BLUMEA 21 (1973) 293—325

STUDIES IN THE FAMILY THELYPTERIDACEAE V.
The genus Pneumatopteris Nakai

R. E. HOLTTUM
Royal Botanic Gardens, Kew

I re-described this genus in Blumea 19 (1971) 42. The principal characters there enumerated are: rhizome-scales broad, thin, with marginal hairs (some bearing mucilage glands) but rarely superficial hairs; lower pinnae, usually several pairs, reduced, the transition to reduced pinnae abrupt or gradual; aerophores at bases of lower pinnae ± swollen and white on young fronds, sometimes much elongate; pinna-lobes with cartilaginous margins which are often toothed at the ends of veins; veins usually anastomosing but free in some species which have deeply lobed pinnae; lamina ± pustular when dried; lower surfaces never densely long-hairy, sometimes with short acicular or capitate hairs; sessile spherical glands lacking on lamina, indusia and sporangia; body of sporangium often bearing club-shaped or capitate hairs, rarely setae; on stalk of sporangium a hair of 3 or 4 cells, terminal cell enlarged but not spherical; spores light brown with many small thin ± quadrate wings, thus spinulose in aspect.

The majority of species here included in this genus conform to all the above characters, but there are some species which differ by showing one or two (rarely three) of the following characters: basal pinnae not or little reduced; scales on bases of stipes elongate and bearing many superficial hairs; spores with a ± continuous wing and anastomosing cross-wings. Almost all these aberrant species have distinctly pustular lower surface, and have the usual accompanying characters of rather thick veins and cartilaginous edges of pinna-lobes.

Probably the most aberrant species is *P. sandwicensis*, which has narrow hairy scales, no much-reduced basal pinnae, and spores with a continuous wing and some cross-wings. It also has peculiar thick hairs scattered on the upper surface of the lamina between veins. The only other Hawaiian species of *Pneumatopteris* is *P. hudsoniana*, which is in no way aberrant.

Another aberrant Pacific species is *P. costata*, with two near allies in eastern Malesia. These lack pustular thickenings and have spores with one continuous wing with cross-wings, but they have the stipe-scales typical of *Pneumatopteris* and capitate hairs on their sporangia. Their lower pinnae are gradually reduced, giving the aspect of *Christella*, with which they have been confused in herbaria.

P. afra, widely distributed in Africa, has a long-creeping rhizome and fronds that are only slightly pustular. A comparable rhizome is only known to occur in two other species assigned to this genus, in Java and Sumatra. *P. afra* is one of the few species examined cytologically, and is tetraploid. There are herbarium specimens which look like hybrids between it and *Thelypteris dentata* (Forsk.) E. St. John (genus *Christella* of my arrangement, l.c. 1971, p. 43) and one of them shows abortive spores. Dr. J. Ghatak of the University of Cape Coast, Ghana, informs me that he has found such a hybrid, with abortive spores

and irregular meiosis, growing in Ghana near plants of the two putative parents; the hybird can persist and spread because of its creeping rhizome. Dr. Ghatak also states that at meiosis a considerable number of pairs were formed, so that it is possible that *P. afra* and *T. dentata* (both tetraploid) have some common ancestry. Further experiments might provide more definite evidence.

The other aberrant species above mentioned have not been cytologically examined. They might also have a hybrid nature, and if tetraploid would be self-perpetuating. In any case, cytological examination of more species, and experimental hybridization, especially of the aberrant species, would probably provide new insights into the status of the genus in its relation to the other genera (or species-groups, for those persons who do not regard my groups as genera).

Spores with a continuous wing and cross-wings are characteristic of *Pronephrium* (see Blumea 20, 1972, 105—126), but spinulose spores, similar to those of *Pneumatopteris* and *Sphaerostephanos*, occur in some species of *Pronephrium*. There are also other indications of intergrading between *Pronephrium* and *Sphaerostephanos*. Such intergrading might occur between *Pronephrium* and *Pneumatopteris*, but I do not see any clear indication of it.

P. unita (Madagascar and Africa) has no reduced pinnae, spores with a continuous wing and a bud on the upper part of the rachis. But it has the broad scales and somewhat pustular fronds of *Pneumatopteris*, and (apart from the absence of small basal pinnae), shows a considerable resemblance to *P. pennigera* of New Zealand. *P. subpennigera* appears to be closely allied to *P. unita*, but the former has spores typical of *Pneumatopteris* and no bud on the rachis. If one or both these ferns are tetraploid, their inter-relations might be traced experimentally.

Manton found that a plant of *P. truncata* in Ceylon was tetraploid (Phil. Trans. R. Soc., B, 238: 138). No related species occurs there, and herbarium specimens are rather uniform, resembling closely specimens from Malaya. But in north India D. S. Loyal found that plants near Darjeeling were diploid (Proc. 48th Ind. Sci. Congr. Part III, 1961, 266—7). Dr. Loyal has kindly sent me a pinna from his dried specimen, and it matches several collections from Assam in Kew Herbarium. There ought to be another diploid; it may be found in the region from NE. India to southern China. Some indication of known variability in *P. truncata* is given below in the systematic part of this paper (species 45).

Throughout the Malayan region, and in the Pacific, there are local species which are clearly related to *P. truncata* but which are distinct in various combinations of characters: number and form of reduced pinnae, shape of lowest large pinnae, depth of lobing of pinnae, pubescence on frond and on indusia, presence or absence of capitate hairs on sporangia. When only a single specimen is known, one may query the significance of its peculiar assemblage of characters, but in many cases further specimens from the same neighbourhood have shown that the peculiar form is constant and distinctive. It would be possible to rank some such local taxa as varieties of *P. truncata*, but if one does this one finds it impossible to delimit an enlarged *P. truncata*. One cannot give an adequate account of the genus without taking such local taxa into consideration, and I think the best treatment is to regard them all as species (as indeed many are already so recognized).

Rhizome characters are always important, and unfortunately are often not recorded; they may serve to distinguish related species which grow in the same habitat, as *P. laeve* (creeping rhizome) and *P. microloncha* (erect caudex) among rocks by streams in the Philippines. For adequate description of species, it is also necessary to have information about all parts of a frond. Individual herbarium specimens rarely supply all necessary data,

and it is only be piecing together evidence from different specimens that one can arrive at a full description. This process has its limitations, and may lead to false conclusions. Fortunately I have seen the whole of some recent collections, and this has been a great help. I am particularly indebted to Mr. M. G. Price for excellent series of Philippine collections which have enabled me to understand Philippine species far better than would otherwise have been possible. Similarly the collections of Dr. T. G.Walker and Mr. A. C. Jermy in Celebes and New Guinea, Dr.W. A. Sledge in Samoa, Dr. A. F. Braithwaite in the Solomon Islands and New Hebrides, and Dr. G. Brownlie in Fiji have been of great value; also other collections of recent years of which I have seen representatives in various herbaria. I have examined, at various times, all specimens of Old World *Thelypteridaceae* in the following herbaria: Kew, British Museum, Leiden, Paris, Berlin, Utrecht, Geneva, Florence, Edinburgh, U.S. National Herbarium, Nairobi, Sydney, Brisbane, Lae, Bogor, Singapore, and Calcutta, and have received on loan at Kew types of specimens from other herbaria. To the Directors of all these institutions I express my grateful thanks, especially to Kew which has been my base of operations since 1954.

In Blumea 19 (1971) 42 I included *Pseudocyclosorus* Ching tentatively in *Pneumatopteris* (see remarks on p. 43, lines 21—25), but in the present account it is excluded. The differences are slight, but I believe distinctive, and there are differences in distribution. *Pseudocyclosorus* is almost confined to mainland Asia, with an extension into Africa; it is absent from the Malay Peninsula and is only represented in Malesia by *P. tylodes* (Kunze) Ching in northern Luzon. I here include in *Pneumatopteris* three free-veined species of New Guinea which in 1965 I placed in *Pseudocyclosorus*. Two of them (*P. caudata* and *P. excisa*) are certainly closely related to *P. ligulata* and *P. keysseriana*, having a thin lamina which is pustular when dried; the third *(P. petrophila)* is related to *P. costata*.

Descriptions of individual species in the present paper are brief, but I have tried to indicate what are the important characters; these have often been omitted from earlier publications. I have not cited all earlier published descriptions because few are satisfactory. As regards synonymy, I have cited place of publication of all basionyms, including those regarded as synonyms.

I have cited also the types of all basionyms, and have seen them all except in the few cases where the contrary is indicated, but descriptions have sometimes been amplified by addition of details from other specimens which I believe to be conspecific with the types. It is possible that in some cases I have erred in my judgement by the addition of characters not shown by the types, but I believe I have included nothing which is not true of the types (except that in some cases I have given larger dimensions of pinna-size, where it seemed obvious that the type was taken from a small plant). This account of *Pneumatopteris* makes no pretension to finality; but I hope it is a beginning from which others can be guided to useful lines of further investigation. Intensive studies in 'biosystematics' can only be undertaken when a broad outline of a wider field has been effectively established; without it, useful narrower fields cannot be selected. An intensive study of the species of the Pacific might be very illuminating; but good new collections from many places would be needed.

KEY TO THE SPECIES OF PNEUMATOPTERIS

1. Veins anastomosing.
 2. Stipe and rachis bearing short dark spines irregularly arranged.
  3. Indusia lacking.
   4. Pinnae to 25 × 1.6—2.2 cm with cauda 3 cm long; spores bearing many small wings . . . . . **1. P. glabra**

4. Pinnae to 12 × 2 cm with cauda to 1½ cm long; spores with continuous wing and cross-wings . . . . . **2. P. sibelana**
3. Indusia present.
5. Sori in an inverted V (basal ones divergent) . . . . . **3. P. dicranogramma**
5. Sori medial, lower ones not divergent . . . . . **1. P. glabra**
2. Stipe and rachis lacking short dark spines.
6. Elongate aerophores present at bases of pinnae.
7. Indusium lacking.
8. Acicular hairs on stalks of sporangia; acicular or capitate hairs near annulus; spores with continuous wing and cross-wings.
9. Sori supramedial . . . . . **4. P. glandulifera**
9. Sori medial.
10. Acicular hairs on body of sporangia . . . . . **5. P. parksii**
10. Capitate hairs on body of sporangia . . . . . **6. P. obstructa**
8. Hair of 2 or 3 cells on stalk of sporangium; no hairs near annulus; spores with many wings . . . . . **7. P. stokesii**
7. Indusium present.
11. Reduced pinnae consisting of a prominent aerophore with a minute rim in place of lamina.
12. 2- or 3-celled hairs with glandular tips on stalks of sporangia. **8. P. callosa**
12. Acicular hairs on stalks of sporangia. . . . . **9. P. mesocarpa**
11. Reduced pinnae with a distinct lamina.
13. Pinnae crenate; veins *c.* 6 pairs . . . . . **10. P. subappendiculata**
13. Pinnae lobed ⅓ towards costa; veins 12—16 pairs . . . . . **11. P. superba**
6. Aerophores not or slightly swollen.
14. Indusia lacking.
15. Lowest pair of pinnae not or little reduced.
16. Upper surface of lamina bearing a few thick hairs between veins; sporangia bearing capitate hairs or setae . . . . . **12. P. sandwicensis**
16. Upper surface lacking hairs between veins; neither capitate hairs nor setae on sporangia.
17. Sori near costules, round, or at most basal ones a little elongate; a bud near apex of rachis . . . . . **13. P. unita**
17. Sori ± medial, many spreading along veins; no bud on rachis **14. P. subpennigera**
15. Lower pinnae gradually reduced, *or* many much-reduced pinnae present.
18. 2—5 pairs lower pinnae gradually reduced.
19. Pinnae crenate; 2 pairs veins anastomosing; sporangia often with a seta near annulus . . . . . **15. P. oppositifolia**
19. Pinnae lobed halfway or more; 1 pair veins anastomosing; sporangia with or without capitate hairs near annulus.
20. Sporangia lacking capitate hairs; lower surfaces of lamina quite glabrous **16. P. pennigera**
20. Sporangia bearing capitate hairs or setae; lower surfaces bearing very short capitate and acicular hairs.
21. Pinnae commonly 12—15 × 1.5—2.0 cm, thin; lower surface of rachis with or without minute acicular hairs; sporangia bearing capitate hairs **17. P. costata**

21. Pinnae to 7×1 cm, rigid when dry; lower surface of rachis densely covered with spreading hairs ⅛ mm long; sporangia mostly bearing setae **18. P. latisquamata**

18. Many much-reduced pinnae or tubercles, nearly to base of stipe.

22. Sporangia bearing capitate hairs; lower surface of costae and costules glabrous **6. P. obstructa**

22. Sporangia sometimes bearing setae; lower surface of costae and costules short-hairy . . . . . **5. P. parksii**

14. Indusia present.

23. Rhizome long-creeping; fronds at least 2—3 cm apart.

24. Pinnae lobed less than halfway to costa.

25. At least 2 pairs of basal pinnae much reduced and auricled.

26. Pinnae crenate; sporangia copiously setiferous . . . . . **19. P. afra**

26. Pinnae lobed ⅓; sporangia with few setae . . . . . **19. × buchananii**

25. One pair of basal pinnae a little reduced, narrowed towards the base **20. P. inclusa**

24. Pinnae lobed more than halfway to costa . . . . . **21. P. longipes**

23. Rhizome erect or short-creeping; or unknown.

27. Veins 2—5 pairs; pinnae in most cases not over 12 cm long.

28. Lower pinnae gradually reduced; stipe 5—15 cm to lowest pinna.

29. Basal pinnae conspicuously auricled at acroscopic base.

30. Basal large pinnae narrowly cuneate at base on basiscopic side **22. P. egenolfioides**

30. Basal large pinnae truncate at base on basiscopic side.

31. Pinnae to 7 cm long, to 8 mm wide above base . . . . **23. P. lucida**

31. Pinnae to 4 cm long, to 11 mm wide above base.

32. Brown hairs on rachis, both sides; no capitate hairs on sporangia **24. P. patentipinna**

32. Lower surface of rachis glabrous; capitate hairs present on sporangia **25. P. cheesmaniae**

29. Basal pinnae not auricled on acroscopic base.

33. Basal pinnae narrowly cuneate at base on basiscopic side; pinnae to 15 cm long including cauda 4—5 cm; rhizome creeping (?) **26. P. angusticaudata**

33. Basal pinnae not narrowly cuneate at base on basiscopic side; pinnae, if 15 cm long, with shorter cauda; caudex quite erect. . . . **27. P. microloncha**

