, Pterid. Fiji (1977) 304, p.p., pl. 29, f. 4. — *Nephrodium fijiense* Hook., Second Cent. Ferns (1861) t. 67. — *Dryopteris fijiensis* (Hook.) C. Chr., Ind. Fil. (1905) 264; Copel., Bishop Mus. Bull. 59 (1929) 44. — *T y p e*: *Milne 159* (K), Fiji, Viti Levu, 'on mountains, not common'.

Lastrea tenuifolia Brack. in Wilkes, U.S. Expl. Exp. Bot. (1854) 199, non Presl 1851. — *Nephrodium tenuifolium* Hook., Sp. Fil. 4 (1862) 144, nom. nov. — *Dryopteris tenuifrons* C. Chr., Ind. Fil. (1905) 297, nom. nov. (not *D. tenuifolia* (Pr.) C. Chr.). — *C. tenuifrons* (C. Chr.) Copel., Gen. Fil. (1947) 125; J. Arn. Arbor. 30 (1949) 437. — *T y p e*: *U. S. Expl. Exp. 1838-1842 no 14* (US), Fiji, Ovalau.

Nephrodium rubiginosum sensu Hook., Sp. Fil. 4 (1862) 143, quoad pl. Fiji tantum.

Caudex erect, its apex covered with a mass of light red-brown scales to 25 mm long; stipe to 50 cm long, its basal 3–4 cm scaly as the caudex, scales above base darker, bristle-like with inflexed edges, distal ones 5–7 mm long, scales on rachis similar, gradually shorter. Lamina to 50 cm long, texture thin, bearing 7–8 pairs of pinnae; basal pinnae to at least 22 cm long, bearing 8 pairs of pinnules; basal basiscopic pinnules 7 cm long (little longer than the next ones), 3 cm wide, bearing one pair very deeply lobed tertiary leaflets 15×6 mm, their basal lobes lobulate; basal

acroscopic pinnules 4.5×1.8 cm, lobed as the basiscopic ones; basal (adnate) pinnules of middle pinnae lobed almost to their costae, basal lobes deeply lobulate, distal ones crenate to entire; lobes of upper pinnae all deeply lobulate, lobules entire and slightly falcate. Lower surface of costae of pinnules bearing many narrow thin scales which have inrolled edges, the basal part with many rather large isodiametric cells; upper surface of costae bearing thick ctenitoid hairs to 1 mm long, sparse similar hairs present also on veins and shorter ones near the margins of lobes. Sori near costules of pinnule-lobes; indusia thin, pale, large, bearing yellowish cylindric glands and also hairs of 2–3 cells.

Distribution. Fiji, Viti Levu and Ovalau, in forest at 500–1300 m.

The type material consists of two fronds, both of which lack their stipes. The above description of stipe-scales is taken from *Parks 20785*, on which Copeland's description of 1929 was based; this specimen agrees exactly with the type (*Milne 159*) in shape of pinnules, also in details of scales on the frond but has less well preserved indusia. Fitch's drawing on Hooker's plate 67 shows an indusium fringed with unicellular glands, but there are also hairs of more than one cell.

I have not seen Brackenridge's type of *Lastrea tenuifolia*, but Dr. D. B. Lellinger has kindly examined it for me and reports that the scales on its frond are like those here described for *C. fijiensis*. Dr. Lellinger also reports that *no 12* of the Wilkes Expedition, also cited by Brownlie under *C. fijiensis*, represents *Ctenitis subglandulosa* (*no 41* below). Of the other specimens cited by Brownlie I have only seen *A. C. Smith 8027* and confirm its correctness.

23. *Ctenitis koordersii* Holttum, *spec. nov.*

Aspidium obtusilobum sensu Christ, Ann. Jard. Bot. Btzg 15 (1898) 130, not *Nephrodium obtusilobum* Bak.

Dryopteris zeylanica v. A. v. R., Handb. (1908) 203, p. p. quoad pl. Celeb. tantum.

Stipes apicem versus paleis c. 3 mm longis, perangustis, marginibus inflexis, basi dilatata convexa clathrata vestitus; lamina saltem 50 cm longa, tenuis; pinnae infimae verisimiliter 18–20 cm longae, pinnulis liberis 2–3-jugatis, adnatis 2–3-jugatis, omnibus contiguus vel imbricatis instructae; pinnula infima basiscopica 9×3.5 cm foliola tertiaria plurijugata plerumque adnata ferens, foliolo tertiaro maximo 20×7 mm profunde lobato lobis 6-jugatis infimis crenatis costulis loborum 3 mm inter se distantibus; pinnula infima acroscopica 5.4×2 cm, foliola tertiaria adnata 4-jugata ferens; pinnulae pinnarum superiorum omnes profunde lobatae; rhachides pinnarum subtus paleis brevibus multis vestitae; pinnulae supra inter venas glandulis tenuibus adpressis varie instructae; sori mediales in lobis pinnularum; indusia parva, tenuia, glandulifera. — *T y p u s*: *Koorders 17027* (BO), Celebes, Minahassa.

The type consists of parts of a single frond; it lacks the base of the stipe. There is also an unnumbered Koorders specimen from Minahassa at Paris. *Nephrodium obtusilobum* Baker, in Ceylon only, belongs to *Ctenitis* subgenus *Dryopsis* Ching, which I regard as a distinct genus (*Dryopsis* Holttum & Edwards, to be published in the Kew

Bulletin). Its scales and hairs are very different from those of the Koorders specimens from Celebes, also the shape of the smaller rachises and the costules of pinnules.

