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THE FERN-GENUS PLEOCNEMIA PRESL

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SUMMARY

1. The genus *Pleocnemia* Presl is redefined and differentiated from *Tectaria*-Cav. and *Arcypteris* Underw., the latter genus being very closely related to *Pleocnemia.*

2. The configuration of the perispore proved to be of importance for the characterisation of the .species. In this regard three types are distinguished, perispore forming[1] crisped anastomosing wings, perispore consisting of many slender spines, and, an intermediate type, perispore forming many small separate wings.

3. Tentatively 15 species are recognized. Of these, *Pleocnemia winitii* Holttum, *P. acuminata* Holttum, P. *pleiotricha* Holttum, *P. presliana* Holttum, *P. dimidiolobata* Holttum, *P. tripinnata* Holttum, and *P. seranensis* Holttum are described as new, aa well as one variety, *P. conjugata* var. *elatior* Holttum.

4. The following new combinations are made: *P. hemiteliiformis* (Racib.) Holttum (basinym: *Pleocnemia leuzeana* var. *hemiteliaeformis* Racib.), *P. olivacea* (Copel.) Holttum (basinym: *Tectaria olivacea* Copel.), *P. kingii* (Copel.) Holttum (basinym: *Tectaria kingii Copel.),* and *P. chrysotricha* (Bak.) Holttum (basinym: *Nephrodium chrysotrichum* Bak.).

5. Reductions to synonymy are: *Pleocnemia javanica* Presl to *P. conjugata* (Bl.) Presl, and *Dictyopteris compitalis* v. A. v. R. to *P. hemiteliiformis* (Racib.) Holtt.

This genus, as originally published in 1836, included only one species, *Pleocnemia leuzeana,* based on *Polypodium leuzeanum* Gaudichaud (1827), the type of which was collected in the Moluccas. Presl placed *Pleocnemia* among the Polypodioid ferns (without indusia), and his figure clearly shows a naked sorus. But when he examined Cuming's Philippine collections, he found that some were indusiate, and in his "Epimeliae" (p. 50) he placed the genus next after *Nephrodium,* describing two more species. It is not however clear whether Presl recognized that some species of *Pleocnemia* could be indusiate and some not. Fee, in his "Genera Filicum," speculated on this point. He remarked on the confusion in the labelling of Cuming's specimens (specimens distributed under the same number not always agreeing together), but he evidently considered that indusiate and exindusiate specimens could represent the same species, though perhaps they did not grow on the same plant.

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Beddome accepted as criteria of the genus the venation pattern (costal and costular areoles present, the remaining veins free) and the presence of an indusium, and he included in *Pleocnemia* all ferns of the *Tectaria (Aspidium)* alliance which combined these characters. All such ferns lacking indusia he placed in the genus *Dictyopteris.* This was clearly an unnatural arrangement, as it separated species which were closely allied, and each of the two genera included a mixture of very different species. Van Alderwerelt van Rosenburgh followed Beddome's scheme.

Christensen and Copeland have included all these ferns, whether indusiate or not, in a large genus *Tectaria (Aspidium* of the original "Index Filicum"). This procedure is defensible, but the genus *Tectaria* in this broad sense is clearly composite. Both Christensen and Copeland have recognized the distinction of the genus *Heterogonium,* a genus which I have attempted to characterize more fully (Holttum *in* Sarawak Mus. J. 5: 156-166. 1949) ; but it seems to me that *Pleocnemia,* based on its original type species, is a far more distinct group. In my papers on the classification of ferns (see Holttum *in* Biological Reviews 24: 292. 1949), I have placed *Pleocnemia* in a separate section of the subfamily Teetarioideae. The distinguishing features of *Pleocnemia* are as follows:

Rhizome scales very narrow and usually twisted, margins finely toothed with short horizontal teeth. *Vascular strands* in stipe more numerous than in *Tectaria,* with small accessory strands in addition to a single ring, and additional large strands on the adaxial side also. *Fronds* bipinnate-tripinnatifid, the basal basiscopic pinnules of basal pinnae much enlarged; a tooth present at the base of each sinus between lobes, the tooth pointing out of the plane of the frond. *Veins* anastomosing in costal, sometimes also costular, areoles, the rest free. *Hairs* on upper surface of rachis stiffly erect, not crisped; costae and costules glabrous except for some hairs at bases of costae. *Glandular hairs,* usually yellow (more rarely red), frequently present on the lower surface of costules and veins; paraphyses with large cylindrical yellow glandular terminal cells (sometimes attached to the stalks of sporangia) present in the sori. *Sori* on free or anastomosing veins, round, with or without a reniform indusium.

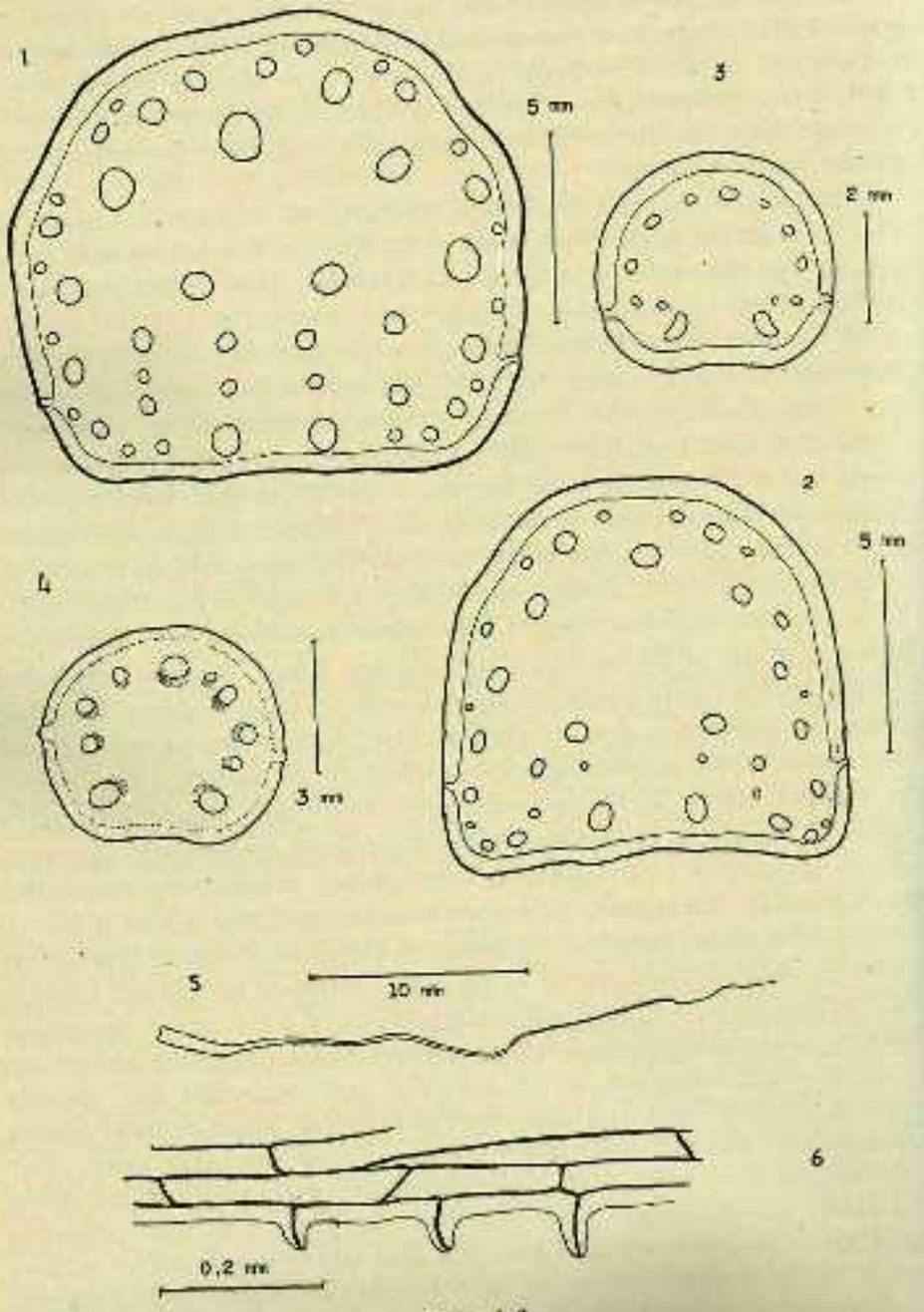
All these characters are shared by the type species of *Dictyopteris* Presl *(Arcypteris* Underwood), which only differs in its more complex venation and less branched fronds. It would be reasonable to unite *Pleocnemia* and *Arcypteris,* but they seem distinct enough to be readily recognizable, and I am not proposing the union at present. *Arcypteris* also has red glands in all specimens seen by me, whereas yellow glands are usual in *Pleocnemia.*