28. Abrupt transition to reduced pinnae; stipe to 50 cm long . **28. P. brooksii**

27. Veins 7—10 pairs or more; pinnae usually much longer.

34. Basal pinnae not or little reduced.

35. Pinnae of well-grown plants 4 cm or more wide, lobed less than halfway to costa . . . . . **20. P. inclusa**

35. Pinnae to 2½ cm wide, lobed more than halfway . . . . **21. P. longipes**

34. At least one pair of basal pinnae conspicuously reduced.

36. Middle and upper pinnae very oblique, their bases asymmetric; apices of pinnae long and very narrow.

37. Larger reduced pinnae and lower normal ones distinctly auricled at base **29. P. laevis**

37. Lower pinnae narrowed towards base and not auricled.

38. Pinnae lobed halfway to costa; *c.* 12 pairs of reduced pinnae, largest 3 cm long . . . . . **30. P. obliqua**
38. Pinnae lobed less than halfway; reduced pinnae *c.* 6 pairs, longest 5 mm long . . . . . **26. P. angusticaudata**
36. Middle pinnae not very oblique, their bases ± symmetric.
39. Reduced pinnae, 1 or more pairs, conspicuously auricled on acroscopic side at base.
40. Reduced pinnae 1 pair, basal normal ones not auricled **31. P. basicurtata**
40. Reduced pinnae at least 2 or 3 pairs; basal normal ones also auricled.
41. Reduced pinnae 2 or 3 (or 4) pairs; lower surfaces glabrous **32. P. ecallosa**
41. Reduced pinnae 6 or more pairs; lower surface of rachis at least hairy.
42. Reduced pinnae with large serrate auricle; rachis and costae closely short-pale-hairy beneath; hairs on upper surface also pale **33. P. auctipinna**
42. Reduced pinnae with small entire auricle; thick brown hairs on upper and sometimes lower surface of rachis, often on bases of costae beneath.
43. Indusia copiously short-hairy; pinnae lobed less than halfway; basal veins uniting at a very obtuse angle . . . . . **34. P. jermyi**
43. Indusia glabrous; pinnae lobed to $\frac{2}{3}$; basal veins meeting at an acute angle . . . . . **35. P. papuana**
39. Reduced pinnae not thus auricled, in some cases widened almost equally both sides at base.
44. Reduced pinnae 1 or 2 pairs, minute (sometimes absent?).
45. Pinnae 1.6 cm wide, basal ones narrowed to base; both surfaces between veins, and indusia, glabrous . . . . . **36. P. microauriculata**
45. Pinnae 2.3 cm wide; basal ones not narrowed to base; both surfaces hairy between veins; indusia hairy . . . . . **37. P. christelloides**
44. Reduced pinnae several pairs, conspicuous.
46. Pinnae lobed distinctly less than halfway to costa.
47. Stiff curved brown hairs present on lower surface of rachis and costae at least near base of frond.
48. Pinnae crenate or lobed less than $\frac{1}{4}$ towards costa **10. P. subappendiculata**
48. Pinnae lobed $\frac{1}{3}$—$\frac{2}{5}$ towards costa.
49. Pinnae to 30 cm long; costules *c.* 4½ mm apart **38. P. remotipinna**
49. Pinnae to 20 cm long; costules 6—7 mm apart . . **11. P. superba**
47. No stiff brown hairs on lower surface.
50. Pinnae 10½ × 1½ cm; reduced pinnae 2 or 3 pairs . **39. P. laticuneata**
50. Pinnae much longer; reduced pinnae more numerous.
51. Gradual reduction of *c.* 4 pairs of lower pinnae +3 pairs of reduced pinnae; lower large pinnae not or little narrowed to base **40. P. usambarensis**
51. Rather abrupt transition to reduced pinnae.
52. Lowest pinnae not or little narrowed to base.
53. Stipe-scales narrow, hairy . . . . . **11. P. superba**
53. Stipe-scales broad, thin, not hairy.
54. Reduced pinnae to at least 10 pairs, upper 3½ × 3½ cm, lowest 2 × 2 cm . . . . . **41. P. kerintjiensis**

54. Reduced pinnae *c.* 6 pairs, upper 2×2 cm, lowest 8 mm long **42. P. humbertii**

52. Lowest large pinnae much narrowed in basal part.
55. Lower sori divergent . . . . . **9. P. mesocarpa**
55. Lower sori not divergent.
56. No capitate hairs on body of sporangium; lower surfaces of costae and costules glabrous.
57. Pinna-lobes truncate and toothed; largest pinnae 1.5—2.0 cm wide . . . . . **43. P. michaelis**
57. Pinna-lobes not truncate nor toothed; largest pinnae 2.5 cm or more wide. . . . . **44. P. novae-caledoniae**
56. Capitate hairs present on sporangium; lower surfaces ± hairy **45. P. truncata**

46. Pinnae lobed at least halfway to costa.
58. Lower sori gradually more divergent from costule; reduced pinnae many, very small. . . . . **9. P. mesocarpa**
58. Lower sori not or little divergent; reduced pinnae not very small.
59. Some sporangia bearing acicular hairs . . . . . **46. P. oxyoura**
59. Sporangia bearing capitate hairs or none.
60. Thick curved brown hairs on lower surface of rachis and costae **35. P. papuana**
60. Thick curved hairs lacking.
61. No capitate hairs on sporangia.
62. Indusia very small with a few long hairs; stipe-scales narrow, spreading . . . . . **47. P. pergamacea**
62. Indusia conspicuous, glabrous; stipe-scales broad, thin, adherent.
63. Largest fronds with pinnae over 4 cm wide . **48. P. sogerensis**
63. Largest fronds with pinnae not over 3 cm wide.
64. Lower pinnae narrowed towards an abruptly dilated base (*Fernando Po*). . . . . **49. P. venulosa**
64. Lower pinnae narrowed to a not-dilated base.
65. Veins 6—8 pairs . . . . . **50. P. prismatica**
65. Veins 11—13 pairs. . . . . **51. P. macroptera**
61. Capitate hairs present on sporangia near annulus.
66. Pinnae lobed ⅔ or more deeply.
67. Reduced pinnae all very small (*Sumatra*) . . . . **52. P. tobaica**
67. Upper reduced pinnae at least 1½ cm long.
68. Pinnae lobed to 2—2½ mm from costa . . . . **53. P. incisa**
68. Pinnae lobed to *c.* 4 mm from costa.
69. Basal large pinnae much narrowed towards base; costules os largest pinnae not over 5 mm apart; reduced pinnae 2—4 pairf **54. P. bryanii**
69. Basal large pinnae little narrowed towards base; costules of large pinnae 7—8 mm apart; reduced pinnae 5 or 6 pairs **55. P. vaupelii**
66. Pinnae lobed to about halfway to costa, or a little more deeply.
70. Lower surface bearing short capitate hairs or small subsessile glands between and on veins, with or without acicular hairs; indusia small . . . . . **17. P. costata**

71. Lower surface or rachis and costae glabrous or bearing minute acicular hairs; indusia inconspicuous . . . . . **var. costata**
71. Lower surface of rachis and costae bearing minute acicular hairs and scattered long ones; indusia small but distinct, bearing short hairs . . . . . **var. hispida**
70. Lower surfaces bearing short acicular hairs or none; indusium conspicuous.
72. Indusia with a few hairs in centre.
73. Costules commonly 5—6 mm apart . . . **56. P. hudsoniana**
73. Costules commonly 4—5 mm apart.
74. Fertile pinnae to 3.0 cm wide . . . . . **57. P. comorensis**
74. Fertile pinnae not over 2.5 cm wide (*Malesia and the Pacific*).
75. Fronds dimorphic; fertile gradually decrescent at base, sterile abruptly . . . . . **58. P. rotumaensis**
75. Fronds not dimorphic.
76. Pinnae of largest fertile fronds more than 2 cm wide, lobed more than halfway to costa . . . . . **59. P. nitidula**
76. Pinnae of fertile fronds not over 2 cm wide, lobed not more than halfway to costa . . . . . **60. P. glaberrima**
72. Indusia glabrous.
77. Lower pinnae gradually reduced; slender erect hairs ± abundant on lower surface between veins . . . . . **61. P. rodigasiana**
77. Transition from normal to reduced pinnae abrupt or subabrupt; no hairs between veins of lower surface.
78. Aerophores swollen; filiform scales abundant on lower surface of costules, veins and lamina . . . . . **62. P. micropaleata**
78. Aerophores not swollen; minute filiform scales very few.
79. Pinnae to 2.5 cm wide, lobed a little more than halfway to costa; lobes rather thin, rounded at apices **63. P. magnifica**
79. Pinnae rarely over 2.0 cm wide, lobed not more than halfway; lobes firm, a little toothed at apices . **64. P. transversaria**

1. Veins free.
80. Largest pinnae 16×6 mm, entire to slightly crenate; many lower pinnae gradually reduced . . . . . **65. P. nephrolepioides**
80. Largest pinnae larger, lobed at least halfway to costa; lower pinnae otherwise.
81. 2—4 pairs of lower pinnae gradually reduced.
82. Pinnae lobed about halfway; indusium lacking or very small . . **17. P. costata**
82. Pinnae lobed almost to costa; indusium distinct . . . . . **66. P. ligulata**
81. Transition to smaller basal pinnae (if present) abrupt.
83. Reduced pinnae 2 or 3 pairs, very small.
84. Basal basiscopic segment of lower pinnae very small.
85. Pinnae to *c.* 23×4 cm . . . . . **67. P. keysseriana**
85. Pinnae to *c.* 8×1.5 cm . . . . . **68. P. caudata**
84. Several basiscopic segments much reduced . . . . . **69. P. excisa**
83. Very small reduced pinnae none or more numerous.
86. Basal pinnae (1 pair) ± reduced.
87. Pinnae 2 cm×6 mm, lobed halfway to costa . . . . . **70. P. versteeghii**
87. Pinnae to 12×2.2 cm, lobed almost to costa . . . . . **71. P. deficiens**
86. Reduced pinnae at least 6 pairs.

88. Pinnae to 15 cm or more long.
89. Reduced pinnae 6 pairs, 1—1½ cm long . . . . . **72. P. regis**
89. Reduced pinnae many pairs, lower much smaller, lowest close together **73. P. imbricata**
88. Pinnae not over *c.* 10 cm long.
90. Pinnae lobed halfway to costa . . . . . **74. P. petrophila**
90. Pinnae lobed almost to costa.
92. Pinnae to 3 cm long, basal segment free . . . . . **75. P. sumbawensis**
92. Pinnae 8—11 cm long; no free segment . . . . . **76. P. walkeri**

1. Pneumatopteris glabra (Copel.) Holtt., *comb. nov.*

Cyclosorus glaber Copel., Philip. J. Sc. 81 (1952) 34; Fern Fl. Philip. (1960) 363. — *Thelypteris sevillana* Reed, Phytologia 17 (1968) 313. — T y p e: *Ramos BS 42976*, Bohol, Sevilla River (UC; BM).
Cyclosorus viridis Copel., Philip. J. Sc. 81 (1952) 35, pl. 24; Fern Fl. Philip. (1960) 364. — T y p e: *Ramos & Edaño BS 37490*, Luzon, Mt Masigit (US; BO).

Rhizome creeping. Stipes short to first reduced pinna, 50—100 cm to basal large pinna, dark, glossy, bearing irregular spines to 1 mm long; reduced pinnae many pairs, consisting of a conical aerophore and very small lamina. Lamina to 120 cm long; largest pinnae to 25 × 1.6—2.2 cm, caudate-acuminate, lobed ⅓ to costa, lobes falcate, acute; costules with small aerophores at their bases; veins 8—10 pairs; lower surface strongly pustular, costules and veins bearing minute capitate hairs only; upper surface hairy on costa only. Sori medial; indusia none or very small; capitate hairs on sporangia.

D i s t r i b u t i o n. Luzon, Bohol.

Copeland's distinction of *C. viridis* on the colour of dried fronds is not valid; the colour depends on method of drying. The other differences between Copeland's types are slight, in width of pinnae and depth of lobing.

2. Pneumatopteris sibelana Holtt., *spec. nov.*

Caudex ignotus; stipes 5 cm longus usque pinnam reductam infimam, 45 cm usque pinnam evolutam infimam, aculeis gracilibus 1 mm longis multis armatus. Frons 65—70 cm longa, pinnis reductis exclusis; pinnae reductae 10—12-jugatae, semicirculares, 2½—3 mm diametro, aerophoris 1 mm longis praeditae; pinnae evolutae c. 28-jugatae, infimae basin versus leviter angustatae, non auriculatae, aerophoris 1 mm longis instructae; pinnae maximae 12 × 1.8—2.0 cm, basi subtruncatae, apice acuminatae (cauda 10—15 mm longa dentata), margine ⅓ versus costam lobatae, lobis falcatis subacutis integris; costulae 5—5½ mm inter se distantes; venae 10-jugatae, graciles, concolores, 1—1½-jugatis anastomosantibus, 2½-jugatis ad membranam sinus procurrentibus; rachis subtus pilis arcuatis brunneis brevibus vestita, costa minute puberula; pagina superior praeter costam glabra. Sori mediales, inferiores non vel paulo divergentes; indusia nulla; sporangia eglandulosa; sporae alatae.

T y p e: *Alston 16942*, Batjan, Mt. Sibela, 1500 m (BM).

3. Pneumatopteris dicranogramma (v. A. v. R.) Holtt., *comb. nov.*

Dryopteris dicranogramma v. A. v. R., Bull. Jard. Bot. Btzg III, 5 (1922) 202. — T y p e: *Bünnemeijer 10454*, Kerintji, Sumatra (BO; L).

Closely related to *P. callosa* (no. 8, *infra*), differing in copious short dark spines on the stipe and lower part of rachis, and in pinnae more deeply lobed.

Distribution. Only known from G. Kerintji at about 2200 m, and on G. Dempo, in Sumatra. The specimen so named and described in Holttum, Rev. Fl. Malaya 2 (1954) 267, is *P. callosa*.

4. **Pneumatopteris glandulifera** (Brack.) Holtt., *comb. nov.*

Goniopteris glandulifera Brack. in Wilkes, U. S. Expl. Exp. 16 (1854) 29. — *Dryopteris subspinosa* C. Chr., Ind. Fil. (1905) 296; Bull. Bishop Mus. 177 (1943) 92. — *Polypodium brackenridgei* Hook., Spec. Fil. 5 (1864) 9. — Type: *Brackenridge*, Samoa, Tutuila (US).

Polypodium muricatum Powell *ex* Bak., Syn. Fil. ed. 2 (1874) 506, *non* Linn. — Type: *Powell 160*, Samoa (K; B).

