4

A REVISION OF THE PTERIDOPHYTA OF SAMOA

BY

CARL CHRISTENSEN

(SELAGINELLA BY A. H. G. ALSTON)

BERNICE P. BISHOP MUSEUM

BULLETIN 177

HONOLULU, HAWAII

PUBLISHED BY THE MUSEUM

1943

Issued June 16, 1943

A Revision of the Pteridophyta of Samoa

By CARL CHRISTENSEN
(SELAGINELLA by A. H. G. Alston)

Due to war conditions, the author was unable to revise the edited manuscript of this paper. Bishop Museum is printing it in the best form possible under the circumstances, rather than withhold publication indefinitely.—Editor.

INTRODUCTION

In 1930, I was asked by Dr. Erling Christophersen (Bernice P. Bishop Museum Fellow, 1929-1930) to work out the collection of pteridophytes made by him in Samoa in 1929. All of his material, together with that collected by Bryan, Eames, and Garber, was sent to me by him. In 1931, Dr. Christophersen went again to Samoa, and the following year I received duplicates of all pteridophytes, except *Selaginella,* collected by him. This paper is based chiefly upon these collections and is prepared at the request of the Director of Bernice P. Bishop Museum. Unfortunately, other urgent work interrupted the study of these ferns, delaying its completion until the end of 1938.

I first planned to write a paper similar to E. B. Copeland's "Ferns of Fiji" and "Pteridophytes of the Society Islands," but I soon found that plan unsatisfactory. Copeland based his two papers chiefly (that on the Society Islands exclusively) on collections worked out by himself, omitting all earlier reports, and his lists of species are therefore rather incomplete. I wished to prepare a complete, revised list of all known Samoan species based, if possible, on an examination of all Samoan collections, particularly types. Through the kindness of the directors of some leading herbaria (Kew, Berlin-Dahlem, Vienna, Paris, Geneva, U.S. National Herbarium), I have had on loan many specimens, including practically all types of species described from Samoa. For this valuable help, without which the work would not have been possible, I sincerely thank the authorities of those herbaria. I especially thank Dr. Christophersen and the Director of Bishop Museum for enabling me to work out their comprehensive collections and for the duplicates given to me.

The difficulty of this work is not in determining and defining the Samoan species, but in determining whether a species is endemic or should be united with forms from other Polynesian islands. This problem cannot be solved without access to large collections from these various islands. I have seen much material, especially types, and Copeland has kindly sent me duplicates from Fiji, Tonga, and Rarotonga. Nevertheless, my results are not always conclusive. Many species seem to occur in Central Polynesia with somewhat

deviating forms, which some writers consider as good species, whereas others, like me, consider them geographical races or varieties.

The fern flora of Samoa is rather well known, for three comprehensive papers (Luerssen, Die Farne de Samoa-Inseln, 1874; Christ, Die Flora der Samoa-Inseln, 1897*; Rechinger, Botaniske . . . Ergebnisse . . . nach den Samoa-Inseln, 1908) besides some lesser ones, give a more or less complete list of the species found there. I have seen most of the specimens cited by these writers and find many of them wrongly named, as I have clearly shown in the synonymy given under each species listed below. It is perhaps necessary to point out that I do not cite any synonym without having seen the specimens in question. The great difference between these papers and the present report is further due to the change of the species concept, and to the totally different nomenclature used.

Copeland's revisions of the ferns of Fiji and the Society Islands have been very helpful to me, and I refer to them whenever keys to families and genera and descriptions of species are given. I do not find it necessary to repeat these keys and descriptions of common species, but give keys to species and descriptions of all critical and new species based on Samoan material. The arrangement of families and genera is as a whole that of my classification of the Filicineae in Verdoorn's Manual of Pteridology, 1938, but I retain here the genera *Dryopteris* and *Polypodium* in the wide sense of Index Filicum. References to literature concerning the single species may be found in Index with supplements, and are omitted in this paper.

The number of genera and species listed are as follows:

	Genera	Species	New Species	Endemic Species
Ferns	59	201	9	32
Fern-allies	4	17	..	5
Total	63	218	9	37

These figures are rather low compared with the corresponding ones of the fern flora of Fiji, but considerably higher than those of the Society Islands, which means that the large number of Central Polynesian species with western distribution reaches its eastern limit in Samoa. I wish to defer a closer analysis of the composition of the Samoa fern flora to another paper, but a few important characters are briefly mentioned here. The great mass of species is either Malayan or closely related to Malayan ones, whereas the antarctic element is weakly represented. The flora is closely related to that of Fiji, 13 species being common to Fiji and Samoa. The occurrence of eight non-endemic species, found nowhere else in Polynesia is remarkable. The percentage of endemic species is 17.5 percent, a rather low figure, but too high in my opinion.

* This date is the year of publication of the volume. The separate was published in 1896.

Herbaria in which collections are stored are referred to by letter as follows:

B = Botanisches Museum, Berlin-Dahlem.
G = Conservatoire botanique, Geneva.
Kew = Royal Botanic Gardens, Kew.
P = Musèum d'Histoire naturelle, Paris.
V = Naturhistorisches Museum, Vienna.
W = U.S. National Museum, Washington.
BM, or specimens without a letter = B. P. Bishop Museum, Honolulu, Hawaii.
CC, C. Christensen.

The principal collections examined by me were made by the following explorers.

1. U.S. Exploring Expedition, 1838-1842, under the command of Charles Wilkes, (W, some duplicates at Kew. Litt. Brackenridge).

2. Eduard Graeffe, 1862-1872. (Collection at Hamburg, not seen, but duplicates in many herbaria. Litt. Luerssen).

3. Thomas Powell, 1868-1885. (Kew and duplicates in many herbaria; exact locality [island] of most specimens is unfortunately not given. Litt. Powell).

4. S. J. Whitmee, 1875-1885? (Kew, duplicates at Copenhagen; localities not given. Litt. Baker).

5. C. Betche, 1879-1881. (Mostly fragmentary specimens seen; the collection is probably at Munich. Litt. Christ).

6. W. E. Safford, 1888 (W).

7. E. Reinecke 1893-1895. (B, duplicates at Kew, W. Litt. Christ).

8. F. Vaupel, 1904-1907. (B, duplicates at Kew, W. Litt. Lauterbach, Brause).

9. B. P. G. Hochreutiner, 1903-1905. (G. Litt. Christ, 2).

10. K. and L. Rechinger, 1905. (V, duplicates in W, Copenhagen. Litt. Rechinger).

11. D. J. McMullin, 1914. (W).

12. W. A. Setchell, 1920. (W, Litt. Setchell).

13. D. W. Garber, 1921. (BM).

14. Dumas, 1922 (P).

15, 16. E. H. Bryan, Jr., and A. J. Eames (BM).

17. Erling Christophersen, 1929, 1931. (BM, duplicates Copenhagen).

I have seen a few specimens collected by casual visitors (Weber, 1882; Funk, 1896; Stearns and others). All specimens collected by Christophersen, Bryan, Eames, and Garber are cited below as well as all critical species seen.

OPHIOGLOSSACEAE

Genus **OPHIOGLOSSUM** Linnaeus

Copeland, B. P. Bishop Mus., Bull. **59**: 19, 1929.

Sterile blade entire, the fertile one a simple spike with immersed sporangia.

1. **Ophioglossum parvifolium** Greville and Hooker, Bot. Misc. Hook. **3**: 218, 1833.

   Ophioglossum vulgatum var. *australasiatica* Luerssen, Jour. Mus. Godde-froy **8**: 246, pl. 13, figs. 66-76, 1875.

   Ophioglossum nudicaule Linnaeus fil. Christ, Engler Bot. Jahrb. **23**: 365, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 445, 1908.

   Ophioglossum pedunculosum Desvaux. Copeland, B. P. Bishop Mus., Bull. **59**: 20, 1929; Bull. **93**: 17, 1932.

The many small Polynesian forms of this genus have been commonly referred to *O. pedunculosum* Desvaux, but for many years I suspected that Desvaux's species was greatly misunderstood, and with reason. I received recently from Mr. Weatherby of Gray Herbarium, a photograph of the type in the Museum of Natural History in Paris, and it proves clearly that *O. pedunculosum* is the same as *O. fibrosum* Schumann, probably originating in West Africa. *O. pedunculosum* of Index Filicum is probably a composite species including such distinct forms as *O. moluccanum* Schlechtendal. The Samoan specimens differ in size, but all forms correspond closely to some of Luerssen's figures of his *australasiatica* and no doubt belong to the same species. The smallest ones are extremely like *O. parvifolium* Greville and Hooker from India, and therefore I use that name here. Whether it is in reality different from the South African *O. nudicaule* Linnaeus fil., I have not decided. The specimens may be separated as follows:

(a). Small forms (Luerssen, Jour. Mus. Godeffroy **8**: fig. 71, 1875).

Common stalk rarely over 1 cm., sterile blade roundish, mostly under 1 cm. long and wide.

Savaii: *Vaupel 307* (W); *Christophersen 637, 3148.* Upolu: *Reinecke 116* (Kew, W).

(b). Intermediate forms between a and c.

Without locality: *Powell 251* (Kew).

Savaii: *Rechinger 125* (V).

(c). Larger forms (Luerssen, Jour. Mus. Godeffroy **8**: figs. 66, 67, 76, 78, 1875).

Common stalk 3-5 cm. or more, sterile blade 1-3 cm. long, elliptic to ovate.

Without locality: *Whitmee* (Kew).

Savaii: *Rechinger 1057* (V, W); *Christophersen 3165, 3182.*

Similar forms in other Polynesian islands, tropical Australia and Asia.[1]

2. **Ophioglossum reticulatum** Linnaeus var. **pacificum,** var. nov. (pl. 1, *A*).
Ophioglossum vulgatum var. *reticulatum* Mettenius. Luerssen, Mitt. Bot. 1: 265, 404, 1874.
Ophioglossum reticulatum Linnaeus. Baker, Jour. Bot. **14**: 345, 1876. Christ, Engler Bot. Jahrb. **23**: 365, 1897.

A typo americano differt: lamina sterili sinu basali profundiore, angustiore potius reniformi quam cordata, areolis majoribus venulas liberas 1-2 vel nullas includentibus.

Without locality: *Horne 12* (Kew); *Brackenridge* (Kew, W); *Whitmee 194* (Kew).

Savaii: Tuisivi Range, 1,600-1,700 m., *Christophersen 817* (type).

Tutuila: *Powell 127* (Kew).

In size and texture this variety is like the West Indian type but the sinus is deeper and narrower and the venation quite different. The larger 4-6 sided areoles are similar, but in the variety they are empty or with 1-2 free veinlets, in the type with a reticulum of smaller areoles. The rhizome often bears 2-3 leaves instead of the usual 1. The shape of the sterile blade of the variety resembles the Philippine *O. Cumingianum* Presl, the veins of which are still more densely reticulate than in the type.

O. reticulatum is said to be pantropic, and is evidently an aggregate of several varieties or perhaps species, one of which is variety *pacificum*.

3. **Ophioglossum pendulum** Linnaeus. Copeland, B. P. Bishop Mus., Bull. **59**: 20, 1929; Bull. **93**: 17, 1932; and all authors..

Epiphyte, common on all islands, found by all collectors.

Savaii: *Christophersen 922*. Tau: *Garber 616, 632* (*laugapapa*).[2]

Tropical Polynesia, Asia west to Madagascar.

Genus **BOTRYCHIUM** Swartz

Sterile and fertile portions of the leaf divided, 1-4-pinnate, the sterile portion of the only Samoan species deltoid, tripinnate, 15 cm. long and wide or even larger. Sporangia sessile.

1. **Botrychium daucifolium** Wallich. Baker, Jour. Bot. **14**: 446, 1876. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 62, 1908.

Savaii: above Aopo, 700-800 m., *Rechinger 1081* (V). Upolu: *Powell* (Kew); *Whitmee 197* (Kew).

Tropical Asia, Samoa, Fiji, Hawaii.

---

[1] The above treatment of the small Samoan *Ophioglossa* was written one year before the publication of Clausen's "A Monograph of the Ophioglossaceae," Torrey Bot. Club Mem. **19** (2), 1938, in which he refers the small forms (a) to *O. nudicaule* (p. 144) and the larger (c) to *O. petiolatum* Hooker (p. 134, and Am. Fern Jour. **28**: 1-11, 1938), which name be uses for *O. pedunculosum* of Index Filicum. I do not wish however to alter my treatment because I am fairly sure that all specimens seen belong to one species, which perhaps should be called *O. nudicaule* Linnaeus fil.

[2] Native names in parentheses.

The few specimens seen agree better in size and division with the Hawaiian *B. subbifoliatum* Brackenridge, than with the genuine Indian type, being subtripinnate with the basal pinnae much produced on the lower side, but on the upper side like the type furnished with several long, pale hairs on stipe and rachis, usually lacking in the Hawaiian form. I would make all forms of one species. The Japanese form *B. japonicum* Prantl differs in its close and very acute marginal teeth and lack of hairs. Rechinger's specimens are very large; sterile blade 20 cm. long, 35 cm. wide, basal pinnae 15 cm. wide.

MARATTIACEAE

Genus **ANGIOPTERIS** Hoffmann

Copeland, B. P. Bishop Mus., Bull. **59**: 20, 1929; Bull. **93**: 18, 1932.

Writers referred all Samoan forms of this genus to one species, *A. evecta;* the material at hand includes at least two or three distinct species.

1. **Angiopteris evecta** (Forster) Hoffmann. Copeland, B. P. Bishop Mus., Bull. **93**: 19, 1932.

Frond dark green and rather thin, the recurrent "veins" distinct and reaching nearly to the costule. Stipe and rachis nearly naked, costules beneath often with a few rufous scales; pinnules 2-2.5 cm. wide, subentire to faintly crenate.

Savaii: *Brackenridge* (W). Upolu: collector unknown (W). Tutuila: *Setchell 38.*

Angiopteris evecta var. **Vaupelii** Hieronymus, Hedwigia **61**: 250, 1919.

Differs from the type by its coriaceous texture and pale green color; recurrent "veins" hardly visible in the dried plant but distinct when wet.

Without locality: *Powell 84* (Kew); *Whitmee 155* (Kew).

Savaii: above Salailua, 1,400 m., *Christophersen 2679.* Upolu: Vailima, 100 m., *Eames 89* (*fa'agase*); *Rechinger 458, 1876* (V). Tutuila: Pago Pago, *Safford 4941* (W); *Eames T 27;* Utulei, *McMullin 17* (W) (*fa'agase*); Aua-Afono trail, *Garber 838.* Tau: *Garber 579* (*la'au fau pale*).

Type of *A. evecta* from Tahiti; recorded from most Polynesian islands but the distribution of the genuine *A. evecta* is unknown.

2. **Angiopteris opaca** Copeland, forma.

Angiopteris opaca Copeland, B. P. Bishop Mus., Bull. **59**: 21, 1929.

Stipe and rachis densely chaffy and ribs more or less paleaceous beneath. Pinnules evenly and distinctly serrate throughout, mostly 1-1.5 cm. wide; recurrent "veins" none or extremely short.

Savaii: Salailua, *Bryan 166;* Papaseea, *Vaupel 22 bis* (Kew, W). Upolu: near Malololelei, 600 m., *Christophersen 220.* Tutuila: above Naval Station, 200-300 m., *Christophersen 991.*

Fiji (type), Samoa.

The dense chaff, consisting of narrow crisp scales, is dull brown in the Samoan form, but described as castaneous by Copeland; otherwise it agrees excellently with his description. The young plant figured by Rechinger (642) (Denkschr. Akad. Wiss. Wien, **84**: 61, 1908) belongs here.

Genus **MARATTIA** Swartz

Copeland, B. P. Bishop Mus., Bull. **59**: 21, 1929; Bull. **93**: 20, 1932.

Marattia Smithii Mettenius. Copeland, B. P. Bishop Mus., Bull. **59**: 22, 1929.

Marattia fraxinea Smith. Luerssen, Mitt. Bot. **1**: 260, 400, 1874. Baker, Jour. Bot. **14**: 13, 1876. Christ, Engler Bot. Jahrb. **23**: 365, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 221, 1912.

Without locality: *Powell* (Kew); *Whitmee 156* (Kew).

Savaii: *Reinecke 73 a* (B); above Patamea, *Vaupel 533* (B, Kew, W) (*laau mumu*). Upolu: Vaisigagoschlucht, *Reinecke 73* (B, Kew, W); Lanutoo Lake, *Hochreutiner 3285, 3313* (G). Olosega: top of Piumafua, *Garber 1053*.

Samoa to New Caledonia and New Guinea.

The differences between the genuine *M. fraxinea* Smith from Réunion and *M. Smithii* from Aneiteum are not very significant. The veins of *M. Smithii* are nearly all simple, distant and nearly at right angles to the midrib, the synangia rather far from the margin, and costules and veins clothed beneath with small brown, dilacerated scales, which are few in the specimens from Fiji and Samoa. Nevertheless, I think I am right in referring the few specimens from Samoa to *M. Smithii*. They are rather different especially in size, but all with the synangia of usually 7-9 pairs of sporangia 2-3 mm. from the margin.

Copeland (B. P. Bishop Mus., Bull. **93**: 20, 1932) cites Samoa as the locality for *Marattia salicina* J. Smith, but I have seen no specimen which I would refer to it. According to his description, it differs chiefly from *M. Smithii* in the synangia being very near the margin and containing 12-17 pairs of sporangia.

OSMUNDACEAE

Genus **LEPTOPTERIS** Presl

Copeland, B. P. Bishop Mus., Bull. **59**: 22, 1929.

Leptopteris Wilkesiana (Brackenridge) Christ. Copeland, B. P. Bishop Mus., Bull. **59**: 22, 1929.

Todea Wilkesiana Brackenridge, Filices, U.S. Expl. Exp., 1838-42, **16**: 309, pl. 43, 1854.[3] Baker, Jour. Bot. **14**: 345, 1876.

Todea Fraseri var. *bidentata* Luerssen, Mitt. Bot. **1**: 257, 354, 1874.

Todea Fraseri var. *Wilkesiana* (Brackenridge). Christ, Engler Bot. Jahrb. **23**: 364, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 444, 1908.

[3] Date of publication of Atlas, 1855.

Without locality: *Powell 207* (Kew); *Whitmee 198* (Kew).

Savaii: *Vaupel 397* (W); *Rechinger 1053* (V); *Christophersen 626, 2066, 2213.* Upolu: *Reinecke 122* (W); *Rechinger 641* (V).

Fiji, Samoa, (New Hebrides, New Caledonia, New Guinea?).

Luerssen segregated the Samoan form from the Fijian one, which he believed to be *L. Fraseri,* as var. *bidentata,* marked by the more deeply divided pinnules with bidentate segments. This difference does exist between the Samoan form and those from New Caledonia and New Hebrides, which perhaps belong to *L. Fraseri,* but the typical *Wilkesiana* from Fiji is exactly the same as the Samoan.

SCHIZAEACEAE

Genus **SCHIZAEA** Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 30, 1929; Bull. **93**: 27, 1932.

Schizaea dichotoma (Linnaeus) Smith. Copeland, B. P. Bishop Mus., Bull. **59**: 30, 1929; Bull. **93**: 27, 1932; and all earlier writers.

On all islands, found by most collectors.

Tutuila: *Garber 939; Christophersen 3536.* Olosega: *Garber 1083* (*soloalao*). Tau: *Garber 626* part. Ofu: *Garber 974.*

Polynesia, tropical Australia, and Asia, west to Madagascar.

GLEICHENIACEAE

Genus **DICRANOPTERIS** Bernhardi

A small genus differing from all other groups of the family in possessing hairs instead of scales.

Dicranopteris linearis (Burmann) Underwood. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 122, 1924.

Gleichenia dichotoma Hooker. Luerssen, Mitt. Bot. **1**: 249, 353, 1874. Baker, Jour. Bot. **14**: 9, 1876. Christ, Engler Bot. Jahrb. **23**: 364, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 444, 1908.

Gleichenia linearis (Burmann) Clarke. Copeland, B. P. Bishop Mus., Bull. **59**: 32, 1929; Bull. **93**: 29, 1932.

Common on all islands and found by all collectors.

Savaii: *Christophersen 692.* Upolu: *Christophersen 141* (*laumasese*). Tutuila: *Garber 868* (*vaotianiu sosolo*); *Christophersen 1026, 3493.* Olosega: *Garber 1078* (*vaotuaniu*).

Tropics and subtropics of the Old World.

Genus **GLEICHENIA** Smith

In this genus I retain provisionally all species with flat scales, but it should probably be divided into three or more natural genera, none of which can be called *Dicranopteris.*

1. **Gleichenia oceanica** Kuhn. Baker, Jour. Bot. **14**: 9, 1876. Christ, Engler Bot. Jahrb. **23**: 364, 1897. Copeland, B. P. Bishop Mus., Bull. **59**: 31, 1929.

Frond 4-5 times dichotomously branched, usually intensely glaucous beneath; all axes except the primary ones pectinato-pinnate or pinnatifid, ultimate segments 15 × 2 mm., and not densely clothed with small red brown lacerate-ciliate scales beneath; midribs of the entire segments with hairlike scales.

Without locality: *Powell 199* (Kew); *Whitmee 1* (Kew).

Savaii: Panafu, 600 m., *Reinecke 82c* (Kew, W). Upolu: unknown collector (W); Mauga Tele, 600 m., *Christophersen 519*.

Fiji, Samoa, New Caledonia, and westward.

2. **Gleichenia circinnata** Swartz.

Gleichenia dicarpa R. Brown. Christ, Engler Bot. Jahrb. **23**: 364, 1897.

Many times dichotomously branched, with linear, 1 mm. broad ultimate pinnae, which are divided to the costa into contiguous, strongly bullate, semispherical lobes with 2-3 sporangia in the hollow.

Upolu: eastern region, Alupata, Père Heugual (?), distributed as *Reinecke 182* (B).

Australia and New Zealand, New Caledonia, New Guinea, related forms in Melanesia and Malaya to French Indo-China.

The occurrence of this species in Samoa is surprising. It is not known from other Polynesian islands, and the only fragmentary specimen may not originate from Samoa but possibly may have been mixed with Samoan plants.

HYMENOPHYLLACEAE

Genus **TRICHOMANES** Linnaeus

Copeland, B. P. Bishop Mus., Bull. **59**: 23, 1929; Bull. **93**: 21, 1932.

Key to Species of Trichomanes

Leaf entire or slightly lobed, rarely over 2 cm. long (*Hemiphlebium*).
  Leaf peltate, suborbicular.....**1. T. omphalodes.**
  Leaf linear-oblong to ovate or obovate, subsessile.
    Radiating "spurious veins" between true veins.....**2. T. bimarginatum.**
    No spurious veins; leaves undivided.....**3. T. Powellii.**
Leaf variously divided, no radiating spurious veins.
  Rhizome filiform, wide-creeping
    Without specialized margin or intramarginal false vein
      Leaf digitate or dichotomous, never proliferous (*Microtrichomanes*)
        Leaf non-ciliate, from entire to subpinnately forked, rarely 2 cm. long.....
        .....**3. T. Powellii.**
        Margins ciliate with some brown hairs.....**4. T. taeniatum.**
      Leaf flabellately incised or bipinnate, sometimes proliferous from the axes, stipe wiry, thin, unwinged (*Gonocormus*)

Leaf roundish, flabellately incised, lamina rarely over 2 cm. each way..... **5. T. saxifragoides.**
Leaf lanceolate to ovate, lamina bipinnate, 5 × 2-3 cm..... **6. T. assimile.**
Leaf pinnate to 3-pinnate, 10-20 cm. or more long
Leaf glaucous with long hairs (*Pleuromanes*)..... **12. T. pallidum.**
Leaf green glabrous, cells large with thick walls..... **13. T. caudatum.**
With specialized margin and intramarginal false vein
Marginal cells different from the others (*Lepidium*)
Small, pellucid; marginal cells in 2 rows..... **7. T. humile.**
Larger (5-15 cm.); marginal cells in 1 row
Marginal cells elongate, hyaline, shining white against the light; leaf lanceolate..... **8. T. Endlicherianum.**
Marginal cells subquadratic, not white; lamina broadly lanceolate to deltoid, 8-12 × 4-5 cm..... **9. T. samoense.**
Intramarginal false vein present (*Taschneria*)
Tiny, 1-2 cm., simply pinnate with simple or forked, acute pinnae; mouth of indusium entire..... **10. T. Nymani.**
5-12 cm., at least bipinnate; mouth of indusium 2-lipped..... **11. T. bipunctatum.**
Rhizome stout, erect or creeping; large species
Rhizome erect, fronds tufted
Simply pinnate, fertile pinnae incised on the upper side with the sori in a row (*Cephalomanes*)..... **14. T. Boryanum.**
1-4-pinnate with the primary pinnae at least deeply pinnatifid on both sides
Stipe and rachis with long, patent hairs, unwinged
Lamina broadly deltoid, veins strong, hairs of rachis few, mouth of indusium dilated..... **15. T. dentatum.**
Lamina broadly lanceolate, hairs many, indusium obconic with truncate mouth..... **16. T. apiifolium.**
Stipe and rachis glabrous, stipe with caducous wings..... **17. T. intermedium.**
Rhizome short creeping
Ultimate segments linear, leaf glabrous, mouth of indusium dilated..... **18. T. maximum.**
Segments capillary, setaceous, leaf slightly hairy, mouth of indusium truncate..... **19. T. Asae-Grayi.**

1. **Trichomanes (Hemiphlebium) omphalodes** (Vieillard) C. Christensen. Copeland, B. P. Bishop Mus., Bull. **59**: 23, 1929; Bull. **93**: 22, 1932; Philip. Jour. Sci. **51**: 203, pl. 31, 1933.

Trichomanes peltatum Baker, 1866 (not Poiret). Luerssen, Mitt. Bot. **1**: 237, 349, 1874. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 337, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 410, 1908.

Without locality: Powell *125* (Kew, type of *T. peltatum* Baker); *Whitmee 17* (Kew).

Upolu: (*Graeffe, Betche*); *Rechinger 1468.*

Tahiti to Java.

2. **Trichomanes (Hemiphlebium) bimarginatum** van den Bosch. Copeland, B. P. Bishop Mus., Bull. **59**: 24, 1929; Philip. Jour. Sci. **51**: 208, pl. 33, 1933.

Trichomanes muscoides Swartz. Luerssen, Mitt. Bot. **1**: 238, 350, 1874. Baker, Jour. Bot. **14**: 343, 1876. Christ, Engler Bot. Jahrb. **23**: 337, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 410, 1908.

Without locality: *Powell 137.*

Upolu: *Whitmee 17* (Kew); *Reinecke 119* (W); *Rechinger 745* (W); Savaii: above Sili, about 400 m., *Christophersen 3249.*

Polynesia, tropical Australia, and Asia.

3. **Trichomanes (Microtrichomanes) Powellii** Baker, Syn. Fil. 76, in Hook. Ic. Pl. III, **7**: 1615. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 27, 1908.

Trichomanes digitatum Swartz, part. Luerssen, Mitt. Bot. **1**: 239, 350, 1874.

Trichomanes digitatum var. *Powellii* (Baker) Hooker. Christ, Engler Bot. Jahrb. **23**: 336, 1897.

Trichomanes vitiense Baker, part. Copeland, Philip. Jour. Sci. **51**: 157, 1933.

Leaves very thin, 1-1.5 cm. long, rarely larger, varying from being entire to once or twice forked or pinnatifid with 2-4 segments, which are usually 2.5-3 mm. wide, entire, non-ciliate, the apex bluntly rounded or subtruncate and usually deeply emarginate. Stipe less than 1 mm. long. The creeping rhizome and stipe black tomentose, the unbranched midvein of the segments with some very minute brown hairs beneath. Sori terminal, immersed, indusium cyathiform-obconic with a rather deeply two-lipped mouth, the lips entire, round, large, spreading or subreflexed at maturity.

Upolu: "Thickly covering like a moss the bark of a large tree on a mountain about 2,000 feet above the level of the sea. Aug. 1864" *Powell 128* (Kew); Lanutoo, 700 m., *Rechinger 3379* (V, W).

This tiny fern is certainly not a form of *T. digitatum* as Luerssen and Christ believed, differing in the subsessile, non-ciliate, much thinner and less divided leaves with broader segments. Without having seen specimens from Fiji and Samoa, Copeland (Philip. Jour. Sci. **51**: 157, 1933) supposed *T. Powellii* to be a more developed form of the Fijian *T. vitiense* Baker, for which Domin (Bibl. Bot. **20**: 10, pl. 3, fig. 3) cited Samoa as locality and gave figures of an Australian plant, which possibly is *T. vitiense.* Copeland, in writing that Domin "depicts the involucre of *T. Powellii*" should have used *T. vitiense.* The figure agrees fairly well with Baker's original of *T. vitiense* (Jour. Linn. Soc. **9**: pl. 8, fig. D), both showing the indusium long, nearly cylindrical, with a two-lipped, scarcely dilated mouth. Moreover, the leaves are usually simple and much smaller than those of *T. Powellii,* hardly 1 cm. long (type at Kew). I dare not therefore unite the two forms. In my opinion, *T. Powellii,* hitherto known only from Samoa is much nearer *T. Francii* Christ from New Caledonia.

4. **Trichomanes (Microtrichomanes) taeniatum** Copeland, B. P. Bishop Mus., Bull. **93**: 6, 22, pl. 2, 1932.

Trichomanes digitatum Swartz. Luerssen, Mitt. Bot. **1**: 239, 350 (part), 1874. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 336 (excl. var.), 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 410, 1908.

Without locality: *Powell 108* (Kew); *Whitmee 20.*

Upolu: *Reinecke 134* (B, Kew, W); *Rechinger 165* (V, W).

Society Islands.

Good specimens agree with Copeland's description and figure of the type from Tahiti and with specimens from there in the Royal Botanical Museum, Berlin, which Mettenius long ago considered distinct from *T. digitatum.* They are certainly quite different from the African type of that species, much more resembling the Malayan form *T. flabellatum* van den Bosch from which it differs chiefly in the broadly expanded mouth of the indusia.

5. **Trichomanes (Gonocormus) saxifragoides** Presl. Copeland, B. P. Bishop Mus., Bull. **59**: 24, 1929.

Trichomanes parvulum Poiret. Luerssen, Mitt. Bot. **1**: 239, 350, 1874. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 337, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 410, 1908. Copeland, Philip. Jour. Sci. **51**: 145, part, 1933; B. P. Bishop Mus., Bull. **93**: 22, 1932.

Hymenophyllum praetervisum Christ, Engler Bot. Jahrb. **23**: 338, 1897.

Savaii: *Powell 144, 154, 229* (Kew); *Christophersen 2300.* Upolu: *Whitmee 18, 182* (Kew); *Rechinger 167* (W), *740* (V). Tutuila: *Reinecke 88 b* (B). Tau: *Powell 181* (Kew); *Garber 744.*

Tropical and east Asia, east to Marquesas.

Most writers, including Copeland, have confused this species with *T. parvulum* Poiret from Madagascar, which I have shown to be *Hymenophyllum sibthorpioides* Bory. The Samoan specimens are rather different, but all belong to one species. Besides the ordinary form with roundish, flabellately cut leaves with the segments again deeply cleft, with short stipe, rarely proliferous, there are others with much longer stipe, frequently proliferous, the segments mostly not folded. Such specimens resemble closely *T. minutum* Blume, but differ in the wide, expanded mouth of the involucre.

6. **Trichomanes (Gonocormus) assimile** Mettenius. Copeland, Philip. Jour. Sci., **51**: 173, 1933.

Trichomanes pyridiferum Linnaeus. Powell, Jour. Bot. **6**: 318, 1868.

Trichomanes bipunctatum Poiret. Luerssen, Mitt. Bot. **1**: 350, part, 1874.

Trichomanes tenue Brackenridge. Christ, Engler Bot. Jahrb. **23**: 336, 1897. Not Brackenridge.

Rhizome creeping, short hairy, not black-tomentose, stipe 2-4 cm. long, unwinged, rachis narrowly winged upward, sometimes proliferous and like the veins with scattered

minute hairs; lamina lanceolate to ovate, about 5 × 2-3 cm., olivaceous green, variously curled and folded when dried, pinnae bi-tripinnatifid; pinnae on short petioles, secondary segments deeply pinnatifid or flabellately incised with the lobes usually cleft, the ultimate segments 0.5-0.7 mm. wide; larger veins strong and flexuose, branched under very acute angles, spurious veins and modified marginal cells none. Sori wholly immersed, cylindrical-ventricose, broadly winged, mouth of indusium dilated but not spreading nor two-lipped.

Without locality: *Powell 152* (Kew).

Savaii: east of Olo, 700-800 m., *Christophersen 2302*. Upolu: *Graeffe 1101* (B, as *T. bipunctatum* Luerssen, W); *Betche;* canyon near Malololelei, 500 m., *Christophersen 100*. Tau: 400 m., *Garber 718*.

New Hebrides and New Caledonia; probably of wider distribution; new to Samoa.