The pubescence of rhachis and bases of costae (and the almost glabrous conditions of costae and costules), and the presence of sinus-teeth not in the plane of the frond, are characters found also in *Pteridrys,* and I believe a relationship to *Pteridrys* is likely. But the rhizome scales of *Pteridrys* are quite different, being comparatively short and broad, without the marginal teeth.

Pleocnemia and *Arcypteris* thus differ from *Tectaria* in scales (figs. 5, 6), in vascular anatomy of stipe (figs. 1-4), in the presence of sinus-teeth, in the character of the hairs on rhachises, and in the presence of glandular hairs on veins and paraphyses or sporangia.

In Christensen's "Index Filicum," all Presl's species of *Pleocnemia* are reduced to one, *P. leuzeana,* and this treatment has since been customary. When studying the specimens collected in Malaya, however, I became convinced that three distinct species were represented, one with indusia and two without. In the Singapore Herbarium also were a number of specimens from Sumatra, Borneo, the Philippines, New Guinea and elsewhere, among which several other distinct species could be recognized. By the courtesy of the Keeper of the Herbarium at Bogor (Buitenzorg) 1 have been able also to examine the specimens from that Herbarium, which add much to my previous information. I have searched published descriptions for further possible species under *Tectaria, Aspidium, Pleocnemia, Dictyopteris* and other genera. The result is the present account of the genus, which is still not very satisfactory, as available information does not characterize all the species clearly. There may be much difference between small and large fertile fronds of the same species, and one needs to know the plants in the field to be sure how much Variation of this kind is possible. Plants of shady and more exposed places may differ in the width of leaflets; possibly also plants at different altitudes. Herbarium specimens, which always consist of parts of fronds, do not always indicate which parts; and it is not satisfactory to have to compare the upper pinnae of one specimen with the basal pinnae (or part of such) of another.

After recognizing (so far as possible) the separation into distinct species of the specimens available, one has to decide which of these species corresponds to the few early descriptions, so that the early names may be correctly assigned; The early descriptions do not always include information about the characters now considered important, so that reference to type specimens is desirable. I have not seen all the types, but by various kinds of evidence (indicated in the text) I hope I have arrived at a reasonable assignment of the early names.



FIGS. 1-6

I have recognized tentatively 15 species, but there may be some duplication. The distinctions between *P. hemiteliiformis* and *P. olivacea,* between *P. cumingiana, P. chrysotricha* and *P. porphyrocaulos* (none of which are here proposed as new) are rather uncertain. On the other hand, there are fragmentary further specimens which do not clearly fit any of the species here described. There is no doubt that careful collecting in the region from New Guinea sastwards and south-eastwards would add further species. Whether there are more in the western part of the distribution of the genus seems doubtful, but we still need further information of the field characters of our Malay Peninsula species.

A question raised by Rosenstock *(in* Fedde Rep. 10: 337) in describing varieties of *P. leuzeana* from New Guinea is the character of the spores, and .this has proved of great importance. I have examined the spores of all specimens which will yield them, and find that there are three types of spore (perhaps with transitions between them), and that the species can be grouped according to their spore characters. Some species have a much folded perispore with crisped anastomosing wings; this form is found mainly in Western Malaysia but it does extend to the Philippines. Other spores are covered with slender spines; this form is exclusively found in Eastern Malaysia and the Pacific. An intermediate spore form has many small flattened wings; this occurs mainly in the middle and eastern regions of Malaysia but has been found in Sumatra. It is interesting to note that a similar variation in the form of the perispore is found in such different groups as *Thelypteris-Cyclosorus, Lomariopsis* and *Elaphoglossum.* One cannot help wondering what its significance may be, and whether the spiny form is to be regarded as primitive or advanced; my own view inclines to the latter.

The species of *Pleoenemia* differ also in the abundance of the cylindrical yellow glandular hairs, both on the veins beneath and with the sporangia; such glands seem in some cases to be quite absent. One species from New Guinea has red glands, apparently almost spherical and resembling those of *Arcypteris (P. tripinnata).* I am not sure however that presence or absence of glands is a very reliable character upon which to base a distinction between species. Two fronds much alike in other ways

EXPLANATION OP FIGURES 1-6

FIGS. 1-6. — Fig. 1, *Pleoenemia conjugate/.* (Bl.) Presl, transverse section of stipe near base. — Fig. *2, Arcypteris irregularis* (Presl) Holtt., same. — Fig. 3, *Tectaria ungulata* (Willd.) C. Chr., same. — Fig. 4, *Tectaria multicaudata* (Wall.) Ching, same. — Figs. 5 and 6, *Pleoenemia conjugata* (Bl.) Presl; fig. 5, a single scale; fig. 6, edge of 5, enlarged.

may differ strikingly in abundance of glands, and the shrivelled glands on some old fronds are not easy to recognize.

Other visible characters which vary from species to species are the width of the pinnules, depth of lobing, width of the lobes, teeth on edges of lobes, hairs on edges of lobes, width of sinus and shape of its base, shape of sinus-teeth, extent of anastomosis of veins, contraction or not of fertile pinnules, and position of sori. In comparing these characters in different specimens, one must so far as possible compare the same parts of fronds. The most satisfactory comparison is between the basal pinnules of sub-basal pinnae. The difference between the size, spacing and venation of the lobes of sterile and fertile pinnules is also significant.

In the citation of specimens, S indicates the Singapore Herbarium^ B the Bogor Herbarium, and B.M. the British Museum.