Rhizome decumbent (Powell). Stipe 100 cm or more to first large pinna, bearing many aerophores as *P. callosa*. Lamina to 120 cm long, pinnae to 40 pairs; largest pinnae 28 × 2.0—2.3 cm, caudate-acuminate, lobed not quite halfway to costa; costules with small aerophores at bases; veins to 15 pairs, lowest 1—1½ pairs anastomosing, 2—3 pairs to sides of long sinus-membrane; lower surface almost glabrous apart from hairs on sinus-membrane and edges. Sori medial on distal veins, supramedial on lower ones; no indusium; capitate hairs on sporangia, acicular hairs on receptacle or sporangia-stalks.

Distribution: Samoa, Solomon Is. (Guadalcanal, S. Ysabel), New Hebrides.

Christensen also described var. *angustata* (l.c. 1943:93) with pinnae 1.3 cm wide, veins to 12 pairs; type: *Whitmee 212*, Samoa (K).

5. **Pneumatopteris parksii** (Ballard) Holtt., *comb. nov.*

Dryopteris parksii Ballard, Kew Bull. (1937) 347; new name for *Dryopteris microsora* Copel., Bull. Bishop Mus. 59 (1929) 12, *non* O. Kuntze 1891. — Type: *Parks 20483*, Viti Levu, Fiji (UC; MICH).

Differs from *P. glandulifera* and *P. obstructa* in setose sporangia.

Distribution. Fiji.

6. **Pneumatopteris obstructa** (Copel.) Holtt., *comb. nov.*

Dryopteris obstructa Copel., Univ. Cal. Publ. Bot. 12 (1931) 378. — Type: *Parks 22536*, Rarotonga (UC; K).

Differs from *P. glandulifera* in all sori medial. Sporangia have 3 or 4 acicular hairs on their stalks, sometimes also a hair of 2 cells, the end cell swollen.

7. **Pneumatopteris stokesii** (E. Brown) Holtt., *comb. nov.*

Dryopteris stokesii E. Brown, Bull. Bishop Mus. 89 (1931) 20, fig. 6. — Type: *Stokes 39*, Rapa (BISH).

Differs from *P. glandulifera*: neither seta nor capitate hair near annulus of sporangium; hair on sporangium stalk of 3 or 4 cells; spores bearing many small wings.

Distribution. Rapa (several collections).

8. **Pneumatopteris callosa** (Bl.) Nakai

P. callosa (Bl.) Nakai, Bot. Mag. Tokyo 47 (1933) 179 .— *Aspidium callosum* Bl., Enum. Pl. Jav. (1828) 152; Mett. Farngatt. 4 (1858) 108. — *Nephrodium callosum* Keys., Pol. Cyath. Herb. Bung. (1873) 48; Racib., Fl. Btzg 1 (1898) 192. — *Dryopteris callosa* C. Chr., Ind. Fil. (1905) 256; v. A. v. R., Handb. (1908) 220; Backer & Posth., Varenfl. Java (1939) 62. — Type: *Blume*, Java (L, *no 908. 339—365*).

Goniopteris lobbiana Fée, Gen. Fil. (1852) 251. — Type: *Lobb 276*, Java (orig.?; BM, K).

Aspidium multijugum Chr., Ann. Jard. Bot. Btzg 15 (1898) 135. — Type: *Sarasin 1323*, Celebes (BAS).

Cyclosorus dicranogramma auct. non (v. A. v. R.) Ching: Holtt., Rev. Fl. Malaya 2 (1954) 267.

Caudex massive, erect. Stipe 60—100 cm, bearing many reduced pinnae each consisting of an aerophore with a very small rim, covered with slime when young; lamina 100 cm or more long; pinnae commonly 15—25 × 2—2½ cm, lower ones gradually narrowed towards their bases, acuminate, lobed ¼—⅓, lobes falcate, entire; small aerophores at bases of costules; veins *c.* 12 pairs, 1½ pairs anastomosing, 2½—3½ pairs to sides of sinus membrane; lower surfaces of costae and costules sometimes sparsely hairy. Sori in inverted V; indusium firm, glabrous; sporangia with gland-tipped hair on stalk and capitate hairs near annulus.

Distribution. W. Malesia, Celebes, Flores, Ceram.

9. **Pneumatopteris mesocarpa** (Copel.) Holtt., *comb. nov.*

Dryopteris mesocarpa Copel., Bull. Bishop Mus. 93 (1932) 9, pl. 7A. — Type: *Grant 5290*, Society I., Huahine (BISH; UC).

Closely related to *P. glandulifera* (no. 4, *supra*), differing in presence of a small indusium.

10. **Pneumatopteris subappendiculata** (Copel.) Holtt., *comb. nov.*

Dryopteris subappendiculata Copel., Univ. Cal. Publ. Bot. 18 (1942) 220. — *Cyclosorus subappendiculatus* Copel., Gen. Fil. (1947) 143; Philip. J. Sc. 78 (1951) 449, pl. 30. — Type: *Brass 12247*, W. New Guinea, Idenburg R. (MICH).

Reduced pinnae 5—7 pairs, lowest 5 mm long, uppermost 2 cm, broadly deltoid and auricled on acroscopic side; lower large pinnae ± dilated at base; largest pinnae 15—18 × 2½—3 cm, crenately lobed to depth of 2 mm (sterile) 3 mm (fertile); veins 6 pairs; lower surface of rachis with some spreading red-brown hairs like those on upper surface; sori medial; indusium thin with a few hairs; sporangia with hair of 3 cells on stalk, no hairs near annulus.

Distribution. Eastern half of New Guinea, at 1400—2200 m, in forest.

11. **Pneumatopteris superba** (Brause) Holtt., *comb. nov.*

Dryopteris superba Brause, Bot. Jahrb. 56 (1920) 105. — Type: *Ledermann 11733*, Sepik, NE. New Guinea (B).

Dryopteris deltiptera Copel., Univ. Cal. Publ. Bot. 18 (1942) 142. — *Cyclosorus deltipterus* Copel., Gen. Fil. (1947) 142; Philip. J. Sc. 78 (1951) 449, pl. 29. — Type: *Brass 11260*, W. New Guinea, Lake Habbema (GH).

Caudex erect; scales elongate, hairy. Stipe and rachis densely red-hairy, lower surface of rachis less densely; reduced pinnae 7 or 8 pairs, spreading, broadly hastate, lowest 3—5 mm; largest pinnae to 17 cm long, 3 cm wide above dilated base, very firm, acuminate, edges lobed ⅓ towards costa; aerophores distinctly swollen; costules 6—7 mm apart; veins 10 or 11 pairs (in basal lobes to 16 pairs); rachis and costae ± hairy beneath (hairs stiff, red, ½ mm), costules and surface not; sori medial; indusia rather thin, glabrous: sporangia lacking hairs near annulus.

Distribution. Eastern half of New Guinea, at 2000—2500 m.

12. **Pneumatopteris sandwicensis** (Brack.) Holtt., *comb. nov.*

Stegnogramma sandwicensis Brack. in Wilkes, U. S. Expl. Exp. 16 (1854) 26, t. 4, f. 2. — *Polypodium sandwicense* Hook., Spec. Fil. 5 (1864) 5, *non* Hook. & Arn. 1832. — *Polypodium stegnogrammoides* Bak., Syn. Fil. (1867) 317. — *Polypodium microdendron* Eaton in Mann, Enum. Haw. Pl. (1868) 218 (*nom. nov. superfl.*) — *Thelypteris hawaiiensis* Reed, Phytologia 17 (1968) 282. — Type: *Brackenridge*, Sandwich I. (US; K).

Polypodium polycarpon Hook. & Arn., Bot. Beechey Voy. (1832) 104, *non* Sw. 1801. — T y p e: *Beechey*, Oahu (K).

Caudex erect. Stipe to at least 50 cm, scales broad, firm, short-hairy. Lamina *c.* 100 cm, basal pinnae deflexed, hardly reduced; middle pinnae commonly 18 × 3 cm, lobed hardly $\frac{1}{4}$, edges strongly cartilaginous; costules 5 mm apart, veins 10 pairs; lower surface pustular, short-hairy on costules and veins; upper surface bearing sparse long thick hairs between veins. Sori elongate along veins, exindusiate; sporangia bearing many capitate or acicular hairs; spores with a broad thin wing and a few cross-wings.

D i s t r i b u t i o n. Hawaii.

13. **Pneumatopteris unita** (Kunze) Holtt., *comb. nov.*

Gymnogramma unita Kunze, Linnaea 18 (1844) 115. — T y p e: *Gueinzius*, Natal (not seen).
Goniopteris patens Fée, Gen. Fil. (1852) 253. — T y p e: *Gueinzius*, Natal (not seen).
Goniopteris silvaticus Pappe & Rawson, Syn. Fil. Afr. austr. (1858) 39. — T y p e: as *Gymnogramma unita* Kunze.
Goniopteris madagascariensis Fée, Gen. Fil. (1852) 251. — *Aspidium malagassium* Kuhn 1868. — T y p e: *Goudot*, Madagascar (not seen).
Nephrodium costulare Bak., J. Linn. Soc. Bot. 16 (1877) 203. — T y p e: *Gilpin*, Madagascar (K).
Dryopteris gladiata C. Chr., Ark. for Bot. II, 14, no 19 (1916) 4, t. 1; Dansk Bot. Ark. 7 (1932) 52, pl. 12, fig. 12. — T y p e: *Palm & Afzelius 354*, Madagascar (BM).

Caudex erect. Young coiled fronds covered with slime, linear aerophores white and swollen. Lamina *c.* 100 cm; basal pinnae slightly reduced, deflexed, auricled on acroscopic side, narrowed basiscopically; largest pinnae to 25 × 3 cm, lobed $\frac{1}{4}$—$\frac{1}{3}$, costules 5—6 mm apart, veins 8—12 pairs; broad thin scales at first present on lower surface of costae which also bears short hairs; a gemma present near apex of rachis. Sori near costules, lower ones spreading a little, exindusiate; no hairs on sporangia; spores with a continuous wing and cross-wings.

D i s t r i b u t i o n. Eastern Africa, Madagascar.

Kunze's description is adequate for identification of this species.

14. **Pneumatopteris subpennigera** (C. Chr.) Holtt., *comb. nov.*

Dryopteris subpennigera C. Chr., Dansk Bot. Ark. 7 (1932) 52, pl. 12, f. 1, 2. — T y p e: *Perrier de la Bathie 15620*, Madagascar (P; BM).

Differs from *P. unita*: no gemma on rachis; sori medial, all elongate along veins; spores with many small wings.

15. **Pneumatopteris oppositifolia** (Hook.) Holtt., *comb. nov.*

Polypodium oppositifolium Hook., Spec. Fil. 5 (1863) 8. — *Cyclosorus oppositifolius* (Hook.) Tard., Mem. I.F.A.N. 28 (1953) 128, *nomen tantum*; Alston, Ferns W. Tr. Afr. (1959) 62. — T y p e: *G. Mann*, S. Thomé (K).

Rhizome short-creeping; stipe 75 cm; lamina 75 cm, basal 2 or 3 pairs of pinnae gradually reduced, lowest 2½ cm long, 2½ cm wide at cordate base; largest pinnae 22 × 2.3 cm, auricled at base, edges crenate to depth of 1½ mm; costules 3½—4 mm apart, veins 8 pairs; lower surface finely pustular, costae and costules with short stiff hairs. Sori inframedial; no indusia; sporangia sometimes with a seta near annulus; spores with a ± continuous wing and cross-wings.

D i s t r i b u t i o n. S. Thomé, Fernando Po, Annobon.

16. Pneumatopteris pennigera (Forst.) Holtt., *comb. nov.*

Polypodium pennigerum Forst., Prodr. (1786) 82; Schkuhr, Kr. Gew. 1 (1804) 17, t. 22. — *Goniopteris forsteri* T. Moore, Ind. Fil. (1858) 99. — T y p e: *Forster*, New Zealand.

Caudex erect; stipe-base bearing flat not-hairy scales; lamina with *c.* 4 pairs of lower pinnae gradually reduced and auricled; largest pinnae *c.* 15 × 2 cm, lobed halfway; costules 5—7 mm apart; veins to 10 pairs; lower surface of rachis and costae bearing ovate scales when young, also sparse brown acicular hairs and very short capitate hairs; sori inframedial, exindusiate; sporangia lacking hairs near annulus; spores with many small wings.

D i s t r i b u t i o n: New Zealand, Australia (Victoria and Tasmania).

I have seen no Forster specimen, but Schkuhr based his description and figure on one, and his evidence is adequate. Swartz (Syn. Fil. p. 250) stated that a minute reniform-peltate indusium is present, and that the veins are pubescent beneath; he must surely have seen another species, perhaps *P. nymphale* Forst. The scales on the under surface of costae of young fronds are like those of *P. unita*, but the spores are different.

17. Pneumatopteris costata (Brack.) Holtt., *comb. nov.*

Goniopteris costata Brack. in Wilkes, U. S. Expl. Exp. 16 (1854) 28. — T y p e: *Brackenridge*, Fiji (US).
Dryopteris rurutensis Copel., Occ. Pap. Bishop Mus. 14 (1938) 55, pl. 7. — T y p e: *St John & Fosberg 16590*, Rurutu, Austral I. (BISH; K).
Dryopteris christophersenii C. Chr., Bull. Bishop Mus. 177 (1943) 87, pl. 3A. — T y p e: *Christophersen 79*, Samoa (BISH).
Lastrea cavitensis Copel., Philip. J. Sc. 81 (1952) 26, Fern Fl. Philip. (1960) 328. — T y p e: *Mangubat BS 1302*, Cavite, Luzon (MICH).
Dryopteris pennigera sensu C. Chr., Ind. Fil. (1905) 284, *p.p.*
Dryopteris parasitica auct. non (L.) O. Ktze: C. Chr. in Skottsb., Nat. Hist. Juan Fernandez & Easter I. (1920) 50.
Dryopteris truncata auct. non (Poir.) C. Chr.: C. Chr. in Rensch, Hedwigia 74 (1934) 232, *quoad Rensch 761 tantum.*

Caudex erect; base of stipe covered with broad flat scales; 3 or 4 pairs of lower pinnae gradually reduced, not auricled, lowest *c.* 1 cm long; largest pinnae to 18 × 2 cm (much smaller ones may be fertile), lobed a little over halfway to costa; veins to 8—9 pairs, basal pair anastomosing; all lower surfaces bearing minute acicular and capitate hairs (the latter often collapsed on old specimens); upper surface between veins sometimes with very short acicular and capitate hairs; sori small, medial, exindusiate or with a very small indusium; sporangia with capitate hairs near annulus and a hair of 3 cells on stalk; spores with a continuous wing and cross-wings.