Compared to other Samoan species, this is very distinct. It has been confused with *T. bipunctatum* which it resembles somewhat in size and division, but differs in the characters described above, and other specimens have been referred to *T. caudatum* Brackenridge. The material examined is rather uniform and agrees exactly with the type collection from Aneiteum (Herus 53, herbarium of C. Christensen). *T. assimile* was unknown to Copeland, who tentatively placed it under *Crepidium,* but it is a genuine, sparsely proliferous *Gonocormus,* and the only question is its differences with *T. Teysmanni* van den Bosch. Copeland mentions this Samoan *Gonocormus* as a distinct species in Samoa (Philip. Jour. Sci. **51**: 144, 1933). If the species originated in Java or Sumatra he might have identified it as *T. Teysmanni,* but supposing it to be *T. novoguineense* Brause, his description did not fit that species. Brause's species is rather typical of *T. Teysmanni,* I believe, and *T. assimile* is very similar, but with larger and broader leaves.

7. **Trichomanes (Crepidium) humile** Forster. Luerssen, Mitt. Bot. **1**: 240, 350 (excl. var.), 1874. Christ, Engler Bot. Jahrb. **23**: 336, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 412, 1908. Copeland, B. P. Bishop Mus., Bull. **59**: 24, 1929; Bull. **93**: 23, 1932; Philip. Jour. Sci. **51**: 164, pl. 12, 1933.

   Without locality: *Powell* (Kew).

   Savaii: *Reinecke 63 b* (Kew, W); *Rechinger 1131* (V). Upolu: *Safford 47, 968* (W). Tutuila: *Reinecke* s. n. [Kew, *T. muscoides* Christ, Engler Bot. Jahrb. **23**: 337, 1897]; *Garber 940; Christophersen 1146*. Tau: *Garber 628*. Olosega: *Garber 1081*.

   Tropical Asia, Australia, and Polynesia.

8. **Trichomanes (Crepidium) Endlicherianum** Presl. Copeland, B. P. Bishop Mus., Bull. **93**: 23, 1932; Philip. Jour. Sci. **51**: 168, pls. 14, 15, 1933.
   Trichomanes humile var. *Endlicherianum* Hooker et Baker. Luerssen, Mitt. Bot. **1**: 240, 1874.

Trichomanes erectum Brackenridge, Filices, U. S. Expl. Exp., 1838-42, **16**: 250, pl. 36, fig. 1, 1854. Copeland, B. P. Bishop Mus., Bull. **59**: 24, 1929.

Trichomanes Naumannii Luerssen et Kuhn. Christ, Engler Bot. Jahrb. **23**: 336, part, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 179, 1912.

Trichomanes tenue Brackenridge? Rechinger, Denkschr. Akad. Wiss. Wien **84**: 413, 1908. Not Christ, Engler Bot. Jahrb. **23**: 336, 1897.

Savaii: *Reinecke 135 a* (B, Kew); *Rechinger 1078* (V). Upolu: *Betche 76* (B, type of *T. Naumannii*); ridge above Malololelei, 670 m., *Christophersen 166*. Tutuila: *Reinecke 135* (B, *T. punctatum,* Christ). Tau: *Powell 155* (Kew). Ofu: *Reinecke 43 d* (B).

Polynesia: Norfolk I. to Tahiti, New Zealand.

Usually much larger (6-8 × 2-3 cm.) than *T. humile* and dark green with much smaller cells, therefore not nearly so pellucid. All specimens referred here may easily be distinguished from other species of similar size and division by the narrow segments and especially by the elongated marginal cells being hyaline and shining white against the light.

9. Trichomanes (Crepidium) samoense, sp. nov.

Rhizomate filiformi, sparse piloso. Stipite ad 5 cm. longo, sursum anguste alato. Lamina late lanceolata, s. ovata s. deltoidea, 8-12 cm. longa, 4-5 cm. lata, olivaceo-viridi, sat firma, glabra, bipinnata-pinnatifida, rachi ubique lata. Pinnis plerisque erectis, maximis ad 4 cm. longis, trapezioideis, versus apicem saepe longe angustatis, pinnulis obliquis, basalibus inaequaliter cuneato-ovatis, 1 cm. longis, 8 mm. latis, profunde pinnatifidis, supremis linearibus vel dentiformibus, segmentis ultimis ca. 1 mm. latis, apice plerumque bifidis. Cellulis sat parvis, marginalibus uniseriatis, subquadrato-rectangularibus, non pellucidis, extus hinc inde nonnullis elongatis pellucidis. Soris axillaribus, basalibus cum rachi superioribus cum costa parallelis, in segmento abbreviato omnino immersis, indusio alato, cylindrico basi angustato, ore valde dilatato, integro, expanso circulari.

Savaii: near Maugaloa, *Vaupel* Sept. 29, 1905, *443* (B, type), *443 a* (W, distribution as *T. tenue*); *Reinecke 152* (B, *T. Naumannii* Christ, Engler Bot. Jahrb. **23**: 336, part, 1897).

I have not succeeded in referring this specimen to any described species, and I do not believe it to be *T. tenue* Brackenridge, which Copeland refers to *T. Endlicherianum.* It is by far the largest of all known *Crepidia,* and in general habit mostly resembles *T. caudatum* though differing widely in cell-structure. It is about intermediate between *T. humile* and *T. Endlicherianum,* but not nearly so pellucid as *T. humile.* Modified subquadratic marginal cells in a single row form a kind of marginal "spurious vein", outside of which may be found some very narrow, hyaline cells, but the margin is not shining white as in *T. Endlicherianum.*

10. Trichomanes (Taschneria?) Nymani Christ. Copeland, Philip. Jour. Sci. **51**: 187, pl. 19, fig. 4, 1933.

Trichomanes Vaupelii Brause, Notizblatt bot. Gart. Mus. Berlin-Dahlem **8**: 138, 1922.

A tiny species, leaves mainly 1-2 cm. long by 1 cm. wide, dark green, pinnate to the winged rachis with 2-4 pairs of erect, narrow, linear, acute, entire or sometimes forked pinnae, with a submarginal "spurious vein" separated from the margin by a single row of subquadrate, unmodified cells. Sori terminal on the upper lobes, fully immersed, indusium subcylindrical with an entire dilated mouth.

Savaii: Olonono, 800 m., *Vaupel 624* (B, type of *T. Vaupelii*).

New Guinea, Borneo.

The only specimen seen is identical with the Papuan *T. Nymani* which Copeland placed in *Taschneria,* but it seems to me to agree better with *Crepidium* in habit and sori. It closely resembles *T. alternans* Carruthers which Copeland probably rightly cited under *T. Endlicherianum,* but the margins are not shining white, and the "spurious vein" is distinctly intramarginal.

11. Trichomanes (Taschneria) bipunctatum Poiret. Luerssen, Mitt. Bot. **1**: 241, 350, 1874. Copeland, B. P. Bishop Mus., Bull. **59**: 25, 1929; **93**: 23, 1932; Philip. Jour. Sci. **51**: 177, pl. 18, figs. 1-4, 1933.

Trichomanes Filicula Bory. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 252, 1854. Baker, Jour. Bot. **14**: 10, 1876. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 412, 1908.

Trichomanes punctatum Poiret, part (*lapsu calami*), Christ, Engler Bot. Jahrb. **23**: 336, 1897. (Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 129, 1924.)

A common epiphyte on tree trunks, found in all islands.

Upolu: Malololelei, Lanutoo, 700 m., *Christophersen 36.* Tutuila: Alava Ridge, 400 m., *Christophersen 1145.* Tau: *Garber 741.*

As usually construed, a species of wide distribution from Africa to Japan, and eastern Polynesia, but it is probably an aggregate of more valid species, though hardly as many as van den Bosch described. The numerous Samoan specimens examined are very uniform, larger than most other forms of the group (leaves, including stipe up to 15 × 4 cm.). The distinct, intramarginal spurious vein is usually continuous and small ones between the true veins are always lacking, thus agreeing with the form regarded as typical.

12. Trichomanes (Pleuromanes) pallidum Blume. Luerssen, Mitt. Bot. **1**: 241, 1874. Baker, Jour. Bot. **14**: 343, 1876. Christ, Engler Bot. Jahrb. **23**: 336, 1897. Copeland, B. P. Bishop Mus., Bull. **93**: 23, 1932; Philip. Jour. Sci. **51**: 141, 1933.

Trichomanes glaucofuscum Hooker, in Night. Ocean. Sketch. app. 131, 1835.

Trichomanes savaiense Lauterbach, Bot. Jahrb. **41**: 218, 1908.

Without locality: *Powell 104* (Kew, W), *Whitmee 30* (Kew).

Savaii: *Reinecke 151 a* (Kew, W); near Maugaloa, *Vaupel 302* (B, type of *T. savaiense*). Manua: *Nightingale* (Kew, type of *T. glaucofuscum*).

Ceylon to the Marquesas, not recorded for Fiji, and evidently rare in Samoa.

The Samoan form is *T. glaucofuscum* Hooker (*T. savaiense* Lauterbach), which Copeland (Philip. Jour. Sci. **51**: 142, 143, 1933) says is indistinguishable from specimens from Ceylon. The specimens average larger than Malayan, besides being relatively thin and naked.

13. **Trichomanes caudatum** Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 256, pl. 36, fig. 5, 1854. Luerssen, Mitt. Bot. **1**: 242, 351, 1874. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 336, 1897. Copeland, B. P. Bishop Mus., Bull. **59**: 26, 1929; Bull. **93**: 24, 1932; Philip. Jour. Sci. **51**: 262, pl. 57, figs. 3-5, pl. 58, fig. 1, 1933.

Without locality: *Powell 103* (B).

Upolu: *Whitmee 31* (Kew); *Betche* (Christensen); *Reinecke 70* (B).

Tahiti, Rarotonga, Samoa, Fiji, New Caledonia, Queensland.

14. **Trichomanes (Cephalomanes) Boryanum** Kunze. Copeland, Philip. Jour. Sci. **51**: 254, pl. 52, fig. 4, 1933.

Trichomanes javanicum Blume, of all earlier writers.

Cephalomanes Wilkesii van den Bosch, Nederl. Kruidk. Arch. **5**(2): 140, 1861.

Cephalomanes australicum van den Bosch, Nederl. Kruidk. Arch. **5**(2): 139, 1861.

Trichomanes australicum van den Bosch. Copeland, B. P. Bishop Mus., Bull. **59**: 27, 1929.

Common on all islands, collected by all.

Savaii: *Christophersen 878, 1841, 3189, 3258; Vaupel 331* (B). Tutuila: *Garber 884; Christophersen 1121, 1144.* Tau: *Garber 621, 715* (*oli oli,* used in pillows).

Fiji, Samoa, New Hebrides, New Caledonia, Carolines, Guam.

The sori of larger specimens are borne in a row on the acroscopic side of upper pinnae which may be slightly or not reduced; sori of smaller specimens often confined to the uppermost much reduced pinnae, 1 or 2 to each, forming a kind of terminal panicle about as in *T. sumatranum* van Alderwerelt van Rosenburgh, the sori of which wholly lack the conspicuous dilated mouth of the indusium, a common feature of all Samoan specimens.

15. **Trichomanes dentatum** van den Bosch. Copeland, B. P. Bishop Mus., Bull. **59**: 27, 1929; Bull. **93**: 25, 1932; Philip. Jour. Sci. **51**: 237, pls. 45, 46, 1933.

Trichomanes rigidum Swartz. Brackenridge, U. S. Expl. Exp., 1838-42,

16: 260, 1854. Luerssen, Mitt. Bot. **1**: 243, 351, 1874. Christ, Engler Bot. Jahrb. **23**: 336, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 411, 1908.

Trichomanes cupressoides Desvaux. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 178, 1912.

Stipe of young leaves with long, patent brown hairs, which soon fall, but those of the stipe-base are more rigid and castaneous, and as a rule, persistent.

Without locality: *Powell 34* (B, Kew); *Whitmee 25* (Kew); *Weber 37* (B).

Savaii: below Vaipouli, in river bed, *Vaupel 197* (B); Maugaloa, *Vaupel 310* (B, Kew, W); above Matavanu, *Christophersen 2094*. Upolu: *Reinecke 86* (B); *86 b* (B, W); *Safford 48, 930* (W); *Rechinger 979* (V); *Hochreutiner 3294 a* (G). Olosega: *Reinecke 66* (B, W); *Garber 1052, 1057*.

New Caledonia to Tahiti.

16. Trichomanes apiifolium Presl. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 335, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 178, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 411, 1908. Setchell, Dept. Marine Biol. Carnegie Inst., Wash. **20**: 129, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 27, 1929; Philip. Jour. Sci. **51**: 227, pl. 42, fig. 1, 1933.

Trichomanes meifolium Bory. Luerssen, Mitt. Bot. **1**: 243, 351, 1874.

Common on all islands, collected by all.

Savaii: *Vaupel 472* (W); *Rechinger 1605* (V, W); *Christophersen 2020*. Upolu: *Vaupel 273* (Kew, W); *Rechinger 158, 1344* (V), *1293* (W); *Hochreutiner 3300* (G); *Christophersen 2645*. Tutuila: *Reinecke 115, 174* (W). Tau: *Garber 722, 740, 743, 757*. Olosega: *Garber 1042*.

Sumatra to Samoa.

17. Trichomanes intermedium van den Bosch. Copeland, Philip. Jour. Sci. **51**: 226, pl. 40, fig. 5, 1933.

Trichomanes anceps β Hooker. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 258, 1854.

Trichomanes maximum, all other writers, not of Blume.

Trichomanes Harveyi Carruthers?, in Seemann's Flora Vitiensis, 344, 1869. Copeland, B. P. Bishop Mus., Bull. **59**: 27, 1929.

Common and collected by all.

Savaii: *Reinecke 115 c* (B, W); *Vaupel 198* (Kew, W); *Christophersen 2737, 3190*. Upolu: *Reinecke 43* (B), *43 a* (B, Kew, W); *Rechinger 583, 1304* (V, W); *Safford 49, 958* (W); *Christophersen 7, 108*. Tutuila: *Setchell 218* (W); *Garber 843, 885; Wilder; Christophersen 1815*. Tau: *Garber 729*. Olosega: *Garber 1063*.

Samoa, Fiji, Papua.

Copeland, probably wrongly, lists *T. Harveyi* Carruthers as a synonym of this species. The only specimen in Kew from Fiji, collected by Harvey, and labelled by Baker "cfr. T. Harveyi", is *T. dentatum,* and the description agrees far better with that species than with *T. intermedium.* A character of this species not sufficiently emphasized is the presence of numerous, short, appressed, pale yellowish or brownish hairs on the under side, much like those found in *T. aphlebioides* Christ, which differs in its creeping rhizome.

18. Trichomanes maximum Blume. Copeland, B. P. Bishop Mus., Bull. **59**: 25, 1929; Bull. **93**: 24, 1932; Philip. Jour. Sci. **51**: 217, pl. 38, 1933. Christ, Engler Bot. Jahrb. **23**: 335, part, 1897. (Not of earlier writers, which at least for the greater part is *T. intermedium.*)

Savaii: *Reinecke 43 b* (B); Siuvao-Auala, about 600 m., *Christophersen 3363; Rechinger 638* (V). Upolu: near Malololelei, 550 m., *Christophersen 311.*

Tropical Asia, Australia, and Polynesia, east to Rapa.

The Fijian and Samoan plants are usually smaller and with shorter rhizomes than the Malayan ones and in a dried state mostly with curled pinnules and segments. Leaves without rhizome may easily be confused with *T. intermedium,* but may be distinguished by the lack of hairs beneath and the much smaller mouth of the indusia.

19. Trichomanes (Macroglena) Asae-Grayi van den Bosch. Copeland, Philip. Jour. Sci. **51**: 264, pl. 61, fig. 1, 1933.

Trichomanes longisetum Bory. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 260, 1854. Luerssen, Mitt. Bot. **1**: 245, 352, 1874.

Trichomanes gemmatum J. Smith. Baker, Jour. Bot. **14**: 10, 1876 (*geminatum,* Christ, Engler Bot. Jahrb. **23**: 336, 1897).

Trichomanes ericoides Hedwig. Christ, Engler Bot. Jahrb. **23**: 335, 1897. (vix Rechinger, Denkschr. Akad. Wiss. Wien **84**: 412, 1908.)

Trichomanes meifolium Bory. Copeland, B. P. Bishop Mus., Bull. **59**: 25, 1929; Philip. Jour. Sci. **51**: 265, ex parte, 1933.

Without locality: *Powell 36* (Kew); *Whitmee 27* (Kew).

Savaii: Mataana, *Vaupel 442* (Kew, W). Upolu: *Reinecke 188* (Kew, W); Mauga Tele Ridge, 500 m., *Christophersen 533.*

Fiji, Samoa.

Though rather variable, I do not doubt that all specimens seen from Fiji and Samoa belong to one species, while Copeland referred some to *T. Asae-Grayi,* others to *T. meifolium.* The synonymy of these species is very confused. The old names *meifolium* Bory, *longisetum* Bory and *ericoides* Hedwig were probably applied originally to the same species from the Mascarenes and Madagascar, which differ from the Malayan-Polynesian forms by the leaves being tufted on a short rhizome. The common Malayan form T. *longisetum* van den

Bosch (Hym. Jav., pl. 21; *T. meifolium* Copeland) has a long creeping rhizome and setaceous segments with usually clear marginal cells. From both of these, the Polynesian form differs by a short-creeping rhizome and by the segments being usually margined by two rows of clear cells, or the lower sterile segments are widened toward the tip with 3-4 rows of clear cells. Such segments resemble *T. gemmatum* Hooker much more than *T. meifolium,* while the upper fertile ones are rather like those of the genuine *meifolium,* and as these marginal cells are rubbed off with age, the segments become setaceous and like those of the Malayan *meifolium,* which I would call *T. pluma* Hooker. If we maintain all these forms as species, we must call the Polynesian ones *T. Asae-Grayi. T. ericoides* Rechinger (Denkschr. Akad. Wiss. Wien **84**: 28, 1908) is, according to a poor specimen of his (*986*), *T. intermedium.*

Genus **HYMENOPHYLLUM** Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 28, 1929.

Key to Species of Hymenophyllum

Segments and valves of indusium entire
- Segments less than 1 mm. wide, sori small ..... **1. H. polyanthos.**
- Segments 1.5-2 mm. wide
  - Rhizome villous, stipe unwinged, sori small, terminal on not shortened segments ..... **2. H. flabellatum.**
  - Rhizome subglabrous, stipe winged, sori large, subglobose, terminal on short, lateral segments ..... **3. H. formosum.**

Segments entire, valves dentate at outer edge ..... **4. H. samoense.**

Segments and valves sharply dentate
- Leaf oblong, at best 6 × 2 cm ..... **5. H. praetervisum.**
- Leaf deltoid, up to 25 cm. long (including stile) 10 cm. wide ..... **6. H. feejeense.**

1. Hymenophyllum polyanthos Swartz. All writers include *H. Blumeanum* (Sprengel and Ind. Fil.) *H. praetervisum* part and *H. fucoides* (Rechinger, Denkschr. Akad. Wiss. Wien **84**: 26, 1908).

Rhizome nearly glabrous, fronds extremely variable (see below), from 3-25 cm. long, bi-tripinnate, glabrous, stipe winged above, rachis winged throughout; sori terminal on the upper, not abbreviated segments, not wider than the segment, lower half of the indusium cuneate and sunk in the segment, the outer divided into two ovate, acute or bluntly rounded, entire valves.

I follow here earlier writers and Copeland (who has named some specimens examined) in referring more Samoan forms to the pantropic *H. polyanthos,* though Kuhn would segregate the Malayan-Polynesian forms as *H. Blumeanum* Sprengel. I followed him in Index Filicum, but this eastern species is an aggregate of numerous rather different forms, some of which no doubt are good species. It is possible that all Samoan forms belong to one species, which is common and found in all islands. Two of these forms look quite different:

(a) Fronds varying from 3-4 to 25 cm. in length, not more than 1-2.5 cm. in width from base to apex, thus nearly linear in outline, bipinnatifid, pinnae obtuse with 2-3 pairs of segments, the upper basal one of which is flabellately cut, the others mostly bifid, ultimate lobes about 0.8 mm. wide. This form corresponds closely to the genuine Malayan *H. Blumeanum* Sprengel and most specimens seen belong to it.

Without locality: *Powell 107* (Kew); *Whitmee 13* (Kew).

Upolu: Fao, *Reinecke 62 a* (Kew, W); *Rechinger 152* (V). Tutuila: *Reinecke 175* (Kew, W); *Christophersen 1056* (depauperate form), *1131, 1195, 1196, 1214, 3529.* Tau: *Garber 737.* Manua: *Reinecke 175* (Kew, W).

(b) Fronds lanceolate-ovate, bipinnate-pinnatifid, about 20 × 4.5 cm., more open than the other form, pinnae often terminating in a long pinnatifid apex, the immersed part of the indusium more campanulate and its valves shorter and roundish. This form resembles more the true *H. polyanthos* and Powell believed it to be another species than form *a*, differing from it, besides the characters just mentioned, in the "stouter caudex and stipe, by the pinnae being more erect, its lighter colour and more flaccid nature" (Powell in sched. Kew). In general habit and size it is not unlike some forms of *H. flabellatum*, but the rhizome is not villous.

Without locality: *Powell 172, 173* (Kew).

Savaii: *Rechinger 1052* (V), *656* (W). Upolu: *Reinecke 622, Betche, Rechinger 600,* part (W). Tau: *Garber 727.*

2. **Hymenophyllum flabellatum** de Labillardière. Christ, Engler Bot. Jahrb. **23**: 337, 1897. Not Rechinger, Denkschr. Akad. Wiss. Wien **84**: 408, 1908. Copeland, B. P. Bishop Mus., Bull. **59**: 28, 1929.

   Hymenophyllum emarginatum Swartz, and var. *microchlamys* Baker, Jour. Bot. **14**: 9, 1876.

   Rhizome, especially at the stipe-bases, villous, with long, pale hairs. Stipe 5-8 cm. long, unwinged, lamina glabrous, broadly lanceolate-ovate to deltoid, up to 30 × 12 cm., usually smaller, bipinnate-pinnatifid, rachis winged upwards, apex of pinnae usually much elongated, ultimate segments 1-1.5 mm. broad, subacute; nearly all fertile with a terminal, slightly immersed sorus of the same width and deeply cleft with ovate, obtuse or subacute, entire valves.

   Savaii: *Powell 222* (Kew); *Whitmee 10* (Kew); *Reinecke 151, 151 a* (B); *Vaupel 454* (B, Kew, W).

   Polynesia, Australia, New Zealand.

3. **Hymenophyllum formosum** Brackenridge, U. S. Expl. Exp. 1838-42, **16**: 268, pl. 37, fig. 3, 1854. Copeland, B. P. Bishop Mus., Bull. **59**: 29, 1929; Bull. **93**: 26, 1932.

   Hymenophyllum dilatatum (Forster) Swartz, of all earlier writers, Rechinger, Denkschr. Akad. Wiss. Wien **84**: 408, figs. 1-2, 1908.

The largest species, glabrous, stipe to about 8 m., winged nearly to base, lamina from rather narrow-lanceolate to broadly deltoid-ovate, usually 12-18 cm. long by 7-10 cm. wide, bipinnate-pinnatifid, rachis broad-winged, pinnae often terminating in a long, subentire apex, segments entire, 1.5-2 mm. wide; sori terminal on abbreviated lateral tertiary segments; when mature broader than the segment, nearly globose, indusia cleft to base with round entire valves.

Common, and found on all islands.

Savaii: above Matavanu, *Christophersen 2060, 2230; Reinecke 114* (W). Upolu: ridge to Mt. Vaitou, *Christophersen 251; Rechinger 722, 1303, 1925* (W). Tutuila: *Setchell 392* (W). Tau: *Garber 759*. Olosega: *Garber 1060* (*sololo*).

Tahiti, Samoa, Fiji, Malaya?

For the differences between this and the genuine *H. dilatatum* Swartz, see Copeland (B. P. Bishop Mus., Bull. **59**: 29, 1929). I see that Copeland has named all of the United States National Herbarium specimens of this species *H. imbricatum* Blume, a hitherto unknown species from Java, but I prefer to use the better known name of *H. formosum*.

4. **Hymenophyllum samoense** Baker, Jour. Bot. **14**: 10, 1876.

Hymenophyllum fucoides Swartz. Christ, Engler Bot. Jahrb. **23**: 337, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 410, 1908.

Glabrous. Stipe up to 8 cm. long, winged nearly to the base, lamina deltoid to ovate, up to 15 × 8 cm., tripinnate, rachis with narrow, somewhat crisped wings, segments entire, not crisped, about 2 mm. wide. Indusium cleft to the base with roundish to ovate-oblong, short-dentate valves.

Without locality: *Whitmee 12, 14* (Kew, type numbers); *Powell 221, 227* (Kew).

Savaii: *Reinecke 160* (B, W, *H. fucoides* Christ); Maugaloa, *Vaupel 59* (B), *741* (W).

Hitherto known only from Samoa, but it certainly occurs in Fiji; and I suppose that *H. australe* (Copeland, B. P. Bishop Mus., Bull. **59**: 29, 1929) is this species, for I cannot distinguish a specimen from Taveuni, Uluingalau summit (A. C. Smith 904). *H. samoense* is a member of the group of *H. australe* Willdenow, marked weakly by the patulous, open habit with divaricating, not crisped divisions and dentate indusium valves. It is surprising that Christ believed it to be *H. fucoides* Swartz, an American species.

5. **Hymenophyllum praetervisum** Christ, Engler Bot. Jahrb. **23**: 338, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 181, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 410, part, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 129, 1924.

Hymenophyllum Tunbridgense Smith. Luerssen, Mitt. Bot. **1**: 246, 349, 1874. Baker, Jour. Bot. **14**: 10, 343, 1876.

Hymenophyllum multifidum (Forster) Swartz. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 26, 1908.

Largest leaves 6 cm. long, including the unwinged; stipe 3 cm. long, 1-2 cm. broad, glabrous or with a few hairs on the narrowly winged rachis, bipinnate, not crisped; pinnae usually with 3-4 sharply dentate, obtuse segments, which are oblique, often deeply forked and hardly 1 mm. wide. Sori few, terminal on the uppermost segments, the indusium turbinate and cleft to about one third with ovate, acute, dentate valves, naked on the back; receptacles sometimes exserted.

Without locality: *Powell 119; Whitmee 22, 23* (Kew).

Savaii: above Sili, *Christophersen 3243.* Upolu: *Reinecke 88, 88 a* (B, Kew, W, type collection), *63* (W); *Rechinger 585* part (V), *1924* (W). Tutuila: *Reinecke 88* (Kew, W). Manua: *Reinecke 88 c.*

Endemic?

Christ believed this species to be identical with the Bornean *Trichomanes denticulatum* Baker (= *Hymenophyllum Bakeri* Copeland), but he was mistaken. Our species is not recorded for Fiji, but Copeland (B. P. Bishop Mus., Bull. **59**: 29, 1929) refers a specimen to *H. denticulatum* Swartz, a Malayan species previously not found in Polynesia. His description does not fit the Samoan species or *Trichomanes Macgillivrayi* Baker, a species which was overlooked by Copeland in his monograph of *Trichomanes.* It is a true *Hymenophyllum* section *Leptocionium* and must be transferred to that genus as *H. Macgillivrayi* (Baker) C. Christensen, comb. nov. The small type specimen at Kew resembles somewhat *H. praetervisum,* but the segments are broader, 2 mm., rachis red-hairy, indusia more campanulate with entire, ovate valves and crests on the back. It is not crisped.

6. **Hymenophyllum feejeense** Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 266, pl. 37, fig. 2, 1854. Luerssen, Mitt. Bot. **1**: 246, 349, 1874.

Hymenophyllum multifidum (Forster) Swartz, Baker, Jour. Bot., **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 337, 1897. Not Rechinger, Denkschr. Akad. Wiss. Wien **84**: 410, 1908.

Large, glabrous, the unwinged stipe up to 10 cm., lamina broadly deltoid, 10-15 cm. long and nearly as broad, tripinnate-pinnatifid, rachis narrowly winged throughout, flexuose, ultimate segments close, under 1 mm. wide, dentate, indusia deeply cleft, campanulate with ovate, dentate valves.

Savaii: Maugaloa, *Vaupel 454* (W), *455* (B). Upolu:

Fiji, Samoa.

This rare Samoan fern is identical with the Fijian type and was hitherto regarded as a form of *H. multifidum,* but Copeland now seems to retain it as a species.

CYATHEACEAE

Genus **CYATHEA** Smith

Cyathea Smith, including *Alsophila,* Copeland, B. P. Bishop Mus., Bull. **59**: 36, 1929; Bull. **93**: 31, 1932.

Key to Species of Cyathea

Indusium complete, persistent
  Rachises smooth
    Midribs of segments with bullate scales, ribs otherwise naked beneath.
      Bipinnate-pinnatifid, segments broad, entire or serrate, glabrous above, no twice furcate veins
        Stipe very short, lamina long decrescent, veins 3-5-jugate.....1. **C. subsessilis.**
        Stipe longer, veins 8-10-jugate.....2. **C. Vaupelii.**
      Subtripinnate, segments with some long setae above, their fertile portion deeply crenulate-serrulate, many sterile veins twice furcate....3. **C. Whitmeei.**
    Costules and midribs densely chaffy with small rufous scales.....4. **C. samoensis.**
  Rachises scabrous by many raised points, with age naked.....5. **C. scabra.**
Indusium fugacious, consisting of one or a few scales hidden under the sporangia
  Rachises smooth. Frond bipinnate-pinnatifid.....6. **C. plagiostegia.**
  Rachises muricate. Frond tripinnate.
    Free tertiary pinnules broadly adnate to costule; rachises I-III practically naked; sterile veins often twice furcate.....7. **C. lunulata.**
    Tertiary pinnules small, petiolulate; all rachises with a thick dull-brown tomentum; veins once furcate.....8. **C. truncata.**
Indusium none; frond quadripinnate.....9. **C. decurrens.**

1. **Cyathea subsessilis** Copeland, Philip. Jour. Sci. **6C**: 359, 1911.
   Cyathea propinqua Mettenius, ex parte. Christ, Engler Bot. Jahrb. 23: 362, 1897.

A near relative of *C. propinqua* and *C. Vaupelii*, smaller (trunk 4 m.) and marked by the short (5-10 cm.) stipe, which is clothed with long, lanceolate-acuminate, concolorous, brown, entire scales. Whole frond about 1 m. long, the lamina very gradually narrowed downwards. Bipinnate-pinnatifid, the pinnae sessile, about 20 × 7 cm., shortly acuminate, pinnules 3-4 × 1-1.2 cm., sessile, rather obtuse, incised nearly to the costule with 6-8 pairs of entire or slightly repand, subfalcate, 4 mm. wide, rounded obtuse or antrorsely subacute segments with 3-5 pairs of veins, the lower of which are furcate about midway; sori about medial, indusia brown, membranous, persistent, at first globose and wholly enveloping the sporangia, later breaking up irregularly. Rachises I and II smooth, brown, when young sparsely pubescent and with a few linear, small scales, costae and costules above antrorsely strigose with brownish articulated hairs, midribs of segments with a single, or rarely two similar long hairs above the middle on the upper side, costules with many bullate, brown scales beneath, surfaces otherwise glabrous. Frond firmly herbaceous, dark green above, light green beneath.

Savaii: Maugaloa, *Vaupel 424* (B, Kew, W, type number); above Matavanu, 900 m., *Christophersen 2064*. Upolu: near Letogo River, *Reinecke 89 b* (W, B?).

Hitherto known only from Samoa; I refer here a specimen from Fiji, Vanua Levu, Mount Ndikeva, A. C. Smith 1902, which differs from the common Fijian *C. propinqua* by the presence of bullate scales and agrees fairly well with the Samoan form in habit, size and color. The question is only whether *C. subsessilis* is a good species and not a form of *C. Vaupelii* or of *C. propinqua*.

2. **Cyathea Vaupelii** Copeland, Philip. Jour. Sci. **6C**: 360, 1911.
   Cyathea propinqua Mettenius (at least pro parte), of all earlier writers.
   Cyathea affinis Brackenridge, as to Samoan specimens.

Cyathea leucolepis Mettenius. Christ, Engler Bot. Jahrb. **23**: 363, 1897 (non Mettenius). Rechinger, Denkschr. Akad. Wiss. Wien **84**: 443, 1908.

Cyathea Brackenridgei Mettenius. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 182, 1912.

Cyathea Setchellii Copeland, Univ. Calif. Pub. Bot. **12**: 389, pl. 50, 1931.

Trunk (according to Setchell and Christophersen), short, 0.6-1.5 m.[4] Stipe variable in length up to 25 cm., its scales brown to castaneous with pale edges, somewhat muricate. Fronds 1-2 m. long, usually not long decrescent, but sometimes with 1-2 remote short pinnae near stipe-base. Pinnae short-stalked (1-2 cm.), middle-sized ones 35-50 × 15-20 cm., the secondary ones 8-9 × 2 cm., acuminate, segments 12-14-jugate, 4-5 mm. wide, falcate, rounded obtuse or antrorsely acute, distinctly serrate toward the tip; veins 8-10-jugate, most of them once forked, none twice, prominent beneath; sori, pubescence and scales as in *C. subsessilis*, but the bullate scales pale brown to whitish. Rachises smooth and stramineous, texture papyraceous to subcoriaceous. the under side light green.