KEY TO THE SPECIES OP PLEOCNEMIA

1- Perispore forming continuous crisped anastomosing wings
  2. Sori indusiate . . . . . 1. *P. conjugata*
  2. Sori not indusiate
    3. No glands with sporangia; bases of pinnules not widened
      4. Fertile pinnule lobes commonly 2.5 mm wide, sparsely fringed with short hairs; sori often confluent; costular areoles several. 2. *P. hemiteliiformis*
      4. Fertile pinnules wider, not fringed; sori not confluent; costular areoles few. . . . . 3. *P. olivacea*
    3. Glands with sporangia present; pinnules conspicuously widened to base, lowest lobes with lobed margins. . . . . 4. P. *winitii*
1- Perispore forming many small separate wings
  5. Sori indusiate
    6. Pinnules narrowly acuminate; lobes falcate acute; veins not glandular on lower surface. . . . . 5. P. *acuminata*
    G. Pinnules shortly tipped; lobes not acute, veins conspicuously glandular on lower surface. . . . . 6. P. *pleiotricha*
  5. Sori not indusiate
    7. Pinnules lobed 3/4or more to the costa; sinuses 2—3 mm wide above the base; teeth 1 mm wide, very blunt. . . . . 7. P. *presliana*
    7. Pinnules lobed less than % to costa; sinuses much narrower; teeth much narrower. . . . . 8. P. *leuzeana*
1- Perispore consisting of many slender spines
  8. Sori not indusiate
    9. Pinnules lobed about half-way to costa. . . . . 9. *P. dimidiolobata*
    9. Pinnules pinnate at base (at least lower ones) . . . . . 10. P. *tripinnata*
  8. Sori indusiate
    10. Whole frond 30—35 cm long (excluding stipe). . . . . 11. P. *kingii*
    10. Whole frond much larger
      11. Pinnules hardly over 2 cm wide

      12. Fertile lobes crenately toothed; sori quite covering them . . . . . 12. *P. seranensis*
      12. Fertile lobes lobed; sori small, one to each lobe. . 13. P. *chrysotricha*_
    11. Pinnules commonly 2.5—3 cm wide, sometimes wider
      13. Largest pinnae not bipinnate at base, pinnules usually not over 3.5 cm wide. . . . . 14. P. *cumingiana*
      13. Largest pinnae fully bipinnate at base, pinnules to 5 cm wide at base . . . . . 15. P. *porphyrocaulos*

1. P. CONJUGATA (Bl.) Presl.—Fig. 1, 5-7, 9

Aspidiurn conjugatum Bl., Enum. PL Jav. 169. 1828.
(Bl.) Presl, Epim. Bot. 259. 1849. — *Pleocnemia conjugata*
Pleocnemia javanica Presl, Epim. Bot. 50. 1849.
Pleocnemia leuzeana quoad Hook. & Bauer, Gen. Fil. *pi. 97 figs. 1,* only.

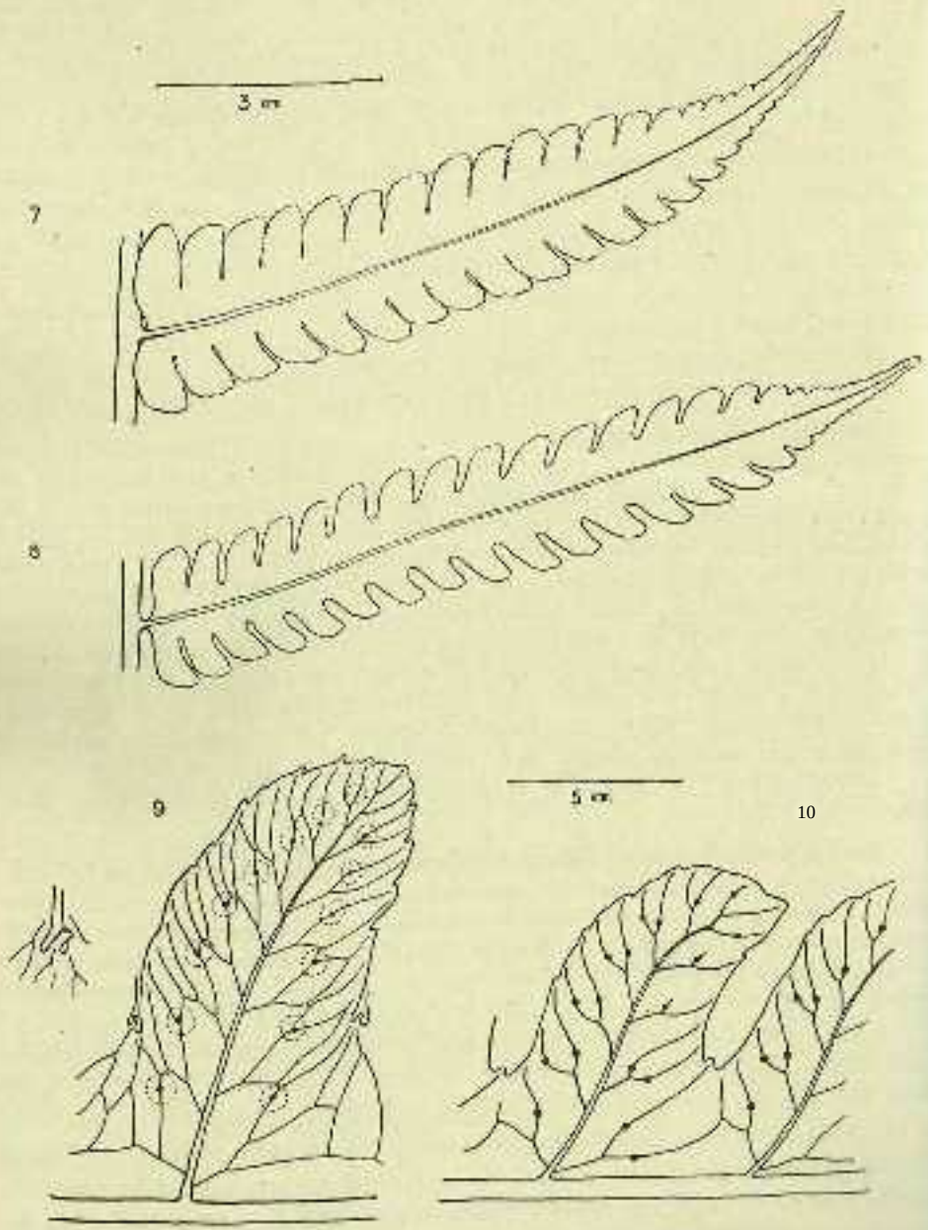
Stipes to at least 120 cm long; scales commonly 1 mm wide at base, narrowing upwards, to 4 cm or more long; fronds to at least 120 cm long and 100 cm wide; largest sub-basal pinnae to 70 cm long and 25 cm wide; largest pinnules of such pinnae sessile, 8—13 cm long, 1.8—2.3 cm wide, lobed rather more than half-way to costa; lobes 5—6(—7) mm wide, oblique, with falcate costules, edges toothed towards apex, sinuses very narrow; costules and veins sometimes bearing yellow or orange oblong glands on lower surface; costal areoles present, costular areoles near base only; sori about half-way between costule and edge of lobe, the lower ones sometimes nearer the edge, rather large, upper ones often touching; indusia persistent, glabrous, brown; spores with convolute perispore forming anastomosing wings, light brown; glands present in sori.

DISTRIBUTION. — Sumatra, Malaya, Borneo, Java, Bali, Flores, Philippines (Cavite).

Blume's original description of *Aspidium conjugatum* was as follows:

Aspidium fronde tripinnatifida quinquangulari (pinna infima conjugata) membranacea glabriuscula, pinnulis sessilibus subcordato-lanceolatis acuminatis pinnatifidis, superioribus confluentibus, laciniis falcato-ovatis obtusis serrulatis, sinibus unidentatis, soris marginalibus, rachibus costisque puberulis. Crescit in sylvis Moluccarum.