D i s t r i b u t i o n. Malesia (Bali, Sumbawa, Luzon, NE. New Guinea), N. Queensland, New Hebrides and New Caledonia to Easter I.

Young plants may have free veins, and one such, already fertile, was the type of *Lastrea cavitensis*; M. G. Price has confirmed this. Specimens from Cook Is., Pitcairn and Easter I. have some longer acicular hairs on lower surface of rachis and costa, and a small hairy indusium, but otherwise do not differ; they deserve varietal rank.

18. Pneumatopteris latisquamata Holtt., *spec. nov.*

P. costata (Brack.) Holtt. affinis, differt: fronde multo minore, coriacea; pinnis maximis c. 3.5 × 0.8 cm; costulis 2 mm inter se distantibus; venis 4-jugatis; indusiis nullis; sporangiis setiferis.

T y p e: *Millar & Holttum NGF 15777*, NE. New Guinea, Morobe Distr., Edie Creek, 2000 m (K; LAE).

19. Pneumatopteris afra (Chr.) Holtt., *comb. nov.*

Dryopteris afra Chr., Bull. Soc. Bot. France 55 (1908) Mem. 8b: 107. — *Cyclosorus afra* Ching 1941; Alston, Ferns W. Trop. Afr. (1959) 63; Tard. in Aubr. Fl. Cameroun 3 (1964) 250, pl. 37. — Lectotype: *Chevalier 5799*, Oubangui (P).
Dryopteris dewevrei Chr. *ex* Bonap., Notes Pterid. 14 (1924) 207. — Type: *Le Testu 1719*, Gabon (P).
Nephrodium abruptum (Bl.) Hook., Spec. Fil. 4 (1862) 77, *p.p.*

Rhizome long-creeping; basal 2 pairs pinnae much reduced, strongly auricled; largest pinnae to 20×2.5 cm, crenate to depth of 2 mm; veins 10—12 pairs, 4—5 pairs anastomosing; lower surface of costae and costules short-hairy; sori medial, indusia hairy; sporangia usually with 2 or 3 setae, a hair of 2 or 3 cells on their stalks; spores with many small wings.

Distribution. West Africa (south to Angola); Uganda.

Probable hybrid: *Thelypteris dentata* var. *buchananii* Schelpe, J. S. Afr. Bot. 31 (1965) 265, fig. 1 d. — Type: *Schelpe 5599*, Moçambique (BOL).

Rhizome long-creeping; pinnae lobed 1/3—2/5 towards costa; 2 pairs of veins anastomosing; minute hairs all over lower surface; few sporangia setose; spores (where observed) abortive.

Distribution. Liberia, Ghana, Cameroons, Tanzania, Uganda, Kenya, Moçambique. Probably a hybrid between *P. afra* and *Christella dentata* (Forsk.) Holtt., *comb. nov.* (*Polypodium dentatum* Forsk., Fl. Aegypt-arab., 1775, 185). The presumed hybrids have a wider distribution than is now known for *P. afra*; but Thelypteroid ferns have not yet been critically collected in Africa.

20. Pneumatopteris inclusa (Copel.) Holtt., *comb. nov.*

Dryopteris inclusa Copel., Univ. Cal. Publ. Bot. 14 (1929) 373, pl. 57. — Type: *Bartlett 8576*, Karo Plateau, Sumatra (UC).
Dryopteris berastagiensis C. Chr., Dansk Bot. Ark. 9, no 3 (1937) 59. — Type: *Ridley s.n.*, 1921, Berastagi, Sumatra (K).

Rhizome creeping, 1 cm diam. Frond with stipe 120—250 cm; pinnae 8—12 (—20) pairs, lower ones 12 cm apart, lowest a little reduced, largest 25×4—5 cm, edges lobed ¼ towards costa; costules 6½—7½ mm apart, veins 10—12 pairs; lower surface glabrous; sori medial, indusia large, thin, with a few hairs.

Distribution. Central Sumatra, several collections.

21. Pneumatopteris longipes (Bl.) Holtt., *comb. nov.*

Aspidium longipes Bl., Enum. Pl. Jav. (1828) 155. — Type: *Blume*, Boerangrang, Java (L, *no 908. 335—1062*).

Rhizome long-creeping, 1 cm diam.; stipe *c.* 100 cm, lamina *c.* 100 cm; basal 1 or 2 pinnae ± reduced (variable, often unequal); largest pinnae on type 17×2.2 cm, largest seen 25×2.7 cm, caudate-acuminate, lobed more than halfway to costa, lobes slightly falcate, rounded and slightly toothed; costules 4 mm apart, veins 10—11 pairs; costae and costules sparsely hairy beneath; sori medial; indusium small, hairy; sporangia with capitate hairs.

Distribution. Java, at 1400—1800 m; Sumatra (?).

22. Pneumatopteris egenolfioides Holtt., *spec. nov.*

Rhizoma procumbens, apice stipites fasciculatos gerens; stipites 10—17 cm longi,

basin versus paleis tenuibus adpressis 1½ mm longis vestiti. Lamina usque 45 cm longa; pinnae c. 28—jugatae, inferiores 3—4-jugatae sensim reductae et remotiores, infimae 5—7 mm longae; textura laminae firmiter herbacea vel rigida, in sicco pallide olivacea; pinnae maximae 2.4—3.2 cm longae, 6—8 mm latae, basi basiscopice anguste cuneatae, acroscopice late cuneatae et valde auriculatae, apice subtruncatae mucroneque minuto praeditae, margine c. ⅓ versus costam lobatae; lobi obliqui truncati, leviter dentati; costulae usque 3 mm inter se distantes, angulo 45° vel paulo ultra e costa orientes; venae plerumque 2-jugatae, infimae anastomosantes vel (prope apicem pinnae) liberae; pagina inferior pilis unicellularibus destituta, costae costulaeque paleis reductis capillaceis praeditae; rachis basesque costarum supra hirsutae, pagina superior cetera glabra. Sori prope costam utrinque uniseriati; indusia glabra; sporangia interdum pilo capitato ornata.

T y p e: *Brass 11497*, W. New Guinea, 18 km NE. of Lake Habbema, 2200 m, on limestone cliffs in forest (L; BO, BM).

23. **Pneumatopteris lucida** (Bak.) Holtt., *comb. nov.*

Nephrodium lucidum Bak., Gard. Chron. N. S. 8 (1877) 456. — T y p e: *cult. Hort. Bot. Reg. Kew, orig.* '*Madagascar*'.

Rhizome short-creeping; frond to 35 cm long; lower 1—3 pairs of pinnae gradually reduced; largest pinnae 7 × 0.8 cm, base auricled, apex acuminate, edges lobed less than ½; veins 3—4 pairs except in basal auricle, 1 pair anastomosing; lower surface quite glabrous; sori with glabrous indusia; sporangia lacking hairs near annulus.

This matches no known species from Madagascar, but is closely similar to *P. laevis* (no. 29, *infra*) from Philippines. I think that the cultivated plant was probably mis-labelled; other Philippine plants were in cultivation at Kew at that time.

24. **Pneumatopteris patentipinna** Holtt., *spec. nov.*

Caudex brevis erectus; stipes 12—15 cm longus, glaber. Lamina 30—35 cm longa, pinnis 14—16-jugatis papyraceis constituta; pinnae inferiores 5-jugatae sensim reductae, fere oppositae, omnes basi acroscopice auriculatae, infima 6 mm longa auricula 5 mm alta praedita, sequentes 9 mm, 11 mm, 20 mm, 2.4 cm longae; pinnae maximae 4.0 × 1.1 cm, alternae, recte patentes, basi truncatae et auriculatae, apice breviter acuminatae, margine usque ⅓ costam versus lobatae, lobis truncatis, antice acutis, leviter dentatis, ciliatis; costulae 3 mm inter se distantes; venae usque 4-jugatae, concolores, unijugis anastomosantibus; rachis subtus pilis brunneis ½ mm longis pilisque pallidis vestita, costae brevipilosae, costulae pilis sparsis tantum praeditae; rachis supra pilis brunneis, costae pilis pallidis vestitae. Sori mediales; indusia tenuia, breviter pilosa; sporangia eglandulosa.

T y p e: *T.G. Walker 8477*, NE. New Guinea (BM).

Specimens from Eastern Highlands, otherwise similar, have up to 10 pairs of lower pinnae gradually reduced; they are almost equally dilated on both sides at their bases.

25. **Pneumatopteris cheesmaniae** Holtt., *spec. nov.*

Caudex ignotus; stipes 26 cm longus, glaber. Frons 26 cm longa, pinnis c. 14-paribus, inferioribus 3-jugatis sensim reductis constituta; pinnae infimae 3—5 mm longae; pinnae maximae 3.3 × 1.1 cm, sessiles, basi truncatae acroscopice auriculatae, apice breviter acutae, margine ⅖—½ versus costam lobatae, lobis quadratis subtruncatis leviter dentatis; costulae 3—3½ mm inter se distantes, recte patentes; venae 3-jugatae (nisi in lobo acroscopico pinnarum inferiorum ubi 4—5-jugatae), infimae anastomosantes, vena

communi excurrenti brevi ad sinum terminata; pagina inferior omnino (membranis sinuum inclusis) glabra. Sori inframediales; indusia glabra; sporangia saepe glandulis pyriformibus ornatis.

T y p e: *L. E. Cheesman 1269*, Japan I., W. New Guinea, 300 m, on log in mossy forest on old coral limestone (BM).

26. Pneumatopteris angusticaudata Holtt., *spec. nov.*

Habitu et habitudioni *P. laevi* congruens, differt: pinnis inferioribus 6-jugatis 3—5 mm longis; pinnis maximis basi non auriculatis, margine non ultra 2 mm versus costam crenatis, apice longe caudatis, cauda 4—5 cm longa subintegra non dentata.

T y p e: *Brass 24984*, Goodenough I., Papua, on a rock-face beside a stream (BM; LAE).

27. Pneumatopteris microloncha (Chr.) Holtt., *comb. nov.*

Dryopteris microloncha Chr., Philip. J. Sc. 2 Bot. (1907) 202. — *Cyclosorus microlonchus* Copel., Gen. Fil. (1947) 143; Fern Fl. Philip. (1960) 366. — L e c t o t y p e: *Mangubat 1304*, Luzon (P).

Caudex erect; stipe 4—10 cm, glabrous; lamina 20—50 cm long, pinnae 15—25 pairs, lowest 3—6 pairs gradually reduced, lowest 3—5 mm long; largest pinnae 3—12 cm long, 0.6—1.3 cm wide, base a little dilated both sides, apex on larger fronds caudate, edges lobed less than halfway to costa; veins 3—4 pairs, lowest anastomosing; lower surface throughout bearing short fine spreading hairs; upper surface hairy on costa only; sori medial, indusia short-hairy; sporangia with yellow capitate hairs.

D i s t r i b u t i o n. Luzon, low altitudes, on rocky stream-banks.

Christ cited several specimens. As lectotype I select the best one now in the Paris herbarium. Christ also cited *Cuming 317*, but this appears to have been a mixed collection, and it is not represented in Christ's herbarium at Paris. It is possible that *P. microloncha* represents a stunted form of *P. nitidula*, due to habitat conditions.

28. Pneumatopteris brooksii (Copel.) Holtt., *comb. nov.*

Dryopteris brooksii Copel., Philip. J. Sc. 3 Bot. (1908) 345. — T y p e: *C. J. Brooks s.n.*, April 1908, Bidi, Sarawak (MICH; BM).

Caudex erect or suberect; stipe 53 cm to lowest reduced pinna; lamina 72 cm long; pinnae *c.* 40 pairs, lowest 3 pairs abruptly reduced, 4—5 mm long; lowest normal pinnae narrowed towards their bases; largest pinnae 12½ × 1.3 cm, base abruptly broad-cuneate, apex gradually attenuate, edges lobed ⅓ or rather less deeply, lobes oblique; costules 3½—4 mm apart, veins 4 pairs, lowest anastomosing with excurrent vein to short sinus-membrane; both surfaces of pinnae glabrous; sori medial; indusia small, glabrous (not seen by Copeland but certainly present); sporangia lacking hairs near annulus.

D i s t r i b u t i o n. Sarawak, on limestone; 3 known collections.

29. Pneumatopteris laevis (Mett.) Holtt., *comb. nov.*

Aspidium laeve Mett., Farngatt. 4 (1858) 104. — N e o t y p e: *Jagor*, Samar (B, *ex* Herb. Mett.).
Dryopteris luzonica Chr., Philip. J. Sc. 2 Bot. (1907) 196, incl. var. *polyotis*, excl. var. *puberula*. — L e c t o t y p e: *Loher s.n.*, Jan. 1906, Mt Makiling (P).

Rhizome quite prostrate, rather slender, with closely seriate fronds; stipe 12 cm to first reduced pinna, 30 cm to lowest large pinna; lamina to 90 cm long including reduced pinnae; lowest 4 pairs of pinnae sub-abruptly reduced, lowest 7 mm long; largest pinnae

to 18 × 1.4—2.0 cm, middle and upper ones oblique, base asymmetric, auricled on acroscopic side, narrower and rounded on basiscopic, apex caudate-acuminate, edges lobed halfway to costa; costules to 4 mm apart; veins 5—8 pairs; lower surfaces quite glabrous; sori medial; indusia glabrous or sometimes with a few hairs; sporangia usually lacking hairs near annulus.

Distribution. Philippines; on rocky banks of streams, fronds pendulous.

Mettenius cited as type of *A. laeve*: '*Cuming 83 bis ex parte*', but no such specimen exists at Berlin; it was probably destroyed in the herbarium at Leipzig. In the Berlin Herbarium are two sheets of Jagor's collection which were named *A. laeve* by Mettenius and agree with his description; I select these as neotype.

Copeland, Fern Fl. Philip. (1960) 364 has *A. laeve* as a synonym of *Cyclosorus nitidulus*, and appears to regard *Dryopteris luzonica* Chr. as partly *C. nitidulus* and partly *C. microlonchus*; his account is very confused. I am indebted to Mr. M. G. Price for ample specimens and also living plants. A living plant sent to Kew has some capitate hairs on the sporangia; perhaps there has been crossing with *P. microloncha*, but in general the two species are quite distinct, and I have seen many specimens.

Dryopteris luzonica var. *puberula* Chr. is *Nephrodium philippinense* Bak., which belongs to the genus *Sphaerostephanos* in my arrangement.

30. **Pneumatopteris obliqua** Holtt., *spec. nov.*

Aspidium extensum auct. non Bl.: Chr., Ann. Jard. Bot. Btzg 15 (1898) 133.