Savaii: Vaipouli, *Vaupel 184* (B, Kew, W, type number); *Reinecke 118* (B). Upolu: *Betche; Powell; Reinecke 89* (B, W); *Rechinger 107* (W), *613, 1867* (V); *Hochreutiner 3342* (G); Vailima, *Eames 104;* top of Fao, *Christophersen 563.* Tutuila: *Setchell 2* (W, type number of *C. Setchellii*), *225* (W); *McMullin 14* (W); *Eames T21;* top of Pioa, *Christophersen 3546; Reinecke 89 d* (B); (native name, *olioli*).

Cyathea Vaupelii var. **lobulata,** var. nov.

Major, subtripinnata, subcoriacea, pinnulis 10 × 3 cm., segmentis 1.8 × 0.5 cm., obtusis, fere e basi crenato-lobulatis.

Without locality: *Safford 52* (W).

I follow Copeland in treating this Samoan tree fern as different from the Fijian *C. propinqua* Mettenius, which is extremely similar as a whole but it lacks bullate scales. It should also be compared with *C. leucolepis* Mettenius from Aneiteum. I find no important differences between Copeland's two species. *C. leucolepis* Mettenius (Rechinger, Denkschr. Akad. Wiss. Wien **84**: 59, 1908, from Upolu, 1384, V) is a doubtful form approaching *C. Whitmeei,* peculiar in the rather densely floccose costules, with hairlike and linear small fringed scales, and in the long, hair-tipped whitish bullate scales.

C. Vaupelii is also extremely near *C. Brackenridgei* Mettenius from Solomon Islands. The type specimen of that species (coll. Milne, B) is rather scanty and was identified with *C. affinis* Brackenridge by Mettenius. It differs slightly from typical *C. Vaupelii* in the larger bullate scales on the costules. Smaller bullate scales are found on the veins as in *C. Whitmeei,* with the larger pinnules regularly crenulate-serrate. It seems natural to consider all these Polynesian tree ferns local forms of one wide spread species.

[4] Christ says (Engler Bot. Jahrb. **23**: 362, 1897): "Baum 5-15 m hoch," but I believe this (exaggerated?) measurement refers to *C. Whitmeei.*

3. **Cyathea Whitmeei** Baker, Jour. Bot. **14**: 343, 1876.
Hemitelia samoensis Mettenius. Christ, Engler Bot. Jahrb. **23**: 362, 1897.
Cyathea Brackenridgei Mettenius? Christ, Engler Bot. Jahrb. **23**: 363 (non Mettenius), 1897.
Cyathea Betchei Copeland, Philip. Jour. Sci. **6C**: 360, 1911.

In general resembles *C. subsessilis* and *C. Vaupelii*, but with distinctive characters. It is larger, the trunk 4-8 m. high, the stipe rufous-brown, perfectly smooth but below covered with a dense brown tomentum (easily abraded) mixed with small linear scales (no large scales seen). Frond 2 m. long, subtripinnate, apparently not narrowed toward base, the lower pinnae 45-50 × 25 cm., narrowed toward the base and on petioles up to 6 cm. long, the upper subsessile. Larger pinnules 3 cm. wide, sessile, acuminate, at base fully pinnate with 3-4 pairs of free, broadly adnate tertiary pinnules, upwards (as those of the smaller upper pinnae) deeply pinnatifid. Segments falcate, 3-4 mm. wide, acute to obtuse, nearly from the base serrate to lobulate with often retuse lobes, veins 8-12-jugate, the sterile ones of larger segments usually twice, the fertile, once furcate. Rachises I and II stramineous, glabrous and quite naked beneath, costules, midribs and veins of segments with pale, bullate scales, which are as a rule rather numerous along the margins; midribs and veins with a number of whitish, long hairs above. Sori and indusium as in the former species. Frond firmly herbaceous to papyraceous, bluish-green beneath.

Without locality: *Whitmee 199* pro parte (Kew, type).

Savaii: Olo, about 700 m., *Christophersen 2247;* Siuvao-Auala, about 600 m., *Christophersen 3364;* Olonono, *Vaupel 348* (B, W). Upolu: *Betche, Reinecke, 84* (Kew, W); near Malololelei, 600 m., *Christophersen 219.*

Endemic.

It may seem improbable that *C. Betchei* is identical with *C. Whitmeei*, but a whole frond collected by Christophersen (219) proves, I believe, that it is true. While the lower pinnae exactly fit *C. Betchei*, the upper smaller and less divided ones agree fairly well with the type of *C. Whitmeei*. However, the long, pale hairs on the upper side, found in the type are few or none; all forms referred to here agree in the bullate scales not being confined to the costules but scattered over the under surface of the segments. (See *C. plagiothecia.*)

4. **Cyathea samoensis** Baker, Jour. Bot. **14**: 9, 1876.

In general habit, color, texture, and division very like *C. scabra* but differing in more important characters. The trunk is 4-5 m. high, the stipe below with pale brown to straw colored, lanceolate scales and often with 1-2 remote, adventitious, short pinnae near base. Rachises I and II cinnamon-colored, smooth or at most with a few minute raised points, immature fronds with a red-brown tomentum consisting of minute, lacerated scales and probably also with larger, lanceolate ones, but in the mature frond they are practically naked and glabrous, the costae above densely brown-tomentose. Upper pinnae sessile, 60-70 × 15 cm., secondary pinnules 2-2.5 cm. wide, fully pinnate in the lower half with broadly adnate pinnules iii 2-2.5 mm. wide, acute, subfalcate, more or less deeply crenate throughout, the lower ones often deeply lobate with quadratic, emarginate lobes. Veins 9-12-jugate, most of the sterile ones twice forked, the fertile usually once forked. Sori costular with persistent, large indusia like those of *C. scabra*. Costules and midribs densely, the veins and surface thinly paleaceous with ovate and lanceolate small red-brown scales.

Without locality: *Whitmee* (Kew).

Savaii: Tuisivi Range, 1,600-1,700 m., *Christophersen 805;* above Matavanu, 1,300 m., *Christophersen 2179, 2183, 2239;* Le To, 750 m., *Christophersen 2904.*

Endemic.

5. **Cyathea scabra** Baker, Jour. Bot. **14**: 343, 1876.

Cyathea deorsilobata Copeland, Philip. Jour. Sci. **6C**: 359, 1911.

A lofty tree fern with a trunk up to 8 m. high, 25 cm. diameter. Stipe dark brown, 2 cm. thick, with lanceolate, dark brown scales, which leave raised points on falling. Leaves large, fully tripinnate, slightly narrowed toward base. Rachises I and II light to dark brown or II sometimes nearly black, densely muricate with numerous small prickles, naked and glabrous, but probably scaly when quite young. Lower pinnae on stalks up to 8 cm. long, the upper sessile, the largest 60-70 × 20-30 cm., secondary pinnules subsessile, up to 15 × 4 cm., caudate-acuminate, fully pinnate nearly to the tip, the tertiary ones about 4 mm. wide, hardly falcate, broadly adnate to the costule, deeply crenate-lobate in the lower, fertile half or two-thirds, the outer sterile portion subentire. Veins 10-12-jugate, not prominent, most of them twice forked. Sori confined to the lobed portion of the pinnules, rather small, inframedial, at least confluent covering the whole surface, indusia brown, membranous, at first wholly enveloping the sporangia, later breaking up irregularly. Frond firmly herbaceous, dark green on both sides (a little lighter beneath), the upper side, except the thinly strigose costules, glabrous, the underside with numerous, minute, appressed, pale hairs spread over the surface, the costules with some brown scales. Easily distinguished from other species by the scabrous rachises, partially lobed tertiary pinnules and pubescent under side.

Without locality: *Whitmee 199,* pro parte (Kew, type).

Savaii: Mataana, 1,600 m., *Vaupel 471* (Kew, B, W, type of *C. deorsilobata*); Tuisivi Range, 1,600-1,700 m., *Christophersen 804;* above Matavanu, 1,300 m., *Christophersen 2176, 2182;* above Salailua, about 1,400 m., *Christophersen 3105.*

Endemic.

6. **Cyathea plagiostegia** Copeland, B. P. Bishop Mus., Bull. **59**: 9, 37, 1929.

Alsophila samoensis Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 287, pl. 40, fig. 1, 1854, and authors. (Not *Cyathea samoensis* Baker, 1879 [1876?], nor *Hemitelia samoensis* (Brackenridge) Christ, Engler Bot. Jahrb. **23**: 362, 1897 = *C. Whitmeei* Baker.

Cyathea Wilkesiana Domin, Acta Bot. Bohem. **9**: 171, 1930.

Alsophila lunulata R. Brown. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 443, 1908.

Frond dark green, herbaceous, subtripinnate, rachises I and II smooth, sparsely short-pubescent and furnished with some narrow linear scales, becoming quite glabrous. Pinnae sessile, 60-70 × 15 cm., pinnules 1.5-2 cm. wide, abruptly short-acuminate, subsessile, incised very nearly to the costule into numerous close, oblique segments, 2 mm. wide with parallel edges, which are finely short dentate, especially towards the rounded obtuse or acute apex; the basal segments somewhat shortened; veins thin, not prominent, 10-12-jugate, most of them once, rarely twice forked, midribs of pinnules ii with many brown ovate small scales beneath, midribs of pinnules iii with bullate scales beneath, surfaces otherwise glabrous. Sori very small, inframedial, indusium reduced to an interior brown scale; receptacle raised, capitate, with a few short paraphyses.

Without locality: *Powell 255* (Kew).

Savaii: above Olonono, 600 m., *Vaupel 417* (Kew, W); above Salailua, 1,450 m., *Christophersen 3110.* Upolu: *Betche* (*C. Christensen*); *Rechinger 1899;* Lanutoo Lake, *Hochreutiner 3298* (G).

Samoa, Fiji.

Apparently a rare species in Samoa as in Fiji. The few specimens seen agree perfectly with Brackenridge's description and figure of *A. samoensis* as well as with *C. plagiostegia* Copeland. From the United States National Herbarium, I have on loan a single sterile pinna labelled "Alsophila Samoensis Sp. Nov." by Brackenridge himself. It is not the species illustrated by him, but without doubt, *C. Whitmeei.* According to Hochreutiner *C. plagiostegia* is a tree fern 6-8 m. high.

7. **Cyathea lunulata** (Forster) Copeland, B. P. Bishop Mus., Bull. **59**: 37, 1929.

Alsophila lunulata R. Brown. Luerssen, Mitt. Bot. **1**: 235, 355, 1874.

Alsophila vitiensis Carruthers. Christ, Engler Bot. Jahrb. **23**: 362, 1897 (not Carruthers). Rechinger, Denkschr. Akad. Wiss. Wien **84**: 443, 1908.

Alsophila extensa (Forster) R. Brown. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 128, 1924.

Cyathea propinqua Mettenius. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 183, 1908.

A tall tree fern with a trunk up to 10 m. high. Stipes up to 60 cm. long, 3 cm. thick, pure brown, densely covered with subappressed, pale straw colored or whitish, narrow-lanceolate, entire scales 2-3 cm. long, 0.5-1 mm. wide, which soon fall and leave the stipe slightly asperulous. Frond up to 2 m. long, green on both sides, tripinnate, herbaceous, rachises I and II stramineous, muricate, naked and glabrous, but probably scaly when young. Pinnae 70 × 25-30 cm. (fertile ones usually narrower), on stalks 2-3 cm. long; pinnules ii, 3-4 cm. wide, sessile, caudate-acuminate, fully pinnate in the lower half with the tertiary pinnules adnate to the costule with their whole base, the basal ones mostly smaller; ultimate pinnules and segments about 3 mm. wide, usually falcate, acute to nearly spinescent at the tip, subentire in the lower third, upward more or less deeply serrate; up to 15 pairs of veins, the sterile ones mostly twice, the fertile once forked; costules thinly pubescent above with articulated hairs (upper side elsewhere glabrous), glabrous beneath, but with some small ovate, pale, subbullate, deciduous scales; the lower half of the midribs of the segments with crowded, whitish, bullate, entire scales, sometimes found also on the veins which bear a few appressed, articulated hairs. Sori small, a little inframedial; indusia reduced to a wreath of pale scales hidden under the sporangia and mostly split up into hairs and soon lost; sporangia mixed with a few septate paraphyses.

Common and found by all collectors.

Savaii: Olonono, *Vaupel 148* (B, W); *Christophersen 1910, 1947, 2067, 2536, 2909, 2995, 3208.* Upolu: *Eames 96; Christophersen 960.* Tutuila: *Setchell 73* (W); *McMullin 32* (W).

All specimens examined are characterized by the crowded, usually bullate scales on the midribs beneath, and agree with Forster's type, but differ from the Fijian form in the fewer and less crowded scales. They also differ in shape and serrature of the segments, those of the typical form being acute to subspinescently acuminate and serrate in the outer two thirds only, of other specimens, obtuse and coarsely serrate from the base with emarginate or bidentate lobules. The scales of the stipes are usually all lost in dried specimens. I regard *C. rugosula* Copeland from Eua Island, Tonga, as a local race of *C. lunulata.*

Our species has been received from most Polynesian islands, but each group of islands apparently has its special form, variety, or species. *A. lunulata* R. Brown was referred to *A. extensa* (Forster) Sprengel in Index Filicum; but, as shown long ago by Carruthers (Fl. Vit. 333) and by my own examination of Forster's types of both species in British Museum (Natural History), *A. extensa* (the type sterile) is certainly a different species with flat and densely ciliate scales on costae and costules. The Fijian specimens referred to it by Copeland are hardly *C. extensa.*

8. Cyathea truncata (Brackenridge) Copeland, Philip. Jour. Sci. **4C**: 39, 1909.

Alsophila truncata Brackenridge, U.S. Expl. Exp. 1838-42 **16**: 289, pl. 41, 1854, and authors.

Trunk 1-2.5 m. high, stipes with pale brown, linear, entire scales, 2-3 cm. long and hardly more than 0.5 mm. wide. Stipes and primary and secondary rachises coated with a dense and thick tomentum consisting of dull brown minute ovate to lanceolate scales and muricate by short, black prickles. Fronds large, dark green, firmly herbaceous, not or slightly narrowed below, tripinnate. Pinnae (the basal ones excepted) sessile, 50-60 × 12-15 cm., pinnules 1.2-2 cm. wide throughout below the short-acuminate apex, sessile, fully pinnate nearly to the tip, tertiary pinnules numerous, straight, a little oblique, most of them distinctly petiolulate, their base truncate and usually subauriculate, 1.5 mm. wide, obtuse to acute and entire to repand or regularly crenulate-serrulate; veins 9-10-jugate, once or the basal ones occasionally twice forked, costules above brown-hairy, beneath densely chaffy with ovate, more or less lacerated, often vaulted, small brown scales; upper side of ultimate pinnules glabrous, their midribs, and here and there the veins with many small, pale bullate scales. Sori small, submedial, furnished with a rudimentary indusium consisting of small, thin scales hidden under the sporangia; paraphyses few and short.

Common and found in all islands.

Savaii: above Letui, 1,300 m., *Christophersen 763;* above Matavanu, 1,300 m., *Christophersen 2180;* Maugaloa, *Vaupel 430* (W, Kew). Upolu: Fao, *Christophersen 550.* Tutuila: top of Matafao, 650 m.; *Setchell 393* (W); *Christophersen 1029;* top of Pioa, 500 m., *Christophersen 3531.*

Samoa, Fiji. Also recorded from Celebes; the specimens from there are extremely similar to the type but nevertheless specifically different.

The numerous specimens from Samoa seen are very uniform, varying only a little in shape and cutting of the tertiary pinnules, and they agree perfectly with Brackenridge's description and plate. The Fijian specimens differ con-

siderably in vestiture, their atropurpureous rachises lacking the dull brown, thick tomentum, which however is often more or less abraded in Samoan specimens, but are clothed with linear, castaneous scales. The midribs are either furnished with a few glassy brown bullate scales or are quite naked.

9. **Cyathea decurrens** (Hooker) Copeland, Univ. Calif. Pub. Bot. **14**: 358, 1929; B. P. Bishop Mus., Bull. **93**: 33, 1932.
Alsophila decurrens Hooker, Sp. Fil. **1**: 51, 1844.

Rachises stramineous, smooth and naked. Pinnae, at least the lower ones, long stipitate, ovate in outline, up to 50 × 15 cm., herbaceous, nearly quadripinnate, the secondary ones 2-2.5 cm. wide, fully pinnate in the lower half with the tertiary pinnules decurrent and deeply pinnatifid with falcate, acute and entire or one-toothed small lobes; costules and midribs with a few long setae above and some scattered bullate, whitish scales beneath; sori small, seated in the center of the lobe, exindusiate.

Without locality: *Brackenridge* (W); *Powell 246* (Kew).

Cyathea decurrens var. **Vaupelii** (Brause) Domin, Acta Bot. Bohemica **9**: 110, 1930.
Alsophila decurrens var. *Vaupelii* Brause, Notizb. bot. Gart. Berlin-Dahlem **8**: 139, 1922.

Much larger, 6 m. high, and quadripinnate-pinnatifid. Pinna I, 50 × 30 cm., the secondary ones stalked, 15 × 6 cm., the tertiary, 3.5 × 1 cm., the quaternary pinnules and segments 6-7 mm. long by 2 mm. wide, straight and with about 4 lobes or teeth at each side, the larger lobes often bidentate.

Savaii: Tuisivi Range, *Vaupel 438* (Kew, W); above Sili, 400 m., *Christophersen 3186.*

Samoa, Rarotonga, Tahiti, Aneiteum, New Caledonia.

Evidently a rare species in Samoa. The two forms described look rather different.

DICKSONIACEAE

Genus **DICKSONIA** l'Heritier

Copeland, B. P. Bishop Mus., Bull. **59**: 67, 1929.

Dicksonia Brackenridgei Mettenius. Copeland, B. P. Bishop Mus., Bull. **59**: 67, 1929.
Dicksonia Berteroana (Colla) Hooker. Luerssen, Mitt. Bot. **1**: 232, 354, 1874 (not Hooker).

Trunk 0.5-2.5 m. high.

Savaii: above Letui, 1,300 m., *Christophersen 789;* crater above Matavanu, *Christophersen 2033.* Upolu: Mauga Tele Ridge, 450 m., *Christophersen 522.* Found in the two islands by most earlier collectors but apparently not recorded from Tutuila.

Fiji, Samoa.

Genus **CULCITA** Presl

Copeland, B. P. Bishop Mus., Bull. **59**: 67, 1929 (*Balantium*).

Culcita straminea (de Labillardière) Maxon. Setchell, Dept. Marine Biol. Carnegie Inst. Wash **20**: 129, 1924. Christensen, Index Suppl. **3**: 57, 1934.

Balantium stramineum (de Labillardière) Diels. Copeland, B. P. Bishop Mus., Bull. **59**: 67, 1929.

Dicksonia dubia Gaudichaud. Luerssen, Mitt. Bot. **1**: 233, 354, 1874.

Davallia dubia R. Brown? Christ, Engler Bot. Jahrb. **23**: 340, 1897 (part?, not R. Brown).

Davallia moluccana Blume, part. Christ, Engler Bot. Jahrb. **23**: 340, 1897.

Common, found on all islands and collected by all.

Upolu: Mauga Tele Ridge, 600 m., *Christophersen 518*. Tutuila: top of Matafao, 650 m., *Christophersen 1027;* top of Le Pioa, 500 m., *Christophersen 3541*.

Central Polynesia to New Caledonia.

May be confused with *Ithycaulon minus*. Reinecke nos. 97, 97 a (part), 121, 143 a (B), cited by Christ under *Davallia moluccana*, belong here.

POLYPODIACEAE

Genus **DENNSTAEDTIA** Bernhardi

Copeland, B. P. Bishop Mus., Bull. **93**: 53, 1932.

Key to the Species of Dennstaedtia

Frond herbaceous with alternate pinnae, axes not spiny
- Light green, rachis, costae and costules densely tomentose-pubescent beneath, with short light brown hairs, quaternary segments lobed ..... **1. D. flaccida.**
- Dark green, rachis and costae glabrous beneath, small ribs with a few articulated hairs, ultimate segments subentire ..... **2. D. samoensis.**

Frond papyraceous with opposite pinnae and pinnules, axes with hooked spines .... **3. D. scandens.**

1. **Dennstaedtia flaccida** (Forster) Bernhardi. Luerssen, Mitt. Bot. **1**: 221, 396, 1874.

   Dicksonia flaccida Swartz. Christ, Engler Bot. Jahrb. **23**: 363, 1897.

   Savaii: above Salailua, about 1,400 m., *Christophersen 2759*, part (W); *Reinecke 184;* Le To, 750 m., *Christophersen 2913*. Reported also from Upolu and Tutuila, but evidently rare in Samoa.

   New Hebrides, Samoa.

   The Samoan specimens agree perfectly with others from Aneiteum.

2. **Dennstaedtia samoensis** (Brackenridge) Moore. Luerssen, Mitt. Bot. **1**: 222, 396, 1874.

Sitolobium samoense Brackenridge, U. S. Expl. Exp. 1838-42, **16**: 274, pl. 38, fig. 1, 1854.

Dicksonia samoensis Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler, Bot. Jahrb. **23**: 363, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 443, 1908.

Without locality: *Brackenridge* (W, type); *Powell 180* (Kew); *Whitmee 51.*

Savaii: *Vaupel 622.* Upolu: *Reinecke 184* (B, Kew, W); *Rechinger 963* (W).

Probably endemic; specimens from other localities referred to it seem to be different; nearest is a specimen from Aneiteum (*Herus 97*).

A very large species with pinnae reaching 100 cm. in length, 50 cm. in breadth. It is often confused with *D. flaccida,* but is quite different in color and pubescence.

3. **Dennstaedtia scandens** (Blume) Moore. Copeland, B. P. Bishop Mus., Bull. **93**: 53, 1932.

Dicksonia moluccana Blume. Baker, Jour. Bot. **14**: 343, 1876. Christ, Engler Bot. Jahrb. **23**: 363, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 443, 1908.

Tapeinidium amboynense (Hooker) C. Christensen. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 196, 1912.

Without locality: *Powell 176* (Kew); *Whitmee 208* (Kew).

Upolu: *Reinecke 146* (B); *Rechinger 318* (V, W), *724, 1332* (V); *Hochreutiner 3416* (G). Savaii: forest in crater above Matavanu, about 900 m., *Christophersen 2024.*

Tahiti, Samoa, Malaya.

A liana of indefinite growth, climbing by aid of the sharp, hooked spines, which are most numerous on the secondary rachises (costae). Together with its close relative *D. moluccana* (Blume) Moore, of which it may be a variety with less coriaceous leaves, it is exceedingly different from the ordinary, thin-leaved *Dennstaedtiae.* All vegetative characters agree with some Malayan species of *Hypolepis* (*H. papuana* Bailey, *H. Brooksiae* van Alderwerelt van Rosenburgh, *H. celebica* C. Christensen) but the indusium is cup-shaped, as in *Dennstaedtia.* It thus bridges the gap between the two genera which most authors place in different tribes. I long ago considered them as belonging to the same group, and Bower arrived at the same conclusion (The Ferns III) interpreting *Hypolepis* as a dennstaedtioid genus with the inner indusium-valve not developed.

In his "Ferns of Fiji" Copeland did not list any species of *Dennstaedtia,* overlooking a Fijian species described by Baker, collected by Horne, as *Dicksonia involucrata,* which I recently identified with the Papuan *D. glabrata*

(Cesati) C. Christensen (Index Filicum, Suppl. 3:70). Besides this species, Horne collected another species there, which Baker named *Dicksonia moluccana* var. *inermis*, but it is neither *D. moluccana* nor *D. scandens*.

Genus **MICROLEPIA** Presl

Copeland, B. P. Bishop Mus., Bull. **59**: 68, 1929.

1. **Microlepia speluncae** (Linnaeus) Moore. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 126, 1924. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 195, 1912. Copeland, B. P. Bishop Mus., Bull. **59**: 68, 1929.
   Davallia speluncae Baker. Luerssen, Mitt. Bot. **1**: 218, 396, 1874. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 341, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 442, part, 1908.
   Microlepia polypodioides Presl. Brackenridge, U.S. Expl. Exp. 1838-42 **16**: 238, 1854.
   Common, and collected by all.
   Savaii: Salailua, 300 m., *Bryan 161*. Upolu: *Vaupel 14, 14 a* (W); *Rechinger 338* (V). Tau: *Garber 598*.
   Tropics of the Old World.

   The numerous specimens of this highly variable species seen from Samoa are rather uniform, with subobtuse and dentately lobed rather than pinnatifid tertiary pinnules, all ribs with short brownish hairs and surfaces between the veins often puberulous. Indusium persistent, half cupshaped, glabrous or nearly so, the receptacle with few or many thick paraphyses not longer than the sporangia.

2. **Microlepia nudisora,** sp. nov.
   Davallia Speluncae Baker. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 442, part, 1908.

   M. speluncae affinis magnitudine similis, tenuiter herbacea, flaccida, subquadripinnata, pinnis I. ord. ad 50 × 15 cm., III. ord. acutis, profunde pinnatifidis vel subpinnatis, costis, costulis venisque pilis longis, septatis, applanatis, hyalinis sat sparse hirtis, parenchymate inter venas glabro. Soris parvis, rotundis, ut videtur exindusiatis sed indusiis vero in squamam inconspicuam mox deciduam reductis; receptaculo pilis nonnullis iis venarum similibus quam sporangiis valde longioribus praedito.

   Savaii: Patamea, *Rechinger 1149, 1151* (V). Upolu: Motootua, in secondary forest, *Rechinger 1249* (V, type, W).

   After much doubt I venture to describe this new species, which I am sure is specifically different from the Samoan form of *M. speluncae*, but it is possibly not very different from other forms of that species from elsewhere. The sori are apparently exindusiate, but I found a few sori with a small scale hidden under the sporangia; the hairs are quite different and some are found on the receptacle, a most remarkable character.

Genus **HYPOLEPIS** Bernhardi

Copeland, B. P. Bishop Mus., Bull. **59**: 76, 1929; Bull. **93**: 55, 1932.

The older writers referred all Samoan specimens to one species, *H. tenuifolia,* but later another species, *H. aspidioides,* was described by Christ. It is certain that two forms at least are found, the extremes of which look rather different; but I find it very difficult, if not impossible, to name many specimens consisting of a single pinna. The characters ascribed below to the two forms, dealt with as species, are not stable ones, and intermediate forms occur. The validity of *H. aspidioides* as a species depends largely on the characters of the rhizome, given below.

1. **Hypolepis tenuifolia** (Forster) Bernhardi (sens. lat.). Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 89, 1854. Luerssen, Mitt. Bot. **1**: 171, 383, part, 1874. Baker, Jour. Bot., **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 343, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 206, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 437, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 124, 1924. Copeland, B. P. Bishop Mus., Bull. **95**: 55, 1932.

Rhizome creeping. Stipe, rachis and costules purplish brown to atropurpureous, somewhat rough with scattered, minute raised points, lamina thin, flaccid, the quaternary segments not close, lobed, pseudoindusium (altered reflexed margin), small, soon disappearing.

Savaii: *Powell 209* (Kew), *Whitmee 56* (Kew); near Maugaloa, *Vaupel 280* (Kew, W); Volcan Maungaafi, 1,400 m., *Rechinger 1080* (V); Tuisivi Range, 1,600-1,700 m., *Christophersen 795;* above Aopo on the 1902 lava field, 1,200-1,400 m., *Christophersen 900;* east of Olo, 700-800 m., *Christophersen 2310.* Upolu: *Rechinger 1336, 1951* (V); above Malololelei, 700 m., *Christophersen 189.* Tutuila: *Setchell 390* (W).

Polynesia to Malaya.

This Samoan form is probably not the genuine *H. tenuifolia.* It approaches *H. rugosula* by the dark colored and somewhat rough rachis, but it is much larger and thinner.

2. **Hypolepis aspidioides** Christ, Engler Bot. Jahrb. **23**: 343, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 437, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 124, 1924.

Rhizome erect (see below). Rachis and costae stramineous, smooth; larger pinnae broadly deltoid, the quaternary segments close, subcontiguous, entire to slightly lobed, frond rather firm; pseudoindusia rather large, subpersistent.

Without locality: *Graeffe* (W); *Safford 41, 947* (W).

Savaii: Olonono, *Vaupel 206* (Kew, W). *Reinecke 132* (Kew, W, type collection); Olo, about 700 m., *Christophersen 2515.* Upolu: *Rechinger 987*

(V); near Malololelei, 600 m., *Christophersen 218*. Tutuila: *Brackenridge* (W); *Setchell 91* (W).

Endemic.

All other species of *Hypolepis* have a creeping rhizome without scales; it is strange therefore that the collectors describe that of *H. aspidioides* as erect. Reinecke says: "mit kurzem, stammartig aufgerichtetem Rhizom, bis 80 cm. hoch" (Christ, Engler Bot. Jahrb. **23**: 343, 1897); Rechinger: "Baumfarn"; and Setchell: "short, erect rootstock with runners." I cannot deny these statements, having seen only one specimen referred here (Christophersen 218) with fragments of rhizome and stipes. The former is 7-8 mm. thick, dark brown and densely tomentose, with short blackish brown hairs; the fragments seen are probably portions of runners; the stipe up to 1.5 cm. thick, dark atropurpureous, glossy, smooth, pubescent near the base only, as a whole like the stipe of *H. tenuifolia*. This is according to Rechinger a climbing fern, up to 7-8 m. long, the rhizome "kletternd."

Genus **LEUCOSTEGIA** Presl

Copeland, B. P. Bishop Mus., Bull. **93**: 62, 1932.

Leucostegia pallida (Mettenius) Copeland, Philip. Jour. Sci. **34**: 252, 1927; B. P. Bishop Mus., Bull. **93**: 62, 1932.

Davallia pallida Mettenius and all authors.

Davallia dubia R. Brown. Christ, Engler Bot. Jahrb. **23**: 340, part?, 1897.

Without locality: *Powell 203* (Kew); *Whitmee 39* (Kew).

Savaii: *Reinecke 187* (Kew, W); Maugaloa, *Reinecke 80 c* (B); *Rechinger 1593* (V). Upolu: *Rechinger 725;* top of Fao, 680 m., *Reinecke 98* (W); *Christophersen 568;* Malololelei-Lanutoo trail, 700 m., *Christophersen 363*. Olosega: top of Piumafua, *Garber 1061* (*oli oli vao*).

Tahiti to Borneo and Malacca, not recorded for Fiji.

Genus **HUMATA** Cavanilles

Copeland, B. P. Bishop Mus., Bull. **59**: 87, 1929; Bull. **93**: 62, 1932.

Key to Species of Humata

Leaves dimorphous, the sterile ones entire, the fertile pinnatifid.....1. **H. heterophylla.**
Leaves uniform, pectinato-pinnate.....2. **H. Banksii.**
Leaves more or less dimorphous, deltoid, 2-3 pinnate
  Coriaceous, pale green, segments subentire, most fertile ones without horn.....3. **H. botrychioides.**
  Less coriaceous, segments sharply dentate, falcate, acute horns beyond sori.....4. **H. serrata.**

1. **Humata heterophylla** (Smith) Desvaux. Copeland, B. P. Bishop Mus., Bull. **59**: 87, 1929. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 126, 1924.

   Humata ophioglossa Cavanilles. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 227, 1854.

   Davallia heterophylla Smith. Luerssen, Mitt. Bot. **1**: 204, 393, 1874. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 338, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 440, 1908.

   Apparently very common, and collected by all.

   Savaii: *Vaupel 191* (Kew, W); above Sili, 350 m., *Christophersen 3257*. Upolu: near Malololelei, 700 m., *Christophersen 185, 420*. Tutuila: *Safford 940* (W); *Garber 827, 881*. Tau: *McMullin 52* (W); *Garber 620, 643*.

   Samoa to Java.

   The Samoan form is very like the Malayan one, perhaps with more slender, bristlelike and entire rhizome-scales and the stipe of the sterile fronds shorter. It varies considerably in size, but even the smaller leaves, which somewhat resemble *H. ophioglossa* Cavanilles, lack the marginal notches.

2. **Humata Banksii** Alston, Philip. Jour. Sci. **50**: 176, 1933.

   Humata pectinata (J. Smith) Desvaux. Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 229, 1854.

   Davallia pectinata Smith. Baker, Jour. Bot. **14**: 343, 1876.

   Davallia Gaimardiana Presl. Luerssen, Mitt. Bot. **1**: 206, 393, 1874.

   Humata Gaimardiana (Gaudichaud) J. Smith. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 126, 1924.

   Davallia parallela Wallich. Christ, Engler Bot. Jahrb. **23**: 339, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 441, 1908.

   Very common and found on all islands, collected by all.

   Savaii: *Vaupel 195* (Kew, W); near Salailua, 100 m., *Christophersen 925*. Upolu: Malololelei, 700 m., *Christophersen 419*. Tutuila: *Safford 16* (W); *McMullin 18* (W); top of Goat Island, *Garber 826*. Tau: *McMullin* 48 (W); *Garber 738*.

   Polynesia, east to Tahiti, reported from New Guinea and Borneo.

   Alston (Philip. Jour. Sci., **50**: 176, 1933) states that the actual type of *Davallia pectinata* Smith is identical with *H. Gaimardiana* (Gaudichaud) J. Smith, and gave a new name to the Polynesian species illustrated as *D. pectinata* by Hooker and Greville (Ic. Fil., pl. 139), which is the species occurring in Samoa. It differs chiefly from the genuine *H. pectinata* (Smith) by the basal segments being pinnatifid on the lower side.