I have seen two specimens from Blume's herbarium, one kindly lent by Prof. H. J. Lam from the Rijksherbarium, Leiden, the other at Kew. Both are sterile, but agree vegetatively with the specimens here ascribed to the species. The Leiden specimen bears the locality Banda, but on a label separate from Blume's label. Blume must surely have had another, fertile specimen. But his words "soris marginalibus" are curious, as no *Pleocnemia* has marginal sori. I have little doubt that Blume's specimens belong to the same species as those above described, but if a fertile specimen should be found, and this should differ in spores or sori from my



FIGS. 7-10. — Figs. 7 and 9, *Pleocnemia conjugata* (Bl.) Presl, cult. Singapore; fig. 7, one pinnule; fig. 9, part of fig. 7, enlarged and, at left, sinus-teeth with adjacent venation. — Figs. 8 and 10, *Pleocnemia oliveacea* (Copel.) Holtt., King's collector 2038; fig. 8, one pinnule; fig. 10, part of fig. 8, enlarged.

description, the name P. *javanica* Presl will have to be used for the present species. I have seen at the British Museum a specimen of Zollinger 1459, upon which collection Presl based *P. javanica.* Vegetatively, and in spores and sori, it resembles the specimens I refer here to *P. conjugata.*

SPECIMENS EXAMINED. — SUMATRA. Sibolangit, 350 m, *Lorzing 6329* (B), 375 m, *Lorzing 6336* (B, S), 400 m, *Lorzing 5299* (B), 500 m, *Lorzing 5516* (B, S). Lampung: near Umbul Tabak, 10 m, *Posthumus lllU* (B); G. Trang, *Forbes 1599* (S). — MALAY PENINSULA. Cult. Singapore (S). Kedah: path to Baling Waterfall, *Best S.F.N.212W* (S). — PHILIPPINES. Indang, Cavite, *Copeland 1795* (S). — BORNEO. Colony of North Borneo. Tawao, *Elmer 20886, 21806* (B, S). Sarawak: Aug. 1884, *Hullett* (S); 1890, *Bishop Hose* (S). — JAVA. P. Panaitan (Prinsen-eiland) *Koningsberger {coll. Amdjah 27, 30)* (B). "Java Occ," *Ploem 16U37HB* (B). Near Batavia, 25 m, *Backer 32961* (B). Buitenzorg, 250 m, *Bakhuizen van den Brink f. 2697, 3667* (B). G. Pantjar, 800 *m, Bakhuizen van den Brink 6092* (B). G. Salak, 1897, *Raciborski* (B). Bandung, *Ploem 16471HB* (B). Nusa Kambangan, *Teysmann* (B), *Raciborski* (B), *Kostermans & van Woerden 159* (B). Kediri Res., Perigi, 5 m. *Backer 11899* (B). Pasuruan Res., G. Tarub, near Tiris, 550 m, *Posthumus 1689* (B). — B AWE AN: 100 m, *Posthumus 1313* (B). — BALI. G. Kelatakan, 320 m, *Sarip 161* (Exp. R. Maier) (B). — FLORES. Endeh, 20 m, *Rensch 950* (B). — CULTIVATED. *Hort. Bogor. II.K(VII).28* (B).

Var. elatior Holttum, *var. nov.*

Paleae 2—3 mm latae, stipites ad 180 cm longi, frondes aequilongae, pinnulae pinnarum sub-basalum ad 22 cm longae, 5 cm latae, % versus costam lobatae, lobi crenati, 7—8 mm lati, sori in lobis maximis inframediales.

TYPE. — Sumatra, Singgalang, 5000 ft., Matthew 512 (B).

The other specimens are none of them quite so large as the type, and show conditions intermediate between the type and normal *P. conjugata.*

SPECIMENS EXAMINED. — SUMATRA. G. Dempo, 3500 ft. and higher, *C. J. Brooks 15901* (B). Singgalang, 5000 ft., *Matthew 512 (type,* B). — JAVA. Kloof van de Salak, *Bakhuizen van den Brink 6303* (B). Tjadas Malang, near Tjidadap (Priangan Res.), 1000 m, *Winckel 1889fj* (B).

2. P. hemiteliiformis (Racib.) Holttum, *comb. nov.*—**Fig.** 11.

Pleocnemia leuzeana var. *hemiteliiformis* Racib., Fl. Buitenz. 1: 194. 1898 *("hemiteliaeformis"). — Dictyopteris hemiteliiformis* (Racib.) v. A. v. R., Bull. Buitenz. II No. 11: 7. 1913.

Dictyopteris compitalis v. A. v. R., Bull. Buitenz. III 5: 194. 1922.

Stock to 50 cm tall; scales to 5 cm long and 3 mm wide; fronds to about 150 cm long; largest sub-basal pinnae commonly to 60 by 15—20 cm; pinnules usually not over 15 mm wide (exceptionally to 20 mm), drying red-brown on the upper surface (especially the costae) and paler beneath, lobed about 2/3 to the costa; lobes subentire, bearing short multicellular hairs on their edges, sterile lobes about 4 mm wide, fertile

commonly 2.5 mm wide or sometimes wider, varying in obliquity to the costa; width of sinus between lobes less than width of lobes, widest in fertile pinnae, teeth at base of sinuses sometimes lacking in wider ones; veins with narrow costal areoles and additional areoles between these and the sinus; costular areoles also usually present; sori almost covering the lower surface of fertile lobes when these are not over 2.5 mm wide; no indusium, no glands with sporangia nor on surface of lamina; spores with winged perispore, wings anastomosing.

DISTRIBUTION. — Java, Celebes, Sumatra, Malaya, at about 3500—4500 ft. elevation (except specimen from Kedah).

TYPE. — From Gunung Salak in Java (B).

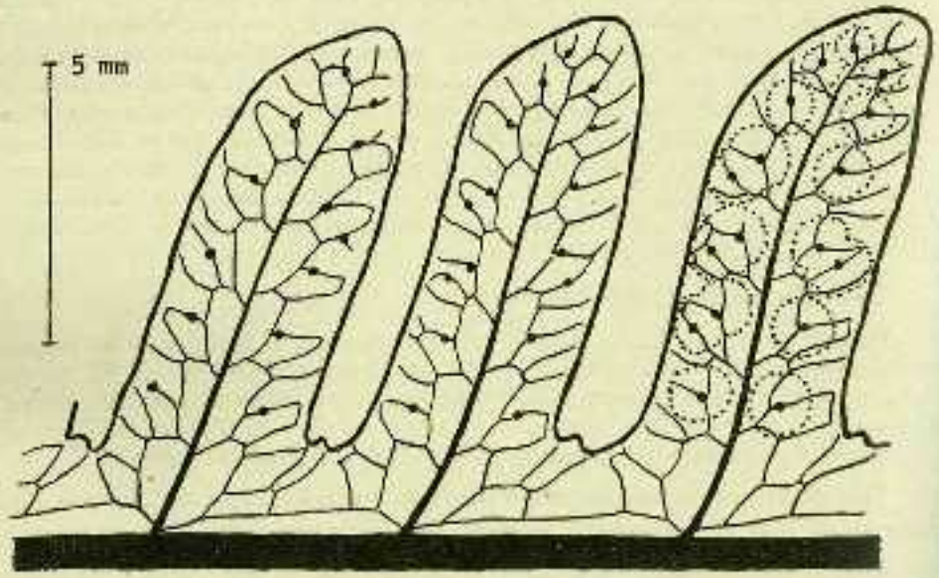


FIG. 11, *Pleoenemia hemiteliiformis* (Racib.) Holtt., S.F.N.3503:7, venation and position of sori; outline of sori shown on right hand lobe.