24. *Ctenitis sumbawensis* Holttum, *spec. nov.*

Caudex brevis, suberectus, stipes 40 cm longus, gracilis, basi solum paleis pallide castaneis usque 15 mm longis vix 1 mm latis planis apice filiformibus, ceterum paleis atrocastaneis patentibus marginibus inflexis vestitus. Lamina 40 cm longa, tenuis; pinnae liberae stipitatae fere contiguae plurijugatae; pinnae infimae 17 cm longae, pinnulis liberis 6-jugatis instructae; pinnula infima basiscopica 8–9 cm longa, foliolis tertiariis usque 5-jugatis profunde oblique lobatis, lobis integris leviter falcatis acutis, instructa; pinnula infima acroscopica 3.5×1.2 cm, foliolo tertiario unico praedita; pinnulae vel lobi pinnarum superiorum omnes profunde lobatae, lobis acutis; venae in lobis pinnularum pinnatae, venulis simplicibus, gracilibus; rhachides pinnarum subtus paleis angustis 2–3 mm longis basi clathratis, supra pilis usque 0.5 mm longis confertis vestitae; pagina pinnularum supra inter venas pilis adpressis tenuissimis praedita; sori ad venas inframediales; indusia parva, persistentia. — *T y p u s*: *Kostermans 18126* (K; L), W. Sumbawa, Batu Lanteh Mt, 800 m. A second specimen is *Sun Hong-Fan 9339* (L) from Lombok.

Distribution. W. Sumbawa, Lombok.

25. *Ctenitis croftii* Holttum, *spec. nov.*

Caudex brevis, suberectus; stipes 50 cm longus, basi paleis angustis planis tenuibus rufo-castaneis usque 20 mm longis vestitus; paleae supra basin stipitis gradatim minores, patentes, marginibus inflexis, supremae 3–4 mm longae; rhachis subtus paleis brevibus, supra pilis ultra 1 mm longis vestita. Lamina usque 50 cm longa, firma; pinnae 12-jugatae, infimis maximis; pinnae infimae usque 23 cm longae, pinnulis liberis 3–4-jugatis etiam pluribus adnatis instructae; pinnulae infimae basiscopicae usque 8.7×2.4 cm, foliolis tertiariis leviter adnatis 1-jugatis 14×6 mm profunde lobatis obtusis praeditae; pinnulae infimae acroscopicae 4 cm longae; rhachides pinnarum subtus paleis angustis basi dilatatis clathratisque et pilis brevibus, supra pilis crassis ultra 1 mm longis confertis vestitae. Sori prope costulas loborum pinnularum siti; indusia minuta, tenuia, glandulis cylindricis rubris ornata, mox marcescentia. — *T y p u s*: *J.R. Croft 583* (K), Papua New Guinea, Mt Misim, 1600 m, on steep slope in forest.

Distribution. Papua New Guinea, Morobe District.

Additional specimens. *Schlechter 17792*, Kani Mts, 1000 m; *B.S. Parris 4325, 4326*, Wau Gorge, 1200 m, on dry bank in *Araucaria* forest; *Nakaike 95*, Mt Misim, 1300–1600 m.

This species is closely related to *C. fijiensis* but has less deeply divided pinnules, much smaller indusia, elongate basal basiscopic pinnules, and the basal stipe-scales show a quite gradual transition in length and shape with little change in colour.

26. *Ctenitis decurrentipinnata* (Ching) Ching

C. decurrentipinnata (Ching) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 291; Tard. & C. Chr., Fl. Gén. I.-C. 7 (1941) 346, f. 40. — *Dryopteris decurrentipinnata* Ching, Bull. Fan Mem. Inst. Biol. Bot. 2 (1931) 195, t. 9. — Type: *McClure 8673* (LU; K, SING), Hainan, Five Finger Mt, 1400 m, in wooded ravine.

Caudex massive, suberect; stipe to 75 cm long, stramineous except at base; basal scales 15×1 mm, medium to dark brown, firm, flat; scales above base 5–6 mm long, stiffly spreading with inrolled edges and widened clathrate base. Lamina to at least 50 cm long, thin; pinnae at least 10 pairs, basal ones 22–30 cm long bearing 5 pairs of free or adnate pinnules; basal basiscopic pinnules of basal pinnae 10 cm long with 1 pair of free deeply crenate tertiary leaflets; basal acroscopic pinnules 4 cm long; second pair of pinnae also 22 cm long, their largest pinnules 6×1.7 cm with basal lobes crenate, costules of the lobes 4 mm apart, several of their middle pinnules with much-decurrent basal lobes; upper pinnae with decurrent basal lobes the costules of which arise from the rachis; scales on lower surface of pinna-rachis 2–4 mm long, their edges inrolled, many cells near their bases isodiametric and clathrate; hairs on upper surface of pinna-rachis c. 0.5 mm long; sori on the middle of veins in pinnule-lobes; indusia small, thin, gland-bearing.

Distribution. Hainan, Vietnam, Luzon.

Additional specimens. Hainan: *Eryl Smith 1621*, Five Finger Mt, 900 m; *F. C. How 70396*, Yaichow; *Tsang & Fung 608*, Hung Mo Shan; *Chun & Tso 43914*, Dung Ka, 750 m; *K. S. Chow 78447*, Janfengling, 750 m; *S. K. Lau 5246*, Chim Fung Mt. — Vietnam: *Cadière 90*; *Poilane 3401, 3723*, Nhatrang. — Luzon: *Cuming 252 p.p.* (BM, K); *Whitford 199*, Prov. Bataan, Mt Mariveles.

Cuming 252 is a mixed collection. The BM specimen consists of a large frond, lacking basal pinnae and stipe. The Kew duplicate of *Whitford 199* is a small plant but agrees in the bases of upper pinnae and in scales.

27. *Ctenitis alteroblumei* Holttum, *spec. nov.* — Fig. 1c; 3a, b.

Nephrodium blumei Hook., Spec. Fil. 4 (1862) 135, quoad spec. ex Herb. Blume tantum, non *Lastrea blumei* Moore 1858 nec *L. blumei* sensu Bedd., Ferns S. India (1864) t. 249. — *Aspidium intermedium* Bl., Enum. Pl. Jav. (1828) 161, non Willd. 1810, p.p. *Aspidium pulvinuliferum* sensu Racib., Fl. Btzig 1 (1898) 177. — *Dryopteris pulvinulifera* sensu v.A.v.R., Handb. (1908) 200.