3. **Humata botrychioides** Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 231, pl. 32, fig. 2, 1854.

Davallia alpina Blume, part. Luerssen, Mitt. Bot. **1**: 207, 393, 1874.

Davallia botrychioides Baker. Christ, Engler Bot. Jahrb. **23**: 339, excel. var. (not of others), 1897.

Savaii: *Reinecke 154* (B). Upolu: at Lake Lanutoo, epiphyte, 700 m., *Christophersen 129.*

Samoa and Fiji.

The specimens agree very well with Brackenridge's plate, but less so with specimens from Fiji. They may be a smaller form of *H. serrata,* from which they differ by the characters of the key.

4. **Humata serrata** Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 230, 1854.

Davallia alpina Blume, part. Luerssen, Mitt. Bot. **1**: 207, 393, 1874.

Davallia botrychioides Baker, Jour. Bot. **14**: 343, 1876; in Hooker, Ic. Pl., pl. 1621. Christ, Engler Bot. Jahrb. **23**: 339, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 441, 1908.

Without locality: *Whitmee* 36 (Kew).

Upolu: *Rechinger 1970, 584* (*D. Graeffei* Rechinger); swamp near Tiavi, 720 m., *Christophersen 177.* Tutuila: *Brackenridge* (W, type).

Samoa, Fiji, New Caledonia.

This species has been identified with *H. alpina* (Blume) by most authors, but it is quite different from that Malayan species in its much larger size; stipe and lamina of the largest fertile leaves seen 12-15 cm. each, and nearly as broad, the sterile ones mostly smaller; it is decidedly dimorphous. Sterile leaves are hard to distinguish from *Davallia Graeffei,* but the segments are acutely dentate, and the rachis usually somewhat paleaceous. *Davallia botrychioides* var. *multifida* (Carruthers) Christ [Engler Bot. Jahrb. **23**: 339, 1897; *H. multifida* Carruthers (?); collected by Jessen, not seen] is probably *H. serrata.*

Genus **DAVALLIA** Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 88, 1929.

Key to Species of Davallia

Leaves decidedly dimorphous, fertile ones more divided, with much contracted divisions; rhizome glaucous with lanceolate scales; indusium a short broad cup ..... **1. D. Graeffei.**

Leaves uniform or a little dimorphous; rhizome not glaucous, with narrow-tipped scales; indusium cylindrical to narrow-ovate

Leaves 2-4 pinnate, coriaceous, pale green beneath, opaque; indusium without a free acuminate lip.

Rhizome-scales with spreading, hairlike, non ciliate tips; outer edge of indusium rounded ..... **2. D. plumosa.**

Rhizome-scales with narrow, lanceolate, subadpressed, when young, woolly-ciliate; indusium with mouth truncate ..... **3. D. solida.**

Leaves 4-5 pinnate, glossy; indusium narrow ovate with a free acuminate lip ..... **4. D. epiphylla.**

1. **Davallia Graeffei** Luerssen, Mitt. Bot. 1:211, 394, pl. 18, 1874. Christ, Engler Bot. Jahrb. **23**:339, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**:441, part, 1908.

   Humata lepida (Presl) Moore. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**:194, 1912.

   Without locality: *Powell 168, 204* (Kew); *Whitmee 43* (Kew).

   Savaii: *Graeffe* (type). Upolu: *Reinecke 154* (W); *Rechinger 164* (V, W, H); Lanutoo Lake, *Hochreutiner 3304* (G); top of Fao, 680 m., *Christophersen 567*. Endemic. Reported from Aneiteum but probably confused with *D. leptocarpa* Mettenius.

   In spite of the sori being davallioid, the indusium forming a half-cup with the sides connate nearly throughout, the systematic position of this species is doubtful to me. In nearly all other characters, it is so like *Humata serrata* that it is easily confused with it, still the ultimate segments of the subtripinnate sterile lamina are entire and rachis without scales. Sterile lamina mostly less than 10 cm. each way, the fertile up to 20 × 15 cm., with many contracted segments, the ultimate ones wholly occupied by the sorus and with a horn protruding beyond.

2. **Davallia plumosa** Baker, Jour. Bot., **14**: 10, 343, 1876.

   Davallia longicauda Christ, Engler Bot. Jahrb. **23**: 339, 1897.

   Davallia pyxidata Cavanilles. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 440, 1908.

   Rhizome branched, brown, 5 mm. thick, very densely paleaceous, the scales from a blackish, broad peltate base suddenly narrowed into a hairlike, rufous, non-ciliate, very spreading tip about 1 cm. long. Leaves in color and texture like *D. solida,* the deltoid lamina up to 20 × 15 cm., the sterile 2-sub-tripinnate, the fertile usually more divided with narrower divisions; apical half or third of lower pinnae and pinnules and the upper pinnae lanceolate-acuminate, about 1 cm. wide, deeply pinnatifid with oblique, oblong lobes, the lower larger ones bifid. Indusium cylindrical or slightly ventricose, about 2 mm. long, 1 mm. wide, the rounded outer edge somewhat dilated and reaching the margin of the segment, or a little longer.

   Without locality: *Whitmee 40* (Kew, type) *217* (Kew).

   Savaii: Volcan Maungaafi, about 1,600 m., *Rechinger 1101* (V); above Matavanu, about 900 m., *Christophersen 2261;* above Salailua, 1,200-1,300 m., *Christophersen 2753*. Endemic.

   No doubt a distinct species and not a form of the variable *D. solida,* best marked by the squarrose, hair-tipped, non-ciliate rhizome scales and by the long pinnatifid apical portion of the pinnae, corresponding to the upper pinnae. *D. longicauda* Christ, according to the description is evidently *D. plumosa.* It was also found in Tutuila.

3. **Davallia solida** (Forster) Swartz, and all authors. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 126, 1924. Copeland, B. P. Bishop Mus.,

Bull. **59**: 89, 1929; Bull. **93**: 64, 1932. Brown, B. P. Bishop Mus., Bull. **89**: 47, pl. 8, 1931.

Common on all islands and collected by all.

Savaii: Safune, on lava field of 1905-1911, 600 m., *Bryan 134;* cracks in lava below Matavanu Crater, 200 m., *Christophersen 616, 1887;* between Vaipouli and Manase, 100 m., *Christophersen 721;* lava field above Aopo, 1,200-1,400 m., *Christophersen 892.* Tutuila: *McMullin 21* (W); Goat Island, *Garber 824.* Tau: *Garber 673.*

Pitcairn to Burma.

Very variable in degree of division and shape of indusia and likely an aggregate. The differently shaped indusia illustrated by Brown may also be found in Samoan specimens.

4. **Davallia epiphylla** (Forster) Sprengel. Christ, Conserv. Jard. bot. Genève, Ann., **15-16**: 195, 1912. Copeland, B. P. Bishop Mus., Bull. **93**: 64, 1932.

Davallia denticulata var. *elata* Mettenius. Luerssen, Mitt. Bot., 1: 215, 395, 1874.

Davallia elegans Swartz. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 247, 1854. Christ, Engler Bot. Jahrb. **23**: 339, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 440, 1908.

Davallia elata Sprengel. Baker, Jour. Bot. **14**: 10, 1876.

Davallia divaricata Blume. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 195, 1912.

Common on all islands and collected by all.

Savaii: Safune, on lava field of 1905-1911, 600 m., *Bryan 135;* cracks in lava below Matavanu Crater, 200 m., *Christophersen 614, 1901.* Upolu: Apia, epiphyte on *Bruguiera, Christophersen 440, Eames 9.* Tutuila: *McMullin, 12* (W), *Wilder.*

Polynesia: Tahiti, west to?

Foster's two species, *Trichomanes elatum* and *T. epiphyllum,* have been regarded as forms of *Davallia denticulata* (Burmann) Mettenius by most authors. I have seen specimens of both in Banks Herbarium (British Museum), and do not find *T. elatum* very different from *D. denticulata,* agreeing with it in the cup-shaped indusium with a straight outer edge. The indusia of *T. epiphyllum* are considerably different, subcylindrical-ovate and outward with a free, usually ovate-acuminate, sometimes nearly rostrate lip protruding beyond the segment. All Samoan specimens show this character and belong to *D. epiphylla.* I dare not decide whether this is a valid species; as to other characters it closely resembles *D. denticulata,* similarly striated with "false veins" between the veins. These "striae" are usually very distinct but in some specimens are lacking.

Genus **ITHYCAULON** Copeland

C. Christensen, Index Suppl. 3. *Saccoloma* auctt. Copeland, B. P. Bishop Mus., Bull. **59**: 66, 1929.

Ithycaulon minus (Hooker) C. Christensen, Index Suppl. 3: 116, 1934.

Microlepia inaequalis var. *minor* Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 235, pl. 33, fig. 1, 1854.

Davallia moluccana Blume. Luerssen, Mitt. Bot. **1**: 217, 395, 1874. Baker, Jour. Bot. **14**: 10, 343, 1876. Christ, Engler Bot. Jahrb. **23**: 340, 1897 (incl. var. *amboynensis* Hooker).

Davallia inaequalis Kunze. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 442, 1908.

Savaii: Maugaloa, *Vaupel 312* (B); above Matavanu, 900 m., *Christopherson 2032, 2065;* above Sili, 400 m., *Christophersen 3265.* Common in Savaii and Upolu, and often collected; not recorded for the other islands.

Samoa to Malacca.

The form with narrow ultimate segments illustrated by Brackenridge is the commonest and the same as var. *stenolobum* (Christ) from Luzon; it is not very different from Blume's type. Christophersen calls it a "tree" with a stem 0.5 m. high. In general habit, this species is very like *Culcita straminea* and is often confused with it; of Reinecke's numbers cited by Christ, 71, 96 a (part) and 143 (B) belong here. The two species differ materially in sori, those of *Culcita* being marginal with a two valved indusium, those of *Ithycaulon* within the margin with the indusium formed as a cuneate pocket. *Culcita* is usually more coriaceous and brown when dried, the other gray-green.

Genus **STENOLOMA** Fée

C. Christensen, Index Suppl. 3, 1934. *Odontosoria* part auctt. *Sphenomeris* Maxon, Copeland, B. P. Bishop Mus., Bull. **59**: 69, 1929; Bull. **93**: 54, 1932.

Stenoloma chusanum (Linnaeus) Ching. Christensen, Index Suppl. **3**: 173, 1934.

Davallia tenuifolia Swartz. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 248, 1854. Baker, Jour. Bot. **14**: 343, 1876. Christ, Engler Bot. Jahrb. **23**: 342, 1897.

Lindsaya chinensis Mettenius. Luerssen, Mitt. Bot. **1**: 224, 397, 1874.

Sphenomeris chusana (Linnaeus) Copeland, B. P. Bishop Mus., Bull. **59**: 69, 1929; Bull. **93**: 54, 1932.

Without locality: *Powell 158* (Kew); *Whitmee 47* (Kew).

Savaii: above Matavanu, about 900 m., *Christophersen, 2049, 2068.* Olosega: *Reinecke 178* (Kew, W).

Marquesas to Madagascar, north to southern Japan. Apparently rare in Samoa.

Genus **LINDSAEA** Dryander

Copeland, B. P. Bishop Mus., Bull. **59**: 70, 1929; Bull. **93**: 54, 1932.

Key to Species of Lindsaea

Simply pinnate or bipinnate, upper margin of pinnules entire or slightly lobed
  Veins free; rhizome wide-creeping; simply pinnate
    Rhizome about 1 mm. thick, stipe up to 10 cm., 4-6 sori to each pinna. Free veined form.....**2. L. Pickeringii.**
    Rhizome at least 2 mm. thick, stipe 1-4 cm., 10-12 sori to each pinna.....**1. L. Merrillii.**
  Veins anastomosing
    Rhizome wide creeping, 1 mm. thick, leaves distant, simply pinnate
      Pinnae slightly lobed, subrectangular with broadly rounded apex....**3. L. pulchra.**
      Pinnae rather deeply lobed and somewhat attenuated toward the apex.....**2. L. Pickeringii.**
    Rhizome short creeping with clustered leaves; simply pinnate or usually bipinnate.....**4. L. decomposita.**
Bipinnate, upper margin of pinnules pinnatifid nearly to the main rib with mostly bifid segments hardly 1 mm. wide; veins free.....**5. L. tenuifolia.**

1. **Lindsaea Merrillii** Copeland?

   Davallia repens Desvaux. Baker, Jour. Bot. **14**: 343, 1876.

   Without locality: *Whitmee 229* (Kew).

   Tau: *Powell 156* (Kew).

   Eastern Malaya and Papua.

   Evidently a very rare species in Samoa, not found by any later collector. I am very much in doubt as to the identity of this fern, but it is certainly not a form of *L. Pickeringii*. Powell's specimen might be referred to *L. Macraeana* (Hooker and Arnott) Copeland (B. P. Bishop Mus., Bull. **59**: 70, 1929), while Whitmee's is very nearly typical *L. Merrillii*. Both are probably forms of one species, which differ from my Fijian specimens of *L. Macraeana* Copeland by the many small round sori placed within the tips of close, rather deep lobes and with very small, deciduous indusia.

2. **Lindsaea Pickeringii** (Brackenridge) Mettenius. Luerssen, Mitt. Bot. **1**: 230, 398, 1874. Copeland, B. P. Bishop Mus., Bull. **59**: 71, 1929 (*Lindsaya*).

   Synaphlebium Pickeringii Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 223, pl. 30, fig. 2, 1854.

   Davallia stolonifera Baker. Christ, Engler Bot. Jahrb. **23**: 342, 1897.

   Lindsaya adiantoides (Blume) Kuhn. Luerssen, Mitt. Bot. **1**: 224, 397, 1874.

   Without locality: *Brackenridge* (W, type); *Powell* (Kew).

Savaii: *Graeffe* (W); Mataana, *Vaupel 339* (W, distributed as *L. stolonifera*). Upolu: *Betche* (W); *Reinecke 64 a, 67* (B).

Samoa, Fiji.

Copeland (B. P. Bishop Mus., Bull. **59**: 71, 1929) maintains both *L. Pickeringii* and *L. adiantoides* as species, remarking that they run together and that fronds, which by themselves would be taken for *L. adiantoides,* may be found mixed with *L. Pickeringii.* I find the same in Vaupel 339, where free-veined leaves are mixed with typical *L. Pickeringii.* By a close examination, I find a few anastomoses in *L. Pickeringii,* and am therefore convinced that all belong to one species. Luerssen observed the same casual anastomosis in what he called *L. adiantoides.* From the Malayan form of this, typical *L. Pickeringii* is quite different.

3. **Lindsaea pulchra** (Brackenridge) Carruthers. Copeland, B. P. Bishop Mus., Bull. **59**: 72, 1929 (*Lindsaya*) .

   Synaphlebium pulchrum Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 223, 1854.

   Lindsaya lobata Poiret, part. Luerssen, Mitt. Bot. **1**: 227, 1874.

   Davallia stolonifera Baker, Jour. Bot. **14**: 10, 1876.

   Davallia pulchella Hooker. Christ, Engler Bot. Jahrb. **23**: 342, 1897.

   Without locality: *Whitmee 49* (Kew); *Powell 122,* part?

   Savaii: above Matavanu, about 1,500 m., *Christophersen 2217.* Tutuila: *Reinecke 72 a* (B). Manua: Ofu, *Reinecke 64 a* (B).

   Samoa, Fiji.

   I maintain this species on Copeland's authority, but doubt its validity, believing that it is only a form of *L. Pickeringii* with pinnae very like those of the simply pinnate forms of *L. decomposita;* fronds without rhizome are indeterminable. The thin, long creeping rhizome marks the species distinctly from *L. decomposita,* but not from *L. Pickeringii,* and Powell 122 (W) contains fronds of both "species." I believe *L. pulchra* has been wrongly identified with *L. stolonifera* from Aneiteum. My specimens from Aneiteum are similar in shape of the pinnae, but the rhizome is much thicker, about 3 mm.

4. **Lindsaea decomposita** Willdenow. Setchell, Dept. Marine Biol. Carnegie Inst., Wash **20**: 125, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 72, 1929; Bull. **93**: 55, 1932 (*Lindsaya*).

   Synaphlebium davallioides J. Smith. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 224, part?, 1854.

   Lindsaya lobata Poiret. Luerssen, Mitt. Bot. **1**: 227, 398, 1874. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 342, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 439, 1908.

This species is usually considered as an aggregate of several races, varieties and species, by Luerssen who quoted 23 synonyms and also by Copeland. In Samoa, three distinct forms occur which in all probability are good species, but as older names among the many now reduced to synonyms very likely should be used for them, I confine myself to characterize them briefly without naming them. The same forms occur in other archipelagos and in Malaya, but the last two cannot be identified with any of the species described by Holttum (Gard. Bull. Straits. Settlem. **5**: 58, 1930) who untangled a number of the Malayan forms of this group.

Form 1, typica?. Simply pinnate or bipinnate with one, rarely two, pairs of lateral pinnae; pinnules oblong, subrectangular, 1.5 × 0.5-0.6 cm., with 3 or 4 rather low notches on the upper edge, separating 4-5 truncate lobes 2-2.5 mm. wide, with oblong sori of the same length, the apex usually truncate.

The commonest form, collected by all.

Without locality: *Whitmee 227* (Kew).

Savaii: near Mataulanu, 800 m., *Christophersen 879; Rechinger 3709* (V). Upolu: *Betche* (CC); *Reinecke 64 b, c* (W); *Safford 38, 961* (W); *Vaupel 196, 334* (W); *Rechinger 978* (W), *1496* (V). Tutuila: *Garber 886;* Alava Ridge, 500 m., *Christophersen 1828.* Tau: *Garber 725.* Olosega: *Garber 1045.*

Form 2. (*L. Seemanni* Carruthers?). Bipinnate with 3-7 pairs of lateral pinnae; pinnules broadest at base and somewhat narrowed toward the obtuse or subacute tip, about 12 × 4 mm., nearly entire, at best slightly crenate at the upper margin; sori narrow, long and sometimes all confluent.

Without locality: *Brackenridge* (W) *Synaphlebium davallioides* (Brackenridge); *Powell* (W).

Savaii: rim of crater above Matavanu, about 1,000 m., *Christophersen 2011.* Upolu: Malololelei Ridge, 750 m., *Christophersen 271.* Tutuila: top of Pioa, 500 m., *Christophersen 3514.* Tau: 650 m., *Garber 742.* Olosega: near top of Piumafua, 600 m., *Garber 1050.*

Form 3. (*L. davallioides* and *L. nitens*, Rechinger, Denkschr. Akad. Wiss. Wien, **84**: 439, 1908). Bipinnate with 5-6 pairs of lateral pinnae; pinnules in size and shape about as in form 1, but the upper edge more deeply cut, with narrower, often somewhat attenuated lobes, the sori accordingly shorter, about 1 mm., rather far from the margin.

Form 3 is a very characteristic form, but neither *L. davallioides* Blume nor *L. nitens* Blume to which Rechinger referred two specimens which seem identical to me; nearer *L. parallelogramma* van Alderwerelt van Rosenburgh, but still considerably larger; largest pinnae 20 × 3 cm.

Savaii: *Rechinger 4497* (V). Upolu: *Betche* (W); *Rechinger 977* (V).

In the wide sense, *L. decomposita* is widely distributed in Polynesia and Malaya.

5. Lindsaea tenuifolia Blume. Luerssen, Mitt. Bot. **1**: 232, 398, 1874. Copeland, B. P. Bishop Mus., Bull. **59**: 73, 1929.

Odontoloma tenuifolium J. Smith. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 227, 1854.

Davallia triquetra Baker. Christ, Engler Bot. Jahrb. **23**: 341, 1897.

Lindsaya triquetra Mettenius. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 439, 1908.

Savaii: *Reinecke 72* (Kew, W); Matautu, *Rechinger 4492* (V). Upolu: mountains, Fagaloa Bay, *Safford 46, 933* (W); *Rechinger 960* (V, W). Tutuila: *Brackenridge* (W), *Tetens* (W).

Samoa to Malaya.

Genus **SCHIZOLOMA** Gaudichaud

Copeland, B. P. Bishop Mus., Bull. **59**: 73, 1929.

Schizoloma ensifolium (Swartz) J. Smith. Copeland, B. P. Bishop Mus., Bull. **59**: 73, 1929.

Lindsaya ensifolia Swartz. Luerssen, Mitt. Bot. **1**: 226, 1874. Christ, Engler Bot. Jahrb. **23**: 342, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 440, 1908.

Without locality: *Powell 18* (Kew).

Savaii: Matautu, *Rechinger 1715* (V, W); near Manase plantation, 100 m., *Christophersen 681*.

Polynesia, east from Samoa, where it seems to be rare, tropical Australia, Asia and Africa.

Genus **OLEANDRA** Cavanilles

Copeland, B. P. Bishop Mus., Bull. **59**: 86, 1929; Bull. **93**: 61, 1932.

Key to Species of Oleandra

Rhizome straight, stick like, with imbricated scales, which are suddenly narrowed into filiform or, when young, lanoso-ciliate tips
Leaves papyraceous-subcoriaceous, rarely over 2.5 cm. wide, subglabrous.....
.....**1. O. neriiformis.**
Leaves thinly herbaceous, densely villous, 4-5 cm. wide.....**2. O. Christopherseniі.**
Rhizome creeping, densely scaly with rufous, spreading scales; leaves herbaceous, 4-5 cm. wide, with many similar scales on the midrib beneath; sori in 1-2 wavy rows at each side, far from the midrib.....**3. O. Sibbaldii.**

1. **Oleandra neriiformis** Cavanilles and all authors. Christensen, Dansk. Bot. Arkiv. **9**(3): 17, pl. 3, figs. 1-4, 1937. *O. Parksii, O. platybasis, O. "mollis"*, Copeland, B. P. Bishop Mus., Bull. **59**: 15, 86, pl. 4, 1929.

After a careful examination of numerous specimens, I find the differences between the forms briefly characterized below rather insignificant and inconsistent, and I do not hesitate to refer them all to *O. neriiformis*, the actual type

of which I have recently described and illustrated [Dansk. Bot. Arkiv. 9(3): 17, pl. 3, figs. 1-4, 1937], and to refer Copeland's three Fijian species to the same. The forms run together, and even a grouping in forms is difficult.

Form 1, typica. Phyllopodia about 1 mm., stipes 1 cm. Sori in a somewhat wavy line about 1 mm. from the midrib. Veins 20-22 to the centimeter.

Without locality: *Powell 86* (W), and others.

Savaii: Pula, *Vaupel 337* (Kew, W); Maugaloa, *Vaupel 337 a* (W); east of Olo, 700-800 m., *Christophersen 2305.* Upolu: Mauga Tele Ridge, 600 m., *Christophersen 520;* Lanutoo, 680 m., *Christophersen 15.*

Form 2. Similar, but fronds subdimorphous, the fertile ones 0.8-1 cm., the sterile 2 cm. wide, all small, up to 15 cm. long.

Upolu: Lake Lanutoo, 700 m., *Christophersen 125.*

Form 3. Phyllopodia and stipes both 5-6 mm. long. Midrib more scaly than in other forms.

Upolu: forest of Tiavi, 500 m., *Rechinger 393* (V).

Form 4. (*O. Parksii* Copeland). Phyllopodia 1-2 mm., stipes 1.5-2 cm. long. Leaves mostly under 2 cm. wide, long caudate at apex. Sori close to midrib.

Copeland says "about 14 veins to the centimeter", but in a cotype specimen received from him, I count 18-20.

Savaii: shores of Mataulanu Lake, on *Pandanus,* 900 m., *Christophersen 866.* Upolu: *Rechinger 992* (V). Tutuila: *Setchell 398* (W). Olosega: near top of Piumafua, 600 m., *Garber 1046.*

Form 5. Phyllopodia 1 cm., stipes 2.5-3 cm. Sori in a wavy line 1-2 mm. from the midrib. A large form with leaves 30 × 3 cm.

Tau: *Garber 724.*

O. neriiformis, taken in a wider sense, distributed through tropical Asia east to Samoa.

2. **Oleandra Christophersenii,** sp. nov. (pl. 1, *B*).

Rhizomate recto, ramoso, 4 mm. crasso, dense paleaceo; paleis e basi peltata, ovata, centro nigra, adpressa, imbricata subito in apicem filiformem, rufum, prius lanoso-ciliatum mox integrum, recte patentem contractis. Foliis sparsis, prope apicem rhizomatis aggregatis, phyllopodiis 0.5-1.5, stipitibus 0.2-2 cm. longis, pilosis; lamina anguste ellipticis vel oblanceolatis, ad 30 cm. longa, 4-5 cm. lata, apice subito caudato-acuminata, basi breve cuneata vel rotundato-cuneata, tenuiter herbacea, pilis griseis, longis, mollibus superne sparsius subtus dense villosa et marginibus longe ciliata, ad nervum medianum paleis parvis, castaneis, lanceolato-acuminatis sparse onusta; venis parum obliquis, ca. 12 pro centimetro, apice incrassato cum margine cartilagineo confluentibus. Folia fertilia non vidi.

Upolu: Lake Lanutoo, epiphyte in forest, 700 m., Aug. 8, 1929, *Christophersen 126.*

This new species differs greatly from the two other Samoan ones in the persistent, filiform, squarrose tips of the rhizome-scales, the thin texture and dense villosity. It appears intermediate between them, uniting the rhizome of *O. neriiformis* with the size and texture of *O. Sibbaldii.* I do not know of any

other species resembling it. It is remarkably variable in the length of the phyllopodia and stipes, but the total length of both together is about the same in all leaves, 2-3 cm.; the articulation may be found in leaves of the same rhizome below, at or above the middle, in extreme cases immediately below the base of the lamina, phyllopodia then long, or these very short (3-4 mm.) and the stipes then long. This variation proves that the position of the articulation is a bad systematic character.

3. **Oleandra Sibbaldii** Greville, Copeland, B. P. Bishop Mus., Bull. **93**: 61, 1932.

Oleandra Whitmeei Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 355, pl. 5, fig. 2, 1897. Rechinger, Akad. Wiss. Wien **84**: 438, 1908. Copeland, B. P. Bishop Mus., **59**: 87, 1929.

Savaii: *Whitmee 121* (Kew, type of *O. Whitmeei*); *Powell 28, 195; Reinecke 157* (W); Olonono, *Vaupel 203* (Kew, W); Mataana, *Vaupel 309* (W); *Rechinger 661* (V); above Matavanu, 1,300-1,400 m., *Christophersen 826, 2138;* above Salailua, about 1,400 m., *Christophersen 3095.*

Marquesas, Tahiti (type locality), Fiji, Philippines, Celebes. In Samoa, it seems to be confined to the higher mountains of Savaii.

Copeland (B. P. Bishop Mus., Bull. **93**: 61, 1932) identified without comments *O. Whitmeei* with *O. Sibbaldii,* and he was certainly right. I have a sketch of the type of *O. Sibbaldii* which might have been drawn from a Samoan specimen such as Christophersen 3095. Two Samoan forms may be distinguished, but intermediates occur; the largest leaf seen is 45 × 5 cm.

Form 1. Lamina wtih a shortly attenuate and abruptly rounded base; stipe and phyllopodium together 3-5 cm. long.

Form 2. Lamina long cuneate below; stipe and phyllopodium 6-8 cm. (typical *O. Sibbaldii*).

Genus **ARTHROPTERIS** J. Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 84, 1929; Bull. **93**: 64, 1932.

1. **Arthropteris obliterata** (R. Brown) J. Smith. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 127, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 84, 1929; Bull. **93**: 64, 1932. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 193, 1912.

Nephrolepis ramosa Moore. Luerssen, Mitt. Bot. **1**: 200, 390, 1874. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 354, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 438, 1908.

Nephrolepis radicans (Burmann) Kuhn. Lauterbach, Engler Bot. Jahrb. **41**: 219, 1908.

Leaves up to 35 × 5 cm., turning brown when dried, middle pinnae 2.5 × 1 cm. (often smaller), auriculate, rounded-obtuse, entire or faintly crenate. Sori indusiate.

Savaii: Salailua, *Christophersen 2631, 2968; Vaupel 203* (W). Upolu: *Graeffe* (W); *Safford 924* (W); *Parks 16428* (W); *Rechinger 307, 845* (V; nearly all specimens from the vicinity of Apia); near Malololelei, 500 m., *Christophersen 72; Eames 103.* Tau: plateau back of Faleasao, 125 m., *Garber 572.* According to Christ, also in Savaii and Tutuila, but Reinecke's specimens may belong to the following species.

Polynesia (east to Tahiti), tropical Australia, Asia, and Africa.

2. **Arthropteris repens** (Brackenridge) C. Christensen, comb. nov.

Nephrolepis repens Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 209, 1854.

Nephrolepis ramosa Moore, part. Luerssen, Mitt. Bot. **1**: 200, 390, 1874. Christ, Engler Bot. Jahrb. **23**: 354, 1897.

Nephrolepis ramosa var. *trichomanoides* J. Smith. Baker, Jour. Bot. **14**: 11, 1876.

Polypodium sp. near *alte-scandens* Colla. Powell, Jour. Bot. **6**: 341, 1868.

Nephrolepis altescandens Baker. Luerssen, Mitt. Bot. **1**: 203, 392, 1874. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 438, 1908.

Rhizome about 1 mm. thick with minute brown scales; leaves 10-20 × 2-3 cm., short-acuminate, gradually narrowed below to a stipe 0.5-1 cm. long with a joint at the middle, green when dried, herbaceous; middle pinnae 1.5 × 0.5 cm., rather coarsely crenate, rounded-obtuse and crenate at apex; rachis rather densely but shortly pubescent; costae sparsely pubescent beneath; surfaces otherwise glabrous. Fertile fronds very rare; sori small, apparently exindusiate. Other characters as in *A. obliterata.*

Without locality: *Brackenridge* (W, type?); *Powell 130* (Kew); *Whitmee 119* (Kew).

Savaii: *Reinecke 4 a* (W, Kew); *Rechinger 85, 685* (V); 200 m., *Christophersen 766;* Salailua-Lataitai, *Christophersen 2630.* Upolu: *Graeffe* (W); *Safford 12, 926; Rechinger 1320* (V); Vailima, *Eames 99.*

Samoa, Fiji.

This is a doubtful species. All specimens but two are sterile and have wholly the appearance of young sterile leaves (bathyphylls) of another species. Luerssen did not doubt that it represents a juvenile state of *A. obliterata,* and Copeland is of the same opinion (B. P. Bishop Mus., Bull. **59**: 84, 1929). I cannot believe in this, because several sheets of *A. obliterata* contain young shoots with leaves entirely resembling the mature ones except in size. Baker referred the first known specimen doubtfully to *A. altescandens* (Colla) J. Smith and this seems more reasonable. That species resembles the Samoan one very much, the most important difference being its rather long stipes, 5-7 cm.; it is broader and the pinnae more deeply crenate-serrate. Still more resembling *A. repens* is *A. Beckleri* (Hooker) Mettenius from Queensland, which likewise has been interpreted as a juvenile state of *A. obliterata* (Syn. Fil. 301). Both are perhaps the same species. For *A. Beckleri,* see Domin (Bibl. Bot. **85**: 62, fig. 11, 1913).

Genus **NEPHROLEPIS** Schott

Copeland, B. P. Bishop Mus., Bull. **59**: 83, 1929.

This intricate genus has never been thoroughly revised, and most authors referred specimens from all tropical countries to a few species, which are aggregates of several more or less distinct forms or species. Like Copeland, I am at present compelled to follow the same conventional treatment and refer therefore the Samoan forms to the same "species" keyed out and briefly described by Copeland (B. P. Bishop Mus., Bull. **59**: 83, 1929).

1. **Nephrolepis "cordifolia** (Linnaeus) Presl." Luerssen, Mitt. Bot. **1**: 198, 390, 1874. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 354, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 438, 1908.
   Nephrolepis obtusifolia Presl. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 210, 1854.
   Nephrolepis pectinata (Willdenow) Schott. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 438, 1908.

   Rhizome short with densely tufted leaves and producing long, slender, stramineous and slightly paleaceous runners, which at intervals of 2-4 cm. bear small tufts of leaves from a scaly bud; these leaves are nearly all fertile and subsessile, those of the main tufts with a stipe 2-4 cm. Fertile leaves about 20 × 2 cm., with close, often imbricated, oblong, auricled, obtuse and undulate-crenate pinnae 3 mm. wide, the sterile fronds somewhat larger (30 × 3.5 cm.) with subentire pinnae; stipe and rachis rather densely paleaceous with narrow, hair-pointed, rufous scales. Indusia large with a broad, open sinus. Plant not tubiferous.

   Apparently not common, found in Savaii and Upolu.

   Without locality: *Whitmee 118* (Kew); *McMullin 39* (W).

   Upolu: swamp near Tiavi, 720 m., *Christophersen 178;* Tuisivi Range, 1,600-1,700 m., *Christophersen 782;* 1902 lava field above Aopo, 1,200-1,400 m., *Christophersen 884.* Savaii: *Rechinger 4493* (V).

   N. cordifolia sens. lat. in all tropical countries; *N. Lauterbachii* from New Guinea.

   The Fijian and Samoan forms of this "species" are unlike the ordinary *N. cordifolia,* but very near the American *N. pectinata* Schott and the Papuan *N. Lauterbachii* Christ, and I would not hesitate to call them *Lauterbachii* if I were sure that the form had not been described earlier.