The type specimen of *Dictyopteris compitalis* has no indication of the reduced auriculiform pinnae on the stipe mentioned by the author. It only differs from typical *P. hemiteliiformis* in having superficial glands and in lacking marginal hairs; but another specimen from the same locality (Lorzing 6380), also referred to *D. compitalis* by Van Alderwerelt van Rosenburgh, has marginal hairs. See also remarks under *P. olivacea*. Kjellberg's specimen from Celebes also lacks marginal hairs.

SPECIMENS EXAMINED. — JAVA. G. Salak, *Raciborski (type,* B). G. Malang, *Raciborski* (B). Tapos, Gede Pangrango Mts., N slope, 900 m, *Donk "9"* (B). Priangan Res.: Tjadas Malang, near Tjidadap, 1000 m, *Winckel 168.9β* (B) ; G. Beser, near Tjidadap, 1200 m, *Bakhuizen van den Brink f. 2792* (B). — SUMATRA. Sibolangit, 800 m, *Lorzing 4330, 6378 (type* of *Dictyopteris compitalis), 6380* (B). Bataklands, Pea Radja, *Winkler (Rosenst., Fil. Sum. Exsic No. U7)* (B). — MALAY PENINSULA. Kedah. G. Lang, 700 ft., *Kiah S.F.N.35037* (B, S). Pahang. Cameron Highlands, 4500 ft., *Holttum S.F.N.31373* (B, S). Fraser's Hill, Sept. 17, 1923, *Holttum s.n.* (S). Perak. Birch's Hill, 3800 ft., *Burkill S.F.N.12988* (S). — CELEBES. Tuljambu, 800 m, *Kjellberg 1766* (B). — CULTIVATED. *Hort. Bogor II.K(X).S9,* in part (rest is *P. winitii;* B).

3. P. olivacea (Copel.) Holttum, *comb.nov.*—Fig. 8, 10.

Tectaria olivacea Copel. *in* Philip. J. Sci. 9 C: 228. 1914.

Original description: "Stipite fere 1 cm crasso, deorsum paleis filiformibus rufocastaneis crinitis densissime vestito, sursum nitido, castaneo; fronde magna, rachibus nitidis; pinnae infimae desunt; sequentibus ca. 60 cm longis, . 20 cm latis, brevistipitatis, acuminatis, (pinnulis) inferioribus stipitatis, basi eordato truncatis, 1.5 cm latis, ultra mediam laminam pinnatisectis, glabris papyraceis, superne castaneo viridibus, subtus olivaceis; lobis falcato oblongis, obtusis, integris, venis inconspicuis, interdum more Pleocnemieae seriem unam areolarum efformantibus, saepius areolas irregulares paucas margini vel sinu propriores includentibus, soris medialibus, utroque latere costulae 5—7, nudis." Lebong Tandai, Benkoelen, Brooks 172.

This species is very near to *P. hemiteliiformis,* and perhaps the two should be united. According to the present interpretation, it seems that *P. olivacea* has usually broader thinner pinnules and the veins in the lobes mostly free, and it also lacks the marginal hairs of *P. hemiteliiformis.* In Malaya, the specimens assigned to *P. olivacea* are from the lowlands; they have thinner texture and broader pinnules than *P. hemiteliiformis,* and the pinnules are slightly stalked. It may be that *P. olivacea* is only the lowland form of *P. hemiteliiformis,* and differences in texture may in part be due to differences of exposure to sun. Specimens referred to *P. olivacea* at present are:

SPECIMENS EXAMINED. — SUMATRA. Sibolangit, 400 m, *Lorzing 6310* (B). — MALAY PENINSULA. Perak: without locality, *Scortechini;* Gopeng, *King's collector 720;* Larut, 300—500 ft., *King's collector 2058, 2093* (**all** S). Singapore. Bukit Timah, *Matthew* (S). Pahang. Ulu Chineras, Kuala Lipis, 300 ft., *Burkill S.F.N.17090* (S). — BORNEO. Colony of North Borneo. Mt. Kinabalu: near Lobang, 4000 ft., *Holttum S.F.N.25545* (B, S) ; *Clemens 27578, 28749, 28852, 29111* (B) ; Kiau, 1915, *Clemens 10241* (B). Sarawak: *Bishop Hose* (S).

4. P. winitii Holttum, *sp. nov.*

Stipites ad 100 cm longi, paleae ad 1.5 mm latae; frondes circa 120 cm longae; pinnae sub basales circa 60 cm longae; pinnulae inferiores 10—11 cm longae, breviter stipitatae, basi dilatatae, fere ad costam lobatae et interdum 3 cm vel ultra latae, lobi inferiores marginibus lobulati, lobi

superiores dentati; lobi basi 4—5 mm lati, sinus circa 2 mm lati, dentes sinuum distincti; areolae prope costulas paucae; venae glandulis luteis copiosis ornatae; sori mediales, exindusiati, glandulis copiosis instructi; sporae perisporio convoluto vestitae.

TYPE. — Thailand, Lampang, 3000 ft, 24 Feb. 1922, Winit 36. (S).

This is nearly related to *P. olivacea,* but seems to be distinct in the shape of the bases of the pinnules. There is however much variation in the width of these bases in different specimens; in the type they are very wide. It seems that this species occupies an area immediately north of Malaya. It would be interesting to know.the origin of the specimens cultivated at Bogor.

SPECIMENS EXAMINED. — ANNAM. Prov. de Quang-Binh, *Cadiere 57* (B, S). — HAINAN. Kap Kao, Kachek, 1000 ft., *Eryl Smith 1U5* (S); Pak Shik Ling, Ching Mai District, *Lei 267* (B, S). — THAILAND. Lampang, 3000 ft., *Winit 36 (type,* S). — ASSAM. Durmia Khal, Cachar, March 188»; *G. Mann* (B, S). Without locality, *Masters* (B). — CULTIVATED: *Hort. Bogor. II.K(X).S9,* in part (rest is *P. hemiteliiformis;* B).

5. P. acuminata Holttum, *sp. nov.*

Paleae circa 4 cm longae, 2 mm latae; pinnae sub-basales circa 65 cm longae, longe acuminatae; pinnulae fertiles maximae haud stipitatae, 10 cm longae, 15—18 mm latae, 3/4 ad costam lobatae; lobi falcati, acuti, basi circa 4.5 mm lati, sinus circa 1 mm lati, dentes sinuum pauci; lamina f irma, glandulae nullae, areolae prope costulas paucae; sporae alis multis parvulis vestitae.

TYPE. — Sumatra, bank of Bentimus R., NW of Sibolangit, 350 m, Lörzing 5644 (B, 4 sheets).