Rhizoma breve, repens; stipes 40 cm vel ultra usque pinnam reductam infimam, 90 cm usque pinnam infimam evolutam, glaber. Lamina 65 cm longa, pinnis reductis exclusis; pinnae reductae c. 12-jugatae, superiores usque 3 mm longae, ovatae; pinnae evolutae inferiores 6-jugatae basin versus multo angustatae (basi 3—4 mm latae), non auriculatae; pinnae mediales et superiores valde obliquae; pinnae maximae c. 16 × 1.9 cm, basi asymmetricae, apice caudatae (cauda 3—4 cm longa subintegra), $\frac{3}{5}$ costam versus lobatae, lobis apice falcatis, margine leviter dentatis; costulae 5 mm inter se distantes, sub angulo 50° abeuntes; venae 7—8-jugatae, subtus pallidae vel rufescentes, infimis anastomosantibus; costae utroque latere sparsim et breviter pilosae, pinnis cetera glabris. Sori mediales; indusia tenuia, glabra vel pilis brevibus paucis praedita; sporangia interdum pilis capitatis ornata.

Type: *P & F. Sarasin 127*, Masarang, Celebes (BAS). Other collections from N. Celebes: *Posthumus 2454;* Alston *15693, 15729, 16370.*

31. **Pneumatopteris basicurtata** Holtt., *spec. nov.*

Caudex ignotus; stipes 42 cm longus, praeter basin fuscam stramineus. Frons 50 cm longa, pinnis c. 15-jugatis constituta, pinnis infimis unijugatis valde reductis, 2 cm longis, 12 mm latis, acroscopice auriculatis; pinnae evolutae infimae leviter remotae, deflexae, basiscopice basin versus valde acroscopice parum angustatae; pinnae maximae 12 cm longae, 2.4 cm latae, basi truncatae non dilatatae, apice breviter acuminatae, margine paullo ultra dimidio lobatae, lobis falcatis integris subacutis; costulae 5—5½ mm inter se distantes; venae 9—10-jugatae, pallidae, prominentes, infimae anastomosantes; pagina inferior praeter pilos paucos submarginales glabra. Sori mediales, inferiores leviter divergentes; indusia magna, pilis brevibus paucis praedita; sporangia interdum pilis brevibus capitatis ornata.

Type: *H. C. Robinson & C. B. Kloss 148*, Korinchi Peak, Sumatra, 2290 m (BM). Also from same locality, *Bünnemeijer 10296*, pinnae to 19 × 2.7 cm.

32. Pneumatopteris ecallosa (Holtt.) Holtt., *comb. nov.*

Cyclosorus ecallosus Holtt., Gard. Bull. Sing. 11 (1947) 269; Rev. Fl. Mal. 2 (1954) 272, fig. 156. — Type: *Holttum 31294*, Cameron Highlands, Malaya (SING; BO, K). Also cited *Holttum 23427*.

Differs from *P. truncata* (no. 45, *infra*) in short-creeping rhizome, 2—4 pairs of basal pinnae abruptly reduced and subequal, strongly auricled, lowest large pinnae slightly narrowed to their bases with a large lobed acroscopic auricle; lower surfaces quite glabrous.

Distribution. Only known from Cameron Highlands; now abundant near streams at 1500 m where forest has been cleared.

33. Pneumatopteris auctipinna Holtt., *spec. nov.*

Aspidium truncatum sensu Chr., Ann. Jard. Bot. Btzg 15 (1898) 133, *p.p.*

Caudex brevis, erectus. Stipes c. 20 cm longus, pallidus, glabrescens. Frons c. 150 cm longa, basin versus subabrupte angustata; pinnae 35-jugatae, inferiores oppositae; pinnae infimae 15 mm longae, sequentes 8 pares sensim longiores earum superiores 2½—4 cm longae, omnes basi acroscopica auriculatae; pinnae intermediae 2—3 pares et pinnae maximae inferiores omnes basi auriculatae; pinnae suprabasales c. 18 × 2 cm, basi truncatae (non auriculatae), apice anguste acuminatae, margine ⅓—⅔ versus costam lobatae, costulis 4—4½ mm inter se distantibus, lobis subtruncatis, margine leviter dentatis; venae 8—9-jugatae utrinque prominentes, infimis anastomosantibus, paribus 2—2½ sequentibus membranam pellucidem elongatam tegentibus (venis in auriculis pinnarum inferiorum saepe furcatis, ut in *Haplodictyum* anastomosantibus); rhachis costaeque subtus dense breviter pilosae, pagina laminae ± pustulosa, pilis brevibus paucis praedita; costa supra antrorse hirsuta, pagina superiore cetera glabra. Sori inframediales; indusia parva, breviter pilosa; aporangia pilis brevibus capitatis prope annulum ornata.

Type: *P. & F. Sarasin 119*, N. Celebes, Tomohon (BAS).

Distribution. Celebes, E. Java, Flores, Ambon, Buru.

This species is strikingly distinct in the form of the base of the frond. The species most nearly resembling it in its auricled lower pinnae is *P. ecallosa* from Malaya, but in the latter species only 2 or 3 pairs of basal pinnae are reduced.

34. Pneumatopteris jermyi Holtt., *spec. nov.*

Caudex brevis, erectus; stipes 23 cm usque pinnam reductam infimam, 50 cm usque pinnam evolutam infimam, breviter hirsutus, basi paleis latis tenuibus vestitus. Frons 60 cm longa, pinnis reductis exceptis; pinnae reductae 6-jugatae, alternae, infimae rotundatae 2—5 mm longae, superiores 15—20 × 8 mm, triangulares, basi truncatae; pinnae evolutae c. 22-jugatae, infimae basin versus leviter angustatae, basi acroscopice paulo auriculatae; pinnae maximae c. 13 × 1.8 cm, basi truncatae, apice caudato-acuminatae (cauda 3—3½ cm longa), 2/5—1/2 costam versus lobatae, lobis subtruncatis, vix dentatis, breve ciliatis; costulae 4 mm inter se distantes, fere rectae; venae usque 9-jugatae, 1—1½-jugatae anastomosantes, sequentibus unijugatis ad membranam sinus longam procurrentibus; rachis subtus pilis brunneis rigidis arcuatis ⅔ mm longis vestita; costae subtus pilis brunneis vel pallidis vestitae, costulae minute hirsutae; rachis basesque costarum supra pilis brunneis vestitae. Sori inframediales, costulas non tegentes; indusia copiose brevi-hirsuta; sporangia eglandulosa.

Type: *Jermy 3739*, NE. New Guinea, Butemu, in secondary forest (BM).

Brass 29766, Morobe Distr., Kaindi, has pinnae to 14 × 2.5 cm.

35. Pneumatopteris papuana Holtt., *spec. nov.*

P. jermyo affinis, differt: frondibus majoribus; pinnis maximis usque 18 × 3.5 cm, fere $\frac{2}{3}$ versus costam lobatis, costulis 5—6 mm inter se distantibus, venis inferioribus prope sinum sub angulo acuto conniventibus vel latera membranae sinus tegentibus, rachi subtus basin versus tantum brunneo-hirsuta, pagina inferiori cetera glabra, indusia glabra.

T y p e: *Brass 22778*, Mt Dayman, 2000 m, Papua (LAE; BM, L). Also *Brass 12273, 12221, 31641.*

36. Pneumatopteris microauriculata Holtt., *spec. nov.*

Rhizoma breviter repens, 5 mm diametro; stipes 50—70 cm longus, glabrescens, paleis tenuibus latis basin versus vestitus. Frons 35—40 cm longa, pinnis evolutis 18—jugatis pinnisque reductis minutis remotis unijugatis constituta; pinnae infimae leviter reductae, e medio basin versus angustatae, basi 8 mm latae, non auriculatae; pinnae maximae 12 × 1.6 cm, basi truncata leviter auriculatae, apicem acuminatam versus sursum arcuatae, $\frac{2}{3}$ costam versus lobatae, lobis falcatis obtusis integris; costulae 3½—4 mm inter se distantes; venae 8-jugatae, concolores, infimae anastomosantes; pagina inferior praeter pilos minutos prope apicem costarum et membranas sinuum glabra. Sori paulo inframediales; indusia magna, tenuia, glabra, caduca; sporangia eglandulosa.

T y p e: *Clemens 27137*, Mt Kinabalu, Sabah, 850 m (BM). Also *Clemens 30463.*

37. Pneumatopteris christelloides Holtt., *spec. nov.*

Caudex ignotus; stipes 40 cm longus, pinnas minutas remotas 2-jugatas ferens, stramineus, paleis latis tenuibus adpressis vestitus. Frons c. 60 cm longa, pinnis 20-jugatis; pinnae infimae paulo reductae, basi nec angustatae nec auriculatae; pinnae maximae 14.5 × 2.3 cm, basi truncatae, apice breviter acuminatae, $\frac{2}{3}$ costam versus lobatae; lobi subtruncati, apiculo obtuso antrorso praediti; costulae 4 mm inter se distantes; venae 11—12-jugatae, concolores, 2-jugatis anastomosantibus, vena composita excurrenti flexuosa, 1½—2-jugatis ad membranam sinus procurrentibus; pagina inferior costae costularum laminaeque omnino pilis pallidis patentibus gracilibus vestita; pagina superior inter venas pilis multis minutis suberectis praedita. Sori leviter supramediales, inferioribus leviter divergentibus, infimis interdum contiguis; indusia parva, pilis multis brevibus vestita; sporangia eglandulosa.

T y p e: *Clemens 27541*, Sabah, Mt Kinabalu, Dallas, 1000 m (K).

The specific epithet *christelloides* is given owing to the resemblance of this species to the genus *Christella* Lév. It differs from all species of *Christella* in its broad flat scales and in its spores, which have many small wings.

38. Pneumatopteris remotipinna (Bonap.) Holtt., *comb. nov.*

Dryopteris remotipinna Bonap., Notes Pterid. 5 (1917) 57; C. Chr., Dansk Bot. Ark. 7 (1932) 50, pl. 12, f. 10. — T y p e: *Perrier 6072*, Madagascar (P).

Dryopteris longifolia Bonap., Notes Pterid. 5 (1917) 55, *non* Hieron. 1907. — *D. sambiranensis* C. Chr. in Perrier, Cat. Pl. Madag. (1932) 25, *nom. nov.*; Dansk Bot. Ark. 7 (1932) 50, pl. 12, f. 11. — T y p e: *Perrier 7665*, Madagascar (P).

Caudex erect; stipe 25—45 cm to lowest reduced pinna, base covered with thin flat scales; frond to 250 cm long; at least 8 pairs of lower pinnae reduced and widely spaced, lowest 5—6 mm long and wide, 5th pair 2.5 × 1.3 cm, triangular, crenate, not auricled; largest

pinnae 25—28 × 2.0—2.5 cm, lower ones not narrowed to their bases, apex narrowly attenuate, lobed to *c.* $\frac{2}{5}$, lobes oblong with rounded tips; costules 4½ mm apart; veins 10—11 pairs, 1—2 pairs anastomosing, 1 pair to sides of sinus-membrane; some stiff red-brown hairs on lower surface of costae, also short pale hairs on costae, veins, and sometimes on surface between veins. Sori near costules, lower ones somewhat divergent; indusia glabrous; sporangia bearing large yellow capitate hairs; red glandular cell at end of hair on sporangium stalk.

Distribution. Madagascar.

Christensen apparently only saw a distal pinna of the type, lower pinnae of which are much larger than his figure 10. The type has slender hairs all over lower surface, but other Madagascan specimens are much less hairy. The yellow glandular hairs on sporangia, and red end-cells of hairs on their stalks are distinctive, and there are always some short red-brown hairs.

39. Pneumatopteris laticuneata Holtt., *spec. nov.*

Caudex brevis, erectus; stipes 22 cm usque pinnam reductam infimam; basi paleis latis tenuibus vestitus. Frons c. 60 cm longa; pinnae reductae 2-jugatae, superiores 15—17 × 6 mm, basi cuneatae, inferiores 5—6 mm longae; pinnae normales 18-jugatae, inferiores basin versus angustatae basi 1 cm latae non auriculatae; pinnae maximae 10.5 × 1.6 cm, late patentes, basi late cuneatae, apicem versus semsim angustatae, ⅓ costam versus lobatae, lobis obliquis, truncatis, integris; costulae 3½ mm inter se distantes; venae 8-jugatae, 1½-jugatae anastomosantes, unijugatae ad membranam sinus procurrentes; pagina inferior omnino glabra; rachis costaeque supra sparsim hirsutae. Sori inframediales; indusia glabra, sporangia eglandulosa.

Type: *Jermy 8044*, NE. New Guinea, Bewani Mts, 250 m (BM).

40. Pneumatopteris usambarensis Holtt., *spec. nov.*

Rhizoma breve repens; stipes 30 cm longus, basi paleis parvis adpressis vestitus; frons 160 cm longa; pinnae inferiores 3-jugatae 5—8 mm longae, pinnae sequentes 3½, 4½, 10, 15 cm longae, omnes basi truncatae; pinnae maximae 30 cm longae, steriles usque 2.6 cm latae, fertiles 2.3 cm, basi leviter dilatatae, apice acuminatae, $\frac{1}{3}$—$\frac{2}{5}$ costam versus lobatae, lobis fertilibus subtruncatis leviter dentatis, sterilibus rotundatis integris; costulae 5—5½ mm inter se distantes, late patentes; venae 8—10-jugatae, 2—jugatae anastomosantes; pagina inferior omnino glabra. Sori paulo inframediales; indusia tenuia glabra vel pilis paucis praedita; sporangia pilis capitatis ornata.

Type: *Faden et al. 70/293*, Tanzania, E. Usambara Mts, 1000 m (EA, one frond on 7 sheets). Also on Usambara Mts *Greenway 4794*, *A. Braun 1427*, *A. Peter 159*, *9999*, *16859*, *C. Holst 4263*, *2266*.

41. Pneumatopteris kerintjiensis Holtt., *spec. nov.*

Caudex ignotus; stipes 5 cm usque pinnam reductam infimam, 75 cm vel ultra usque pinnam evolutam infimam. Frons 120 cm longa pinnis reductis exclusis, textura rigide papyracea; pinnae reductae 10—12-jugatae, inferiores 2 × 2 cm, supremae 3½ × 3½ cm, triangulares, margine crenatae; pinnae evolutae infimae basin versus non angustatae, basi dilatatae; aerophorae dilatatae, non elongatae; pinnae maximae 25 × 2½ cm, basi truncatae, apice acuminatae non caudatae, $\frac{1}{3}$—$\frac{2}{5}$ costam versus lobatae, lobis rotundatis integris; costulae 4½ mm inter se distantes; venae usque 12-jugatae, graciles, 2-jugatae anastomo-

santes, 1—1½-jugatae ad membranam sinus procurrentes; pagina inferior valde pustulosa, costa costulae venaeque subtus pilis minutis praeditae; pagina superior praeter costam hirsutam glabra. Sori paulo inframediales, inferiores non divergentes; indusia tenuia, glabra; sporangia pilis capitatis ornata.