A *Ctenitide vili* quam per Blume etiam in *Aspidio intermedio* inclusa fuit differt: lamina multo majore, pinnulis pinnarum medialium profunde lobatis, indusiis manifestis, paleis costarum pinnularum basin versus valde clathratis; a *Lastrea blumei* sensu Bedd. 1864 differt: marginibus inflexis basibusque incrassatis palearum minorum frondis. — Typus: *Blume s.n.* (L, 908, 337-1011), Java.

Caudex short, erect, its apex covered with red-brown scales to 28×1 mm; stipe to more than 60 cm long, its basal scales like those of the caudex, those above the base dark, bristle-like, spreading at right angles, 10–12 mm long decreasing distally

to 6–7 mm. Lamina to more than 60 cm long; basal pinnae to 26 cm long (including stalk 1.5 cm) bearing c. 6 pairs of free pinnules and 2–3 pairs adnate; basal basiscopic pinnule to 12 × 3.6 cm bearing 1 pair very deeply lobed tertiary leaflets to 2.8 × 1.2 cm; basal acroscopic pinnule to 6 cm long; second pair of pinnae bearing up to 5 pairs of free pinnules with basal lobes lobulate to crenate, distal lobes entire; lower surface of pinna-rachis bearing scales 2–3 mm long with inrolled edges and widened clathrate basal part; appressed glands variably present on and between veins of pinnules. Sori about medial on veins in pinnule-lobes (sometimes near bases of both branches of a forked vein); indusia thin, rather large when young, crumpled when old, bearing slender glands.

Distribution. S. Sumatra, Java, Bali, in mountain forest.

Blume did not cite Willdenow when describing *Aspidium intermedium*. As indicated by his naming of specimens, he included in his species specimens here named *Ctenitis vilis* as well as those now distinguished as *C. alteroblumei*. The specimen now accepted as type of *Aspidium intermedium* Bl. is *C. vilis*. Hooker adopted Moore's new epithet *blumei* with a description which is an English translation of Blume's. He based his idea of the species on a single pinna sent to him by Blume; the specimen in the Rijksherbarium from which this pinna was detached is here cited as type of *C. alteroblumei*. But Hooker also cited specimens which belong to other species; he did not examine details of structure which would have shown him their differences.

28. *Ctenitis setosa* (Presl) Holttum

C. setosa (Presl) Holttum, Novit. Bot. Univ. Carol. Prag. 1968 (1969) 20, excl. *Cuming* 80 & 151. – *Lastrea setosa* Presl, Epim. Bot. (1851) 40, new name for *Polypodium hirtum* Presl, Rel. Haenk. (1825) 27, not Sw. 1806. – Type: *Haenke s.n.* (PR; BM, K), Luzon.

Basal scales of stipe not seen; lamina to 30 cm long, firm but veins distinct on lower surface; free pinnae 4 pairs and several pairs adnate, the costules of basal lobes of distal pinnae arising from junction of pinna-midrib with rachis; basal pinnae to 15 cm long, bearing 2 pairs of free pinnules, their distal parts shaped like the frond apex; basal basiscopic pinnules of basal pinnae to 6.5 × 3 cm with acute apex, bearing one pair of almost free tertiary leaflets, the largest 18 × 10 mm lobed to its costa near its base, the lobes entire (or the basal ones with sinuous margin) with broadly rounded apices; basal acroscopic pinnules of basal pinnae 3.7 × 2 cm; pinnules or lobes of second, third and fourth pairs of pinnae all deeply lobed and with broadly obtuse apices. Lower surface of main rachis and pinna-rachises bearing minute hairs and many very narrow scales 2–3 mm long which are not stiffly spreading, their margins inflexed and their widened bases consisting of isodiametric cells; lower surface of costae of pinnules bearing sparse very short hairs of 2–3 cells and possibly short slender appressed red glands (not clearly seen); hairs on upper surface of costae c. 0.5 mm long, thick; no hairs nor glands seen between veins on upper surface. Sori about medial on simple veinlets in pinnule-lobes or near the bases of one or both branches of forked veinlets; indusia very small, bearing a few slender glands which may be red.

Distribution. Known only from the type collection in the National Herbarium at Pruhonice (not found in Presl's herbarium in PRC) and two duplicates at BM and K acquired from the herbarium of Forbes Young (they bear the species name in Presl's hand), also probably a sterile specimen (*Edaño PNH 16654*) from the extreme north of Luzon (K). The sori of the Kew isotype specimen are all old and I have seen very few indusia which are well preserved. Presl did not cite a locality for the type; Haenke travelled widely in Luzon including the extreme north (see Alston, *J. Bot.* 72, 1934, 223–230).

In my comments on Presl's types (1969) I allocated *Cuming 80 & 151* to this species; the former is here distinguished as a new species, *C. erythradenia*, the latter as *C. silvatica*.

29. *Ctenitis atrorubens* Holttum, *spec. nov.*

Dryopteris intermedia (Bl.) O. Ktze var. *microloba* Christ, *Philip. J. Sc.* 2 (1907) Bot. 215.

Stipes c. 20 cm longus, atrorubens, basi paleis arcte caespitosis angustis 15 mm longis rufobrunneis, proxime supra basin sursumque paleis atrobrunneis rigide patentibus vestitus; paleae rhachidis eis stipitis similes sed sensim breviores. Lamina usque 34 cm longa, tenuis; pinnae imbricatae, liberae c. 12-jugatae etiam adnatae plurijugatae; pinnae infimae 11.5 cm longae, brevi-stipitatae, pinnulis infimis basicopicis 5.2 × 1.6 cm foliolis tertiariis unijugatis profunde lobatis (lobis 3-jugatis) instructis, pinnulis infimis acroscopicis 20 × 8 mm; pinnulae pinnarum medialium omnes profunde lobatae, lobis obtusis leviter obliquis, costulis loborum 3 mm inter se distantibus; rhachides pinnarum subtus paleis 2–3 mm longis marginibus inflexis basi clathratis instructae, supra pilis 1 mm longis vestitae. Sori ad venas supramediales; indusia tenuia, soros juveniles tegentia. — *T y p u s* : *Copeland 1702* (MICH), Mindanao, Prov. Zamboanga, San Ramon, 820 m.