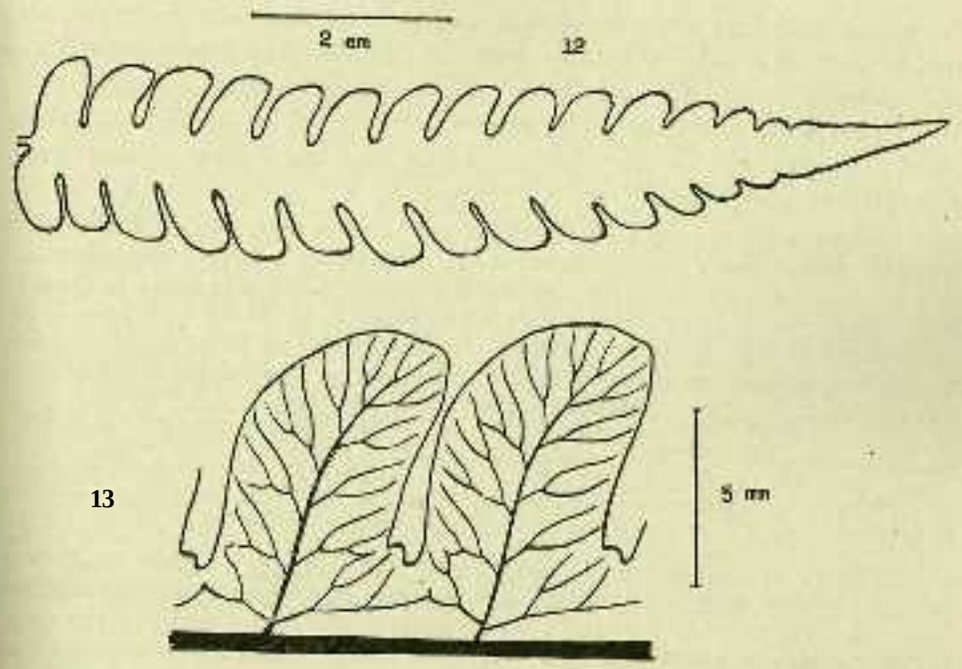
This is very like *P. conjugata,* but differs in the form of the spores, and also in the very firm texture and acuminate pinnules with acute falcate lobes. Further material from Sumatra should be studied.

6. P. pleiotricha Holttum, *sp. nov.*—Figs. 12, 13.

Pinnulae maximae circa 11 cm longae, 2.2 cm latae, stipitatae, 2/3—3/4 costam versus lobatae; lobi 4—6 mm lati, apice rotundati, sinus circa 2 mm lati, dentes sinuum inferiorum obtusissimi; lamina tenuis; areolae prope costulas paucae; venae glandulis luteis cylindricis multis vestitae; sori exindusiati; stipites sporangiorum glandulis luteis ornati; sporae alis multis parvis vestitae (?).

TYPE. — North Borneo, Tawao, Elmer 21421 (S; dupl. in B).

In general aspect, this is not far from *P. olivacea,* but its very copious yellow glands and broader sinuses seem distinctive, as also probably the spores, but the latter are not well shown by the specimens available.



FIGS. 12-13, *Pleocnemia pleiotricha* Holtt.; fig. 12, pinnule of type; fig. 13, part of fig. 12, enlarged.

SPECIMENS EXAMINED. — PHILIPPINES. Mindanao. Todaya (Mt. Apo), *Elmer 105U7* (sterile, B). — BORNEO. Colony of North Borneo. Tawao, *Elmer 21A21 (type,* S; dupl. in B, 2 sheets).

7. P. presliana Holttum, *sp. nov.*—Figs. 14, 15.

Pinnulae maximae 14—25 mm latae, 3/4 versus costam lobati, apice acuminatae; lobi obliqui, falcati, crenati, circa 4 mm lati; sinus inferiores 2—3 mm lati, dentes sinuum inferiorum lati obtusi, sinuum superiorum triangulares, acuti; costae venaeque infimae glabrae; sori exindusiati, mediales; sporae alis multis parvis vestitae.

TYPE. — Luzon, Cagayan Prov., Mt. Bawa, Bur. Sci. 78717, Edano (S, B).

Presl cited Cuming nos. 107 and 33 as *Pleocnemia cumingiana,* but both specimens of the latter number which I have seen are different from those of 107, which seem to me to agree best with the description of Presl's species. The specimens no. 33 differ not only in general aspect, but in spores. On Cumming's no. 33 in the Singapore Herbarium is written "tree 20 feet high." This statement, in a latinized form, is quoted by Presl after the description of *P. cumingiana.* It is hardly possible that the

fronds of this fern are 20 feet tall, and it is certain that the trunk was not so high; I wonder therefore whether the note has got misplaced and should have belonged to another of Cuming's specimens.

P. presliana has pinnules which are more shortly acuminate than those of *P. cumingiana,* and the lobes are closer and more oblique; the spores are different, and the sori lack indusia.

SPECIMENS EXAMINED.— PHILIPPINES. Palawan. Mt. Gantung, *Edaño B.Sci. 77969* (S, young plant) ; Imolnod, *Edaño B.Sci.77922* (B, S). Leyte. Palo, *Elmer 7062* (B). Mindanao. Surigao Prov., *Ramos & Pascasio 34557* (S). Luzon. Cagayan Prov., Mt. Bawa, *Edaño B.Sci.78717 (type,* S; dupl. in B). Without locality: *Cuming 33* (S, B.M.). — NEW GUINEA. Hollandia, 100 m, *Gjellerup 133a;* Gutta Percha Expedition 1901-1902, *Schlechter 14.096* (B) ; Papua, *C.King 321* (B). — JAVA. Besuki Res., G. Idjen, 1000 m, *Posthumus 3791* (B).

8. P. LEUZEANA (Gaud.) Presl

Polypodium leuzeanum Gaud., Preyc. Voy. Bot. 361 *t. 6.* 1827. — *Pleocnemia leuzeana* (Gaud.) Presl, Tent. Pterid. 183 *pi. 7 fig. 12.* 1836.

Similar in aspect to *P. conjugata,* but without indusia, and with spores covered with many small wings; pinnules lobed 2/3 to 3/4 towards costa, sinuses narrow (hardly 1 mm wide), lobes 5 mm wide at the base, slightly toothed, costule falcate, ends of lobes rounded; no conspicuous glands on veins, but such glands present in the sori.

I have seen a specimen from the type collection, at Kew. The other specimens cited below, all from the Bogor Herbarium, agree well with it. The species has the aspect of *P. conjugata,* but the spores of *P. presliana.*