2. **Nephrolepis hirsutula** (Forster) Presl. Luerssen, Mitt. Bot. **1**: 202, 392, 1874. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 438, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 127, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 84, 1929.
   Nephrolepis acuta var. *rufescens* Presl. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 355, 1897.
   Nephrolepis rufescens Wawra. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 194, 1912.

Common and found in all islands, collected by all.

Savaii: *Bryan 133, 152; Christophersen 606, 619, 682, 711, 713, 1886, 2446.* Upolu: *Eames 8.* Tutuila: *Garber 873; Christophersen 3499.*

Polynesia to tropical Asia.

Very variable. Many specimens were collected in the lava fields and are more coriaceous, pale green, small (pinnae often only 3 × 0.8 cm.), rounded, obtuse and the fertile ones subentire, very slightly paleaceous beneath. I wonder whether Copeland referred such forms to *N. exaltata,* which he mentions as common in Fiji. I have seen no Samoan form which may be referred to that species.

3. **Nephrolepis "biserrata** (Swartz) Schott." Luerssen, Mitt. Bot. **1**: 200, 391, 1874. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 126, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 84, 1929.

Nephrolepis acuta Presl. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 355 (excl. var. *rufescens*), 1897.

Nephrolepis acuta var. *laurifolia* Christ, Engler Bot. Jahrb. **23**: 355, 1897.

Larger than *N. hirsutula,* pinnae up to 15 × 2 cm., and much less scaly, or nearly naked; sori variable as to position, usually rather far from the margin; indusia peltate. Very variable. The variety *laurifolia* Christ is a form with subentire fertile pinnae, but it runs gradually into another with coarsely serrate pinnae. All are evidently forms of one species, which is probably quite different from the genuine *N. biserrata,* which is African. It was more appropriate to call the Asiatic-Polynesian forms *N. acuta* Presl.

Common and found in all islands.

Upolu: at Lake Lanutoo, 700 m., *Christophersen 124;* top of Fao, 680 m., *Christophersen 547.* Tutuila: top of Matafao, 650 m., *Christophersen 1032.* Tau: *Garber 570, 756.*

N. biserrata sens. lat. is pantropic.

Genus **PTERIS** Linnaeus

Copeland, B. P. Bishop Mus., Bull. **59**: 77, 1929; Bull. **93**: 57, 1932.

Key to the Species of Pteris

Frond not tripartite
- Veins free
  - Dimorphous, fertile pinnae linear, entire or with a pair of pinnules..... **1. P. ensiformis.**
  - Uniform, bipinnatifid
    - Costae with two interrupted, broad, brown wings above, central pinnae up to 35 × 6 cm..... **2. P. mertensioides.**
    - Costae with straw-colored spines above
      - Rachis purplish, fronds dark green, basal pinnae 15-20 cm..... **3. P. pacifica.**
      - Rachis stramineous, fronds usually light green, basal pinnae up to 55 cm..... **4. P. Vaupelii.**

All veins regularly reticulate; bipinnatifid with segments 1-2 cm. wide....**7. P. comans.**
Frond tripartite (with two lateral branches equalling the central portion in size)
No costular areoles but sometimes with costal ones.....**5. P. Wallichiana.**
Both costal and costular areoles.....**6. P. tripartita.**

Neither the widespread *P. vittata* nor any form of *Pteridium* have been found in Samoa.

1. **Pteris ensiformis** Burmann, and all authors. Copeland, B. P. Bishop Mus., Bull. **59**: 78, 1929.

Pteris crenata Swartz. Brackenridge, U. S. Expl. Exp., 1838-42,**16**: 114, 1854.

Common; found on all islands and collected by all.

Savaii: *Vaupel 26* (Kew, W); near Manase, *Christophersen 2422*. Upolu: Vailima, 200 m., *Eames 100*. Tutuila: *Garber 877*. Tau: *Garber 605*.

From Samoa, west to east Asia and Malaya.

2. **Pteris mertensioides** Willdenow.

Pteris patens Hooker. Luerssen, Mitt. Bot. **1**: 127, 368, 1874. Baker, Jour. Bot. **14**: 343, 1876. Christ, Engler Bot. Jahrb. **23**: 344, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 423, 1908.

Pteris decussata J. Smith. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 207, 1912. Copeland, B. P. Bishop Mus., Bull. **59**: 79, 1929; Bull. **93**: 58, 1932.

Without locality: *Powell; Whitmee 180; Horne* (all Kew).

Savaii: Olonono, *Vaupel 272* (Kew, W); above Matavanu, 900 m., *Christophersen 2031;* Le To, above Salailua, 750 m., *Christophersen 2937*. Upolu: *Reinecke 38* (Kew, W); above Malololelei, 700 m., *Christophersen 191; Rechinger 748* (V).

Malaya to Polynesia, east to Tahiti.

Pteris quadriaurita Retzius. spec. coll. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 344, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 208, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 422, 1908.

Pteris biaurita Linnaeus. Luerssen, Mitt. Bot. **1**: 123, 367, 1874.

Hieronymus published in 1914 a revision of the Asiatic-Polynesian forms of this "species", describing a score of new species, including two based on specimens from Samoa. This is not the place to express my opinion of the validity of these many species but to deal only with the Samoan forms. The two species are very different in their extreme forms, and may well be regarded as valid species, but in the comprehensive material examined, some specimens are difficult to identify with certainty, at least without having a whole frond. A couple of specimens I refer to a variety. These three forms may be characterized as follows:

3. **Pteris pacifica** Hieronymus, Hedwigia **55**: 355, 1914. Copeland, B. P. Bishop Mus., Bull. **59**: 79, 1929.

Stipe 50-60 cm., scaly near base, lamina 40-50 cm. or smaller, with usually 4-7 pairs of short stalked pinnae, dark green, herbaceous; stipe and rachis and the lower part of costae purplish brown or wine colored, at least beneath; basal pinnae 15-20 × 3-3.5 cm. with 1-2 basiscopic secondary pinnules and usually without free, simple pinnules at the upper side, segments subfalcate, about 2 cm. × 3-4 mm., entire; costae above with soft, stramineous spines, midribs of segments without such or more often with a few, short ones.

Savai: *Safford 965* (W); *Vaupel 45* (Kew); *94* (Kew, W); above Matavanu, 1,300 m., *Christophersen 2177* (doubtful). Upolu: *Rechinger 693* (W), *1188* (V); Vailima, *Eames 101; Hochreutiner 3235* (G). Tutuila: *McMullin 9* (W); *Garber 872* (*vao tiamu laiti*); *Dumas 8* (P); *Wilder*. Tau: *Garber 587, 660*.

Polynesia (east to Samoa), Melanesia to Sumbawa and Hainan.

Pteris pacifica var. **eximia** (Rechinger), comb. nov.

Pteris quadriaurita var. *eximia* Rechinger, Denkschr. Akad. Wiss. Wien **84**: 423, 1908.

Stipe densely paleaceous to above the middle, rachis and costae stramineous; lamina about 60 cm., with 12-14 pairs of sessile pinnae, the basal ones with 3-4 basiscopic pinnules; segments above with numerous, long spines; as to other characters agreeing with the type.

Upolu: Tiavi and Lanutoo, *Rechinger 432, 612* (V).

A quite distinct form, resembling *P. spinescens* Presl, Hieronymus (Hedwigia, **55**: 368, 1914) in its very numerous spines, and perhaps referable to that species. Unfortunately both specimens are sterile.

4. **Pteris Vaupelii** Hieronymus, Hedwigia **55**: 364, 1914.

Pteris Blumeana Agardh. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 115, 1854.

Pteris quadriaurita Retzius var. *longipinnula* Wallich. Christ, Engler Bot. Jahrb. **23**: 344, 1897.

Pteris longipinnula Wallich. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 423, 1908.

Pteris quadriaurita Retzius var. *asperula* J. Smith. Lauterbach, Engler Bot. Jahrb. **41**: 220, 1908.

Much larger than *P. pacifica*, stipe and lamina up to 1 meter each, light green, papyraceous, rachis and costae stramineous; basal pinnae up to 55 cm. long, the pinnatifid portion 7 cm. wide and narrowing gradually to the caudate apex, below with 3-4 basiscopic pinnules up to 25 × 4 cm. and on the upper side with several free, distant, simple pinnules; segments about 4 cm. × 4-5 mm.; costae and midribs of segments with several long straw colored spines above.

Savaii: *Powell 213* (Kew); *Whitmee 60* (W, 32); *Vaupel 458* (Kew, W, type collection); *Rechinger 1099, 4495* (V). Upolu: Lanutoo Lake, *Hochreutiner 3314* (G). Manua: *McMullin 51* (W); *Garber 709*. Endemic?

5. **Pteris Wallichiana** Agardh var. **samoensis,** var. nov. (pl. 2, *A*).
Pteris Wallichiana Agardh. Baker, Jour. Bot. **14**: 343, 1876. Christ, Engler Bot. Jahrb. **23**: 344, 1897. Not Rechinger, Denkschr. Akad. Wiss. Wien **84**: 424, 1908.

A typo indico differt: aerolis costularibus rarissime clausis sed ramis inferioribus venularum basalium ad sinus conniventibus.

Savaii: *Whitmee 179* (Kew); Maliolio, 1,200 m., *Vaupel 464* (Kew, W); near Mataulanu Lake, 800 m., *Christophersen 876* (type); above Salailua, 1,300-1,400 m., *Christophersen 2760, 3106.*

Area of *P. Wallichiana:* tropical Asia (Himalaya to Philippines).

As far as I can see, the described difference is the only reliable one by which this Polynesian form deviates from the type, though some less important ones may be observed, such as the somewhat sharper and larger teeth of the sterile tips of segments and the quite glabrous fronds, whereas some forms of the type are pubescent. The variety is known from Samoa only. This distance from the type locality is peculiar, and it is perhaps more natural to consider it as a valid species, *P. samoensis* C. Christensen which stands to *P. Wallichiana* as does *P. linearis* Poiret to *P. biaurita* Linnaeus.

6. **Pteris tripartita** Swartz. Setchell, Dept. Marine Biol. Carnegie Inst., Wash. **20**: 123, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 79, 1929; Bull. **93**: 58, 1932.
Litobrochia intermedia Brackenridge. U.S. Expl. Exp., 1838-42, **16**: 107, 1854.
Pteris marginata Bory. Luerssen, Mitt. Bot. **1**: 131, 368, 1874. Baker, Jour. Bot. **14**: 11, 1876. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 424, 1908. Christ, Engler Bot. Jahrb. **23**: 344, 1897.
Pteris Wallichiana Agardh. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 424, 1908.
Common on all islands and collected by all.
Savaii: Olonono, *Vaupel 18* (W). Upolu: *Safford 36, 951* (W); *Rechinger 1439* (V, *Wallichiana* Rechinger). Tutuila: *McMullin 31* (W). Ofu: *Garber 998* (*oli oli*).
A composite species found in tropics of the Old World, east to Marquesas.

7. **Pteris comans** Forster. Copeland, B. P. Bishop Mus., Bull. **59**: 80, 1929; Bull. **93**: 59, 1932.
Pteris aculeata Swartz. Powell, Jour. Bot. **6**: 319, 1868. Luerssen, Mitt. Bot. **1**: 128, 368, 1874. Christ, Engler Bot. Jahrb. **23**: 344, 1897.
Pteris litoralis Rechinger, Denkschr. Akad. Wiss. Wien **84**: 423, fig. 7, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 124, 1924.
Without locality: *Powell 41* (Kew); *Whitmee* (Kew).

Savaii: *Rechinger 1176;* Lealatele, *Vaupel 189* (B, Kew, W, C. Christensen). Tutuila: *Setchell 124; Stearns* (W); *Garber 973; McMullin 26.* Tau: *Garber 674.* Upolu: Père Henquel distributed as *Reinecke 144 a* (B, not *144 b* as cited by Christ).

Polynesia, east to Marquesas and Rapa I. (related form in Juan Fernandez), New Zealand, Australia.

Very variable as to size; some specimens have pinnae 50 × 25 cm., with segments 20 × 2 cm.; others described as *P. litoralis* Rechinger are much smaller with 1-2 pairs of lateral pinnae 15-20 cm. long, and pale green; they have wholly the appearance of plants growing on dryer, sunny places, but are by no means specifically different. It is questionable whether this Samoan fern is the genuine *P. comans,* which seems to be represented by different forms in different archipelagos. Should it appear to be a distinct form, this must be named *P. litoralis* Rechinger.

Genus **HISTIOPTERIS** J. Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 77, 1929; Bull. **93**: 56, 1932.

Histiopteris incisa (Thunberg) J. Smith. Christ, Conserv. Jard. bot. Genève, Ann., **15-16**: 208, 1912. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 123, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 77, 1929; Bull. **93**: 56, 1932.

Pteris incisa Thunberg. Luerssen, Mitt. Bot. **1**: 130, 368, 1874 (var. *aurita*); Baker: Jour. Bot. **14**: 343, 1876. Christ, Engler Bot. Jahrb. **23**: 344, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 421, 1908.

Litobrochia vespertilionis Presl. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 109, 1854.

Common, found on all islands, collected by all.

Savaii: Maliolio, 1,200 m., *Vaupel 77* (Kew, W); above Letui, 1,600-1,700 m., *Christophersen 733;* Olo, 700 m., *Christophersen 2523;* crater rim, Papafu, 1,500 m., *Christophersen 2732;* above Matavanu, 1,550 m., *Christophersen 2235.* Olosega: top of Piumafua, 600 m., *Garber 1065.*

"All tropical countries" north to Japan, south to New Zealand.

H. incisa is usually considered a composite species; however, the genus needs revision. All Samoan specimens are much alike and resemble the typical form from Japan, except for the larger size, with leaves up to 3 m. long, tripinnate. A basal pinna (Christophersen 773) is 85 cm. long by 45 cm. wide; the veins not so densely reticulate with fewer but larger areoles. All pinnae and pinnules bear much abbreviated basal pinnules (stipules) set close to the rachis. The oldest name of this form if valid, seems to be *Pteris Brunoniana* Endlicher.

Genus **ACROSTICHUM** Linnaeus

Copeland, B. P. Bishop Mus., Bull. **59**: 80, 1929; Bull. **93**: 59, 1932.

Acrostichum aureum Linnaeus, and most authors. Copeland, B. P. Bishop Mus., Bull. **59**: 80, 1929; Bull. **93**: 59, 1932.

Chrysodium aureum Mettenius. Luerssen, Mitt. Bot. **1**: 66, 357, 1874.

Common on the shore, bordering the mangroves. Two forms may be distinguished.

Form 1. Sterile pinnae oblong, up to 30 × 5 cm., sometimes 7 cm. broad, acuminate and cuneate at base.

Savaii: *Christophersen 2511.* Upolu: *Christophersen 348, 476; Eames 56.* Tutuila: *Garber 967; Eames T23.*

By far the commonest form, growing in brackish water.

Form 2. Sterile pinnae ovate or elliptic, 10 × 5 cm., obtusely acute or apiculate, the base rounded-short cuneate; fertile pinnae broadly lanceolate. Leaves short, mostly less than 50 cm.

Savaii: near Taga, rocky shore, 10 m. above sea level, *Christophersen 919.* Tutuila: sandy soil, on beach, *McMullin 43* (W). Tau: at rocky point, 6 m. above sea level, *Garber 782.*

Tropics and subtropics.

Evidently a form of dryer habitat, such as sandy beaches and coastal rocks above the sea. Sometimes it is highly depauperate, as in Setchell 238 (W) from Tutuila (Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 122, 1924). It is fertile, with more simple leaves under 10 cm.

Genus **STENOCHLAENA** J. Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 65, 1929, part.

Stenochlaena palustris (Burmann) Beddome. Copeland, B. P. Bishop Mus., Bull. **59**: 65, 1929.

Acrostichum scandens Hooker. Christ, Engler Bot. Jahrb. **23**: 361, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 414, 1908.

Without locality: *Powell 179* (Kew).

Upolu: *Reinecke 21,* above Moa Moa, *Rechinger 40* (V).

Tropical Africa and Asia east to Samoa, where it seems to be very rare.

Besides Copeland's description, I refer to Holttum's elaborate treatment of this species (Gard. Bull. Straits Settlem. **5**: 254, 1932).

Genus **ADIANTUM** Linnaeus

Copeland, B. P. Bishop Mus., Bull. **59**: 82, 1929; Bull. **93**: 60, 1932.

1. **Adiantum philippense** Linnaeus. Copeland, B. P. Bishop Mus., Bull. **59**: 82, 1929.

Adiantum lunulatum Burmann, and all authors.

Simply pinnate with the rachis sometimes prolongated; sori and indusia oblong or semilunate.

Upolu: *Eames 95.*

Samoa to tropical Asia and Africa.

Common in Upolu but apparently rare in Savaii, not recorded from Tutuila.

2. **Adiantum diaphanum** Blume, and all authors. Copeland, B. P. Bishop Mus., Bull. **59**: 82, 1929.

Larger leaves mostly bipinnate with a pair of lateral pinnae, smaller ones often simply pinnate, the rachis never prolongated; sori in deep sinuses, indusium reniform.

Savaii: *Rechinger* (W, V).

Upolu: *Reinecke 42 a, c* (Kew, W); canyon of Vaisingano River, *Christophersen, 88, 102.*

New Zealand, Samoa to tropical Asia.

3. **Adiantum capillus-veneris** Linnaeus. Copeland, B. P. Bishop Mus., Bull. **93**: 61, 1932.

To this pantropic and subtropic species, I refer a small bit from Manua, Powell 216 (Kew). From the two former species it differs in its bi-tripinnate fronds with flabellate leaflets. It is recorded from Tahiti, not from Fiji. It is new to Samoa, and has only been collected once.

Genus **DORYOPTERIS** J. Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 81, 1929; Bull. **93**: 60, 1932.

Doryopteris concolor (Langsdorff et Fischer) Kuhn. Copeland, B. P. Bishop Mus., Bull. **59**: 81, 1929; Bull. **93**: 60, 1932.

Pteris geraniifolia Raddi. Baker, Jour. Bot. **14**: 11, 1876. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 111, 1854.

Pteris concolor Langsdorff et Fischer. Luerssen, Mitt. Bot. **1**: 119, 367, 1874.

Pellaea concolor Baker. Christ, Engler Bot. Jahrb. **23**: 345, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 421, 1908.

Without locality: *Powell 15* (Kew); *Whitmee 57* (Kew).

Savaii: Matautu, *Vaupel 129* (Kew, W). Upolu: *Henquel* (W); *Rechinger 796* (V). Manua: *Brackenridge* (W).

Pantropic. Rare in Samoa, always on lava rocks near the coast (Rechinger).

Genus **CHEILANTHES** Swartz

Copeland, B. P. Bishop Mus., Bull. **59**: 80, 1929; Bull. **93**: 59, 1932.

Cheilanthes tenuifolia (Burmann) Swartz. Copeland, B. P. Bishop Mus., Bull. **59**: 80, 81, 1929; Bull. **93**: 59, 1932.

"Without locality: *Whitmee*" (Kew).

Tahiti to east and tropical Asia.

Not mentioned by the authors as Samoan and only one specimen quoted in my journal made at Kew in 1930. As no specimens have been found in more recent collections, the occurrence of the species in Samoa is perhaps questionable.

Genus **CONIOGRAMME** Fée

Copeland, B. P. Bishop Mus., Bull. **59**: 75, 1929.

Coniogramme fraxinea (Don) Diels. Hieronymus, Hedwigia **57**: 286, and (as to the Samoan form) 327, 1916. Copeland, B. P. Bishop Mus., Bull. **59**: 76, 1929.

Gymnogramme javanica Blume. Baker, Jour. Bot. **14**: 13, 1876. Christ, Engler Bot. Jahrb. **23**: 360, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 417, 1908.

Without locality: *Whitmee 73* (Kew, H).

Savaii: *Reinecke 168* (B); *Rechinger 629* (W), *1596* (V); *Vaupel 308* (W); above Matavanu, 900 m., *Christophersen 2023*. Upolu: *Reinecke 168 a* (B); canyon of Vaisingano River near Malololelei, 500 m., *Christophersen 80*.

Samoa to India.

The Samoan form is very nearly the same as the Malayan one, the pinnae perhaps broader (5-6 cm.) and paraphyses none or very few and short. The frond is pinnate with 4-6 pairs of pinnae, the basal ones as a rule with a pair of secondary pinnules.

Genus **PITYROGRAMMA** Link

Copeland, B. P. Bishop Mus., Bull. **93**: 55, 1932.

Pityrogramma Brackenridgei (Carruthers) Maxon, apud Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 124, 1924.

Gymnogramme Brackenridgei Carruthers in Seemann's Fl. Vit. 370, 1869.

Gymnogramme tartarea Desvaux. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 24, 1854 (*tartareum*). Luerssen, Mitt. Bot. **1**: 113, 366, 1874.

Gymnogramme calomelanos Kaulfuss. Baker, Jour. Bot. **14**: 345, 1876. Christ, Engler Bot. Jahrb. **23**: 360, 1897.

Without locality: *Powell 21* (Kew); *Whitmee 140* (Kew).

Savaii: Matavanu lava field, on smooth lava, about 600 m., *Christophersen 1966.* Tutuila: *Brackenridge* (W); *Setchell 118, 237* (W); *McMullin 42* (W). Tau: *Garber 666.* Endemic.

I maintain this species on the authority of Maxon, but it seems difficult to point out good characters by which it may be distinguished from the variable and wide spread *P. calomelanos.* The few specimens seen are quite different in size and degree of cutting. The lamina is narrowly to very broadly ovate-deltoid, and from bipinnatifid to bipinnate-pinnatifid, of smaller fronds 10-20 × 5-10 cm., of the largest 40 × 25 cm. (McMullin 42); the secondary pinnules ovate-roundish and subentire to oblong, acute and deeply pinnatifid, of smaller forms 1 × 0.5, of the large 2.5 × 1 cm. Powder thin or dense, gray, whitish to pale sulphureous.

Genus **VAGINULARIA** Fée

Copeland, B. P. Bishop Mus., Bull. **93**: 77, 1932.

Vaginularia angustissima (Brackenridge) Mettenius. Christensen, Index Filicum, Suppl. **3**: 194, 1934.

Diclidopteris angustissima Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 135, pl. 17, 1854.

Vaginularia Junghuhnii Mettenius. Luerssen, Mitt. Bot. **1**: 75, 359, 1874.

Monogramme Junghuhnii Hooker. Baker, Jour. Bot. **14**: 13, 1876.

Monogramme paradoxa (Fée) Beddome. Christ, Engler Bot. Jahrb. **23**: 359, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 416, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 123, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 102, 1929; (Bull. **93**: 77, 1932?).

A grasslike epiphyte, common in all islands, and collected by all.

Savaii: *Vaupel 158* (V); above Salailua, 100 m., *Christophersen 920, 2609;* above Sili, 250 m., *Christophersen 3273.* Upolu: *Eames 150.* Tutuila: *Garber 904.* Tau: *Garber 627, 767, 770.* Olosega: *Garber 1080.*

Samoa, Tahiti?, Fiji.

This Polynesian species differs from the Malayan *V. paradoxa* Fée by its larger size, the leaves attaining 25 cm. in length and at least 1 mm. in width (in *paradoxa* hardly 0.5 mm.), and proportionally shortly narrowed toward the base, the sterile apical portion of the fertile leaves short in relation to the length of the leaf.

Genus **VITTARIA** Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 103, 1929; Bull. **93**: 77, 1932.

1. **Vittaria rigida** Kaulfuss var. **samoensis** (Luerssen), comb. nov.

Vittaria elongata var. *samoënsis* Luerssen, Mitt. Bot. **1**: 90, 95, pl. 11, figs. 1-2, 1874.

Vittaria elongata Swartz, part, auctt.

Leaves 25-35 cm. long and 5-7 mm. wide, nearly from base to tip, subsessile mature ones firm and rather thick to coriaceous, midrib hardly visible and veins hidden, even invisible against the light. Rhizome scales very long, hair-pointed, shortly and remotely pseudo-ciliate or subentire, the cells large with clear lumina. Differs from the Hawaiian type chiefly in scale-structure; the scales of the type are not nearly so long hair-pointed, more conspicuously ciliate and cells much smaller.

Savaii: Olonono, *Vaupel 245* (W); *Reinecke 40 c* (W); 1902 lava field above Aopo, 1,200-1,400 m., *Christophersen 896;* above Siuvao, 300 m., *Christophersen 3303.* Upolu: *Rechinger 1828, 1956,* part (V); near Moa Moa Plantation, on stones, 100 m., *Eames 191;* near Apia, on *Bruguiera, Christophersen 444.* Tutuila: near Leone, *McMullin, 47* (W).

Type of *V. rigida* from Hawaii; type of variety from Samoa, also found in Fiji, Tonga, Rarotonga and probably in most other islands of southern Polynesia.

I find it difficult to place this form. I do not doubt that it is Luerssen's variety *samoensis* which he referred to first as a variety of *V. zosteraefolia* Bory, regarded by him as a form or subspecies of *V. elongata,* but it is considerably different from that species and seems to me to far better agree with *V. rigida.* I would refer *V. confusa* Fournier to the same form. It is evidently the commonest *Vittaria* in Samoa and no doubt specifically different from the following species.

2. **Vittaria elongata** Swartz, and authors, part.

Leaves up to nearly 1 m. long, long attenuated below and about 1 cm. wide above the middle; midrib distinct to the middle or more, veins quite distinct against the light. Rhizome scales hair-pointed, freely pseudociliate.

Tau: *Garber 734, 758.*

"Tropics of the Old World."

758 is near the common Malayan form usually called *V. zosterifolia.*

3. **Vittaria scolopendrina** (Bory) Thwaites, and all authors. Copeland, B. P. Bishop Mus., Bull. **59**: 103, 1929.

Without locality: *Powell 110* (W); *Whitmee 146* (Kew).

Savaii: above Matavanu, 800 m., *Christophersen 2288;* Panafu, *Vaupel 347.* Upolu: Lanutoo, *Rechinger 1956* part; Mount Fao, 300 m., *Christophersen 561.* Tau: *Garber 733.*

Samoa west to Malaya and Madagascar.

The Samoan (Polynesian) form of this species (var. *Reineckei* Christ, Engler Bot. Jahrb. **23**: 360, 1897) is very like the type from the Mascarenes, deviating chiefly in scale structure; its rhizome scales are narrower and very long hair-pointed, the cells larger and more elongated. *Taeniopsis Richiana* Brackenridge (U.S. Expl. Exp. 1838-42, **16**: 60, 1854) from Fiji is this form, I believe.

Genus **ANTROPHYUM** Kaulfuss

Copeland, B. P. Bishop Mus., Bull. **59**: 103, 1929; Bull. **93**: 75, 1932.

1. **Antrophyum subfalcatum** Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 65, 1854. Luerssen, Mitt. Bot. **1**: 98, 361, 1874. (Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 211, 1912.) Copeland, B. P. Bishop Mus., Bull. **59**: 104, 1929.

Leaves sessile, narrow oblanceolate, about 10-15 × 1 cm. (often smaller) sori superficial, usually placed along the margins.

Without locality: *Powell 126* (Kew). Reported from Tutuila by Luerssen.

Savaii: Olonono, *Vaupel 298* (W); above Matavanu, about 750 m., *Christophersen 1986*. Upolu: Vaisingano Canyon, 500 m., *Christophersen 95;* ridge above Malololelei, 700 m., *Christophersen 193*.

Samoa, Fiji.

The Bornean *A. Brookei* Hooker, usually referred to this species, is distinct in its filiform paraphyses.

2. **Antrophyum plantagineum** (Cavanilles) Kaulfuss. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 64, 1854. Luerssen, Mitt. Bot. **1**: 97, 361, 1874. Copeland, B. P. Bishop Mus., Bull. **59**: 104, 1929.

Leaves with an unwinged or very narrowly winged stipe, sori deeply immersed, very narrow, more or less reticulated.

In Fiji, Samoa and Tahiti this species is represented by two forms quite different in their extremes; but intermediates occur, and after examination of numerous specimens I find it impossible to regard them as species.

Forma typica.

Leaves pale green, lamina 15 × 3 cm., stipe 4-6 cm.

Tutuila: Utulei, *McMullin 20* (W).

The only specimen seen matches Cavanilles' type from Guam perfectly. Some specimens quoted under the following variety resemble the type in that the tufts have both rather short stalked, narrowly elliptic leaves resembling *plantagineum,* and long stalked ones with linear or sublanceolate lamina like those of the typical variety.

Antrophyum plantagineum var. **angustatum** (Brackenridge) Hooker. Luerssen, Mitt. Bot. **1**: 98, 361, 1874. Christ, Engler Bot. Jahrb. **23**: 360, 1897. Rechinger Denkschr. Akad. Wiss. Wien **84**: 416, 1908.

Antrophyum angustatum Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 63, 1854.

Antrophyum Grevillei Balfour. Baker, Jour. Bot. **14**: 13, 1876.

Leaves dull green, lamina linear or suboblanceolate, rarely narrowly elliptic, up to 25 × 2 cm., or narrow; stipe sometimes very long.

Common, found in all islands, collected by all.

Savaii: *Vaupel 39* (W); *Christophersen 921, 2606, 2610.* Upolu: *Eames 190.* Tutuila: *McMullin 34* (W); *Garber 840, 903* (*limu limu lau tele*).

A. plantagineum is distributed through Polynesia and Malaya, the variety in central Polynesia.

3. **Antrophyum alatum** Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 64, 1854. Copeland, B. P. Bishop Mus., Bull. **59**: 104, 1929; Bull. **93**: 76, 1932.

Antrophyum callaefolium Blume. Luerssen, Mitt. Bot. **1**: 96, 361, 1874. Christ, Engler Bot. Jahrb. **23**: 360, 1897 (*callifolium*).

Antrophyum semicostatum Blume. Baker, Jour. Bot. **14**: 13, 1876. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 211, 1912.

Antrophyum reticulatum (Forster) Kaulfuss. Luerssen, Mitt. Bot. **1**: 98, 361, 1874. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 210, 1912; Engler Bot. Jahrb. **23**: 360, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 416, 1908.

Leaves spathulate, up to 30 × 9 cm., mostly smaller, narrowed gradually downwards to the rhizome (winged stipe); midrib distinct to the middle, blackish or pale. Sori deeply immersed with long rufous, filiform paraphyses, not or rarely reticulated.

Common and found on all islands, collected by all.

Savaii: Olonono, *Vaupel 38* (Kew, W); near Vaipouli, 75 m., *Christophersen 1840.* Salailua, 300 m., *Bryan 164; Christophersen 2615.* Upolu: *Eames 192;* Vaisingano Canyon, 500 m., *Christophersen 70, 94.* Tutuila: *Garber 839.*

Samoa, Tahiti, Fiji, Philippines.

I maintain *A. alatum* as a species though it probably is a form of *A. reticulatum,* to which some authors referred some Samoan specimens, but all specimens seen belong undoubtedly to the same species. The only marked difference is the color of the midrib, which in some specimens is very distinctly blackish brown, in others pale straw colored. I have seen the type sheet of *A. reticulatum* in the British Museum (Natural History). It is labelled *Hemionitis reticulata* Forster (Otaheite 1769) and consists of two plants with two fronds each, which are rather different; one with oblanceolate fronds, 30 × 4 cm., with a blackish midrib not reaching the middle and very long areoles, paraphyses long, filiform, yellowish; this form seems to be *A. Grevillei* Balfour. The second plant has spathulate fronds, 25 × 6 cm., midrib pale, vanishing below the middle; paraphyses filiform, reddish brown. This form may be regarded as the genuine *A. reticulatum* and comes very near to *A. alatum,* differing a little in the narrower wings to the stipe and less distinct midrib. In this character, *A. alatum* resembles *A. semicostatum* Blume with which it has been confused, but that species has clavate or capitate paraphyses.

Genus **BLECHNUM** Linnaeus

Copeland, B. P. Bishop Mus., Bull. **59**: 56, 1929; Bull. **93**: 45, 1932.

Key to the Species of Blechnum

Fronds uniform, pinnate, pinnae 10-30 × 1-1.5 cm., acuminate.....**1. B. orientale.**
Fronds dimorphous, fertile ones contracted, linear (*Lomaria*)
  Sterile frond deeply pinnatifid throughout, at best 10 cm. wide, the lower segments gradually dwindling into mere auricles.....**2. B. lanceolatum.**
  Sterile frond pinnate at base only, or deeply pinnatifid throughout, 25-40 cm. wide, segments contiguous at base, the lower ones not or slightly reduced.....**3. B. vulcanicum.**
  Sterile frond pinnate throughout, 20-30 cm. wide, paleaceous, lower pinnae somewhat reduced.....**4. B. procerum.**

1. **Blechnum orientale** Linnaeus, and all authors. Copeland, B. P. Bishop Mus., Bull. **59**: 56, 1929; Bull. **93**: 45, 1932.

   Common and collected by all.

   Savaii: near Vaipouli, about 75 m., *Christophersen 1839*. Tutuila: *Eames T16;* top of Matafao, 650 m., *Christophersen 1031;* top of Pioa, 500 m., *Christophersen 3516*. Tau: top of peak, 600-700 m., *Garber 749*. Olosega: top of Piumafua, 630 m., *Garber 1048*.