Distribution. Known only from the type collection.

30. *Ctenitis erythradenia* Holttum, *spec. nov.*

Stipes usque 37 cm longus, in sicco pallidus, basi paleis laete brunneis planis 10 mm vel ultra longis, supra basin paleis perangustis fusco-brunneis usque 8 mm longis marginibus inflexis vestitus. Lamina usque 32 cm longa, tenuis; pinnae infimae 15 cm longae, pinnulis liberis unijugatis adnatis 2–3-jugatis, pinnulis infimis basicopicis 6.5 × 2 cm, foliolis tertiariis unijugatis usque 12 × 5 mm dimidio costulam versus lobatis instructis; pinnulae infimae acroscopicae 2.5 × 1 cm, profunde lobatae, lobis subintegris. Rhachides pinnarum subtus paleis angustissimis 2–3 mm longis marginibus inflexis basi clathratis instructae; pagina pinnularum subtus ad et inter venas glandulis plerumque rubris adpressis praedita; rhachides pinnarum supra pilis brevibus vestitae. Sori mediales; indusia parva, tenuia, glandulis rubris ornata. — *T y p u s* : *M. G. Price 1773* (K), Luzon, Mt Makiling, 500 m, in ridge-crest forest.

Distribution. Luzon, Mindanao.

Additional specimens. Luzon: *Cuming 80*; *C. G. Matthew s.n.*, 1 March 1907, Mt Makiling, 450 m; *M. G. Price 1328, 2409*, Mt Makiling; *M. G. Price 2347*, Batangas Prov., Mt Makulot; *Borden FB 1240, 1241*, Mt Mariveles. – Mindanao: *Copeland 1765D*, San Ramon; lamina 45 cm long.

In my comments on Presl's types (1969) I identified *Cuming 80* as *Ctenitis setosa*, but the type of the latter has pinnae and pinnules different in shape from those of the present species. *Ctenitis erythradenia* resembles *C. eatonii* of Taiwan rather closely in frond-form but differs in its rachis-scales, indusia and red glands. I am indebted to Mr M.G. Price for recognition of the distinctive characters of this species.

31. *Ctenitis angusta* Holttum, *spec. nov.*

Stipes usque 45 cm longus, pallide castaneus, basi paleis brunneis tenuibus planis angustis 15 mm longis, supra basin paleis fusco-brunneis marginibus inflexis sursum sensim minoribus patentibus vestitus. Lamina usque 37 cm longa, 20 cm lata, tenuis, pinnis liberis 9–10-jugatis et adnatis 3–4-jugatis; pinnae infimae usque 11.5 cm longae, pinnulis liberis 2–3-jugatis infimis 4 × 1 cm fere ad costam lobatis, foliolo unico tertiaro 7 × 3 mm fere libero leviter crenato instructae; pinnulae pinnarum medialium omnes profunde lobatae; rhachides pinnarum subtus paleis 2–3 mm longis angustis marginibus inflexis basi dilatatis clathratis etiam pilis brevibus multis, supra pilis crassis brevibus vestitae. Sori leviter inframediales; indusia tenuia, parva, reniformia, glandulis pallidis vel rubris ornata. – *T y p u s*: *L. J. Brass 23208* (BM; A), Papua New Guinea, Milne Bay District, Mt Dayman, moist valley in oak forest at 1550 m.

Distribution. Known only from the type collection.

32. *Ctenitis paleolata* Copel.

C. paleolata Copel., Philip. J. Sc. 81 (1952) 24; Fern Fl. Philip. (1960) 293. – *T y p e*: *Copeland s.n.*, 9 May 1912 (MICH), Luzon, Benguet Subprovince, Pauai.

Stipe nearly 50 cm long, its basal scales 15 mm long, narrow, mid-castaneous, in a close tuft, above base an abrupt transition to narrow flat scales 2–3 mm long, their cells all somewhat elongate but with dark walls and clear lumina. Lamina to at least 50 cm long, texture thin, wholly catadromous; basal pinnae 20 cm long with stalks 3.5 cm and 6 pairs of widely spaced pinnules; basal basiscopic pinnules 9 cm long bearing one pair of free tertiary leaflets and several pairs adnate, all widely spaced; largest tertiary leaflet 2 cm long, lobed almost to its costa, the lobes well spaced, very oblique and falcate, the largest 4–5 × 1.5 mm; basal acroscopic pinnule 6.5 cm long; pinnules of suprabasal pinnae all widely spaced with widely spaced narrow falcate lobes; scales on lower surface of pinna-rachis narrow, evenly attenuate from base to apex, clathrate but few basal cells isodiametric. Sori small, medial or supramedial; indusia small, distinct, bearing cylindric glands; spores not seen.

Distribution. Known only from the type collection.

Indusia are certainly present, though Copeland did not see them. I judge that this species belongs to the group of *C. subglandulosa*, but the small scales are not quite point-attached. It is a very distinct species and more collections are needed.

33. *Ctenitis thwaitesii* Holttum, *nom. nov.*

Lastrea blumei Bedd., Ferns S. India (1864) t. 249, excl. syn. *Aspidium intermedium* Bl. —

Type: *Thwaites 3059* (K; P), Ceylon.