T y p e: *Alston 14149*, Sumatra, Sungei Kering, Kerintji (BM).

Other collections from central Sumatra are: *Alston 13096*, *Bünnemeijer 3575*, *4172*, *5051*. The large number of large deltoid reduced pinnae and widened base of lower normal pinnae are distinctive. Sterile pinnae look very much like those of *P. callosa*, but lack aerophores.

42. **Pneumatopteris humbertii** Holtt., *spec. nov.*

Cyclosorus subpennigerus (C. Chr.) Tard. in Humbert, Fl. Madag. Polypod. 1 (1958) 298, *p.p.*

Caudex ignotus; stipes 20 cm longus usque pinnam reductam infimam; frons usque 100 cm longa. Pinnae inferiores 6-jugatae reductae, infimae 8 mm longae, superiores 2 cm vel ultra longae, basi truncata 2.2 cm latae; pinnae evolutae inferiores 20 cm longae, 2.5—3.0 cm latae, basin versus non vel paulo angustatae, basi acroscopice non auriculatae, apice acuminatae non caudatae, ⅕ costam versus lobatae, lobis leviter falcatis, integris, interdum apiculatis; costulae 5 mm inter se distantes, venae 8—10-jugatae, crassae, pallidae, 2½—3-jugatae anastomosantes, venam excurrentem valde sinuatam facientes; costa subtus pilis brevibus rigidis praesertim distaliter vestitae, costulae venae laminaque pilis brevibus sparsim praeditae; costa supra hirsuta, costulae minute setiferae. Sori mediales, inferiores interdum divergentes et leviter elongatae; indusia magna, glabra; sporangia eglandulosa.

T y p e: *Humbert 31679*, Madagascar, partie occidentale du Massif de Marojejy, 1400 m (P). Also *Humbert 22465* (K).

43. **Pneumatopteris michaelis** Holtt., *spec. nov.*

Caudex erectus; stipes usque pinnam reductam infimam 17 cm longus, usque pinnam infimam evolutam 50 cm, glaber, viridis. Lamina usque 60 cm longa, pinnis reductis exclusis; pinnae reductae 4—5-jugatae, superiores 12 × 8 mm, triangulares, basi truncatae non auriculatae; aerophorae in vivo dilatatae; pinnae intermediae 1—2-jugatae interdum praesentes; pinnae inferiores basin versus angustatae (parte angusta fere integra), basi 8 mm latae non auriculatae; pinnae maximae usque 22 cm longae, 1.5 cm (fertiles)—1.8 cm (steriles) latae, basi subtruncatae, apicem versus sensim angustatae, ⅛ costam versus lobatae, lobis obliquis truncatis, dentatis; costulae 4 mm inter se distantes, sub angulo 60° vel ultra egredientes; venae 7—8-jugatae, 1—1½-jugatae anastomosantes; pagina inferior, marginibus loborum inclusis, glabra. Sori inframediales; indusia tenuia, glabra; sporangia pilis non praedita.

T y p e: *M.G. Price 317*, Luzon, Mt Makiling, 1050 m (K). Also from same locality *Price 557*, *2418*, *2177*. From Sabah: *Kloss SFN 19113*, Bettotan, near Sandakan (K).

44. **Pneumatopteris novae-caledoniae** Holtt., *spec. nov.*

Cyclosorus truncatus sensu Brownlie, Fl. Nouv.-Cal. no 3 (1969) 219, *p.p.*

P. truncata et *P. sogerensi* similis; a *P. truncata* differt lobis pinnarum nec truncatis nec dentatis, costis subtus fere glabris, sporangiis eglandulosis; a *P. sogerensi* differt pinnis numquam usque dimidium lobatis, pinnis reductis basi angustatis.

T y p e: *Lécard s.n.* Oct. 1876, New Caledonia, 'prenant un très-grand développement sur le bord des sources d'eau', 0—400 m (P, a single frond on 5 sheets).

45. **Pneumatopteris truncata** (Poir.) Holtt., *comb. nov.*

Polypodium truncatum Poir., Encycl. Meth. 5 (1804) 534. — T y p e: Brézil, no collector (P).
Aspidium abortivum Bl., Enum. Pl. Jav. (1828) 154. — T y p e: *Blume*, 'ad pedem Boerangrang', Java (L, *no 908. 337—855*).
Aspidium abruptum Bl., Enum. Pl. Jav. (1828) 154. — *Nephrodium abruptum* J. Sm., Hook. J. Bot. 3 (1841) 411; Hook., Spec. Fil. 4 (1862) 77, *p.p.*, not t. 241B. — T y p e: *Kuhl & van Hasselt*, Java (L, *no 908. 337—817*).
Aspidium eusorum Thw., Enum. Pl. Zeyl. (1864) 391. — T y p e: *Thwaites, C. P. 3064* (K).
Cyclosorus lepidopodus C. Chr. *ex* Tard. & C. Chr., Notul. Syst. 7 (1938) 73. — T y p e: *Eberhardt 5252*, Tonkin, Bac Kan (BM).
Nephrodium truncatum auct. non (Gaud.) Presl: Bak., Syn. Fil. (1867) 294, *p.p.*; Racib., Fl. Btzg 1 (1898) 190. — *Dryopteris truncata auct. non* (Gaud.) O. Ktze: v. A. v. R., Handb. (1908) 227, *p.p.*; Backer & Posth., Varenfl. Java (1939) 54.

Caudex erect; stipe to lowest reduced pinna 5—10 cm; reduced pinnae to *c.* 8 pairs, largest *c.* 2 cm long, obovate; lower normal pinnae narrowed in basal part, narrow part shallowly lobed; largest pinnae to *c.* 25 × 3 cm, base broadly cuneate, apex rather abruptly acuminate, lobed a little less than halfway to costa; lobes subtruncate and slightly toothed; costules 4—5 mm apart, veins to 10 pairs, 1½—2 pairs anastomosing, next pair to sides of sinus-membrane; lower surface of rachis, costae and costules usually ± hairy. Sori inframedial, lower ones not divergent; indusia glabrous; sporangia with small colourless capitate hairs near annulus.

D i s t r i b u t i o n. Ceylon & S. India, NE. India to S. China; Western Malesia and Philippines.

The type represents the lower large pinnae of a fertile frond. It resembles specimens from Ceylon and Malaya and cannot have come from Brazil. As mentioned in the introductory part of the present paper, Manton found that a Ceylon plant was tetraploid, and subsequently Loyal found a diploid near Darjeeling. The latter is sufficiently distinct to justify recognition as a variety as follows.

Pneumatopteris truncata var. **loyalii** Holtt., *var. nov.*

A typo speciei differt; pinnis angustioribus; lobis pinnarum valde dentatis; sporangiis glandulis luteis magnis fere globosis ornatis.

T y p e: *D. S. Loyal s.n.* Aug. 1956, Manjitar-Teesta Road, Darjeeling, 600 m (Herb. Panjab Univ. no. *3172*). Several other specimens, from various places in Assam, in Kew Herbarium, agree with Loyal's specimen in the details described.

Ching has described var. *angustipinna* from Hainan (Bull. Fan Mem. Inst. Biol. 8, 1938, 218); it has small colourless glandular hairs on sporangia, much as in Ceylon specimens of *P. truncata*, but much narrower pinnae. It might be another diploid.

In Sabah, on Mt Kinabalu, is a possibly distinct variety with pinnae to 4 cm wide but no other obviously distinctive character.

The types of *Aspidium abortivum* Bl. and *A. abruptum* Bl. differ slightly from each other, but other specimens from Java appear to be intermediate. There may be a distinct mountain variety of the species in Java, but new field study is necessary to show its distinctive characters.

A plant from Sabah, cultivated at Kew, has densely short-hairy indusia, also short erect hairs on lower surface of lamina; it could be of hybrid origin.

There has been confusion in the literature between *Polypodium truncatum* Poir. and *Polystichum truncatum* Gaud.; the latter is here placed as a synonym of *Pneumatopteris glaberrima*.

46. Pneumatopteris oxyoura (Copel.) Holtt., *comb. nov.*

Dryopteris oxyoura Copel., Philip. J. Sc. 60 (1936) 107, pl. 12. — T y p e: *Brass 2696*, Solomon Is., San Cristoval (BRI).

Caudex erect; stipe 50 cm or more long; reduced pinnae very small, 1 or 2 pairs; frond 100 cm or more long; several pairs of lower pinnae narrowed towards their bases; largest pinnae 25 × 3 cm, caudate-acuminate, lobed a little more than ½; lobes subentire; costules to 5 mm apart, veins 10—12 pairs, 1—1½ pairs anastomosing, 1—1½ pairs to sides of sinus-membrane; short stiff spreading hairs on lower surface of costae. Sori medial; indusium small with a few short hairs; sporangia setose.

D i s t r i b u t i o n. San Cristoval, two collections.

47. Pneumatopteris pergamacea Holtt., *spec. nov.*

Caudex suberectus; stipes 10 cm usque pinnam reductam infimam, 45 cm usque pinnam evolutam infimam, omnino pilis brevibus pallidis basi paleis patentes 10 × 1 mm setiferis vestitus. Frons 50 cm longa, pinnis reductis exclusis; pinnae reductae 11—15-jugatae, infimae 8 × 6 mm, hastatae, superiores usque 2.4 × 1.5 cm, basi late cuneatae margine lobatae; pinnae evolutae c. 20-jugatae, infimae leviter deflexae, medio 3.4 cm latae, basin late cuneatam versus sensim angustatae; pinnae fertiles maximae 23 × 2.8 cm (steriles interdum latiores), acuminatae, ⅗ costam versus lobatae, lobis leviter falcatis sursum paulo angustatis, subintegris; costulae usque 5½ mm inter se distantes; venae 11—12-jugatae, concolores, infimae tantum anastomosantes, sequentibus 1—1½-jugatis ad membranam sinus procurrentibus; rachis costae costulaeque subtus minute et sparsim hirsutae; pinnae reductae supra inter venas pilis pallidis adpressis vestitae, pinnae evolutae supra glabrae. Sori mediales, inferiores leviter divergentes; indusia minuta, pilis paucis praedita; sporangia eglandulosa.

T y p e: *Jermy 7877*, origin New Ireland, cult. Hort. Bot. Kew. (*123/70, no 1035*). Original plant found in Danfu river valley, 630 m, on mossy limestone boulder in forest.

48. Pneumatopteris sogerensis (Gepp) Holtt., *comb. nov.*

Dryopteris sogerensis Gepp, J. Bot. 61 (1923) Suppl. 61 — L e c t o t y p e: *Forbes 446*, Papua, Sogeri (BM).

Caudex erect; stipe to 30 cm to basal reduced pinna; reduced pinnae *c.* 6 pairs, largest 2—4 cm long, ± triangular with broad base; basal large pinnae narrowed towards their bases; largest pinnae commonly 27 × 2½—3 cm (to 36 × 4½ cm), lobed more than halfway to costa (on smaller fronds to about ½); costules commonly 4—5 mm apart; veins 10—14 pairs, 1 pair anastomosing, next 1 or 2 veins to sides of sinus-membrane; lower surface of costa usually glabrous, sometimes with sparse spreading hairs to ½ mm long. Sori inframedial, lowest not divergent; indusia glabrous; sporangia lacking hairs near annulus.

D i s t r i b u t i o n. Moluccas, New Guinea, Bismarck Arch., Solomon Is. in low country, frequent; Queensland.

49. Pneumatopteris venulosa (O. Kuntze) Holtt., *comb. nov.*

Nephrodium venulosum Hook., Spec. Fil. 4 (1862) 71, *non* Desv. — *Aspidium elatum* Mett. *ex* Kuhn, Fil. Afr. (1866) 131, *non* Bojer. — *Dryopteris venulosa* O. Ktze, Rev. Gen. Pl. 2 (1891) 814, *nom. nov.* — *Dryopteris elata* C. Chr., Ind. Fil. (1905) 263. — *Cyclosorus elatus* Alston, Bol. Soc. Brot. 2, 30 (1956) 13; Ferns W. Trop. Afr. (1959) 63. — *Thelypteris elata* Schelpe, J. S. Afr. Bot. 31 (1965) 265. — *Thelypteris venulosa* Reed, Phytologia 17 (1968) 323. — T y p e: *G. Mann s.n.*, Fernando Po (K).

Stipe to at least 40 cm to basal reduced pinna; reduced pinnae *c.* 4 pairs, lowest 1.5 cm long, highest to 5 cm, auricled on acroscopic base, largest pinnae 20 × 2½—3 cm, lower ones narrowed in basal 4—5 cm, base 2 cm wide, acuminate (not caudate), lobed a little more than ½, lobes oblique, oblong, ± toothed at vein-ends; costules 5 mm apart; veins 9 pairs, lowest pair anastomosing, one pair to sinus-membrane; rachis and costae ± hairy beneath. Sori inframedial; indusia thin, glabrous; sporangia lacking hairs near annulus.

Distribution. Fernando Po & S. Thomé.

Christensen regarded *A. elatum* Mett. as correct basionym for this species, believing that *A. elatum* Bojer (1837) was a *nomen nudum*; but Bojer printed a brief description, so that *A. elatum* Mett. is a later homonym.

50. **Pneumatopteris prismatica** (Desv.) Holtt., *comb. nov.*

Nephrodium prismaticum Desv., Mem. Soc. Linn. Paris 6 (1827) 256. — Type: Mauritius, no collector named (P).

Aspidium caudiculatum Sieber *ex* Kunze, Linnaea 24 (1851) 280. — *Nephrodium caudiculatum* Sieber *ex* Presl, Epim. Bot. (1851) 46. — Type: *Sieber 47*, Mauritius (dupl. K).

Rhizome short-creeping; stipe *c.* 20 cm to lowest reduced pinna; reduced pinnae 3—4 pairs, ± orbicular, 5—10 mm long and wide; 1—2 pairs pinnae of intermediate length sometimes present; lower large pinnae much narrowed to their bases; largest pinnae *c.* 17—23 × 2.2—2.5 cm, base of middle ones sometimes dilated on basiscopic side, acuminate, lobed to a little more than halfway to costa, lobes slightly oblique, apices rounded to subtruncate and ± dentate; costules 4—5 mm apart; veins 6—8 pairs, 1 pair anastomosing, next pair to sides of sinus-membrane; lower surfaces glabrous. Sori medial; indusia glabrous; sporangia lacking capitate hairs.