   A common fern in tropical Asia and Polynesia, east to Austral Islands.

2. **Blechnum lanceolatum** (R. Brown) Sturm. Copeland, B. P. Bishop Mus., Bull. **59**: 58, 1929.

   Lomaria lanceolata Sprengel. Baker, Jour. Bot. **14**: 11, 343, 1876.

   Lomaria attenuata Willdenow. Christ, Engler Bot. Jahrb. **23**: 343, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 425, 1908.

   Blechnum attenuatum (Swartz) Mettenius. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 125, 1924.

   Without locality: *Whitmee 69,* part, *181* (Kew).

   Savaii: Maugaloa, *Vaupel 433* (Kew, W); above Letui, 900 m., *Christophersen 760;* above Matavanu, 870 m., *Christophersen 833*. Also Upolu and Tutuila (see Christ, under *Lomaria attenuata*).

   Samoa, Australia, New Zealand, Fiji, Chile (?).

   Apparently rare in Samoa. The specimens agree more closely with the New Zealand form than with the Fijian *Lomaria doodioides* Brackenridge. The species also differs in the many auriculiform, confluent lower segments from *B. attenuatum* (Swartz) Mettenius, an African species often recorded from Polynesia and by Copeland from Tahiti.

   Baker (Ann. Bot. **5**: 219, 1891) states that *Lomaria acuminata* Baker [*Blechnum norfolkianum* (Heward) Christensen, Index] was collected in Samoa by Whitmee; it resembles a gigantic form of *B. lanceolatum*. No specimen in the Whitmee collection seen is that species, and I suppose that Baker

mistook a large specimen of *B. lanceolatum* or perhaps an incomplete *B. vulcanicum.*

3. **Blechnum vulcanicum** (Blume) Kuhn. Luerssen, Mitt. Bot. **1**: 137, 369, 1874 (var. *gigantea* Luerssen).

Lomaria vulcanica Blume. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 343, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 425, 1908.

Without locality: *Powell 91* (Kew); *Whitmee 69,* part (Kew).

Savaii: *Reinecke 162* (Kew, W); Maugaloa, *Vaupel 77* (Kew), *333* (W); *Rechinger 650;* lava field above Aopo, 1,200-1,400 m., *Christophersen 899;* above Matavanu in wet forest, 1,600 m., *Christophersen 2163, 2201.* Upolu: *Reinecke s.n.* (Kew, W). Tutuila: Alava Ridge, 400 m., *Christophersen 1129;* top of Pioa, 500 m., *Christophersen 3561.*

Malaya to Polynesia: Java to Marquesas to New Zealand.

The smaller specimens are very like the Javanese form, but most are much larger with pinnae up to 20 × 2 cm. and correspond to the variety *gigantea* Luerssen, and in size to the Fijian *Lomaria pilosa* Brackenridge (U.S. Expl. Exp., 1838-42, **16**: 125, pl. 15, 1854); they are usually quite glabrous though slightly pubescent ones are also seen. Except in size and in the number of free lower pinnae (0-10) all specimens are alike. Specimens with many free pinnae may be distinguished from the following species by the lack of scales.

4. **Blechnum procerum** (Forster) Swartz. Luerssen, Mitt. Bot. **1**: 138, 369, 1874.

Lomaria procera Sprengel. Baker, Jour. Bot. **14**: 11, 343, 1876.

Blechnum capense (Linnaeus) Schlechtendal, auctt., pro parte, et Index Fil. Copeland, B. P. Bishop Mus., Bull. **59**: 56, 1929 (description); Bull. **93**: 46, 1932.

Without locality: *Powell 223* (Kew); *Whitmee 69,* part, *148* (Kew.)

Savaii: bottom of crater above Matavanu, 1,500 m., *Christophersen 799;* Tuisivi Range, 1,600-1,700 m., *Christophersen 802.* Evidently rare and confined to the higher mountains of Savaii.

Australia, New Zealand, Polynesia east to Marquesas, west to Borneo. Very similar forms in some Antarctic islands.

The plant collected in the crater is small with lamina only 20 × 25 × 15 cm.; number 802 is much larger with the largest pinnae 30 × 2 cm. From *B. vulcanicum* var. *giganteum* it differs in nearly all pinnae being free and not cordate at base, the lower ones more or less shortened, rachis and costae beneath with few or many pale brown spreading scales, margins of pinnae finely serrate.

B. procerum was for a long period united with the South African *B. capense* (Linnaeus) Schlechtendal. I am not at all sure that is correct, and prefer to

use Forster's old name for the Polynesian species. The whole group of *B. capense* is highly in need of revision.

Genus **ASPLENIUM** Linnaeus

Copeland, B. P. Bishop Mus., Bull. **59**: 59, 1929.

Key to Species of Asplenium

Fronds simple and entire
- Vein tips united, stipe very short
  - Lamina 15-25 cm. wide, sori close ..... **1. A. nidus.**
  - Lamina 5 cm. wide, gradually attenuate downwards ..... **2. A. phyllitidis.**
- Vein tips free, stipe long
  - Lamina 5-7 cm. wide, usually with an apical bud ..... **3. A. feejeense.**
  - Lamina 1.5-2 cm. wide, not proliferous; simple sterile fronds ..... **4. A. marattioides.**

Fronds 1-5-pinnate
- Simply impari-pinnate
  - Terminal pinna much larger than the lateral ones, proliferous ..... **3. A. feejeense** var.
  - Terminal pinna like the lateral ones, these with equal sided base, 10-15 × 1.5-2 cm., not proliferous, sori close, a little oblique ..... **4. A. marattioides.**
  - Terminal pinna less distinct, the lateral ones decidedly unequal at base, sori very oblique ..... **8. A. falcatum.**
- Gradually narrowed into a pinnatifid apex
  - Stipe and rachis glossy black, simply pinnate, with dimidiate, thinly herbaceous pinnae ..... **5. A. unilaterale.**
  - Stipe and rachis grayish green to dull blackish brown
    - Simply pinnate to bipinnatifid
      - Green or grayish when dried, pinnae 3-5 cm. long, usually obtuse
        - Lower pinnae not or slightly reduced; pinnae coarsely dentate, rather firm ..... **6. A. tenerum.**
        - Frond narrowed below, bipinnatifid, herbaceous ..... **7. A. sphenolobium.**
      - Brown or blackish when dried, papyraceous-coriaceous, pinnae acuminate
        - Rachis of adult fronds nearly naked
          - Pinnae unequal-sided, irregularly lobate-dentate, papyraceous, sori close; not proliferous ..... **8. A. falcatum.**
          - Pinnae usually with a free upper auricle, carnose-coriaceous, sori remote; often proliferous ..... **9. A. lobulatum.**
        - Rachis densely bearded with scales; pinnae incised about to the middle ..... **11. A. horridum.**
    - Bipinnate
      - Scandent; dissected forms of ..... **4. A. marattioides.**
      - Rhizome short
        - Light green, not proliferous, pinnae 3-5 cm. long; small forms of ..... **12. A. cuneatum.**
        - Brownish, subcoriaceous, often proliferous, pinnae 10 cm. or more long ..... **10. A. insiticium.**
    - 3-5-pinnate
      - Sori not dareoid
        - Frond about 20 × 10 cm., deltoid, tripinnate, light green ..... **12. A. cuneatum.**
        - Frond up to 70 cm. wide, 3-4-pinnate, dark green ..... **13. A. laserpitiifolium.**
      - Sori dareoid
        - Tripinnate ..... **14. A. multifidum.**
        - 5-pinnate ..... **15. A. Powellii.**

1. **Asplenium nidus** Linnaeus, and all authors. Copeland, B. P. Bishop Mus., Bull. **59**: 60, 1929; Bull. **93**: 47, 1932.

   Common epiphyte on all islands.

   Upolu: *Eames 181.* Tau: *Garber 682.*

   Tropics and subtropics of the Old World.

   The Samoan form of this variable species corresponds at best to the large form with leaves up to 25 cm. wide, which is dealt with as a distinct species, *A. musifolium* Mettenius by some authors.

2. **? Asplenium phyllitidis** Don. C. Christensen, B. P. Bishop Mus., Bull. **141**: 7, 1936.

   Asplenium Nidus forma resembling *A. Griffithii,* Rechinger, Denkschr. Akad. Wiss. Wien **84**: 41, 1908.

   Without locality: *Powell 201* (Kew).

   Upolu: Papaloloa Falls, *Rechinger 266* (V, not *269* as quoted by Rechinger).

   Tropical and subtropical Asia east to Samoa?

   The determination is not quite certain, but the specimen matches perfectly A. C. Smith 1124 from Fulanga Island, Fiji, which I recorded as new for the Fiji islands (B. P. Bishop Mus., Bull. **141**: 7, 1936). It may perhaps be a young plant of *A. nidus.* The fronds are oblanceolate, 45 cm. long and 5 cm. wide above the middle from where they very gradually narrow to the base; unwinged stipe almost absent, the underside dotted with minute lacerated scales. In typical *A. phyllitidis,* the sori are not nearly as close as in *A. nidus.*

3. **Asplenium feejeense** Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 147, pl. 19, fig. 1, 1854. Baker, Jour. Bot., **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 345, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 426, 1908. Copeland, B. P. Bishop Mus., Bull. **59**: 60, 1929.

   Asplenium amboinense Willdenow. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 201, 1912.

   Asplenium amboinense var. *Feejeense* (Brackenridge) Luerssen, Mitt. Bot. **1**: 149, 370, 1874.

   Fronds tufted, the unwinged scaly stipe 15-20 cm. long, the blade lanceolate, up to 50 × 7 cm., shortly narrowed at both ends and nearly always terminating in an apical, proliferous bud, thinly herbaceous, fresh green, dotted beneath with a few minute, reddish scales, the margins undulate-repand; veins 3-4 mm, apart at base, simple or forked, their tips not united, terminating within the margin; sori at distances of 2-4 mm., neither reaching the midrib nor the margin, usually very unequal in length.

   Without locality: *Brackenridge* (W, type); *Powell* (Kew); *Whitmee 72* (Kew).

   Savaii: *Olonono, Vaupel 218* (Kew, W); above Letui, 900 m., *Christophersen 739;* Siuvao-Auala, 600 m., *Christophersen 3293.* Upolu: *Graeffe*

41 (V, W); *Reinecke 39* (Kew, W); *Hochreutiner 3336* (G); above Malololelei, 700 m., *Christophersen 34.* Tau: *Garber 736, 766.*

Samoa, Fiji (?). Brackenridge's type is no doubt from Samoa. Neither Copeland nor I have seen any Fijian specimens.

Asplenium feejeense var. **semiadnatum** C. Christensen.

Asplenium decurrens Baker, Syn. 484, 1874 (non Willdenow, 1810).

Asplenium semiadnatum C. Christensen, Index Filicum, 1905.

Asplenium emarginatum Palisot-Beauvois. Luerssen, Mitt. Bot. **1**: 151, 372, 1874.

Fronds pinnate with 1-6 pairs of pinnae which are much smaller than the terminal pinna.

Without locality: *Powell 72* (Kew).

I do not hesitate to reduce Baker's species to a variety or casual pinnated form of *A. feejeense.* Besides fronds of typical *feejeense,* the type collection contains three pinnated ones which differ by no other character from the type. This is also true of the Bornean *A. trifoliatum* van Alderwerelt van Rosenburgh.

4. **Asplenium marattioides** (Brackenridge) C. Christensen, comb. nov.

Polybotrya marattioides Brackenridge, U. S. Expl. Exp. 1838-42, **16**: 79, 1854.

Asplenium distans Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 155, 1854 (non Don).

Asplenium remotum Moore. Copeland, B. P. Bishop Mus., Bull. **59**: 61, 1929.

Asplenium multilineatum Hooker. Luerssen, Mitt. Bot. **1**: 150, 370, 1874. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 345, pl. 4, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 428, 1908.

Asplenium dubium Brackenridge. Luerssen, Mitt. Bot. **1**: 377?, 1874.

Without locality: *Brackenridge* (W, *A. distans*); *Whitmee 75* (Kew).

Savaii: *Brackenridge* (W, type); *Reinecke 120* (B); Olonono, *Vaupel 188* (B, Kew); above Letui, about 1,000 m., *Christophersen 761;* above Matavanu, 1,300 m., *Christophersen 2146;* east of Olo, 700-800 m., *Rechinger 623* (V); *Christophersen 2309.* Upolu: *Reinecke 31, 87, 120 a, b.* Tau: *Powell 199* (Kew); *Garber 679.*

Young plants with bipinnate leaves (*Acrostichum sorbifolium,* part, Rechinger, Denkschr. Akad. Wiss. Wien **84**: 413, 1908; Copeland, B. P. Bishop Mus., Bull. **59**: 61, 1929; Christ, Engler Bot. Jahrb. **23**: pl. 4, 1897).

Savaii: *Rechinger 3708, 4494* (V). Upolu: *Rechinger 1573* (V).

Samoa and Fiji west to Celebes (?).

The type specimen of *P. marattioides* Brackenridge is sterile but identical with other simply pinnate specimens, perhaps somewhat more coarsely ser-

rated. The specific name is the oldest and not preoccupied in *Asplenium*. *A. remotum* Moore and *A. multilineatum* Hooker are both new names for the invalid *A. distans* Brackenridge, and *A. dubium* Brackenridge is probably one of the many juvenile forms excellently illustrated by Christ (pl. 4). The variety *semipinnata* Luerssen (Mitt. Bot. **1**: 371, 1874) is also one of these forms, which Rechinger believed to be young plants of his *Acrostichum* (*Stenochlaena*) *sorbifolium*.

5. **Asplenium unilaterale** Lamarck. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 125, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 60, 1929.

   Asplenium resectum J. Smith. Luerssen, Mitt. Bot. **1**: 157, 373, 1874. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 347, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 426, 1908.

   Common on all islands and collected by all.

Two extreme forms, which look quite different but contain intermediate forms, are found in Samoa as well as in the wide area where this species occurs.

(a) f. **major** (*Asplenium excisum* Presl).

Lamina 30-35 up to 15 cm.; pinnae up to 8 × 2 cm. or smaller, 5 × 1 cm.

Savaii: Salailua, 275 m., *Bryan 165*. Upolu: Tiavi, *Rechinger 1330* (V); Vaisingano Canyon, 500 m., *Christophersen 85*.

(b) f. **minor** Prantl. Christ, Engler Bot. Jahrb. **23**: 347, 1897.

Lamina 15 × 3-4 cm., pinnae 1.5-2 × 0.5 cm. or a little larger.

Savaii: *Rechinger 1129* (V). Upolu: *Reinecke 35* (W); Vaisingano Canyon, 500 m., *Christophersen 84;* below Mt. Vaitou, 700 m., *Christophersen 248*. Tau: *Garber 681*.

Most of the numerous specimens seen are intermediate between these two extremes.

Africa through tropical and subtropical Asia east to Samoa.

6. **Asplenium tenerum** Forster, and all authors. Copeland, B. P. Bishop Mus., Bull. **59**: 61, 1929; Bull. **93**: 48, 1932.

   Common and collected by about all; no specimens seen from Manua.

   Savaii: *Vaupel 207* (W); above Sili, 300 m., *Christophersen 3239*. Upolu: near Malololelei, *Christophersen 69, 87, 200*.

   Polynesia, tropical and east Asia (Marquesas to India).

7. **Asplenium sphenolobium** Zenker apud Kunze, Linnaea **24**: 264, 1851. Hieronymus, Hedwigia **60**: 226, 1918.

   Asplenium erectum Bory. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 426, 1908.

Tufted. Stipe 4-5 cm. long; whole leaf and stipe glabrous and without scales, brownish stramineous. Lamina lanceolate, 20-25 × 3-5 cm., more or less narrowed downward, herbaceous, pinnate to the acuminate tip; rachis grayish or brownish green, margined below, narrowly winged above, not proliferous. Pinnae numerous, sessile, cuneate at the lower side, truncate or oblique at the upper side of the base, rather gradually narrowed towards the obtuse or subacute apex, 5-6 mm. wide at base, lobed about one third toward the costa with square and bifid lobes or teeth, the upper and lower ones triangular and acute. The upper basal one much the broadest, with 3-4 short teeth. Sori medial in the lobes, neither reaching costa nor margin.

Savaii: above Aopo, 600 m., *Vaupel 303* (Kew, W); volcano Maugaafi, 1,500-1,600 m., *Rechinger 637* (V).

India and Ceylon, scattered through Malaya, Hawaii, Samoa.

The determination of no. 303 is by Hieronymus, who made a special study of the group of *A. lunulatum* to which the present species belongs. It is evidently one of the rarest ferns in Samoa, easily distinguished from the other species of the genus found there.

8. **Asplenium falcatum** Lamarck, and all authors.

Asplenium adiantoides (Linnaeus) C. Christensen, Index. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 201, 1912. Copeland, B. P. Bishop Mus., Bull. **59**: 62, 1929 (not Bull. **93**: 49, 1932).

Common in all islands and collected by all.

Savaii: *Bryan 109;* near Manase, 25 m., *Christophersen 2415;* Salailua, 100 m., *Christophersen 2607.* Upolu: Apia, *Eames 15;* Malololelei-Lanutoo, 700 m., *Christophersen 21* (*22,* young). Tutuila: *Garber 855, 864, 865; Eames T18.* Tau: *Garber 541, 591, 595, 695.*

From East Africa through tropical Asia east to Easter Island, south to New Zealand.

This common Polynesian species has been identified as *Trichomanes adiantoides* Linnaeus, which I now believe to be a form of *A. macrophyllum* Swartz. I therefore prefer to use the well known name of Lamarck. Surprisingly, Copeland identified *T. adiantoides* Linnaeus with *A. praemorsum* Swartz (B. P. Bishop Mus., Bull. **93**: 49, 1932) in the belief that its type is South African. The type was collected in Ceylon by Hermann and first described by Linnaeus in his Flora Zeylanica.

9. **Asplenium lobulatum** Mettenius. Baker, Jour. Bot. **14**: 11, 1876. Hieronymus, Hedwigia **61**: 39, 1919. Copeland, B. P. Bishop Mus., Bull. **93**: 48, 1932.

Asplenium anisodontum Presl. Christ, Engler Bot. Jahrb. **23**: 346, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 426, 1908.

Asplenium falcatum Lamarck, part. Christ, Engler Bot. Jahrb. **23**: 347, 1897.

Very like *A. falcatum* in size and whole habit, but thicker and somewhat fleshy, rachis often with a proliferous bud below the apex, pinnae usually with a nearly free broadly

spathulate auricle at the upper side of base and upward coarsely dentate or lobed with oblique obtusely toothed lobes; sori remote, oblique, parallel, neither reaching the costa nor the margin, straight, the blackish brown, firm indusium 1 mm. or more wide.

Without locality: *Whitmee 81,* part (Kew).

Savaii: *Reinecke 76 b, c;* Maungaafi Volcano, *Rechinger 636;* Tuisivi Range, 1,600-1,700 m., *Christophersen 788.* Upolu: *Reinecke 33* (B). Tutuila: *Reinecke 37 a* (B).

Hawaii, Samoa (Tahiti), New Guinea.

Possibly a less divided form of *A. insiticium.*

10. **Asplenium insiticium** Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 161, pl. 22, 1854. Copeland, B. P. Bishop Mus., Bull. **59**: 62, 1929.

Asplenium nitidum Swartz. Luerssen, Mitt. Bot. **1**: 160, 374, 1874.

Asplenium cuneatum Lamarck, part. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 482, 1908.

Savaii: *Graeffe* (W). Upolu: *Betche?* (W); Lanutoo, *Rechinger 744* (V).

Hawaii, Fiji, Samoa, New Caledonia.

Probably the fully developed form of *A. lobulatum,* bipinnate with 7-9 subrhomboidal, toothed pinnules below the shorter or longer coarsely dentate or lobed, subcaudate apex; color, texture and sori the same as in *A. lobulatum* and sometimes with auricled pinnae.

Copeland (B. P. Bishop Mus., Bull. **93**: 48, 1932) suspected that *A. lobulatum,* including *A. pseudocaudatum* Hillebrand, the Philippine *A. Steerei* Harrington, and I add the Formosan *A. cuneatiforme* Christ, are all forms of *A. insiticium.* Furthermore he was not sure that *insiticium* was the first name given to that species, in which I think he was right. There occur in Malaya a number of intricate forms which belong to the same narrow group, the oldest of which seems to be *A. acutiusculum* Blume (synonym *A. anisodontum* Presl?). It is extremely like the simpler forms of *A. lobulatum* in size, color and texture and often proliferous with auricled pinnae. Sori are closer together, more oblique and nearly reaching the costa, but ending far from the margin. Nevertheless, it is natural to refer the Samoan form to that Malayan species. Though not proliferous in habit, *A. spathulinum* J. Smith (restored as a species in Index Filicum, Suppl. 3) is also hard to distinguish from *A. insiticium.*

11. **Asplenium horridum** Kaulfuss. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 201, 1912. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 125, 1924.

Asplenium caudatum Forster. Luerssen, Mitt. Bot. **1**: 156, 372, 1874 (an Forster?).

Asplenium caudatum var. *horridum* (Kaulfuss) Christ, Engler Bot. Jahrb. **23**: 346, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 427, 1908.

Leaf, including stipe, up to 2 m. long, firmly herbaceous or papyraceous, dark green; stipe and rachis densely bearded with dark rufous brown scales, which from a broad base narrow suddenly into a long, filiform, entire, squarrose apex. Pinnae numerous, sessile, unequal at base, long caudate-acuminate, 10-15 × 1.5-2 cm., deeply pinnatifid with oblique oblong, rounded-obtuse or truncate and often bifid, obtusely dentate lobes 7-8 mm. wide; costae and veins with a few filiform scales beneath. Sori parallel to and close to the costa and in larger specimens 1-3 running out into the lobes.

Common on all islands, and collected by all.

Savaii: *Vaupel 72* (V, W); 1902 lava field above Aopo, 1,200-1,400 m., *Christophersen 897;* crater rim, 1,500 m., *Christophersen 2734;* above Salailua, 1,400 m., *Christophersen 3098.* Upolu: above Malololelei, 700 m., *Christophersen 244.* Olosega: *Garber 1070.*

Hawaii, Rarotonga, (Malaya).

This common Samoan fern is certainly identical with the Hawaiian type, which most authors regard as a large, more deeply cut and more densely paleaceous form of *A. caudatum* Forster. Not having seen the actual type of Forster's species from Tahiti, I dare not decide the validity of *A. horridum,* but I refer the readers to Copeland's description of *A. caudatum* (B. P. Bishop Mus., Bull. **93**: 48, 1932). It is possible that some of the smaller Samoan specimens, especially Rechinger 1097 from Savaii (V) are the genuine *A. caudatum,* but I am of the opinion that only one species of this group occurs in Samoa.

12. **Asplenium cuneatum** Lamarck. Luerssen, Mitt. Bot. **1**: 158, 373 (excl. var.) 1874. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 163, 1854. Christ, Engler Bot. Jahrb. **23**: 347, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 428, part, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 125, 1924.

Asplenium affine Swartz. Baker, Jour. Bot. **14**: 11, 1876.

Fronds tufted, the stipe about 15 cm. long, like the rachis grayish green and furnished with some minute scales which, from a broader, clathrate and fimbriate red brown base, terminate rather abruptly into a narrow darker tip. Lamina ovate or deltoid, about 20 × 10 cm., firmly herbaceous, usually light green, glabrous, subtripinnate; rachis margined above. Pinnae short stalked, deltoid with unequal sided base, 3 cm. wide, rather obtuse to short-acuminate, with about 5 pairs of rather distant secondary pinnules, the lower of which are subpinnate with 1-2 pairs of tertiary pinnules, the upper ones subdimidiate-trapezoidal and often with an anterior basal lobe; the tertiary pinnules broadly cuneate-spathulate and rounded-obtuse; margins of all pinnules obtusely dentate. Sori 2-3 to each ultimate pinnule, remote, indusia narrow, pale brown, entire.

The described form is the fully developed one; smaller specimens are bipinnate only. See my remarks under the following species.

Without locality: *Whitmee* (Kew, *A. affine* Baker).

Savaii: *Reinecke 3 d* (Kew, W); Matautu, *Vaupel 246* (W); *Rechinger 86* (V); Vaisingano Canyon, 500 m., *Christophersen 86.* Upolu: *Reinecke*

3 b (bipinnate, Kew, W); *Rechinger 1423* (V). Tutuila: *Setchell 395* (bipinnate, W); *Dumas 17* (P); *Garber 844?, 854.* Tau: *Garber 680, 707.* "Pantropical."

13. Asplenium laserpitiifolium Lamarck, sens. lat. Copeland, B. P. Bishop Mus., Bull. **59**: 63, 1929; Bull. **93**: 50, 1932; and all authors.

Asplenium cuneatum var. *laserpitiifolia* (Lamarck) Luerssen, Mitt. Bot. 1: 158, 373, 1874.

Common in all islands and collected by all.

Savaii: Olo, 700 m., *Christophersen 2248.* Upolu: ridge to Mt. Vaitou, epiphyte, 750 m., *Christophersen 254* (see below). Tutuila: *Garber 926.*

Seychelles through tropical Asia and Polynesia east to Tahiti.

The commonest Samoan form of this composite species is very large, quadripinnate, the larger pinnae up to 35 × 15 cm. and very closely resembling a whole frond of *A. cuneatum,* but some smaller specimens come very near to that species, of which Luerssen made *A. laserpitiifolium* a variety. I do not agree with him in this; there are some rather indescribable differences in the shape of the ultimate pinnules; these of *A. laserpitiifolium* as here confined being more rhomboidal in outline and somewhat attenuated toward the apex; the rachis is usually dark colored, and the whole frond dark green, but none of these characters is consistent.

Tardieu-Blot and Ching have recently published a revision of the Indochinese forms related to the genuine *A. cuneatum* Lamarck from Jamaica, and *A. laserpitiifolium* Lamarck from the Seychelles, with photographs of the actual types of both of these species (Notulae Systematicae, Paris **5**: 134-154, 1936). According to the authors, neither of these species occurs in continental Asia. This may be true for *A. cuneatum,* but I cannot find any important difference between the Samoan form and the West Indian type. The scales of the rachis are a little different, and very similar forms occur in tropical Africa. Lamarck's type is a rather poor specimen, nearly exactly matching the smaller bipinnate Samoan form mentioned above, but more complete Jamaican specimens agree closely with the larger Samoan ones.

Concerning *A. laserpitiifolium* I have seen no Asiatic or Polynesian specimens matching the type, and the authors may be right in separating the Indochinese forms into four new species. These are hardly all well founded, and unfortunately, they did not consider the Malayan and Polynesian forms hitherto referred to *A. laserpitiifolium.* For several other unrevised forms, I find it best to use the old, well-known name for the Samoan form. It comes next to *A. neolaserpitiifolium* Tardieu and Ching, and might very well be called by that name. A much smaller form the size of *A. cuneatum* is Christophersen 254, which appropriately might be referred to *A. pseudolaserpitiifolium* Ching.

14. Asplenium multifidum Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 171, pl. 23, 1854. Luerssen, Mitt. Bot. **1**: 163, 377, 1874. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 347, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 428, 1908. (*A. bulbiferum,* Luerssen, Mitt. Bot. **1**: 160?, 1874.)

Asplenium Shuttleworthianum Kunze. Copeland, B. P. Bishop Mus., Bull. **59**: 64, 1929; Bull. **93**: 50, 1932 (an Kunze?).

A large epiphytic, subquadripinnate species, easily distinguished from all other Samoan species by its subdimorphic fronds and especially by the dareoid sori (each ultimate lobe bearing one sorus 1-2 mm. long on the upper side of the unbranched midvein), the outer edge of the entire indusium reaching the margin of the lobe. Large leaves are 60-70 cm. long by 40-45 cm. wide, grass-green and of a somewhat carnose texture, the rachises bearing some red-brown scales. The tertiary pinnules of sterile fronds are not so deeply lobed as the fertile ones, which are dissected into linear lobes 1-1.5 mm. wide.

Apparently common in Samoa and collected by all, but not found in Tutuila and Manua.

Savaii: Olonono, *Vaupel 65* (Kew, W); slope of Mataulanu Lake, epiphyte on tree, 900 m., *Christophersen 863;* above Matavanu, 1,300 m., *Christophersen 2133;* above Salailua, Le To, 750 m., climber in wet forest, *Christophersen 2948.* Upolu: ridge above Malololelei, 700 m., *Christophersen 232.*

Samoa, Tahiti, Fiji.

A. multifidum Brackenridge was perhaps correctly listed as a synonym of *A. Shuttleworthianum* Kunze in Index Filicum, and by Copeland. Not knowing Kunze's species, however, I prefer the well-known name of Brackenridge.

15. Asplenium Powellii Baker, Syn. Fil. 224, 1867. Luerssen, Mitt. Bot. **1**: 164, 377, 1874.

Very likely an extremely dissected form of *A. multifidum,* fully 5-pinnate with the ultimate, fertile lobes hardly over 0.5 mm. wide, but I have seen no real intermediate form; it is thinly herbaceous in texture, quite different from the thick, subcarnose fronds of *A. multilineatum.*

Without locality: *Powell 44* (Kew, type).

Tau: on decayed tree trunk below peak, 500 m., *Garber 723.* Endemic, and very rare.

DIPLAZIUM AND ATHYRIUM

Copeland (B. P. Bishop Mus., Bull. **59**: 52, 1929; Bull. **93**: 42, 1932) unites the old genera *Athyrium* and *Diplazium* into one genus, *Athyrium,* but I cannot follow him in this, because most of the numerous tropical *Diplazia* seem to me to be too different from the type species of *Athyrium* (*A. filix mas*). This genus, even in the sense of Index Filicum, is no doubt an aggregate of more phylogenetically different groups, some of which, I confess, might naturally be united with *Diplazium,* such as the group of *A. sylvaticum* to which the Samoan species *A. oosorum* belongs. I retain it here in *Athyrium,* chiefly

because I am not sure that it is a valid species, and therefore I do not wish to transfer it to *Diplazium,* but I include it in the following key to the other Samoan species, which are genuine *Diplazia.*

KEY TO THE SPECIES OF DIPLAZIUM

Veins free
- Frond simply pinnate-pinnatifid
  - Frond pubescent-paleaceous, never proliferous ..... **1. D. Petersenii.**
  - Frond glabrous, rachis often gemmiferous ..... **2. D. silvaticum.**
- Frond bipinnate with shallowly lobed pinnules
  - Stipe and rachis smooth; lower anterior sorus diplazoid ..... **3. D. dilatatum.**
  - Stipe and rachis spiny; no diplazoid sori ..... **4. D. echinatum.**
- Frond bipinnate with deeply pinnatifid pinnules; smooth ..... **5. D. harpeodes.**
- Frond tripinnate-pinnatifid; sori extremely short ..... **Athyrium oosorum.**

Veins, at least the basal ones, united in pairs
- Frond simply pinnate; stipe usually spiny, rachis gemmiferous ..... **6. D. proliferum.**
- Frond bipinnate-pinnatifid, not spiny nor gemmiferous ..... **7. D. esculentum.**

Genus **DIPLAZIUM** Swartz

1. **Diplazium Petersenii** (Kunze) Christ.

Diplazium congruum Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 141, pl. 18, fig. 2, 1854 (not Rechinger).

Asplenium congruum (Brackenridge) Christ, Engler Bot. Jahrb. **23**: 348, 1897.

Athyrium congruum (Brackenridge) Copeland, B. P. Bishop Mus., Bull. **59**: 52 (description), 1929.

Asplenium japonicum Thunberg. Luerssen, Mitt. Bot. **1**: 166, 381, 1874. Baker, Jour. Bot. **14**: 11, 1876.

Without locality: *Brackenridge* (W, type); *Powell* (Kew); *Whitmee 89* (Kew).

Savaii: near Sili, *Vaupel 297* (Kew, W). Upolu: canyon of Vaisingano River, 500 m., *Christophersen 96.* Tutuila: from *J. G. Veitch* (Kew).

Tropical and subtropical east Asia east to Samoa, south to New Zealand.

I refer to Copeland's description, which fits the Samoan specimens very well, but I do not agree with him in regarding *D. congruum* Brackenridge as a distinct species. The right naming of it is difficult, however. It seems to me by no means different from East Asiatic and Malayan specimens usually called *D. Petersenii* to which *Asplenium lasiopteris* Kunze was referred in Index, but perhaps wrongly because I suspect the genuine *A. Petersenii* from Canton to be *D. japonicum. A. lasiopteris* may be different, or at least a variety to which the Samoan form belongs. From the other Samoan species, it is easily distinguished by the stipe, rachis and costae beneath being clothed with small brown scales and short articulated hairs; the rhizome is creeping with larger scales.

2. **Diplazium silvaticum** (Bory) Swartz var. **bulbiferum** (Brackenridge) C. Christensen.

Diplazium bulbiferum Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 141, pl. 18, fig. 1, 1854.

Athyrium bulbiferum (Brackenridge) Copeland, B. P. Bishop Mus., Bull. **59**: 53 (description), 1929.

Asplenium Brackenridgei Baker, Syn. Fil. 234. Luerssen, Mitt. Bot. **1**: 165, 1874.