C. rhodolepis sensu Sledge, Kew Bull. 27 (1972) 408.

Caudex erect, to 60 cm tall (Gardner); stipe to at least 60 cm long, light castaneous, its basal scales to 20 mm long and 0.5 mm wide, medium brown, scales from 3–4 cm above its base darker, clathrate but with most cells narrow. Lamina to 100 cm long, thin; basal pinnae to at least 26 cm long with 6–7 pairs of free pinnules and several pairs adnate, basal basiscopic pinnules to 13 cm long bearing 2 pairs of free tertiary leaflets and several pairs adnate, the largest 2.8 × 1.2 cm; scales on lower surface of pinna-rachis to 3 × 0.5 mm, narrowed evenly from base to apex, isodiametric cells present near the base only, scales on smaller axes similar in shape. Sori about medial on pinnule-lobes; indusia thin, distinctly reniform, bearing glands on the upper surface and margin.

Distribution. Ceylon, Central Provinces, in forest at 750–1650 m.

This species is closely allied to *C. subglandulosa*, but has much narrower rachis-scales with few isodiametric cells. In this group of species it is isolated geographically, its nearest relatives being in NE. India and E. Java. W.A. Sledge has published a list of specimens and information about local distribution.

34. *Ctenitis pseudorhodolepis* R.C. Ching & C.H. Wang

C. pseudorhodolepis R.C. Ching & C.H. Wang, Acta Phytotax. Sinica 19 (1981) 121. — Type: *K. H. Hsing 1857* (PE), Sichuan, Emei, 600–700 m, in bamboo thicket by stream.

Differs from *C. thwaitesii*: basal scales on the stipe 1 mm wide, gradually smaller above the stipe-base; scales on lower surface of costae of pinnules broad at their bases and filiform distally; sori apparently exindusiate, usually covered with small scales.

Distribution. Known only from the type and nos *1834* & *1854* by K.H. Hsing.

35. *Ctenitis lepigera* (Bak.) Tagawa

C. lepigera (Bak.) Tagawa, Acta Phytotax. Geobot. 8 (1939) 95; Nakaïke, New Fl. Jap. Pterid. (1982) 330. — *Nephrodium lepigerum* Bak., Syn. Fil. (1867) 284. — *C. subglandulosa* (Hance) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 302, p.p. — Lectotype (Ching): *Ex Imp. Acad. Petersb. no 36* (K), Bonin Islands.

Differs from *C. thwaitesii*: tertiary leaflets on basal pinnae 3.5 × 1.5 cm, their basal lobes 4 mm wide, crenate; scales on lower surface of smaller axes with broad base and abrupt hair-point, their lateral cell-walls thin, their margins denticulate.

Distribution. Bonin Islands.

Baker cited also C. Wright, U.S. N. Pacific Expl. Exped. 1853–56. Ching first selected the Petersburg specimen as type and Nakaike published a photograph of it. Ching placed this species as a synonym of *C. subglandulosa*, but its scales are much narrower, with isodiametric cells near the base only.

36. *Ctenitis microlepigera* (Nakai) Ching

C. microlepigera (Nakai) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1939) 280; H. Ito in Nakai & Honda, Nov. Fl. Jap. 4 (1939) 85; Nakaike, New Fl. Jap. Pterid. (1982) 332 with phot. – *Dryopteris microlepigera* Nakai, Bot. Mag. Tokyo 43 (1929) 5. – Type: *M. Ogata* (TI, not seen), Bonin Islands, Hahajima.

Differs from *C. lepigera*: stipe to 30 cm long, its basal scales to 12 mm long; lamina to 40 cm long; lobes of pinnules of middle pinnae deeply lobulate; tertiary leaflets on basal pinnae to 11 \bar{n} 6 mm, very deeply lobed.

Distribution. Bonin Islands, Hahajima and Chichijima.

I am indebted to Prof. T. Nakaike for a specimen of this species, taken from a plant cultivated in the Tsukuba Botanic Garden, originating from Chichijima. It agrees closely with a specimen *no 51* from 'Imperial Academy Petersburg' sent to W.J. Hooker. The details specified above are taken from these two specimens.

37. *Ctenitis dumrongii* M. Tagawa & K. Iwatsuki

C. dumrongii M. Tagawa & K. Iwatsuki, Acta Phytotax. Geobot. 23 (1968) 115, f. 11. – Type: *Tagawa & Iwatsuki T10908* (KYO, not seen), Thailand, Chiang Rai, 400 m, moist bank of stream in forest.

C. yunnanensis Ching, Acta Phytotax. Sinica 19 (1981) 124. – Type: *Yunnan Complex Exped. 5702* (PE).

Differs from *C. subglandulosa*: fronds smaller with basal pinnae commonly 20 cm long; apices of pinnules of middle pinnae broadly obtuse to rounded; scales on pinna-rachis 0.5 mm wide, their distal part consisting of narrow elongate cells.

Distribution. N. Thailand and Yunnan.

I have seen the specimens from the herbarium of Eryl Smith at SING cited by Tagawa and Iwatsuki, also the type of *C. yunnanensis*.

38. *Ctenitis samoensis* (C. Chr.) Holttum, *comb. nov.* – Fig. 2e, f.

Dryopteris samoensis C. Chr., Ind. Fil. (1905) 290; Bishop Mus. Bull. 177 (1943) 95, new name for *Polypodium paleaceum* Powell ex Bak., Syn. Fil. ed. 2 (1874) 505, not Hook. f. 1847. – Type: *T. Powell 161* (K), Samoa.

Caudex 'only a few inches high' (Powell); stipe to 90 cm long (Powell), its basal scales to 5 cm long, thin, light brown, gradually decrescent upwards; lamina to 100 cm long; basal pinnae to 42 cm long including a stalk of 4 cm, bearing up to 8 pairs

of free pinnules; basal basicopic pinnule to 20 cm long bearing a pair of stalked tertiary leaflets 5×1.7 cm which bear a pair of free deeply lobed quaternary leaflets 10×5 mm; scales on pinna-rachis narrow, to 2 mm long, their distal cells all narrow and elongate; indusia small, thin, gland-bearing.