Distribution. Mauritius, Bourbon.

A further possible synonym is *Aspidium mascarenense* Kaulf. *ex.* Spr., Syst. Veg. ed. 16, 4 (1827) 101. No type was indicated, only 'Ins. Mascaren.'

51. **Pneumatopteris macroptera** (Copel.) Holtt., *comb. nov.*

Dryopteris macroptera Copel., Univ. Cal. Publ. Bot. 12 (1931) 392. — Type: *Parks 16177*, Tonga (UC; US).

Stipe 70 cm to lowest normal pinna; lowest 4 pairs pinnae gradually reduced and more widely spaced, not auricled; lowest normal pinnae narrowed towards their bases; largest pinnae 25—28 × 1.8—2.4 cm, lobed more than halfway to costa; costules 4 mm apart; veins 11—13 pairs, lowest pair anastomosing, next pair to sinus-membrane; lower surface of rachis and costae slightly hairy. Sori medial, lower ones not divergent; indusia small, glabrous; sporangia lacking hairs near annulus.

Distribution. Tonga.

52. **Pneumatopteris tobaica** Holtt., *spec. nov.*

Caudex ignotus; frons typi imperfecta (basi stipitis et dimidio apicali laminae deficientibus); pinnae reductae plurijugatae, c. 7 × 7 mm, non auriculatae, inter se 5—6 cm distantes; pinnae evolutae inferiores plures basin versus sensim multo angustatae; pinnae maximae 24 × 2.8 cm, acuminatae, fere ¾ costam versus lobatae, lobis oblongis subtruncatis, dentatis; costulae 5—5½ mm inter se distantes; venae 11—12-jugatae, infimae anastomosantes, ceterae omnes ad marginem procurrentes; pagina inferior praeter pilos paucos ad rachin, membranas sinuum et marginem glabra. Sori inframediales, inferiores non divergentes;

indusia firma, fusca, pilis brevibus praedita; sporangia pilis capitatis prope annulum ornata.

T y p e: *Surbeck 14*, NE. Sumatra, S. side of Lake Toba, 1900 m (L; BO).

The pinnae of this specimen are much like those of *P. longipes*, but the reduced pinnae are distinctive; the rhizome might show another difference.

53. **Pneumatopteris incisa** Holtt., *spec. nov.*

Caudex ignotus; stipes atroviridis (Alston), glabrescens, 15 cm longus usque pinnam reductam infimam, 50 cm usque pinnas evolutas; pinnae reductae 7-jugatae, infimae 5—6 mm longae et latae, superiores 15 × 10 mm, triangulares, crenatae; pinnae evolutae inferiores basin versus sensim angustatae, non auriculatae; pinnae maximae 21 × 2.7 cm, acuminatae, $\frac{4}{5}$—$\frac{5}{6}$ costam versus lobatae, lobis leviter falcatis, integris, apice rotundatis; costulae 5 mm inter se distantes; venae usque 12-jugatae, graciles, infimae tantum anastomosantes; rachis subtus sparsim hirsuta, costae costulae venae laminaque subtus pilis gracilibus pallidis erectis sparsim vestitae. Sori inframediales, costulas non tegentes; indusia tenuia, pilis gracilibus praedita; sporangia pilis capitatis ornata.

T y p e: *Alston 16623*, Ternate, G. Gamalama (BM). Also *Pleyte 397*, Halmahera, G. Sembilan, 600 m, by stream in forest (L).

54. **Pneumatopteris bryanii** (C. Chr.) Holtt., *comb. nov.*

Dryopteris bryanii C. Chr., Bishop Mus. Bull. 177 (1943) 89, pl. 4A. — T y p e: *Bryan 160*, Samoa (BISH; K).

Caudex erect; stipe 30—40 cm, minutely hairy; basal 2—4 pairs of pinnae abruptly much reduced and widely spaced, lowest 1 cm long; lower large pinnae much narrowed towards their bases; largest pinnae 25 × 2.8 cm, acuminate, lobed $\frac{2}{3}$ or more deeply, lobes slightly falcate, tips broadly pointed and slightly toothed; costules to 5 mm apart; veins to 14 pairs, 1—1½ pairs anastomosing; lower surfaces glabrous. Sori near costules; indusia small, glabrous; sporangia with capitate hairs near annulus.

55. **Pneumatopteris vaupelii** (C. Chr.) Holtt., *comb. nov.*

Dryopteris vaupelii C. Chr., Bishop Mus. Bull. 177 (1943) 89, pl. 3B. — T y p e: *Vaupel 228*, Samoa (B).

Caudex not known; frond in all 250 cm long. Basal 4 or 5 pairs of pinnae 1—2 cm long, orbicular, then *c.* 3 pairs transitional to normal pinnae; largest pinnae 30 × 3.5 cm, lobed *c.* $\frac{2}{3}$, lobes somewhat narrowed to subtruncate apex; costules 7 mm or more apart; veins 10—12 pairs, 1 pair anastomosing, 1 or 2 veins to sides of sinus-membrane; lower surface glabrous. Sori inframedial; indusia glabrous; sporangia with capitate hairs.

56. **Pneumatopteris hudsoniana** (Brack.) Holtt., *comb. nov.*

Nephrodium hudsonianum Brack. in Wilkes, U. S. Expl. Exp. 16 (1854) 188, t. 25. — T y p e: *Brackenridge s.n.*, Sandwich I. (US; K).

Stipe *c.* 17 cm to first reduced pinna, 45 cm to first large pinna; reduced pinnae *c.* 6 pairs, lowest under 1 cm long, upper ones not auricled; basal large pinnae not narrowed to bases; largest pinnae 20—25 cm long, 2½—3 cm wide, acuminate, lobed a little over halfway to costa; lobes oblong with minutely dentate apex; costules 5—6 mm apart; veins to 9 pairs, basal pair anastomosing, next 1 or 2 veins to sides of sinus-membrane; lower surface glabrous apart from marginal hairs. Sori medial, lowest not divergent; indusia with a few hairs; sporangia with capitate yellow hairs near annulus.

D i s t r i b u t i o n. Hawaii.

57. Pneumatopteris comorensis Holtt., *spec. nov.*

Caudex verisimiliter erectus; stipes 30 cm longus usque pinnam reductam infimam, paleis adpressis vestitus; pinnae reductae 4-jugatae, infimae 1 × 1 cm, superiores usque 2 × 1.5 cm, crenatae, non auriculatae; pinnae infimae evolutae basin versus non angustatae; pinnae maximae 33 × 3.0 cm, basi truncatae, caudato-acuminatae (cauda 2½ cm longa), dimidio vel paulo ultra versus costam lobatae; lobi non falcati, integri, apice rotundati, ciliati; costulae 4½—5(—6) mm inter se distantes; venae usque 12-jugatae, 1—1½-jugatis anastomosantibus; rachis subtus sparsim hirsutae, costae copiose costulae sparsim pilis patentibus vestitae. Sori mediales; indusia tenuia, longe-pilosa; sporangia pilis capitatis elongatis ornata.

T y p e: *Hildebrandt 1782*, Comoro I., Johanna, 200—800 m (K; BM, B, L, FI).

58. Pneumatopteris rotumaensis (St John) Holtt., *comb. nov.*

Cyclosorus rotumaensis St John, Occ. Pap. Bishop Mus. 21 (1954) 180. — T y p e: *St John 19139*, Rotuma I. (BISH; K).

Caudex erect, to 20 cm tall. Fronds dimorphous, sterile with subabrupt transition to basal reduced pinnae, lower large pinnae narrowed to their bases, largest to 24 × 2.7 cm, lobed a little more than ½; fertile frond with basal pinnae, *c.* 9 pairs, gradually reduced, lowest large pinnae not narrowed to their bases, largest 20 × 2.2 cm; costules 5—6 mm apart, veins 8—10 pairs (sterile) 5—7 pairs (fertile); rachis beneath minutely hairy; sori slightly inframedial; indusia large, thin, with a few hairs; sporangia bearing capitate hairs.

D i s t r i b u t i o n. Rotuma I., New Hebrides. Perhaps only a fully developed form of *P. glaberrima* (no. 60, *infra*).

59. Pneumatopteris nitidula (Presl) Holtt., *comb. nov.*

Nephrodium nitidulum Presl, Epim. Bot. (1851) 46, Holtt., Novit. Bot. Inst. Bot. Univ. Carol. Prag. 1968 (1969) 40. — *Cyclosorus nitidulus* Copel., Fern Fl. Philip. (1960) 364, *syn. omn. excl.* — T y p e: *Cuming s.n.*, Philippines (PRC).

Caudex erect; reduced pinnae 5—7 pairs, lowest *c.* 6 × 6 mm, orbicular, uppermost 3 cm long, 2 cm or more wide at truncate base, edges crenate; basal large pinnae not or little narrowed to their bases; largest pinnae of type 24 × 2.2 cm, sterile ones sometimes to 3 cm wide, evenly attenuate to slender tip, lobed a little over ½, lobes with rounded tips; costules 4½—5½ mm apart; veins 9—10 pairs, concolorous, slender, lowest pair anastomosing, next pair to sinus-membrane; lower surfaces with minute erect hairs. Sori slightly inframedial; indusia hairy; sporangia with capitate hairs.

D i s t r i b u t i o n. Philippines, Luzon to Mindanao.

60. Pneumatopteris glaberrima (Richard) Holtt., *comb. nov.*

Aspidium glaberrimum Rich., Sert. Astrol. (1834) xviii. — T y p e: *Durville s.n.*, 1827, W. New Guinea, Port Dorei (P).

Polystichum truncatum Gaud. in Freyc. Voy. Bot. (1827) 332. — *Aspidium truncatum* Gaud., ibid. pl. 10. — *Cyclosorus truncatus* Tard., Notul. Syst. 7 (1938) 78, *nomen tantum.* — T y p e: *Gaudichaud*, Rawak (Lawak) I., W. New Guinea (P; B).

Caudex probably erect; reduced pinnae 4—6 pairs, lowest *c.* 1 × 1 cm, uppermost *c.* 2 × 1 cm, base truncate not auricled; largest pinnae probably *c.* 16 × 1.6 cm, lobed halfway or rather less deeply; veins 7—8 pairs; lower surface glabrous (or with some minute erect hairs). Sori medial; indusia with a few short hairs; sporangia bearing capitate hairs.

Distribution. New Guinea, Bismarck Arch.

Better specimens are needed for clear characterization of this species. It is possible that Gaudichaud's species is distinct; if so, it cannot bear the name *truncata* in the genus *Pneumatopteris*.

61. **Pneumatopteris rodigasiana** (T. Moore) Holtt., *comb. nov.*

Nephrodium rodigasianum T. Moore in Linden, Ill. Hort. 29 (1882) 27, pl. 442. — Type: cult., origin Samoa (K).

Caudex apparently erect; basal 8 pairs of pinnae very gradually reduced; lowest large pinnae not narrowed to their bases; largest pinnae (type) 15×2 cm, acuminate, lobed almost halfway to costa, texture thin, lobes with rounded tips slightly toothed; costules 4—4½ mm apart; veins to 9 pairs, very oblique except lowest, 1 pair anastomosing; lower surface of rachis and costae closely very-short-hairy, some short hairs on lamina also. Sori inframedial; indusia thin, glabrous; sporangia bearing capitate hairs.

Distribution. Samoa, Solomon Is., Bismarck Arch.

I am not sure whether this is distinct from *P. rotumaensis*.

62. **Pneumatopteris micropaleata** Holtt., *spec. nov.*

Caudex erectus; stipes usque pinnam reductam infimam 10 cm, usque pinnam infimam evolutam 50 cm; pinnae reductae infimae 5 mm longae, superiores 10 mm; pinnae evolutae inferiores basin versus leviter angustatae, non auriculatae; pinnae maximae 17×1.8 cm, ad basin aerophoris tumidis hemisphaericis praeditae, basi truncatae, apice caudatae, dimidio costam versus vel leviter ultra lobatae, lobis fere rectis non falcatis apice late rotundato leviter dentatis; costae pinnarum fertilium 3—3½ mm inter se distantes; venae 7—8-jugatae, infimae solum anastomosantes, unijugatae ad membranam sinus procurrentes; pagina inferior rachidis pilis tenuibus rectis paleisque minutis praedita, costarum, costularum, venarum laminaeque paleis per-reductis filiformibus multis ornata. Sori paulo inframediales, infimi non divergentes; indusia glabra; sporangia pilis capitatis ornata.

Type: *Holttum 58*, Sabah, Mt Kinabalu, 1800 m, on wet rocks near waterfall, Nov. 1972 (K; SING).

63. **Pneumatopteris magnifica** (Copel). Holtt., *comb. nov.*

Dryopteris magnifica Copel., Bull. Bishop Mus. 59 (1929) 11. — Type: *Parks 20187A*, Fiji, Viti Levu, 1000 m (UC; BISH).

Caudex erect; frond in all 200 cm long; reduced pinnae *c.* 5 pairs, lowest 5 mm, uppermost 15 mm long, not auricled; lowest large pinnae a little narrowed at their bases; largest pinnae 28×2.4 cm, base truncate, apex acuminate; lobed a little more than ½, lobes oblong, distinctly oblique, apex rounded entire; costules 5 mm apart; veins 7—9 pairs, lowest anastomosing, next to sinus-membrane; lower surface with slender short hairs on rachis and bases of costae. Sori medial or inframedial; indusia glabrous; sporangia bearing many capitate hairs.

Distribution. Fiji.

64. **Pneumatopteris transversaria** (Brack.) Holtt., *comb. nov.*

Nephrodium transversarium Brack. in Wilkes, U. S. Expl. Exp. 16 (1854) 187. — *Dryopteris transversaria* Brause, Bot. Jahrb. 56 (1920) 104; C. Chr., Bull. Bishop Mus. 177 (1943) 88. — Type: *Brackenridge*, Samoa (US).

Caudex erect; *c.* 6 pairs of reduced pinnae, lowest 1 cm, uppermost 3 cm long, then 1 or 2 pairs intermediate; lowest large pinnae gradually narrowed to base, largest pinnae 20 × 1.6—2.0 cm, base broadly cuneate, apex evenly attenuate, lobed about halfway to costa, lobes firm, slightly narrowed distally, toothed; veins 7 pairs; lower surface hairy on costae. Sori near costules; indusia small, firm, glabrous; sporangia bearing capitate hairs.

Distribution. Samoa, Fiji.