Asplenium sylvaticum Presl. Luerssen, Mitt. Bot. **1**: 164, 380, 1874. Christ, Engler Bot. Jahrb. **23**: 348, 1897. (*Diplazium silvaticum* Rechinger, Denkschr. Akad. Wiss. Wien **84**: 430, 1908.)

Diplazium congruum Brackenridge. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 430, 1908 (not Brackenridge).

Without locality: *Powell 239* (Kew).

Savaii: Vaipouli, *Vaupel 200* (Kew, W). Upolu: *Graeffe* (W); *Rechinger 1006, 1395* (V, *D. congruum* Rechinger); Moa Moa Plantation, 200 m., *Eames 144*. Tutuila: reported by *Luerssen*. Manua: reported by *Christ*.

From Africa through tropical and subtropical east Asia east to Samoa.

The Samoan specimens are larger than figured by Brackenridge; the pinnae up to 13 × 2.5-3 cm., incised a fourth or a third with square, truncate toothed lobes, short stalked and with a truncate, somewhat unequal base, of firm texture. The rhizome is not creeping as described by Brackenridge, but decumbent-erect with the fronds clustered at the apex, and clothed with numerous narrow black scales. This form differs slightly from the genuine *D. silvaticum* from the Mascarenes and is often proliferous. The Fijian form of *D. bulbiferum* Brackenridge resembles the Malayan form more, with long stalked, lower pinnae, more unequal sided at base and is on the whole smaller.

3. **Diplazium dilatatum** Blume. C. Christensen, Contr. U. S. Nat. Herb. **26** (6): 302, 1931.

Diplazium maximum (Don) C. Christensen, Index Filicum.

Athyrium maximum (Don) Copeland, B. P. Bishop Mus., Bull. **59**: 54 (description), 1929.

Diplazium speciosum Brackenridge, U. S. Expl. Exp. 1838-42, **16**: 145, 1854 (not Blume).

Diplazium Brackenridgei Moore, Index Fil., 324, 1861.

Asplenium Graeffei Luerssen, Mitt. Bot. **1**: 168, 382, 1874.

Asplenium latifolium Don. Christ, Engler Bot. Jahrb. **23**: 348, 1897.

Diplazium latifolium Don. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 429, 1908. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 199, 1912 (excl. forma *lanutoensis*).

Asplenium sororium Mettenius, Ann. Sci. Nat. IV Bot., **15**: 73, 1861.

Diplazium sororium (Mettenius) Carruthers, Seemann's Fl. Vit. 356, 1869. C. Christensen, Index Suppl. 3.

Athyrium sororium (Mettenius) Copeland, Univ. Calif. Pub. Bot. **14**: 359, 1929.

Without locality: *Brackenridge* (W, type of *D. speciosum*).

Savaii: *Reinecke 156* (Kew, B, W); Olonono, *Vaupel 496* (Kew, W, B). Upolu: *Reinecke 9* (Kew, W); *Rechinger 106, 1000* (V); near Malololelei, 600 m., *Christophersen 217; Hochreutiner 3344* (G).

A common species in tropical and subtropical east Asia, east to Samoa.

Like other large bipinnate *Diplazia,* very variable within its area; it is probably a composite species. In my 1931 paper quoted above, I gave my reasons for using the unquestioned name *dilatatum* for the obscure *maximum* and I can see no essential differences between Blume's species and the Samoan one, which is *D. speciosum* Brackenridge, an invalid name and therefore changed to *D. Brackenridgei* by Moore and later to *A. Graeffei* by Luerssen. The Samoan specimens are identical with a specimen of a pinna at Kew from New Caledonia, Vieillard 1640, the type number of *A. sororium* Mettenius, but collected in 1864 and not in the type locality; thus not a cotype. It agrees perfectly with the original description; the indusium was described as densely ciliate, but it is not truly ciliate, but better described as eroso-lacerate and probably at first entire. Copeland (Univ. Calif. Pub. Bot. **14**: 359, 1929) tried to separate *sororium* from *maximum,* but the New Caledonia specimens, which he considered more like *maximum,* seem to me to be a different species described below.

In Samoa this species may easily be distinguished from others of the genus by its broad pinnules being shallowly lobed only, with the faintly denticulate lobes usually not longer than wide (4-5 mm.). Stipe and rachis not spiny, the texture thin, the sori narrow, upcurved, the basal anterior one diplazioid. Basal scales linear, brown with thick, black, dentate margins; costae beneath, especially at base, with narrow brown scales. If a revision of this intricate group should justify making this Polynesian fern a valid species, its name must be *D. Brackenridgei* Moore.

4. **Diplazium echinatum** C. Christensen, nom. nov. (pl. 2, *B*).

Asplenium Mettenii Fournier, Ann. Sci. Nat. V, **18**: 311, 1873 (non Kuhn 1867).

Asplenium maximum Don. Baker, Jour. Bot. **14**: 344, 1876.

Asplenium latifolium Don, part. Christ, Engler Bot. Jahrb. **23**: 348, 1897.

Diplazium latifolium forma *lanutoënsis* Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 199, 1912.

Rhizomate (repente?) crasso, apice paleis ovatis brunneis in acumen longum linearem nigro-dentatum productis dense vestito. Stipite valido, ca. 8 cm. crasso, sordide stramineo, versus basin decidue paleaceo, sursum spinis nigris, brevibus muricato, 40

cm. vel ultra longo. Lamina ovata, 1 m. longa et fere lata, juvenili gramineo-viridi herbacea matura lutescenti-viridi, in sicco chartacea (in vivo verisimiliter carnosula), glabra, bipinnata; rachi costisque spinis parvis plus minusve asperulis, stramineis, costis versus basin subtus leviter furfuraceo-paleaceis. Pinnis remotis, breviter (1-2 cm.) stipitatis, subdeltoideo-oblongis, basalibus reductis, maximis 45-50 cm. longis, 20 cm. latis, apice deltoideo acuminato acuminatis. Pinnulis liberis ad 20-jugis, subsessilibus vel inferioribus breve petiolatis, 5-3 cm. inter se remotis, basalibus maximis, ad 15 cm. longis 3 cm. latis, basi truncatis, acuminatis, maximis serrulato-lobatis, lobis 6-7 mm. longis latisque (rarius majoribus, interdum multo minoribus) postice rotundatis antice rectis et antrorsim acutis, subintegris vel leviter denticulatis. Venis 7-8-jugis, simplicibus, oblique adscendentibus, basalibus subarcuatis, posteriori sinum attingente anteriori infra sinum terminante vel interdum cum posteriori unita, omnibus soriferis. Soris maturis crassis, subcontiguis, marginem non attingentibus, basali anteriori subcurvato ceteris rectis; indusio angusto, mox evanidis, nullis diplazioideis. Sporis ellipsoideis cum perisporio.

Without locality: *Whitmee 88* (Kew).

Upolu: ridge above Malololelei, 700 m., *Christophersen 190, 214* (described specimen), *959*. The following, doubtless, belong here: *Reinecke 9,* reported by *Christ,* but not the specimen of that number in W., *Hochreutiner 3292* (G).

Samoa, New Caledonia (*Franc 34 bis,* Herbarium C. Christensen), Aneiteum reported by *Fournier.*

In my opinion a very distinct species, in its whole appearance intermediate between *D. proliferum* and *D. dilatatum,* approaching the former in the spiny stipe and rachises, somewhat carnose texture and thick sori and especially by the tendency of the basal veins to anastomose, still more like the latter in being bipinnate with similarly shallowly lobed pinnules, but larger in all parts, spiny, thicker texture, different scales (?). I have found no diplazioid sorus.

5. Diplazium harpeodes Moore.

Diplazium falcatum Brackenridge, U. S. Expl. Exp. 1838-42, **16**: 143, 1854. Luerssen, Mitt. Bot. **1**: 168, 382, 1874 (not Don).

Diplazium membranaceum Mettenius. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 430, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 125, 1924.

Diplazium arborescens (Bory) Swartz. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 143, 1854.

Asplenium arborescens (Bory) Mettenius. Luerssen, Mitt. Bot. **1**: 167, 381, 1874.

Asplenium membranaceum Mettenius. Christ, Engler Bot. Jahrb. **23**: 348, 1897.

Asplenium polyanthes Solander. Baker, Syn. Fil. 492, 1874.

Diplazium polyanthos (Solander) C. Christensen, Index. Brown, B. P. Bishop Mus., Bull. **89**: 55, pl. 10, 1931.

Athyrium polyanthes (Solander) Copeland, B. P. Bishop Mus., Bull. **93**: 44, 1932.

Athyrium tripinnatifidum Copeland, B. P. Bishop Mus., Bull. **59**: 54(?), 1929.

A large bipinnate-pinnatifid, glabrous and naked, herbaceous species, when full-grown with an epigaeous stem 0.51 m. high (Christophersen); the thick stipe towards base with several dull black, thick, lanceolate-acuminate patent scales up to 3 cm. long by 2 mm. wide at base; stipe and rachises smooth. Pinnae up to 30 cm. long, the pinnules 8-10 × 1.5-2.5 cm., deeply (⅝ to ¾) pinnatifid, with oblong, oblique, or subtriangular lobes, which are about 4 mm. wide at base, bluntly rounded on the posterior side, antrorsely acute and usually sharply denticulate (see below); veins simple, 6-7-jugate; sori straight, oblique, usually extending from midrib to margin; the basal anterior one more curved and diplazioid; indusia red-brown, narrow, entire.

Without locality: *Powell* (W); *Safford 26, 27, 28, 954, 955* (W).

Savaii: Maugaloa, *Vaupel 620; Rechinger 1056, 1093* (V); near Mataulanu Lake, 750 m., *Christophersen 868, 880;* Le To, above Salailua, 750 m., *Christophersen 2915.* Upolu: *Reinecke 102 b* (W); *Rechinger 712, 1247.* Tutuila: *Brackenridge* (W, type of *D. falcatum*); *Setchell 204.*

Polynesia: Fiji east to Marquesas and Pitcairn I.

D. falcatum Brackenridge renamed *D. harpeodes* by Moore, was hitherto an unknown species. It was based on a small leaf whose identity with the large arborescent Polynesian fern known as *D. membranaceum* is proved by more specimens, especially Setchell 204, the apical portion of which exactly matches the upper half of *D. falcatum,* while a pair of lower pinnae is identical with all full grown specimens of *D. membranaceum.* Such immature though fertile fronds are frequently met with in these large *Diplazia.* The actual type of *D. membranaceum* Mettenius from Pitcairn (Cuming 1389) is very slightly different from the Samoan form, and the Fijian *Athyrium tripinnatifidum* Copeland is possibly the same. Copeland considers *D. polyanthes* from Tahiti as this species. The type specimen (British Museum of Natural History) differs from *D. membranaceum* in its narrower pinnules with entire lobes, but I possess some specimens of the same collection (N. J. Andersson) from Tahiti which are typical *polyanthes,* others *membranaceum* (*Asplenium Arnottii* Baker, Drake, Fl. Polyn. Française, 296, 1893), both forms occurring in Samoa. Christophersen 880 is thus typical *polyanthes,* superficially rather different from the larger *membranaceum* by thin texture, pinnules 10-12 mm. wide only, the short entire or subentire lobes with only 3-4 pairs of veins. I am rather sure, however, that it belongs to the same species as the other Samoan specimens, possibly a form or variety. *D. latifolium* forma *fiamoiensis* Christ (Conserv. Jard. bot. Genève, Ann. **15-16**: 199, 1912) seems to be this species.

6. **Diplazium proliferum** (Lamarck) Thouars. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 200, 1912. Setchell, Dept. Marine Biol. Carnegie Inst., Wash. **20**: 125, 1924.

Asplenium proliferum Lamarck. Luerssen, Mitt. Bot. **1**: 168, 382, 1874.
Asplenium decussatum Swartz. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 349, 1897.
Diplazium decussatum Swartz. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 430, 1908.
Athyrium accedens (Blume) Milde. Copeland, B. P. Bishop Mus., Bull. **59**: 55, 1929.

Apparently common and found by most collectors.

Savaii: Salailua, 350 m., *Bryan 159; Vaupel 21* (W). Upolu: *Parks 16427* (W); near Malololelei, 600 m., *Christophersen 216*. Tutuila: near Pago Pago and Utulei, *McMullin 15, 16* (W); base of Le Pioa, 60-100 m., *Garber 836*.

Tropical Africa, Asia and Polynesia, east to Samoa, often cultivated.

Rather variable. A form with bulbils in nearly all the axils of the pinnae, slightly asperous or smooth stipe and rachis, and from subentire to coarsely serrate pinnae may be regarded as typical. Two other forms occur, a second form with rather densely spiny stipe and rachis and rarely proliferous; this is *D. accedens* Blume. The third form is considerably larger, the pinnae deeply pinnatifid or subpinnate at the base with the veins anastomosing in the segments. This corresponds to *Digrammaria robusta* Fée, described from a Reunion specimen. All are no doubt forms of one species. Copeland uses the name *Athyrium accedens* Milde, as far as I understand, not because he considers *D. accedens* Blume different from *D. proliferum*, but because the specific name is invalid in *Athyrium*.

7. Diplazium esculentum (Retzius) Swartz.
Asplenium esculentum Presl. Luerssen, Mitt. Bot. **1**: 170, 382, 1874. Baker, Jour. Bot. **14**: 11, 1876. Christ, Engler Bot. Jahrb. **23**: 349, 1897.
Athyrium esculentum (Retzius) Copeland, B. P. Bishop Mus., Bull. **59**: 55, 1929, description.
Diplazium latifolium Don, part. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 429, 1908.

Without locality: *Powell 62; Whitmee 86* (Kew); *Safford 22 a, 978* (W). Upolu: *Reinecke 106* (Kew, W); *Rechinger 1248*.

Tropical Asia, where common, west to Samoa where it becomes rare.

Genus **ATHYRIUM** Roth

Athyrium oosorum (Baker) Christ, Engler Bot. Jahrb. **23**: 349, 1897.
Asplenium oosorum Baker, Jour. Bot. **14**: 343, 1876.
Dryopteris sandwicense (Hooker et Arnott) C. Christensen. Lauterbach, Engler Bot. Jahrb. **41**: 219, 1908.

Large, tripinnate-pinnatifid, dark green, herbaceous, glabrous, costae and costules beneath furnished with some brown, linear, easily abraded scales. Stipe strong, 50 cm. or more long, dark, pinnae 40-50 × 15 cm., stipitate, secondary pinnules about 10 × 3 cm., petiolate, distant, alternate, truncate at base, oblong, acuminate, the tertiary ones about 15 × 4 mm., obtuse or subacute, adnate to the costule or the lower of large pinnae free and sometimes petiolulate; all incised to about the middle with oblique, truncate or subacute, entire or faintly denticulate lobes. Veins usually unifurcate in the lobes, soriferous below the furcation. Sori very short, at best 1 mm. long, many diplazioid; indusia broadly adnate to the back of the vein, often blackish with lighter free flaps at either side of the vein or one-sided, early falling.

Without locality: *Whitmee 213* (Kew, type); *Vaupel 461* (B, W).

Savaii: Le Paega, *Reinecke 170* (reported by Christ) above Letui, 800-900 m., *Christophersen 770,* above Salailua, 1,400 m., *Christophersen 3101.* Upolu: "Centralkamm", *Reinecke* and *Funk, s.n.* (W). Endemic (see below).

As described above, I am not sure that this is a valid species. It is extremely like *A. sylvaticum* (Blume) Milde from Malaya and Aneiteum and probably only a large form of it with very short sori. I have also specimens from Hawaii named *Diplazium sandwichianum* (Presl) Diels, which are very nearly the same.

Genus **DIPLAZIOPSIS** C. Christensen

Leaf simply impari-pinnate with oblong-linear, acuminate, entire pinnae, about 15 × 2.5-3 cm., grass-green, herbaceous and practically naked and glabrous. Veins forked at or near the base with the anterior branch soriferous, the branches united about midway between costa and margin thus forming a row of elongated costal areoles, outside of which they form a single or double row of smaller angular areoles. Sori linear, near the costa, oblique and reaching about halfway to the margin; indusium brown, fixed at both sides of the fertile vein and at maturity rupturing longitudinally (allantodioid sori); no diplazioid sori observed in Samoan specimens.

In his later papers, Copeland merges this genus with *Athyrium* (including *Diplazium*) and I grant that the reticulate venation is hardly sufficient for its segregation, but this combined with the allantodioid sori makes it as good a genus as many other fern genera.

All forms belonging here may be referred to a single species, *Diplaziopsis javanica* (Blume) C. Christensen.

Diplaziopsis javanica (Blume) C. Christensen.

Allantodia Brunoniana Wallich. Baker, Jour. Bot. **14**: 344, 1876. Christ, Engler Bot. Jahrb. **23**: 349, 1897.

Athyrium javanicum (Blume) Copeland, B. P. Bishop Mus., Bull. **59**: 55, 1929; Bull. **93**: 45, 1932.

Without locality: *Whitmee 184* (Kew).

Savaii: *Reinecke 169* (Kew, W); Pula, *Vaupel 440* (W); above Matavanu, 1,300 m., *Christophersen 2181;* Le To above Salailua, 750 m., *Christophersen 2902.* Upolu: *Betche* (reported by *Christ*).

Apparently a rare fern in Samoa. The specimens agree as a whole with

Asiatic ones; the pinnae are perhaps proportionally longer and narrower and more acuminate, the costal areoles more elongated.

Tropical Asia and Polynesia (Tahiti, Samoa, Fiji, New Caledonia).

Genus **DRYOPTERIS** Adanson

Copeland, B. P. Bishop Mus., Bull. **59**: 39, 1929.

This genus is here taken in the wide sense of Index Filicum. In my monograph of the American species I divided it into a number of subgenera, most of which are very natural genera. The Samoan species belong to five of these subgenera, the characters of which are not used in the following artificial key, but the arrangement in the descriptive part is natural, namely such that species

nos. 1- 8 belong to the subgenus (genus) Thelypteris (Lastrea)
nos. 9-21 belong to the subgenus (genus) Cyclosorus
nos. 22-23 belong to the subgenus (genus) Eudryopteris
nos. 24-25 belong to the subgenus (genus) Ctenitis
nos. 26-27 belong to the subgenus (genus) Parapolystichum

I am not quite satisfied with my treatment of this difficult genus. Many of the specimens examined are incomplete and usually without rhizome, and many of the defined species show considerable variation; it is difficult to state with certainty which of the discriminating characters are stable, and it is very probable that the number of included species is too large. Another difficulty is to prove whether the "endemic" species is identical with or merely a form of another species described earlier from other Polynesian islands.

Key to the Species of Dryopteris

Veins free
  Lamina bipinnatifid
    Veins not reaching the margin; stipe and rachis with numerous, narrow patent scales, hairs none ..... **22. D. hirtipes.**
    Veins reaching the margin; lamina more or less pubescent with simple gray hairs at least on the costae above, scales usually confined to the rhizome
      Basal veins both running to the margin above the bottom of the sinus; lamina not attenuate below
        Stipe when young with many scales; lamina blackish green, the pinnae 4-6 cm. long ..... **1. D. pubirachis.**
        Stipe without scales, pinnae 10-11 cm ..... **2. D. savaiensis.**
      Anterior basal vein running to bottom of sinus
        Lamina herbaceous, grass green, attenuate below ..... **3. D. Harveyi.**
        Lamina subcoriaceous, dark green, reduced pinnae usually absent
          Smaller species with equal-sided pinnae about 1 cm. broad ..... **4. D. pycnosora.**
          Larger pinnae 2-3 cm. broad, decidedly unequal-sided by the lower basiscopic segments being gradually shortened toward rachis ..... **5. D. Brackenridgei.**
  Lamina bipinnate-pinnatifid to decompound
    Bipinnate-pinnatifid, herbaceous, all ribs with slender, gray needle hairs; exindusiate. Pinnules equal sided at base
      Ribs without scales
        Needle hairs numerous, long ..... **7. D. uliginosa.**

Needle hairs very few and short.....**6. D. persimilis.**
Ribs with narrow, light-brown, ciliate scales.....**8. D. leucolepis.**
Without such hairs
Pinnules equal-sided at base; axes with few or many scales
Without hairs of any kind, scales thin, light colored.....**23. D. arborescens.**
Costae and costules above rufo-tomentose by intestiniform hairs (pluricellular with constrictions between the cells); basal pinnae produced on lower side
Bipinnate-pinnatifid with broad decurrent segments; scales very few, veins forked.....**24. D. dissecta.**
Tri-quadripinnate-pinnatifid, rachis and costae densely scaly; veins simple.....**25. D. samoensis.**
Pinnules unequal-sided at base, cuneate at the posterior, truncate and usually produced at the anterior side
Bipinnate-pinnatifid, herbaceous, without scales and glandular hairs.....
.....**26. D. decomposita.**
4-5-pinnate, papyraceous, subcoriaceous, axes with small scales and veins with ferrugineous or yellow cylindrical hairs.....**27. D. davallioides.**
1-6 lower pairs of veins united into a vein running to the sinus; bipinnatifid species (*Cyclosorus*)
Basal pair of pinnae not or slightly reduced; pinnae seldom over 1.5 cm. wide; one pair of veins united; sori indusiate, rhizome wide-creeping
Sori supramedial; subglabrous or ribs only pubescent; segments usually falcate
Without scales and glands on the ribs beneath; the lower pinnae sometimes somewhat shortened.....**18. D. subjuncta.**
With small scales and glands; no reduced pinnae.....**9. D. gongylodes.**
Sori medial; frond downy pubescent throughout; no scales.....**10. D. parasitica.**
Basal pinnae gradually or abruptly reduced to auricles or abortive, appearing as tubercles along the stipe
Sori subcostular or inframedial; fronds herbaceous, fascicled on an erect rhizome; 3-4 (1½-2 pairs) united veins
8-20 pairs of reduced pinnae, many auriculiform; frond light or grass green; sori rather large
Rachis and costae villous, up to 20 pairs of auricles; exindusiate.....
.....**13. D. Hochreutineri.**
Subglabrous, indusiate, up to 10 pairs of auricles
Pinnae 15-18 × 1.5-2 cm.....**14. D. transversaria.**
Pinnae up to 35 × 3-4 cm.....**15. D. Vaupelii.**
1-2 (3) pairs of abruptly reduced auricles, dark green; sori small....**16. D. Bryani.**
Sori medial (see also *D. parasitica*); rhizome erect
Practically glabrous; exindusiate; small species.....**11. D. Christophersenii.**
Pubescent
Indusia pilose; reduced pinnae few.....**12. D. nymphalis.**
Exindusiate?; numerous auricles.....**13. D. Hochreutineri.**
Sori supramedial
Sporangia setose; one pair of veins united, but several connivent to sinus.....
.....**19. D. invisa.**
Sporangia glabrous
One pair of united veins
8-9 pairs of veins; few somewhat reduced pinnae, indusiate..**18. D. subjuncta.**
14-15 pairs of veins; exindusiate; up to 15 pairs of wholly abortive tuberculiform pinnae; rachis scaly.....**17. D. Reineckei.**
4-6 pairs of united veins; lowest reduced pinnae tuberculiform
Indusiate; coriaceous and often glandulose.....**20. D. unita.**
Exindusiate, firmly herbaceous.....**21. D. subspinosa.**

1. Dryopteris pubirachis (Baker) C. Christensen.

Nephrodium pubirachis Baker, Jour. Bot. **14**: 344, 1876.

Dryopteris Mataanae Brause, Notizbl. Bot. Gart. Berlin-Dahlem **8**: 139, 1922.

Rhizome decumbent-erect or erect, prolongated and up to 15 cm. high, with the leaves tufted at its top, clothed with brown, lanceolate-acuminate, slightly lacerate-fimbriate scales. Stipes black or blackish brown, 15-20 cm. long, rather densely pubescent with short grayish brown, crisped and soft hairs, and when young with numerous light brown, ovate or lanceolate-linear, thin scales which soon fall. Lamina lanceolate, 20-25 × 10-12 cm., without basal reduced pinnae, blackish when dried, firmly herbaceous to subpapyraceous, bipinnatifid; rachis, like the stipe pubescent and deciduously paleaceous. Pinnae in 10-12 pairs, subsessile (longest petiole of the lower ones 1 mm. long) 5-6 ×1.2-1.8 cm., short acuminate, the lower ones usually reflexed, pinnatifid nearly to the costa into slightly oblique, entire or crenate-dentate, subacute segments 2-3 mm. broad, the basal ones sometimes free and mostly somewhat shortened, especially in the lower pinnae. Costae and costules more or less densely gray-pubescent on both sides, the under surface besides with globose sessile, dull red large glands which are found especially on the costae and costules. Veins 6-7-jugate, simple and free. Sori about medial, furnished with large persistent, reniform, sometimes subathyrioid, brown glandular indusia.

Without locality: *Whitmee 202* (type, Kew); *Powell 211* (Kew).

Savaii: *Mataana, Vaupel 460* (type of *D. mataanae*); Tuisivi Range, 1,600-1,700 m., on ground in forest, *Christophersen 785;* above Matavanu, 1,500 m., *Christophersen 2214, 2231.*

Samoa, Fiji (Tahiti?).

Not easily confused with any other Samoan species, but it may not be specifically different from the Philippine *D. viscosa* (J. Smith) O. Kuntze, to which Copeland referred specimens from Fiji and Tahiti (B. P. Bishop Mus., Bull. **59**: 41, 1929; Bull. **93**: 37, 1932). I believe I have correctly named A. C. Smith 1669 from Fiji *D. pubirachis* (B. P. Bishop Mus. Bull. **141**: 6, 1936), in spite of the light-colored stipes and rachis, and the less glandular ribs.

2. Dryopteris savaiensis (Baker) C. Christensen, Index Fil.

Nephrodium savaiense Baker, Ann. Bot. **5**: 318, 1891 (not *Aspidium savaiiense* Christ, Engler Bot. Jahrb. **23**: 350, 1897).

Rhizome short creeping with dull brown lanceolate scales. Stipe 25 cm. long, brownish, shortly pubescent. Lamina ovate-lanceolate, 40 × 20 cm., without auricles or reduced pinnae below, firmly herbaceous, dark green, bipinnatifid with a subdistinct end-pinna; rachis rather densely and shortly gray hairy. Pinnae sessile at distances of 2-2.5 cm., with aërophores tuberculiform when dried, at the base, the largest 11 × 2.5-3 cm., short acuminate, pinnatifid to a wing about 1 mm. wide, the basal ones not reduced, reflexed; segments ligulate, entire, oblique, 3.5 mm. wide at base, acute or subobtuse, both of the basal pair of the lower pinnae considerably reduced; costae at both sides and costules beneath with short, stiff hairs. Veins 10-12-jugate, simple, the two basal ones running to the margin above sinus. Sori a little inframedial, small with few sporangia furnished with some deciduous, stiff, whitish bristles, indusia subpersistent with stiff hairs.

Without locality: *Powell 183* (Kew, type, only specimen seen). Endemic.

3. **Dryopteris Harveyi** (Mettenius) O. Kuntze. Setchell, Dept. Marine Biol. Carnegie Inst. **20**: 128, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 41, 1929.

Aspidium patens Swartz. Luerssen, Mitt. Bot. **1**: 187, 1874, part? Christ, Engler Bot. Jahrb. **23**: 352, 1897.

Aspidium molle var. *patens* (Swartz) Luerssen, Mitt. Bot. **1**: 387, 1874.

Aspidium calcaratum Blume. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 436, 1908.

Without locality: *Powell 75* part (Kew) *261* (B, Kew).

Savaii: Matautu, *Vaupel 92* (B, W); *Rechinger 1126* (V); Salailua-Lataiuta, 50 m., *Christophersen 3021*. Apolima: *Rechinger 332* (V). Upolu: *Graeffe 1094* (B); *Betche* (CC); *Safford 20*, part (W); *Rechinger 115* (V); Vailima, *Eames 102*. Tutuila: *Setchell 25* (W); *Stearns* (W); *McMullin 2* (W).

Fiji, Samoa, Aneiteum, and reported from the Marquesas.

Though very variable as to size (the largest specimen seen measures: stipe 40 cm., lamina 90 × 30 cm.) and density of pubescence, this species is easily distinguished from the few other bipinnatifid Samoan species of the subgenus *Thelypteris* by its long creeping rhizome, equal-sided, acuminate pinnae, the 1-3 lower pairs of which are more or less reduced but never to mere auricles, the largest ones up to 15 × 2 cm. and pinnatifid nearly to the costa into oblique and rather distant, acute or obtuse segments not more than 2 mm. wide, the simple and free veins in 9-11 pairs, distant, the basal acroscopic one runs to the sinus or to the margin a little above its bottom, the basiscopic one much upcurved and reaches the margin far from the bottom; sori usually confined to the upper veins, supramedial and furnished with persistent, reniform indusia. The lamina is herbaceous, grass green and usually furnished with few or many whitish, rather long hairs on the costae and veins on both sides, sometimes also finely downy, the under surface of some specimens with sessile glands, the rachis glabrous or downy.

4. **Dryopteris pycnosora,** sp. nov.

Nephrodium calcaratum Hooker. Powell, Jour. Bot. **6**: 340, 1868.

Aspidium calcaratum Blume. Luerssen, Mitt. Bot. **1**: 177, 385, 1874 (not Blume).

Thelypteris rhizomate? Stipite 35 cm. longo, stramineo basi nigrescente, et sparse paleaceo-puberulo. Lamina lanceolata, 30-35 cm. longa, 10-12 cm. lata, papyracea, bipinnatifida; rachi dense villosa. Pinnis sessilibus, alternis, anguste lanceolatis, 8-9 cm. longis 8-10 mm. latis, acuminatis, inferioribus paulo versus basin angustatis, reductis in specim. Betchei nullis, in specim. Powellii 2-jugis, auriculiformibus, normalibus ad alam 1 mm. latam pinnatifidis; lobis obliquis, integris, obtusis vel antrorsim acutis, 1.5 mm. latis; venis 6-7-jugis, liberis, simplicibus, basali acroscopica ad sinum connivente; pagina superiori ad costas densissime, ad costulas venas marginesque pilis longis sparsius hirta, inferiori ad costas glabra, ad venas pilis longis nonnullis instructa, ad parenchyma glandulis (?) globosis, sulfureis, opacis sat dense onusta. Soris omnes venas occupantibus,

indusiis magnis, persistentibus, reniformibus, brunneis, pilis nonnullis hirtis, sese contiguis et paginam totam lobi impleentibus. Sporis glabris.

Without locality. *In sylvaticis ad littora maris, Betche,* Dec. 14, 1879 (type, Herbarium C. Christensen); *Powell 90* (W).

Although having seen only two specimens without rhizome of this peculiar fern, I dare to describe it as new. It is closely related to *D. Harveyi* but apparently well-marked by its narrow, more coriaceous pinnae, the very large, persistent indusia which cover the whole surface, and the peculiar globose, light yellow glandlike excrescences on the under side. I am not quite sure of their nature and have seen none similar in any other species.

5. Dryopteris Brackenridgei (Mettenius) O. Kuntze. Copeland, B. P. Bishop Mus., Bull. **59**: 41, 1929; Bull. **93**: 37, 1932.

Aspidium Brackenridgii Mettenius. Luerssen, Mitt. Bot. **1**: 176, 384, 1874.

Nephrodium Brackenridgei Baker, Jour. Bot. **14**: 11, 1876.

Lastrea attenuata Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 193, pl. 26, fig. 2, 1854.

Nephrodium attenuatum (Brackenridge) Powell, Jour. Bot. **6**: 340, 1868.

Nephrodium inaequilaterum Baker. Powell, Jour. Bot. **6**: 340, 1868 (= *N. inaequilaterale* Baker, Synopsis Filicum, ed. **1**: 454, 1868).

Aspidium inaequilaterale Luerssen, Mitt. Bot. **1**: 181, 384, 1874.

Aspidium Prenticei Christ, Engler Bot. Jahrb. **23**: 352, 1897 [not *Dryopteris Prenticei* (Carruthers) Kuntze].

Without locality: *Powell 114* (B, Kew); *Whitmee 110* (Kew).

Savaii: Tuafa, *Reinecke 106* (B); above Sili, river bank, 400 m., *Christophersen 3159.* Tutuila: Pago Pago, *Wilder.*

Fiji, Samoa, Tahiti, Aneiteum(?).

Easily recognized by its large, coriaceous fronds, blackish when dried, with the lower basiscopical segments characteristically reduced. The acroscopic basal vein runs to the sinus. It is variable as to the position of the sori; in the type and in most Samoan specimens they are a little inframedial, in some from Fiji costular as described by Copeland, and in Christophersen 3159 they are distinctly supramedial. That specimen differs besides by a pair of much reduced basal pinnae. Reinecke 106 (*A. Prenticei* Christ) is certainly a sterile frond of this species.

6. Dryopteris persimilis (Baker) C. Christensen, Index Fil.

Polypodium persimile Baker, Jour. Bot. **14**: 344, 1876.

Frond herbaceous, grass green with stramineous rachises, bipinnate-pinnatifid. Pinnae opposite, sessile, oblong-acuminate, about 20 × 8 cm.; pinnules sessile or mostly adnate and the upper ones connected by a wing to costa, spreading, about 1 cm. wide, short acuminate, pinnatifid nearly to the costules into ligulate, broadly obtuse and repand-crenate segments 3 mm. wide; rachis, costae and costules beneath sparsely pubescent with short, spreading, whitish needle-hairs, the underside with scattered, minute shining glands. Veins about in 4 pairs in the lobes, some furcate. Sori near the margin, exindusiate.