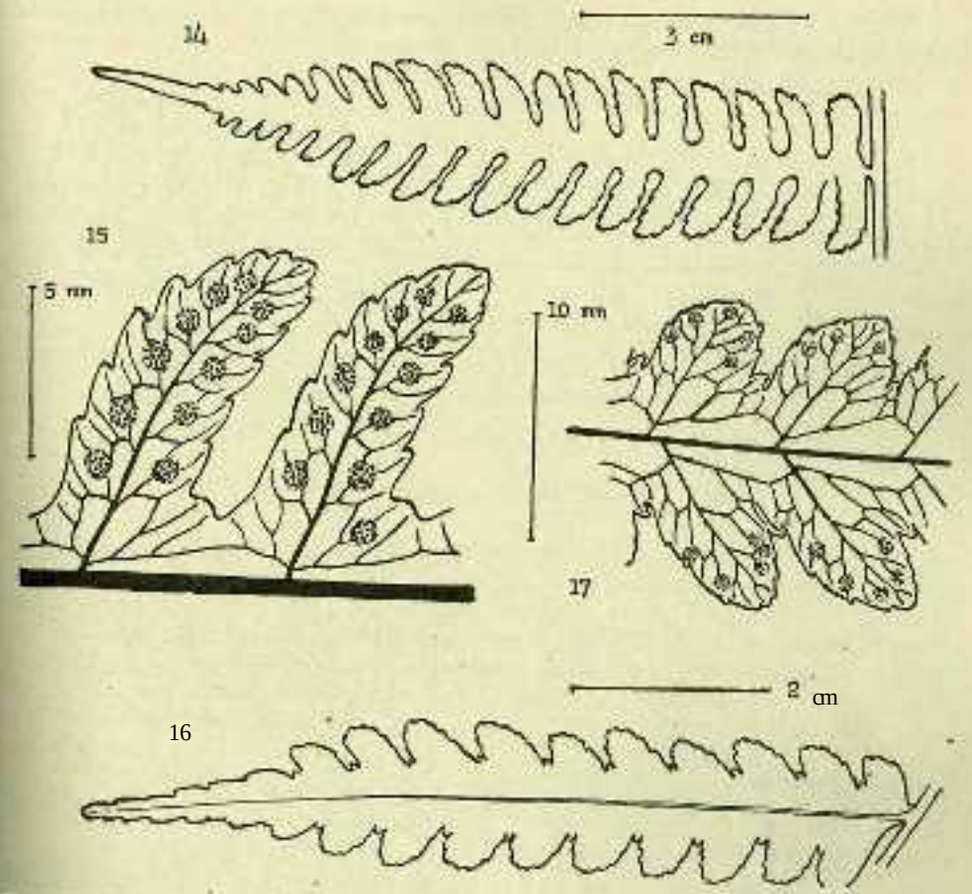
SPECIMENS EXAMINED.— BATJAN: *Teysmann* (B). — TERNATE. Tabahawa, 250 m, *Begum 963* (B). — AMBOINA: *C. J. Brooks 17781* (B) ; 1893, *Treub* (B); *Teysmann* (B).___• BURU: *Teysmann* (B). — ALOR: 200 & 300 m, *Jaag 674, 686* (B).___NEW GUINEA. Papua, *C. King 143* (doubtful; B).

9. P. dimidiolobata Holttum, *sp. nov.*—Figs. 16, 17.

Stipites vulgo 80 cm longi (fide Brass); paleae circa 2 cm longae, haud 1 mm latae; fftondes circa 130 cm longae, fere 100 cm latae (fide Brass) ; pinnulae circa 8 cm longae, 1.5 cm latae, obliquae, dimidio costam versus lobatae; lobi Irotundati, dentes sinuum magni; sori exindusiati; sporae pallidae, spinosissimae.

TYPE.___Solomon Islands, San Cristoval, Waimamura, Brass 2648 *(B)*

This appears to be a very distinct species. The dimensions of the frond and stipe above quoted are given by Brass, but the specimen seen is smaller, the largest pinna in it being 35 cm long. It is therefore possible that larger pinnae may have longer pinnules, but I do not think the cutting



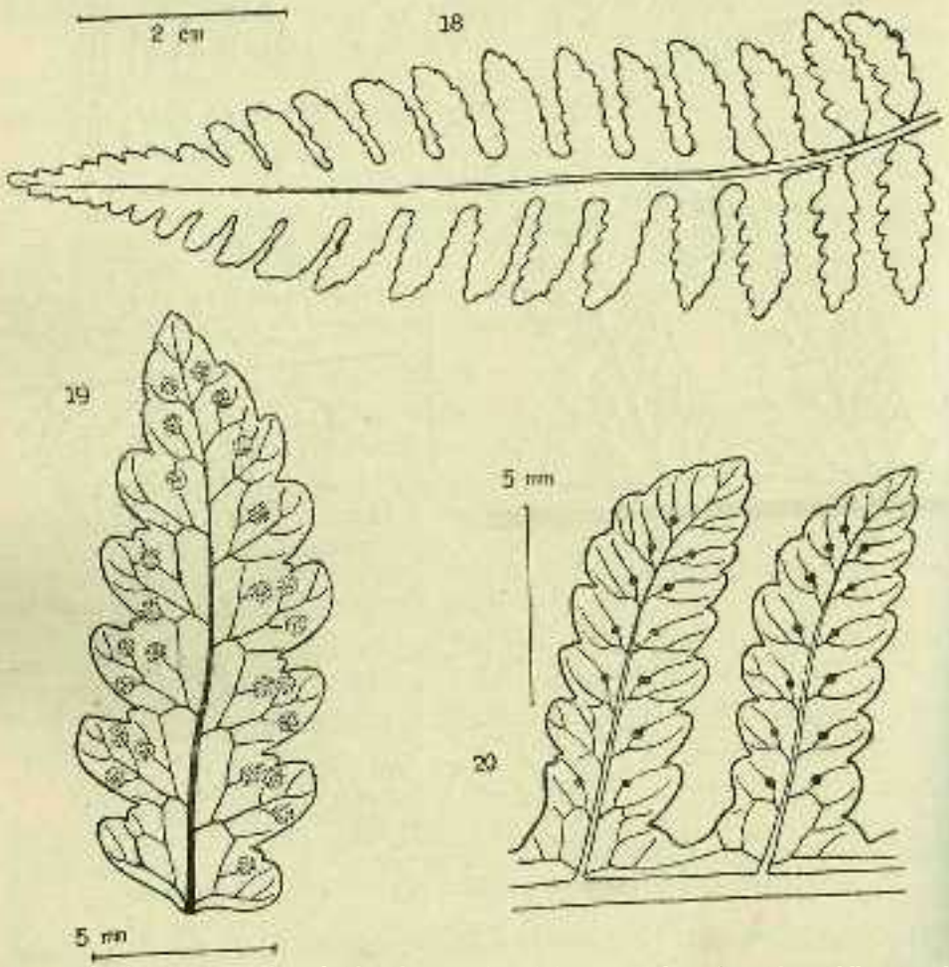
FIGS. 14-16. — Pigs. 14 and 15, *Pleocnemia presliana* Holtt.; fig. 14, pinnule of Cuming 33 (S) ; fig. 15, part of fig. 14, enlarged. — Figs. 16 and 17, *Pleocnemia dimidiolobata* Holtt.; fig. 16 pinnule of type; fig. 17, part or fig. 16, enlarged.

of the pinnules would be very different. A somewhat smaller specimen from New Guinea (Docters van Leeuwen 11223, Mamberamo) also appears to belong to this species.

10. P. tripinnata Holttum, *sp.nov.*—Figs. 18, 19

Pinnae ad 60 cm longae, forsan ultra; pinnulae ad 10 cm longae et 3.5 cm latae, breviter acuminatae; pinnulae infimae basi pinnatae; lobi basales pinnularum superiorum adnati; foliola ordinis tertii ad 2 cm longa et 7 mm lata, dimidio costulam versus lobata, lobi integri, dentes in sinibus parvi obtusi; areolae uniseriatae solum, prope costulas foliolorum; lobi pinnularum superiorum ad 5 mm lati, margine leviter lobati; sori exindusiati, glandulis rubris instructi; sporae spinulosae.

TYPE.—New Guinea, Iter Lauterbachianum primum, 1889-1891, Lauterbach 560 (S). [Dupl. in B.—Editor.]



18 20 — Figs 18 and 19, *Pleocnemia tripinnata* Holtt.; fig. 18, middle pinnule of type fig. 19 a basal leaflet from fig. 18, enlarged. — Fig. 20, *Pleocnemia enmin-giana presl,* part of Cuming 107 (sf, showing position of attachment of son.