Distribution. Samoa (Upolu), Rarotonga.

At K are other specimens collected by Powell (253, 258) and unnumbered ones from S.J. Whitmee, also *Reinecke 112* and *W.A. Sledge 1488, 1829*. At P are 4 sheets of *Betsche 55*.

From Rarotonga (Cook Islands) at K is *T.A. Cheesman 779*. This differs little from the Samoan specimens except in the presence of abundant hairs on the lower surface of smaller axes of the frond. *Parks 22147* (BISH) is similar.

39. *Ctenitis sciaphila* (Maxon) Ching — Fig. 2a.

C. sciaphila (Maxon) Ching, *Sunyatsenia* 5 (1940) 250. — *Dryopteris sciaphila* Maxon, *Univ. Cal. Publ. Bot.* 12 (1924) 24; Copel., *Bishop Mus. Bull.* 93 (1932) 35. — Type: *Setchell & Parks 444* (US; P), Tahiti, Maara Valley, on mossy bank in deep shade.

var. *sciaphila*

Caudex decumbent (Maxon); stipe to 50 cm long, almost stramineous, the basal 3–4 cm covered with light brown scales 15–20 mm long, above them a transition to much smaller darker ones which are soon caducous; lamina to 50 cm long; basal pinnae to 33 cm long including stalks 3.5 cm long, bearing 3 pairs of stalked pinnules, 2–3 pairs sessile and 2–3 pairs adnate; basal basicopic pinnule 18 cm long, bearing several pairs of widely spaced tertiary leaflets, the largest 4 cm long, its lowest lobe 20×5 mm and deeply lobulate; scales on pinna-rachis to 2 mm long, narrow, clathrate with isodiametric cells except near the apex, scales on costae of pinnules thin and translucent; sori small, medial on lobes of pinnules; indusia thin, covering young sori, with marginal cylindrical glands.

Distribution. Society Islands; Tahiti, Moorea, Raiatea.

Additional specimens. Tahiti: *M.L. Grant 3536, 4069, 5267, 5395; Leland Chase & Tilden 42; Cuming 1414* (K); *Bidwill 41* (P). — Moorea: *H.M. Smith 31, 34*. — Raiatea: *J. W. Moore 718*.

var. *raivavensis* (E. Brown) Holttum, *comb. nov.*

Dryopteris sciaphila Maxon var. *raivavensis* E. Brown, *Bishop Mus. Bull.* 89 (1931) 32. — Type: *A. M. Stokes 84* (BISH), Austral Islands, Raivavae.

Differs from var. *sciaphila*: fronds to 90 cm long; basal pinnae to 40 cm long; largest tertiary leaflets on basal pinnae 8.2 cm long, bearing a pair of free deeply lobed quaternary leaflets.

Distribution. Austral Islands; Raivavae, Rurutu.

Additional specimens. Raivavae: *Quayle 263; St. John & Fosberg 15858*. — Rurutu: *St. John 16663*.

The constancy of difference in size between the two varieties needs to be checked by further field study. Not all specimens show the basal pinnae, and possibly not all have been taken from plants of mature size.

40. *Ctenitis rapensis* (E. Brown) Holttum, *stat. nov.*

Dryopteris sciaphila Maxon var. *rapensis* E. Brown, Bishop Mus. Bull. 89 (1931) 33. – Type: Quayle X (BISH), Rapa Island.

Caudex short, massive; stipe to at least 50 cm long, its base covered with medium brown hair-pointed scales c. 20 × 1 mm, rest of stipe covered with scales 2–4 mm long, the distal ones and those on the rachis consisting wholly of isodiametric cells apart from a narrow tip varying length; lamina to at least 60 cm long, basal pinnae to 38 cm long, their basal basisopic pinnules to 18.5 cm long (including stalk 6 cm) bearing 3 pairs of widely spaced stalked tertiary leaflets 4.5 × 1.8 cm which have two pairs of very deeply lobed quaternary leaflets the largest 12 × 3 mm, the quaternary leaflets and lobes separated by sinuses as wide as their own width; pinnules of upper pinnae similar to tertiary leaflets of basal pinnae with widely spaced narrow lobes; scales on smaller axes similar to those of the main rachis but smaller; indusia small, thin, reniform.

Distribution. Rapa Island.

Additional collection. *St. John & Fosberg 15245* (BISH; K).

The type was originally cited 'Rapa (?), 1921 (?), Quayle no X'. The later collection by St. John & Fosberg agrees closely with the type and confirms the locality; I have examined specimens of both collections from BISH.

41. *Ctenitis cumingii* Holttum, *spec. nov.* – Fig. 2b.

A *Ctenitide rapense* differt: paleis stipitis sursum non atrobunneis, lobis pinnularum sinibus angustis separatis, parietibus cellularum palarum minorum pallidis. – Typus: *Cuming 1388* (K; BM), Pitcairn Island.

Caudex massive, prostrate; stipe 50 cm long, light castaneous, its basal scales medium brown, thin, 10(–15?) mm long, gradually shorter upwards for a distance of 5 cm, scales on rest of stipe and rachis pale, thin, appressed, 2–3 mm long and nearly 1 mm wide, their cells isodiametric almost throughout but the cell-walls thin and light brown. Lamina to 50 cm long, thin; basal pinnae to 28 cm long (stalk 1.5 cm), their basal basisopic pinnules 14 cm long, bearing 1 pair of free tertiary leaflets 3 × 1.4 cm lobed almost to the costa, the lobes lobulate with costules 4 mm apart, apex acute; basal acroscopic pinnules 8 × 2.8 cm with 2 pairs of adnate deeply lobed tertiary leaflets; pinnules of middle pinnae very deeply lobed, lobes of larger ones deeply crenate, sinuses between the lobes narrow; scales on lower surface of pinna-rachis 1–2 mm long, their cells as those on the main rachis. Sori medial or supra-medial on veins in pinnule-lobes, small; indusia thin, reniform but soon crumpled, bearing pale glands.