65. **Pneumatopteris nephrolepioides** (C. Chr.) Holtt., *comb. nov.*

Dryopteris nephrolepioides C. Chr., Brittonia 2 (1937) 268, 295, fig. 1, c, d. — Type: *Brass 5354*, Papua, Mafulu, Centr. Div., on limestone, 1700 m (BM; NY).

Rhizome short, fronds closely tufted; stipe 3—4 cm, slender, scales ovate, 1 mm long; frond to 40 cm long, pinnae 40 pairs; lower pinnae gradually reduced, more widely spaced and deflexed; largest pinnae 13—16 × 5—6 mm, edges sinuous to crenate; veins 7—8 pairs in each pinna, oblique, simple except basal acroscopic one, with white scales at their tips on upper surface; minute capitate hairs on costae and veins beneath; short erect hairs on upper surface throughout. Sori medial on veins, exindusiate; very small capitate hairs on sporangia.

Distribution. Known also from one collection in Morobe District, Sambanga: *Clemens 7207* (BM, B).

66. **Pneumatopteris ligulata** (Presl) Holtt., *comb. nov.*

Lastrea ligulata Presl, Epim. Bot. (1851) 35; Copel., Fern Fl. Philip. (1960) 327. — Type: *Cuming 74*, Philippines (PRC; K, E).
Lastrea philippina Presl, Epim. Bot. (1851) 36. — Type: *Cuming 393*, Zebu (PRC).
Nephrodium luerssenii Harr., J. Linn. Soc. Bot. 16 (1877) 29. — Type: *Steere*, Bulukai I. (K).
Dryopteris foxii Chr., Philip. J. Sc. 2 Bot. (1907) 208. — Lectotype: *Copeland 940*, Mindanao (US).

Rhizome short-creeping; stipe to 40 cm, basal scales narrow, hairy; frond to 70 cm, pinnae *c.* 20 pairs, well spaced, basal 2—4 pairs reduced, variable; largest pinnae to 20 × 3 cm, lobes on basiscopic side all shorter than on acroscopic, base unequally cuneate, apex caudate-acuminate, lobed to ½ mm from costa; lobes oblique, sometimes toothed distally, sinuses broad; veins 9—12 pairs, free; both surfaces bearing fine short spreading hairs. Sori submarginal; indusia short-hairy or glabrous; sporangia sometimes with capitate hairs.

Distribution. Philippines, Talaud I., beside rocky streams.

The type of *D. foxii* is much smaller than that of *P. ligulata*, but all grades of intermediates occur. The lectotype of *D. foxii* has glabrous indusia. Christ cited several specimens under *D. foxii* without specifying a type; they are not in his herbarium at Paris and were presumably on loan to him from Manila, now destroyed; the lectotype is from a Copeland collection cited by Christ.

67. **Pneumatopteris keysseriana** (Rosenst.) Holtt., *comb. nov.*

Dryopteris keysseriana Rosenst., Fed. Repert. 10 (Feb. 1912) 333. — Type: *Keysser 23*, Sattelberg 1911 (not seen).
Dryopteris schultzei Brause, Bot. Jahrb. 49 (Aug. 1912) 19. — Type: *L. Schultze 253*, NE. New Guinea, Sepik (B).

Rhizome short-creeping, stipes tufted; stipe to 70 cm, base with thin ovate appressed scales; frond to 80 cm, pinnae 20 pairs or more; basal 2 or 3 pairs pinnae abruptly reduced

and remote; largest pinnae to 23 × 4 cm, base unequally broadly cuneate, basal basiscopic segment reduced, apex caudate-acuminate, lobed to 1½—2 mm from costa; lobes slightly tapering, separated by wide sinuses; costules 5—6 mm apart, veins to 16 pairs; rachis and costae ± hairy beneath. Sori supramedial; indusia small with short hairs; sporangia sometimes bearing capitate hairs.

Distribution. NE. New Guinea, by streams in lowland forest.

I have not seen the type; at Kew is a specimen of *Bamler L. 56*, Logaueng, also cited by Rosenstock. The type of *D. schultzei* is firmer in texture, with short hairs between veins on lower surface.

68. Pneumatopteris caudata (Holtt.) Holtt., *comb. nov.*

Pseudocyclosorus caudatus Holtt., Blumea 13 (1965) 133. — Type: cult. Hort. Bot. Kew *545/68, no 12*, origin near Lae, New Guinea, *leg. Holttum*.

Caudex erect; stipe 15 cm or more long, bearing *c.* 2 pairs of very small reduced pinnae, basal scales small, ovate; frond 30 cm, pinnae 15 pairs, lower ones slightly reduced, largest 8 × 1.5 cm, basiscopic basal lobe minute, apex abruptly caudate, lobed to 1 mm from costa, lobes oblique with rounded apices; costules 3½ mm apart, at 45°; veins 9 pairs, free; lower surfaces of rachis, costa, costules and veins with minute acicular and capitate hairs. Sori supramedial; indusia short-hairy; sporangia eglandular.

Distribution. NE. New Guinea.

69. Pneumatopteris excisa (Holtt.) Holtt., *comb. nov.*

Pseudocyclosorus excisus Holtt., Blumea 13 (1965) 133. — Type: *Millar & Holttum NGF 18623*, NE. New Guinea, Kerowagi, E. Highlands, 2000 m (K; L).

Differs from *P. caudata:* several basiscopic basal lobes in each pinna much reduced; sori medial, filling lower surface at maturity; indusia minute, glabrous. The type has pinnae to 10 × 1.5 cm; *Brass 31505*, also from E. Highlands, has pinnae to 14 × 1.8 cm; there are two other collections.

70. Pneumatopteris versteeghii Holtt., *spec. nov.*

Rhizoma breve-repens, 2 mm diametro, stipites arcte seriatos gerens. Stipes 8 cm longus, paleis minutis adpressis basi vestitus; lamina translucens, 15—18 cm longa, pinnis usque 20-jugatis; pinnae infimae ± abbreviatae, deflexae, remotiores; apex laminae acuminatus, profunde lobatus; pinnae maximae 20 × 6 mm, basi valde asymmetricae (basiscopice anguste cuneatae acroscopice truncatae et auriculatae, auricula dentata), apice obtusae, marginibus dimidio costam versus lobatae, lobis interdum leviter dentatis; venae liberae, vulgo 2-jugatae (in auriculis pinnarum majorum 4-jugatae), tenues, fuscae, vena infima acroscopica basi sinus terminata; pagina inferior omnino glabra; costa supra basin versus pilis paucis praedita. Sori prope costam utrinque uniseriati; indusia pilis brevibus multis vestita; sporangia pilis brevibus capitatis ornata.

Type: *Versteegh BW 10259*, W. New Guinea, Div. Fak-Fak, Genofa Mts., 1100 m, in forest on steep rocky soil (L).

71. Pneumatopteris deficiens Holtt., *spec. nov.*

Caudex brevis, erectus; stipes usque 40 cm longus, glaber, paleis tenuibus ovatis vestitus; lamina usque 35 cm longa, pinnis 8-jugatis; pinnae infimae reductae, interdum 5 mm longae, vulgo majores; pinnae inferiores maximae basin versus sensim angustatae; pinnae

usque 12 × 2.2 cm, basi asymmetrice truncatae, acuminatae, fere ad costam lobatae, lobis obliquis acutis leviter dentatis breviciliatis; costulae 5—6 mm inter se distantes; venae usque 8-jugatae, liberae, utroque pallidae prominentes; costa subtus pilis minutis praedita. Sori leviter inframediales; indusia parva, pilis brevissimis paucis praedita; sporangia pilis capitatis destituta.

T y p e: *Posthumus 3183*, Flores, S. of Roeleng, 1300 m, wet shady place on earth banks in ravine (BO, K). Also *Posthumus 3323*, *3293* (BO, L).

72. **Pneumatopteris regis** (Copel.) Holtt., *comb. nov.*

Dryopteris regis Copel., Univ. Cal. Publ. Bot. 18 (1942) 220. — *Lastrea regis* Copel., Philip. J. Sc. 78 (1951) 425, pl. 19. — T y p e: *C. King 486*, Papua, mountains behind Wedan (MICH).

Rhizome and stipe not known; frond 120 cm long; reduced pinnae 6 pairs, 1—1½ cm long and wide, deeply lobed; largest pinnae 15 × 2.5 cm, base truncate and a little dilated (most on acroscopic side), acuminate, lobed to 1 mm from costa; lobes 13 × 4 mm, slightly oblique, entire, tips rounded; costules 5 mm apart; veins 8 pairs, oblique, free; lower surfaces glabrous. Sori small, inframedial; indusia lacking (sori of type are old); few sporangia seen, no capitate hairs observed on them.

73. **Pneumatopteris imbricata** Holtt., *spec. nov.*

Rhizoma ignotum. Stipes usque pinnam infimam reductam 5 cm longus, usque pinnam evolutam infimam 45—60 cm; pinnae reductae c. 1 cm longae, profunde lobatae (lobis basalibus majoribus lobulatis), oppositae, superiores 3—4 cm inter se distantes, inferiores 2 cm. Lamina (pinnis reductis exclusis) 100 cm longa, pinis 35-jugatis, oppositis; pinnae inferiores basi dilatatae, lobis infimis dentatis, acroscopicis rachin subtus, basiscopicis supra imbricantibus; pinnae medianae usque 24 × 3 cm, basi truncatae ± auriculatae, apice anguste acuminatae, marginibus fere ad costam lobatae, sinubus late rotundatis, lobis oblongis, obliquis, leviter falcatis, integris, in sicco 3 mm latis; costulae 4½—5½ mm inter se distantes; venae liberae, usque 12-jugatae, infimae ambae ad marginem supra basin sinus protentae; pagina inferior praeter margines et membranas sinuum glabra. Sori leviter inframediales, parvi, exindusiati; sporangia pilis brevibus capitatis interdum ornata.

T y p e: *Brooks 17775*, Amboina, Hila, 200 m, on rock by river (BM; L, BO).

D i s t r i b u t i o n. Halmahera (*Pleyte 370*); Solomon Is., Guadalcanal (*Womersley & Whitmore BSIP 1038*). No other specimens seen.

74. **Pneumatopteris petrophila** (Copel.) Holtt., *comb. nov.*

Dryopteris petrophila Copel., Univ. Cal. Publ. Bot. 18 (1942) 220. — *Lastrea petrophila* Copel., Gen. Fil. (1947) 139; Philip. J. Sc. 78 (1951) 424, pl. 18. — *Pseudocyclosorus petrophila* Holtt., Blumea 13 (1965) 133. — T y p e: *Brass 11326*, W. New Guinea, Bele river, NE. of Lake Habbema, 2200 m, on moist rock (MICH; L, BM).

Caudex short, erect; stipe 5—6 cm, at base small appressed scales; frond 40 cm long, pinnae *c.* 20 pairs, almost opposite throughout; lower 8—10 pairs of pinnae reduced, lowest 3 mm long and wide, upper ones lobed; largest pinnae 4 × 0.8—0.9 cm, base broadly cuneate and sometimes distinctly auricled on acroscopic side, short-pointed, lobed about halfway to costa, lobes falcate, narrowed a little to blunt tips; costules 3 mm apart; veins 3—4 pairs, free, slender and prominent; lower surface of rachis copiously short-hairy; on rest of lower surface minute hairs, acicular and capitate; short hairs on upper surface between veins. Sori medial, exindusiate; sporangia with capitate hairs near annulus.

Distribution. Also known from several collections in NE. New Guinea, some with pinnae to 9×1.0 cm: *Millar & Holttum NGF 15842, Clemens 7147; T. G. Walker 7744, 8371, 8372, 8510.*

75. **Pneumatopteris sumbawensis** (C. Chr.) Holtt., *comb. nov.*

Dryopteris sumbawensis C. Chr. in Rensch, Hedwigia 74 (1934) 231, tab. vii, fig. 1. — Type: *Rensch 578* Sumbawa, Batu Dulang, 900 m, on rocks in forest (BO; B).

Rhizome not known. Stipe 2—3 cm long; frond 30 cm long, pinnae 35—40 pairs; 6 pairs of lower pinnae gradually reduced, lowest 3 mm long; lower pinnae ± deflexed, a little narrowed to base on basiscopic side; largest pinnae 2.5—3.0×1.0 cm; basal acroscopic segment free, then 2 or 3 pairs of segments separately adnate to costa; costules or bases of free segments to 3 mm apart; veins 3—4 pairs, dark but not prominent beneath, basal acroscopic one sometimes forked, rest simple and free; lower surfaces of all parts bearing minute capitate hairs; upper surface with very short acicular and capitate hairs between veins. Sori supramedial to medial, exindusiate; no hairs on sporangia.

Only known from original collection. In its copious capitate hairs on lower surfaces this species matches *P. costata*, which also occurs in Sumbawa.

76. **Pneumatopteris walkeri** Holtt., *spec. nov.*

Caudex brevis, erectus vel suberectus; stipes usque pinnam reductam infimam 20 cm, usque pinnam evolutam infimam 45—50 cm, minute hirsutus, basin versus paleis latis adpressis vestitus; pinnae reductae 2—3 mm longae, alternae; lamina (pinnis reductis exclusis) 55 cm longa, pinnis 20-jugatis, alternis; pinnae inferiores 1—2-jugatae leviter reductae; pinnae maximae 8—11 cm longae, 1.1—1.9 cm latae, basi acroscopice truncatae, basiscopice anguste cuneatae, apice caudato-acuminatae (cauda 3 cm longa, dentata, sorifera), fere ad costam lobatae, lobis acroscopicis patentibus quam basiscopicis longioribus, lobis basiscopicis valde obliquis, lobis omnibus apice dentatis; costulae 4 mm inter se distantes; venae usque 9-jugatae, liberae, subtus pallidae, utroque prominentes; rachis subtus pilis erectis minutis praedita, pagina inferior cetera glabra. Sori mediales; indusia tenuia, glabra; sporangia glandulis destituta.

Type: *T. G. Walker 9980*, NE. New Guinea, Eastern Highlands, Waisa (BM).

DOUBTFUL SPECIES

Cyclosorus blastophorus Alston

C. blastophorus Alston, Bol. Soc. Brot. II, 30 (1956) 12; Fl. W. Trop. Afr. (1959) 62. — Type: *Savory & Keay FHI 25062*, S. Nigeria (BM).

This species appears to be closely allied to *Pneumatopteris unita* (Kunze) Holtt. (no. 13 *supra*) from which it differs in almost entire pinnae and medial sori. I have not seen spores, nor any good specimen except the type. Some very similar specimens from West Africa have costular sori.

INDEX

of basionyms, and of all binomials in *Pneumatopteris* (numbers refer to the serial numbers of species in the present paper; new names are in **bold type**).