11. P. KINGII (Copel.) v. A. v. R.

Tectaria kin/ii Copel. *in* Philip. J. Sci. 9 C: 4. 1914. - *Pleocnemia kingii* (CopeU v. A. v. R., Handb. Suppl. 147. 1916.

Original description: "Pleocnemia parva, gracile, deltoidea; stipite 4 cm alto castaneo, deorsum paleis anguste linearibus 1 cm longis sparsis vStito ; fronde 30-35 cm alta et lata, deltoidea, tripinnata; pinnis in-Snis deltoideis, sequentibus 1-3-paribus profunde bipinnatifidis, superiorum profunde pinnatifidarum segmentis lanceolatis obtusis pinnatifidis deinde serratis, supremis integris; venis tomentellis, lamina superne glaberrima, inferne fere glabra; venis more *T. leuzeanae* anastomosantibus; soris parvis, multis, plerisque submarginalibus; indusio persistente.

"Woodlark Island, King 402.

"Distinguished from *Tectaria subaequalis* . . . *(Aspidium subaequale* Rosenst., Fedd. Rep. 13 (1913) 176) by the form of the frond, and from this and other related species by the fine dissection of the frond. The color is that of *T. leuzeana."*

I have not seen the type of this species, nor any specimen which could be ascribed to it. I think it may be fairly inferred from the description that this is a true *Pleocnemia,* though the sinus-teeth are not mentioned; but it should be noted that *Aspidium subaequale* Rosenst., from which the author distinguishes *P. kingii,* is not a *Pleocnemia.*

12. P. seranensis Holttum, *sp. nov.*

Pinnae ad 70 cm longae et 20 cm latae; pinnulae ad 12 cm longae, 16—20 mm latae, fere ad costam lobatae; lobi steriles ad 4 mm lati (prope basin) ; lobi fertiles 2.5—3 mm lati, crenati, sinibus aequilatis separati; sinus subapicales solum dentibus parvis latis instructi; areolae prope costam angustae, venae ceterae plerumque liberae; venae glandulis luteis cylindricis (marcescentibus brunneis) copiose instructae; sori indusiati, superficiem inferiorem laminae fere totam occuludentes; sporae dense spinulosae.

TYPE. — Ceram (Seran), N of Lower Kawa (Beneden Kawa), 200—300 m, Rutten 1850 (B, dupl. in S).

This was distributed from Bogor (Buitenzorg) as *Dictyopteris hemiteliiformis,* but it is distinctly indusiate, and the spores are quite different.

13. P. chrysotricha (Baker) Holttum, *comb. nov.*

Nephrodium chrysotrichum Bak. *in* Ann. Bot. 5: 328. 1891.

Original description: "Frond ample, decompound, moderately firm, furnished on the rachises and ribs beneath with short bright yellow hairs. Lower pinnae oblong-lanceolate, 1—1 1/2 ft. long, 6—8 in. broad; pinnules lanceolate, sessile, 1/2—3/4 in. broad, cut down to a broad wing into pinnatifid tertiary segments with oblong lobes. Upper veins forked, lower forming an arch. Sori small, one in each final lobe. Indusium persistent, glabrous. Samoa, *Whitmee."*

I have seen the type of this at Kew. It comes near *P. cumingiana,* but is probably distinct in its narrower pinnules with much narrower sinuses. The largest pinnules on the type are about 10 by 2 cm; the sinuses

are not over half the width of the lobes; there are many narrow cylindrical glands; the spores are spiny.

14. P. CUMINGIANA Presl.—Fig. 20

Pleocnemia cumingiana Presl, Epim. Bot. 50. 1849.
Pleocnemia leuzeana quoad Hook. & Bauer, Gen. Fil. *pl. 97 figs. 5-6 only.*

Pinnules commonly about 14 by 2.5—3 cm, sometimes to 20 by 4 cm, long-acuminate, lobed almost to the costa, lobes 3—5 mm wide, crenate (sometimes lobed again half-way to the costule), the fertile ones separated by sinuses 3—5 mm wide, sinuses of sterile pinnules often narrower; a narrow costal areole present and sometimes no other anastomosis, the lateral veins in the lobes commonly once forked with sorus on the acroscopic branch, sometimes twice forked with occasional anastomosis; costae and veins beneath bearing short appressed unicellular hairs which are sometimes bright yellow; sori indusiate, indusia persistent; spores pale yellowish, densely spiny.

Under this species, Presl quoted Cuming no. 107 and also no. 33. As noted under *P. presliana* (p. 183), the specimens of no. 33 which I have seen differ from those of no. 107. I believe that Presl's description agrees best with no. 107, and in view of this, and of the fact that he cited no. 107 first, I have taken that number as the type, and have given the specimens of no. 33 a new name. The above description is based on the specimens cited below.

Presl's original description of *P. cumingiana* is as follows:

Pinnis ultra medium pinnatifidis longe angustato-acuminatis laciniis linearibus falcatis pinnarum inferiorum rotundato-dentatarum sinu late rotundato, superiorum dente ovato obtuso interstinctis, acumine moniliformi obtuse dentato, rachibus costisque subtus planis puberulis, venis remotiusculis, sori medio venularum affixis.

SPECIMENS EXAMINED. — PHILIPPINES: *Cuming 107* (S, B.M.). Luzon. Pampanga Prov., Camp Stotsenburg, *Elmer 22658* (B, S). Prov. of Laguna, Los Baños (Mt. Maquiling), *Elmer 17759* (B). Sorsogon Prov., Irosin (Mt. Bulusan), *Elmer 14980* (B). Mindanao. Davao Distr., Todaya (Mt. Apo), *Elmer 10682* (B); Mati-Iukui River, *Ramos & Edaño B.Sci.88683* (B). Negros. Prov. of Negros Oriental, Dumaguete (Cuernos Mts.), *Elmer 10097* (B). Catanduanes. *Ramos & Edaño B.Sci.75953* (B). — SOLOMON IS. San Cristoval, Huro River, *Brass 2637* (B). — SAMOA. Upolu, *Reinecke 90* (B), 1880, *K. Betche* (S). — NEW GUINEA. Nassau Mts., 700 m, *Docters van Leeuwen 10665* (?).

15. P. PORPHYROCAULOS v. A. v. R.

Pleocnemia porphyrocaulos v. A. v. R. in Bull. Buitenz. III 5: 215. 1922.

Base of stipe 3 cm or more thick, very dark shining purplish when dry; scales copious, to 1 mm wide at the base. Largest pinnae 135 cm long; pinnules to 25 cm long and 5 cm wide at the base, pinnate for

half this length; smaller pinnules deeply pinnatifid to the base; third order leaflets of largest pinnules to 30 by 8 mm, lobed half-way to the midrib, with a row of areoles along the midrib, and 2 or 3 sori on each lobe; pinnatifid pinnules with falcate toothed lobes about 3 mm wide separated by more than their own width; no red or yellow glandular hairs seen either on surfaces or in sori; sori indusiate; spores light brown, copiously spiny.

This is very near P. *cumingiana*, chiefly- differing in its large size, and I am doubtful of a clear distinction between the two.

SPECIMENS EXAMINED. — TERNATE. Foramadiahi, in forest, alt. 800 m, *Beguin 1123 (type*, B). — CELEBES. Todjambol, 100 m, *Kjellberg 3513* (doubtful; upper part of frond; B.).