Distribution. Pitcairn Island.

Additional specimens. *St. John 14968* (BISH), in moist woods at 310 m; the description of caudex and stipe is taken from this. *A. W. Moverley 22, 23* (BM), at 60–300 m, within the crater area.

42. *Ctenitis subglandulosa* (Hance) Ching – Fig. 2c, d; 3c, d.

C. subglandulosa (Hance) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 302; Tagawa, Col. Ill. Jap. Pterid. (1959) f. 223; Copel., Fern Fl. Philip. (1960) 292; DeVol & Kuo, Fl. Taiwan 1 (1975) 327. – *Alsophila subglandulosa* Hance, Ann. Sci. Nat. V, 5 (1866) 253. – *Dryopteris subglandulosa* (Hance) Hayata, Ic. Pl. Formosa 6 (1917) 101, non (Fée) O. Ktze 1891. – Type: *Oldham s.n.*, March 1864 (BM; K), N. Taiwan, ex Herb. Hance no 11186.

Polypodium oldhamii Bak., Syn. Fil. (1867) 311. – Type: *Oldham s.n.*, 1864 (K), Taiwan, Tamsuy.

Aspidium subtripinnatum Miq., Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 179. – *C. subtripinnata* (Miq.) H. Ito in Nakai & Honda, Nov. Fl. Japan 4 (1939) 74, excl. syn. [not *Nephrodium subtripinnatum* sensu Bak., Syn. Fil. (1868) 485]. – Type: 'Siebold et Buerger', Japan [L 908.337-521 (Siebold), 515, 527, 537 (Buerger)].

Nephrodium rhodolepis Clarke, Trans. Linn. Soc. II, Bot. 1 (1880) 526, t. 72. – *Lastrea intermedia* var. *rhodolepis* Bedd., Handb. Suppl. (1892) 62. – *Dryopteris rhodolepis* (Clarke) C. Chr., Ind. Fil. (1905) 288, excl. syn.; v.A.v.R., Handb. (1908) 202, excl. syn. – Lectotype (selected here): *Clarke 26934* (K), Darjeeling, 6000 ft, August 1875.

C. costulisora Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 299, excl. *W. T. Tsang 20974*. – Type: *Y. K. Wang 31589* (not seen), Kwangtung.

Caudex massive, suberect; stipe to at least 120 cm long (Hance), its base covered with light brown thin scales 20–40 mm long, the scales gradually shorter upwards for 5–10 cm, then a subabrupt change to copious appressed overlapping clathrate scales. Lamina as long as stipe; basal pinnae of lectotype 45 cm long, their largest pinnules bearing 4–5 pairs of tertiary leaflets, the largest very deeply lobed; scales on smaller axes of the frond to 1 mm wide, consisting almost entirely of isodiametric cells or at least of cells not much longer than wide; indusia thin, rather irregular in shape, bearing cylindrical glands and sometimes also hairs of several cells.

Distribution. NE. India, S. China, Taiwan, Ryukyu Islands and S. Japan; Guam; Philippines (Luzon, Panay, Mindoro), E. Java, Bali, Eastern New Guinea, Fiji.

Additional specimens. East Java: *Mousset 209, 739* (L), Tengger Mts, and in Rosenst. Fil. Jav. or. exsic. 99; *Buysman 203*. – Bali: *Posthumus 3725* (BO); *Dilmy 934* (L); *Kostermans et al. 176* (L). – Papua New Guinea: *B. S. Parris 4324*, Morobe Dist., Bulolo; *Streiman & Kairo NGF 47627*, Wau. – Fiji: *Milne 303, 334*; *Degener 15364*, Viti Levu; *Degener & Ordonez 13553*, Viti Levu.

Ching (1938) distinguished *C. rhodolepis* from *C. subglandulosa*, stating that the former has broadly ovate scales on the rachis and no indusia, the latter long-acuminate scales and subpersistent indusia; some exindusiate specimens at Kew cited by him as *rhodolepis* are *C. membranifolia* (no 43), and I find that the shape of scales may vary on a single frond. Ching distinguished *C. costulisora* by its pale-coloured hairs on the upper surface of costae and by sori near costules. I have not seen the type, but there are several specimens in Kew herbarium which he cited. Copeland

(1960) distinguished *C. rhodolepis* from *C. subglandulosa* in the Philippines but all Philippine specimens I have seen appear to belong to one species. Specimens seen from the Ryukyu Islands and southern Japan have in most cases narrower rachis-scales but do not otherwise differ. In his book on the ferns of Fiji (1977) Brownlie did not distinguish this species from *C. fijiensis*.

43. *Ctenitis membranifolia* R.C. Ching & C.H. Wang

C. membranifolia R.C. Ching & C.H. Wang, Acta Phytotax. Sinica 19 (1981) 121. – Type: *K.M. Feng 5174* (PE), Yunnan, Pingbian, on limestone rocks.

C. calcarea R.C. Ching & C.H. Wang, Acta Phytotax. Sinica 19 (1981) 118. – Type: *S.K. Wu s.n.*, 22 June 1957 (PE), Guizhou, Dushan, on limestone rocks.

C. rhodolepis sensu R.C. Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 301, p.p.

The types of *C. membranifolia* and *C. calcarea* are small plants (stipes 9 cm long, lamina 12 cm long) but in other respects they agree with several much larger specimens from China which were cited by Ching as *C. rhodolepis* in 1938. These specimens agree in general with the type of *C. rhodolepis*, the largest fronds measuring 70 cm in length with basal pinnae 35 cm long, but differ in having minute indusia which are shorter than the mature sporangia and are hidden by them, also very short erect hairs between veins always on the upper surface and rather irregularly on the lower surface.

Distribution. China (Yunnan, Guizhou, Sichuan, Hupeh).

Additional specimens in K. Yunnan: *A. Henry 13687*, Mengtse, 1500 m. – Sichuan: *Faber 1062*, Mt Omei; *H.P. Brown 33*, Mt Omei; *W.P. Fang 2009*, Kuan Hsien. – Hupeh: *A. Henry 4318, 11110*, Ichang; *1945*, Nan To; *7877* without locality; *E.H. Wilson 2630*. – Guizhou: *Esquirol 2548*; *Cavalerie 1805*.

DOUBTFUL SPECIES

Ctenitis changanensis Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 297. – Type: *A.N. Steward & H.C. Cheo 1165* (not seen), Chang-an, Yung Hsien, 23 Oct. 1933.

Dryopteris rizalensis Christ, Bull. Herb. Boiss. II, 6 (1906) 1001. – Type: *Loher s.n.*, March 1906 (not found at P), Luzon, Rizal Prov., Mabacal.

Christ published a different description under the same name in 1907, without reference to the publication of 1906. Copeland typified the second name by a specimen which is here referred to *Ctenitis pallens*. The 1906 type may have been the species here named *C. erythradenia*, but this is quite uncertain.

EXCLUDED SPECIES

I have seen specimens of all the following species (in nearly all cases the type) and believe that they should be excluded from the genus *Ctenitis*. The original places of

publication of the names may be found in Index Filicum and its Supplements. The generic name which I regard as correct is shown in brackets after the specific name but no new combinations are here proposed. The unpublished generic name *Dryopsis* Holttum & Edwards is to be published in the Kew Bulletin and the names *Aenigmopteris* and *Ataxipteris* Holttum are published in Blumea 30 (1985) 1–11.

<i>C. adnata</i> (Bl.) Ching	(<i>Dryopsis</i>)
<i>C. alpina</i> (Ros.) Copel.	(<i>Stenolepia</i>)
<i>C. angustidissecta</i> (Hayata) H. Ito	(<i>Tectaria</i>)
<i>C. apiciflora</i> (Hook.) Ching	(<i>Dryopsis</i>)
<i>C. aureovestita</i> (Ros.) Ching	(<i>Dryopsis</i>)
<i>C. balabacensis</i> (Christ) Copel.	(<i>Tectaria</i>)
<i>C. boryana</i> (Willd.) Copel.	(<i>Dryoathyrium</i>)
<i>C. clarkei</i> (Bak.) Ching	(<i>Dryopsis</i>)
<i>C. copelandii</i> (Christ) Copel.	(<i>Dryopsis</i>)
<i>C. dentisora</i> Ching	(<i>Dryopsis</i>)
<i>C. dissecta</i> (Forst.) H. Ito	(<i>Tectaria</i>)
<i>C. dubia</i> (Copel.) Copel.	(<i>Aenigmopteris</i>)
<i>C. fengiana</i> Ching	(<i>Dryopsis</i>)
<i>C. ferruginea</i> (Bak.) Ching	(<i>Dryopsis</i>)
<i>C. hendersonii</i> (Bedd.) H. Ito	(<i>Nothoperanema</i>)
<i>C. heterolaena</i> (C. Chr.) Ching	(<i>Dryopsis</i>)
<i>C. hypolepioides</i> (Ros.) Copel.	(<i>Stenolepia</i>)
<i>C. kawakamii</i> (Hayata) Ching	(<i>Dryopsis</i>)
<i>C. kusukusensis</i> (Hayata) H. Ito	(<i>Tectaria</i>)
<i>C. laxa</i> Copel.	(<i>Tectaria</i>)
<i>C. leptorachis</i> (Hayata) Ching	(<i>Nothoperanema</i>)
<i>C. manipurensis</i> (Bedd.) Ching	(<i>Dryopsis</i>)
<i>C. mariformis</i> (Ros.) Ching	(<i>Dryopsis</i>)
<i>C. matsumurae</i> (Makino) Koidz.	(<i>Dryopsis</i>)
<i>C. maximowicziana</i> (Miq.) Ching	(<i>Dryopsis</i>)
<i>C. mearnsii</i> Copel.	(<i>Nothoperanema</i>)
<i>C. mesodon</i> Copel.	(<i>Tectaria</i>)
<i>C. minima</i> Brownlie	(<i>Tectaria</i>)
<i>C. nidus</i> (Clarke) Ching	(<i>Dryopsis</i>)
<i>C. obscura</i> (Fée) Copel.	(<i>Heterogonium</i>)
<i>C. obtusiloba</i> (Bak.) Ching	(<i>Dryopsis</i>)
<i>C. quepaertensis</i> (Christ) H. Ito	(<i>Oreopteris</i>)
<i>C. ramosii</i> Copel.	(<i>Tectaria</i>)
<i>C. recedens</i> (J. Sm.) Copel.	(<i>Lastreopsis</i>)
<i>C. sacholepis</i> (Nakai) H. Ito	(<i>Dryopsis</i>)
<i>C. sagenioides</i> (Mett.) Copel.	(<i>Heterogonium</i>)
<i>C. shikokiana</i> (Makino) H. Ito	(<i>Dryopteris</i>)
<i>C. silaensis</i> Ching	(<i>Dryopsis</i>)

<i>C. simozawae</i> (Tagawa) Ching	(<i>Lastreopsis</i>)
<i>C. sinii</i> (Ching) Ohwi	(<i>Ataxipteris</i>)
<i>C. speciosissima</i> Copel.	(<i>Stenolepia</i>)
<i>C. sphaeropteroides</i> (Bak.) Ching	(<i>Dryopsis</i>)
<i>C. tenerifrons</i> (Christ) Copel.	(<i>Acystopteris</i>)
<i>C. thrichorhachis</i> (Hayata) H. Ito	(<i>Dryopteris</i>)
<i>C. transmorrisonensis</i> (Hayata) Tagawa	(<i>Dryopsis</i>)
<i>C. waiwaiensis</i> (C. Chr.) Brownlie	(<i>Dryoathyrium</i>)
<i>C. wenzelii</i> Copel.	(<i>Tectaria</i>)