Without locality: *Whitmee 204* (type, Kew). Endemic.

Baker compared this with *D. Boryana,* which it certainly resembles in color, texture and cutting, but its alliance is not with that species, but with *D. uliginosa,* which is proved by the presence of needle-hairs. The only specimen seen does not enable me to decide whether it is really specifically different from *D. uliginosa.*

7. **Dryopteris uliginosa** (Kunze) C. Christensen, Index Fil., Suppl. **3**: 100, 1934.

Polypodium nemorale Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 16, 1854.

Nephrodium tenericaule Hooker. Powell, Jour. Bot. **6**: 340, 1868.

Aspidium setigerum Kuhn. Luerssen, Mitt. Bot. **1**: 190, 385, 1874. Christ, Engler Bot. Jahrb. **23**: 352, 1897 (excl. var.). Rechinger, Denkschr. Akad. Wiss. Wien **84**: 436, 1908.

Dryopteris setigera (Blume) O. Kuntze. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 128, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 43, 1929 (without description); Bull. **93**: 36, 1932.

Fronds large, deltoid-ovate, herbaceous, bipinnate-pinnatifid or subtripinnate; stipe and rachis stramineous, glabrous; largest pinnae up to 30 × 10 cm. but usually smaller, the basal ones equal sided; pinnules incised nearly to the costules into oblong, 1.5-2 mm. broad and more or less deeply dentate lobes; costae, costules and veins beneath with long scattered, spreading whitish needle-hairs. Sori small, exindusiate.

Upolu: Apia, *Rechinger 913* (V). Tutuila: *Brackenridge* (W, type of *P. nemorale*); *McMullin 29* (W); *Dumas 6* (P).

Subtropics and tropics of the Old World and an escape from cultivation in several places in tropical America.

8. **Dryopteris leucolepis** (Presl) Maxon. Copeland, B. P. Bishop Mus., Bull. **59**: 43, 1929; Bull. **93**: 36, 1932.

Aspidium setigerum var. *ornatum* (Wallich) Christ, Engler Bot. Jahrb. **23**: 352, 1897.

Tau: *Garber 667* (*oli oli*).

Malaya, Tonkin, Melanesia, Fiji, Samoa, Rarotonga, Tahiti, Austral Islands (*D. setigera,* Brown: B. P. Bishop Mus., Bull. **89**: 30, 1931).

On the whole, like *D. uliginosa* but firmer in texture, stipe at base with a thick tuft of pale brown, linear, ciliate scales, and similar smaller ones occur throughout on all ribs beneath, the hairs shorter, softer and more numerous; margins of ultimate lobes usually reflexed.

9. **Dryopteris gongylodes** (Schkuhr) O. Kuntze. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 187, 1912. Copeland, B. P. Bishop Mus., Bull. **59**: 45, 1929; Bull. **93**: 38, 1932.

Nephrodium unitum R. Brown. Baker, Jour. Bot. **14**: 11, 1876.

Aspidium unitum (R. Brown) Mettenius. Christ, Engler Bot. Jahrb. **23**: 351, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 434, 1908.

Without locality: *Whitmee* (Kew).

Savaii: Matautu, *Vaupel 210* (B, Kew, W); Fagamalo, *Christophersen 2513*. Upolu: *Reinecke 49* (B, Kew).

Dryopteris gongylodes var. monstr. **cristata.**

All pinnae cristately dissected at apex.

Without locality: *Powell 208; Whitmee 97.*

Pantropical, usually in wet places.

Easily recognized by the wide-creeping rhizome, lack of auriculiform and reduced basal pinnae and the presence of some light brown scales on the costae beneath. Pinnae about 1 cm. wide, segments triangular, acute with one pair of united veins; sori supramedial.

10. Dryopteris parasitica (Linnaeus) O. Kuntze, variety.

Rhizome very long creeping with the fronds at distances of 3-6 cm. Stipe very long (30-45 cm.), the lamina ovate-lanceolate, 35-50 × 20-25 cm., light green, herbaceous, more or less densely pubescent with mostly short hairs throughout, bipinnatifid. Pinnae sessile, 10-12 × 1.5-2 cm., acuminate, the basal ones not or slightly shortened, usually reflexed, incised to a wing 2 mm. wide into oblique, entire, obtuse or subacute segments 3 mm. wide. Veins 8-10-jugate, those of the basal pair only united, furnished beneath with few or many cylindrical, yellow glandular hairs. Sori medial, rather large, with persistent, hairy indusia, on all veins or didymosorous (on the united veins only). Sporangia glabrous.

Without locality: *Powell 235, 253* (Kew).

Savaii: Paia, *Vaupel 634 a* (glabrescent form), *636 a* (W). Manua: Ofu, *Reinecke 10 d* (B).

Type from east and tropical Asia, distribution in Polynesia unknown.

I cannot distinguish detached fronds from the genuine east Asiatic *D. parasitica.* Like it, they show the same variation in density of pubescence, in number of sori (polysorous or didymosorous) and in the characteristic thick, cylindrical yellow glands, which may be lacking. I have, however, seen no Asiatic specimen with such long, horizontally creeping rhizomes, which in one specimen is 25 cm. long. It is possible that this Samoan form should be referred to *D. procurrens* (Mettenius) O. Kuntze, but I believe this to be a variety of *parasitica.*

Under the names *Nephrodium molle* (Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 186, 1854; Powell, Jour. Bot. **6**: 340, 1868; Baker, Jour. Bot. **14**: 11, 1876) and *Aspidium molle* (Luerssen, Mitt. Bot. **1**: 184, 386, 1874; Christ, Engler Bot. Jahrb. **23**: 351, 1897; Rechinger, Denkschr. Akad. Wiss. Wien **84**: 433, 1908) have been listed a number of specimens which belong partly to *D. parasitica,* partly to *D. nymphalis* and, probably, to other species.

11. Dryopteris Christophersenii, sp. nov. (pl. 3, *A*).

Nephrodium Haenkeanum Presl? Baker, Jour. Bot. **14**: 344, 1876.

Cyclosorus rhizomate decumbente, stipitibus fasciculatis, stramineis, ad auriculas infimas 6-8 cm. longis, glabris. Lamina lanceolata, versus basin subgradatim angustata, 30-50 cm. longa, 10-15 cm. lata, gramineo-viridi, herbacea, bipinnatifida; rachi albido-straminea, superne pubescente inferne glaberrima. Pinnis sessilibus (aerophoris nullis), alternis, maximis 8-10 cm. longis, 1-1.2 cm. latis, acuminatis, infimis in auriculas subgradatum reductis, ad medium pinnatifidis; segmentis 3 mm. latis, integris, antrorsim subacutis; venis 6-jugis, iis infimi paris unitis secundi paris ad sinum conniventibus; paginis utrisque praeter costas superne sparse strigosas glaberrimis vel inferiori hinc inde pilis perpaucis longis albidis instructa. Soris distincte medialibus, parvis, exindusiatis, sporangiis glabris.

Without locality: *Whitmee 211* (Kew).

Upolu: canyon of Vaisingano River near Malololelei on rocks, 500 m., Aug. 6, 1929, *Christophersen 79* (type). Savaii: river bank above Sili, 400 m., *Christophersen 3176.*

A rather small species, in general aspect closely resembling *D. dentata* (Forskål) C. Christensen. Compared with other Samoan species it is intermediate between *D. nymphalis* and *D. transversaria,* differing from *D. nymphalis* in its practically glabrous fronds and the many reduced pinnae, from *D. transversaria* in its much smaller size and especially in the medial sori, and from both by the lack of indusia.

12. Dryopteris nymphalis (Forster) Copeland, B. P. Bishop Mus., Bull. **59**: 46, 1929; Bull. **93**: 39, 1932.

Rhizome described as erect with fascicled leaves, the stipe rarely exceeding 15 cm., the lamina more or less narrowed below with 2-3 pairs of shortened but not auriculiform pinna, the lower 3-4 veins united; all other characters hardly different from *D. parasitica;* the differences mentioned (rhizome excepted) are not very reliable or stable.

Upolu: *Reinecke 10 b, c* (B). Manua: Ofu, *Reinecke 10 d* (B).

Widely dispersed in Polynesia, south to New Zealand, and very similar forms in tropical Asia [*D. subpubescens* (Blume) C. Christensen].

13. Dryopteris Hochreutineri Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 188, 1912.

Aspidium hispidulum Decaisne. Christ, Engler Bot. Jahrb. **23**: 351, 1897 (excl. syn.). Rechinger, Denkschr. Akad. Wiss. Wien **84**: 434, figs. 10-11, 1908.

Fronds clustered on an erect rhizome, the stipe to lowest auricles not more than 6-8 cm. long, strong, densely covered with pure brown, ovate-acuminate, thin and broad entire scales as is the lower portion of the rachis. Lamina up to 1 m. or more long, by 40 cm. wide, light green, herbaceous, bipinnatifid, below abruptly narrowed with numerous (20 or more pairs) close abbreviated pinnae, which are either all of about the same size (2-3 cm. long) or gradually dwindling downward into mere auricles. Developed pinnae close, subcontiguous, sessile, alternate, the lower ones deflexed, the upper horizontal, linear-oblong, up to 20 cm. long by 2-2.5 cm. wide, acuminate, pinnatifid into a wing 2 mm. wide; segments numerous, rather close, oblique, oblong, entire, rounded obtuse or subacute, 3 mm.

wide; veins simple, 11-13-jugate, the basal pair united, the following connivent to sinus. Rachis, costae and veins on both sides softly pubescent with long, whitish, patent hairs, especially underneath; the under surface glutinose by sessile, small glands. Sori inframedial to medial, apparently exindusiate, often confined to the lowest veins; sporangia glabrous.

Upolu: *Betche 148* (CC), Lanutoo, 700 m., *Hochreutiner 3286* (type, G); *Rechinger 727, 738, 739* (V). Endemic.

Formerly with doubt referred to the Malayan *D. hispidula* (Decaisne) O. Kuntze, but very different from that species and easily distinguished from the other Samoan species of the subgenus *Cyclosorus* by its size, large number of abruptly abbreviated, close pinnae, about as in *D. sagittifolia* (Blume) O. Kuntze, the thinly herbaceous, densely pubescent, and glandular lamina. It is very near or perhaps identical with *D. Metcalfei* (Baker) C. Christensen from the New Hebrides.

14. Dryopteris transversaria (Brackenridge) Brause. Maxon, Biol. Soc. Wash., Proc. **36**: 170, 1923.

Nephrodium transversarium Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 187, 1854.

Aspidium pennigerum Swartz. Luerssen, Mitt. Bot. **1**: 188, 387 (part?), 1874.

Aspidium truncatum Gaudichaud. Luerssen, Mitt. Bot. **1**: 192, 386, 1874. Christ, Engler Bot. Jahrb. **23**: 351, 1897.

Aspidium patens (Desvaux) Swartz. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 436, 1908.

Fronds fascicled on an erect rhizome, 1 m. or more long. Stipe thick, trisulcate with brown lanceolate scales below, rarely more than 10 cm. long up to the lowest auricles, often much shorter, together with rachis and costae of a very pale stramineous color and minutely grayish downy, sometimes nearly glabrous. Lamina herbaceous, pale green beneath, the surfaces glabrous but usually more or less verruculose beneath, bipinnatifid, attenuate below rather gradually with about 8-10 pairs of dwindling pinnae; the lowermost ones reduced to mere auricles. Pinnae sessile with an oblong brown spot in the axils beneath (scars of pneumatophores) 3 cm. apart, 15-18 × 1.5-2 cm., obliquely truncate at the not widened base, acuminate, pinnatifid ½ to ⅝ with oblong entire subtruncate or subacute segments 2.5-3 mm. wide. Veins simple in about 7-8 pairs, those of the basal pair united, the acroscopic one of the second pair and sometimes also the basiscopic one running to a callous membrane at the bottom of the sinus. Sori distinctly inframedial, subcostular, with small brown deciduous indusia (often absent). Sporangia glabrous.

Without locality: *Powell* (Kew); *Weber 20,* part, (B).

Savaii: *Reinecke 133* (B). Upolu: *Reinecke 26* (B); Fangaloa Bay, *Safford 19, 20* (W); *Rechinger 1282* (V); Moa Moa Plantation, 150 m., *Eames 137, 147.* Tutuila: *Brackenridge* (W, type); Pago Pago, *McMullin 10* (W, forma).

Dryopteris transversaria var. **Rodigasiana** (Linden) C. Christensen, comb. nov.

Nephrodium Rodigasianum (Linden) Moore, L'Illustration horticole **29**: 27, pl. 442, 1882.

Dryopteris Rodigasiana (Linden) C. Christensen, Index Fil.

Nephrodium truncatum Presl. Baker, Jour. Bot. **14**: 11, 1876.

Aspidium pennigerum Blume. Christ, Engler Bot. Jahrb. **23**: 351, 1897.

Dryopteris truncata (Poiret) O. Kuntze. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 127, 1924.

Without locality: *Powell 234, 264; Whitmee 10* (Kew), cultivated cotype (Kew).

Upolu: *Safford 32* (W); *Rechinger 186*. Tutuila: *Setchell 519* (W). Manua: *Reinecke 21* (22? B).

Type and variety known from Samoa only.

Differs from the type chiefly in the grass green color of both sides, the broader (4-5 mm.) and more bluntly rounded segments and the more persistent blackish indusia. Though differing in habit and color, it agrees with the type in all essential characters; intermediate specimens are also found. The variety comes very near the Hawaiian *D. Hudsoniana* (Brackenridge) Rosenstock, and it may prove to be specifically distinct from both *D. transversaria* and *D. Hudsoniana*. From the badly named *D. truncata* (Gaudichaud) O. Kuntze the type and variety differ both in pubescence and the large number of reduced pinnae.

15. Dryopteris Vaupelii, sp. nov. (pl. 3, *B*).

Cyclosorus D. transversariae var. Rodigasianae proxime affinis, rhizomate erecto, lamina decrescente, colore stipitis rachidisque, venatione cum ea congruens, differt: multo major. Stipite ad auriculas infimas 20-30 cm. longo, lamina 2-2.5 m. longa, 60-70 cm. lata, pinnis ad 35 cm. longis 3-4 cm. latis, ad ½-⅔ pinnatifidis, laciniis e basi 6-7 mm. lata versus apicem obtusum vel subacutum aliquot angustatis, sic triangulari-oblongis vel ligulatis, sinubus latis separatis, venis pinnarum latiorum 10-12-angustiorum 7-8-jugis, soris inframedialibus, sat magnis, indusiis subpersistentibus. Stipite rachique persparse et minute puberulis vel glabris, lamina praeter costas superne sparse hirtis ubique glaberrima.

Without locality: *Powell 77* (Kew).

Savaii: by crater lake, Le Paega, March 27, 1906, *Vaupel 228* (B, type, Kew, W); Olo, 700 m., *Christophersen 2522;* Salailua-Lataiuta, terrestrial in forest, 50 m., *Christophersen 3013*. Upolu: Malololelei, 600 m., *Christophersen 215*.

Certainly very near *D. transversaria* var. *Rodigasiana,* agreeing with it in most characters; its much larger size, longer stipe, and whole habit seem to justify its segregation as the largest of the Samoan species of *Cyclosorus*.

16. Dryopteris Bryani, sp. nov. (pl. 4, *A*).

Aspidium patens (Desvaux) Swartz, part. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 436, 1908.

Cyclosorus D. transversariae proxime affinis, differt: lamina obscure-viridi, stipite 30-40 cm. longo, pinnis infimis 1-2-jugis abrupte et valde reductis, auriculiformibus, vix i

cm. longis, pinnis oppositis vel superioribus alternis, inferioribus versus basin distincte angustatis, maximis ad 25 × 2.5 cm., laciniis approximatis, oblongis, obtusis, venis 10-12-jugis, infimis 1.5-2-jugis unitis. Soris inframedialibus, indusiis subpersistentibus.

In Powell's specimens the fronds are tufted; stipe, and rachis, usually brown-stramineous, often somewhat violescent, scaly below and minutely downy or nearly glabrous, 30-40 cm. long. Lamina firmly herbaceous, dark green, 1 m. or probably more long by 50 cm. wide, abruptly reduced below with 1-2, rarely 3, distant pairs of small auriculiform pinnae. Developed pinnae opposite or nearly so, sessile at distances of 3-4 cm., spreading, the largest up to 25 × 2-2.5 cm., linear, acuminate, the lowest ones distinctly narrowed toward their base, the upper ones with an obliquely truncate, not widened base, incised about ⅝ into a wing 4 mm. wide with close, oblique-oblong, entire or faintly crenate, obtuse or subacute segments 3-4 mm. wide, their margins parallel and often sparsely ciliate. Veins simple, 10-12-jugate, those of the two lower pairs united or more often the basiscopic one of the second pair runs to a cuneiform, hyaline membrane below the sinus. Costae strigose above, the surfaces otherwise glabrous and smooth (not verruculose). Sori distinctly inframedial, small, with subpersistent, dark brown, small, glabrous indusia; sporangia glabrous.

Savaii: Salailua, in forest, 300 m., May 19, 1924, *Bryan 160* (type). Upolu: *Powell 243* (Kew); *Lloyd 34* (W); *Rechinger 1273* (W), *1306* (V).

This new species resembles *D. transversaria* in most characters, such as the tufted leaves, size, cutting, venation and position of sori, but I am sure that it is specifically different. It is best distinguished by the long stipe, the few small abruptly reduced auricles, the dark green color, close segments, opposite pinnae, the more numerous veins and small sori.

17. Dryopteris Reineckei, sp. nov. (pl. 4, *B*).

Nephrodium Harveyi Baker, Jour. Bot. 14: 11, 1876 (not *Dryopteris Harveyi* supra).

Aspidium savaiiense Christ, Engler Bot. Jahrb. 23: 350, 1897 (not *Dryopteris savaiensis* supra).

Aspidium truncatum Mettenius, part. Rechinger, Denkschr. Akad. Wiss. Wien 84: 435, 1908.

Cyclosorus rhizomate?; stipite valido, sparse piloso et paleis perpaucis linearibus onusto, fere a basin ad laminam evolutam auriculis aut tuberculis aut cicatricibus eorum (pinnis abortivis) ad 15-jugis praedito. Lamina basi abrupte in auriculas reducta, evoluta magna, deltoideo-ovata, ad 30 cm. lata, firmiter herbacea, bipinnatifida; rachi ut stipite sparse pubescente et paleis perpaucis instructa. Pinnis evolutis subopppositis vel alternis, 3-4 cm. inter se remotis, sessilibus, basi aërophoris deciduis praeditis, maximis 15-18 cm. longis, 2 cm. latis, acuminatis, inferioribus versus basin angustatis, ad alam 2 mm. latam pectinato-pinnatifidis; segmentis sinubus angustis separatis, oblique subfalcatis, integris marginibus subrevolutis, acutis, basi 2 mm. latis. Venis simplicibus, 14-15-jugis, basalibus unitis, iis secundi paris aut cum vena excurrente unitis aut ad sinum conniventibus. Costis dense costulisque sparse pilis longis superne hirtis, inferne cum venis brevius pubescentibus, pagina inferiori glandulis globosis pallide luteis sat sparse glanduligera. Soris parvis, supramedialibus, indusio nullo (?), sporangiis glabris.

Without locality: *Powell* s. n.; *Whitmee 103* (Kew).

Savaii: Mataulanu, 1,000 m., *Reinecke 164* (B); Maugaloa, *Vaupel 92 a* (W); above Matavanu in wet forest, 1,300 m., *Christophersen 2178*. Upolu:

Betche 150; Lanutoo, *Rechinger 1921* (V). Manua: *Powell 252* (Kew); Ofu I., *Reinecke 110* (B, type).

In general aspect, this new species resembles some other Samoan *Cyclosorus,* especially *D. Bryani.* Its distinguishing characters are the great number of minute auricles or mere tubercles along the stipe without transitional intermediates between them and the developed pinna, the glandular under side and the small supramedial, apparently exindusiate sori. The presence of some linear scales on stipe and rachis is also a reliable character.

18. Dryopteris subjuncta (Baker) C. Christensen, Index Fil. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 190, 1912, part.

Nephrodium subjunctum Baker, Ann. Bot. **5**: 321, 1891.

Aspidium cucullatum Blume, part. Christ, Engler Bot. Jahrb. **23**: 350, 1897.

Aspidium patens (Desvaux) Swartz. Christ, Engler Bot. Jahrb. **23**: 352, 1897.

Rhizome horizontally creeping. Stipe up to 50 cm. long, brownish glabrous, with a few brown narrow scales below, without tubercles and small auricles. Lamina up to 1 m. long by 30 cm. wide, lanceolate, firmly herbaceous or subpapyraceous, dark green (brownish when dry), bipinnatifid; rachis, especially upwards, minutely downy. Lower 2-3 pairs of pinnae gradually reduced, the basal ones 2-3 cm. long, the largest 15-18 × 1.2-1.5 cm., all sessile without pneumatophores, the lower ones opposite at distances of 3 cm., the upper alternate, long acuminate, lobed ⅔ or ¾, with falcate, acute, entire lobes, the basal upper one often somewhat broader; veins simple, 8-9-jugate, the basal ones of the same pinnae either connivent to the sinus or united just below it; costae strigose above, sparsely downy beneath as are the costules, surfaces otherwise glabrous. Sori near the margins, small, indusia brown, subpersistent, slightly ciliate, sporangia glabrous.

Without locality: *Powell 248* (Kew, type, B).

Upolu: *Betche* (CC); *Reinecke 10 a* (B); Falefa, *Hochreutiner 3451, 3460* (part?). Tutuila: "Lower level", *Setchell 10 b* (W, a larger form with pinnae up to 2.5 cm. wide); hills back of Utulei, *McMullin 2 a* (W).

A variety with shorter stipe, with the lower pinnae not reduced but with a pair of tubercles on the stipe below the basal pinnae, and with the lamina finely downy throughout beneath was collected by Powell (75, Kew).

19. Dryopteris invisa (Forster) O. Kuntze. Copeland, B. P. Bishop Mus., Bull. **59**: 45, 1929; Bull. **93**: 38, 1932.

Aspidium dissectum Mettenius, part. Luerssen, Mitt. Bot. **1**: 179, 386, 1874.

Aspidium invisum (Forster). Christ, Engler Bot. Jahrb. **23**: 350, 1897.

Aspidium cucullatum Blume, part. Christ, Engler Bot. Jahrb. **23**: 350, 1897.

Without locality: *Powell 212* (Kew), *Safford 21, 983* (W).

Upolu: *Reinecke 53, 53 a, 130 a* (B); *Funk s. n.* (W); *Weber 22* (B).

Polynesia, from Marquesas west to the Philippines (?).

Very like *D. subjuncta* in general habit, size, and division but usually of firmer texture, the rachis pilose and the under side downy throughout; the pinnae are less deeply incised (about half way to the costa) with triangular, falcate, acute lobes or teeth, the basal pair of the usually raised veins united into a long vein running to the sinus where it meets 2-4 of the following connivent veins. Sori supramedial, small, indusia pilose and sporangia furnished with a few lateral, hyaline hairs.

20. Dryopteris unita (Linnaeus) O. Kuntze. Christensen, Index Fil. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 127, 1924.

Aspidium dissectum Mettenius, part. Luerssen, Mitt. Bot. **1**: 179, 386, 1874.

Aspidium cucullatum Blume. Christ, Engler Bot. Jahrb. **23**: 350, 1897, part. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 433, 1908.

Aspidium invisum (Forster) Christ. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 436, 1908.

Dryopteris subjuncta (Baker) C. Christensen, part. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 190, 1912.

In general habit very similar to *D. invisa* and often confused with it. The coriaceous leaves are usually more abruptly contracted below with often several pairs of small auricles, all ribs beneath are generally more or less densely rough-hairy (rarely subglabrous) and the veins often furnished with sessile, yellow glands. Pinnae incised one fourth to one third only with deltoid or semiovate lobes or teeth, which because of the revolute margins are sharply acute or even mucronate. Veins in up to 13 pairs, in average 9-10, of which the lower 4-6 pairs are united. Sori near the margins, small, indusia pilose, deciduous, sporangia glabrous.

Without locality: *Powell 208* (Kew).

Upolu: *Rechinger 5, 239, 402, 538, 575* (V); Vailele, *Weber 30* (B); Fangaloa Bay, *Safford 937* (W); *Hochreutiner 3196, 3197* (G); Vailima, 150 m., *Eames 6*. Tutuila: *Setchell 10, 226* (W).

Polynesia and tropical Asia west to Madagascar.

Very variable as to size, density of pubescence and number of veins. The species is another aggregate in need of revision. It is not included in Copeland's "Ferns of Fiji", but I suspect that his *D. arida* would fall under *D. unita* as here confined. It is said by some collectors to be common at low altitudes, but I have seen only the few specimens listed above.

21. Dryopteris subspinosa C. Christensen, Index Fil. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 128, 1924.

Goniopteris glandulifera Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 29, 1854 [not *Dryopteris glandulifera* (Liebmann) C. Christensen].

Polypodium Brackenridgei Hooker, Species Fil. **5**: 9, 1863 [not *Dryopteris Brackenridgei* (Mettenius) O. Kuntze].

Polypodium muricatum Powell. Baker, Syn. Fil. ed. **2**: 506, 1874 (not Linnaeus, 1753).

Aspidium pennigerum Swartz. Luerssen, Mitt. Bot. **1**: 188, 387, part?, 1874.

Aspidium pteroides Mettenius. Luerssen, Mitt. Bot. **1**: 189, 386, 1874.

Fronds tufted on a decumbent rhizome, the strong stipe up to the lowest developed pinnae 1 m. or more long, brownish stramineous, minutely and deciduously downy, furnished at base with dull brown, broad, appressed scales and upwards with "alternate, stiffish, fleshy, acuminate, whitish glands, having an oblong, flattened base persistent, but in the dry state losing their normal appearance and becoming brown, hard and somewhat spiny" (Powell in Herb. Kew) (abortive pinnae). Lamina 1 m. or more long, 40-45 cm. broad, firmly herbaceous, bipinnatifid; pinnae sessile and furnished at the base beneath with "a small deltoid, acuminate, white, fleshy gland, guarding the pinnae in the crucial state and enlarging as the frond develops, but finally becoming hardened and so shrunk as to give the rachis a muricated rather than a glandular appearance" (Powell) (that is, thornlike pneumatophores). Pinnae 20-25 cm. long by 2-2.5 cm. wide, their base truncate and not widened, the apex long acuminate, the basal developed ones hardly shortened, incised about ½ with subdeltoid, more or less falcate, entire, rounded obtuse or subacute segments, 5 mm. wide at base. Veins simple, about 15-jugate, the lower 4-5 united and running to a brown membrane below the sinus. Rachis and costae beneath slightly downy, the margins ciliate. Sori usually confined to the lobes, rather near the margin, small exindusiate, often confluent; sporangia glabrous.

Without locality: *Powell 115* (B).

Tutuila: *Brackenridge* (W, type of *G. glandulifera*); *Setchell 283* (W).

Manua: *Powell 160* (Kew, type of *P. muricatum*).

Dryopteris subspinosa var. **angusta,** var. nov.

Nephrodium pteroides J. Smith. Baker, Jour. Bot. **14**: 344, 1876.

Aspidium unitum R. Brown, part. Christ, Engler Bot. Jahrb. **23**: 351, 1897.

A typo differt: pinnis vix ultra 1 cm. latis.

Without locality: *Whitmee 212* (Kew, type).

Upolu: *Reinecke 155* (B).

Looks at the first glance very different from the type, but a close examination shows that it agrees in all characters except size.

D. subspinosa is a very distinct species, hitherto reported from Samoa only, but I am rather convinced that it occurs also in other islands. *D. Stokesii* E. Brown from Rapa, and *D. obstructa* Copeland from Rarotonga (except for the more medial sori), seem to me very nearly the same species as *D. subspinosa*. *D. tannensis* C. Christensen from Aneiteum is a third very similar but probably distinct form.

To *Cyclosorus* belongs also *Aspidium arbuscula* Willdenow (*Dryopteris,* Index Filicum) to which Christ probably wrongly referred a specimen from Upolu (Reinecke 12, not seen).

22. **Dryopteris hirtipes** (Blume) O. Kuntze.

Aspidium hirtipes Blume. Luerssen, Mitt. Bot. **1**: 384, 1874. Christ, Engler Bot. Jahrb. **23**: 352, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 52, 1908.

Nephrodium hirtipes Hooker. Baker, Jour. Bot. **14**: 344, 1876.

Fronds tufted on the oblique rhizome, the stipe densely covered towards the base with black or blackish brown, long, lanceolate, acuminate, entire scales, upward with rachis with smaller blackish, nearly piliform fibrils. Lamina several decimeters long, 30-35 cm. or more broad, light green, firmly herbaceous, quite glabrous but with a few fibrils on the costae beneath, bipinnatifid, not narrowed below. Pinnae alternate, sessile, spreading, 2-2.5 cm. wide the whole way below the acuminate apex, pinnatifid about a third of the way down to the costa, sometimes somewhat deeper, into oblique, rectangular lobes, which are obliquely truncate or rounded and usually faintly crenulate at their apex, about 4 mm. wide. Veins pinnate in the lobes, simple, in about five pairs, adscending, the basal anterior one ending in the leaf-tissue below the sinus. Sori rather large, about medial on the vein, indusia subpersistent, reniform.

Without locality: *Whitmee 201* (Kew).

Savaii: above Aopo, in ravines, 800 m., *Vaupel 301* (B, W); *Rechinger 1061* (V). Upolu: Mt. Tofua, *Graeffe* (reported by *Luerssen*); *Betche s. n.* (W).

Malaya and several closely related species or subspecies in North India, east to Formosa, known in Polynesia from Samoa only, as far I know.

Evidently a very rare fern in Samoa. The few and rather fragmentary specimens seen resemble closely the Javanese type, but better material would possibly show some small, more constant differences.

23. Dryopteris arborescens (Baker) O. Kuntze.

Nephrodium arborescens Baker, Syn. Fil., 286, 1867.

Aspidium arborescens (Baker) Luerssen, Mitt. Bot. 1: 176, 385, 1874.

Nephrodium Powellii, N. ludens Baker, Ann. Bot. 5: 325, 1891.

Aspidium ludens (Baker) Christ, Engler Bot. Jahrb. 23: 352, 1897.

Dryopteris ludens, D. Powellii (Baker) C. Christensen, Index. Fil.

Fronds tufted on an erect or decumbent (?) rhizome which is clothed at the top with a mass of 2-3 cm. long, linear, brown, entire scales, glabrous (without hairs), but rachises with some early falling, ovate-lanceolate or linear, thin, light-brown scales beneath, becoming a little rough by their persistent bases. Lamina ample, subcoriaceous, deltoid or deltoid-oblong, tripinnate-pinnatifid with all pinnae of I-III order distant from each other. Basal pinnae long-stalked, up to 40 × 20 cm., a little produced on the lower side, deltoid, the following pair even longer but narrower and equal-sided. Secondary pinnules petiolulate, subdeltoid to oblong, acuminate, those of the basal pinnae up to 15 × 5 cm., of the upper ones 10 × 2.5-3 cm.; tertiary pinnules subsessile (or the lowest ones on a short petiole), the upper ones adnate and decurrent, subacute or obtuse 1.5-2 × 0.5-1 cm., more or less deeply pinnatifid into rectangular dentate lobes. Veins 2-3-jugate in the quaternary lobes, simple. Sori medial with brown, reniform, glabrous, usually persistent indusia.

Without locality: *Powell 245* (type of *N. Powellii,* Kew) (*87,* and *167,* Kew, the last two numbers quoted under *N. ludens*).

Savaii: Maugaloa (*Reinecke 149,* reported by *Christ*); *Vaupel 24* (B, W), *324* [W, distributed as *D. ornata* (Baker) C. Christensen]; above Matavanu, 1,550 m., *Christophersen 2236.* Manua Ils.: *Powell 87* (Kew). Evidently rare. Endemic?

Baker himself dropped his own name *arborescens,* because the species is not arborescent, and described two new species, *N. Powellii* and *N. ludens,* the

descriptions of which are very nearly identical. The only real difference is in the rhizome, which is erect in *N. Powellii* and decumbent in *N. ludens*. I see no important differences, the two "species" being fully identical to me. A third form probably belonging here is *D. maxima* (Baker) C. Christensen from Fiji. All of these Polynesian forms come very near to the Malayan *D. subarborea* (Baker) C. Christensen, and I suspect that they are only geographical varieties of that species.

24. Dryopteris dissecta (Forster) O. Kuntze. Copeland, B. P. Bishop Mus., Bull. **59**: 43, 1929.

Aspidium dissectum Desvaux. Christ, Engler Bot. Jahrb. **23**: 353, 1897, part.

Nephrodium dissectum Desvaux. Baker, Jour. Bot. **14**: 11, 1876.

Aspidium membranifolium (Presl) Kunze. Luerssen, Mitt. Bot. **1**: 183, 385, 1874, part?

?Dryopteris pacifica Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 186, 1912.

Without locality: *Powell; Whitmee 107* (Kew).

Upolu: Apia, *Betche 38* (CC); Lotupa, *Vaupel 50* (Kew, W).

Polynesia from Samoa west to Malaya and India.

I refer here to only the specimens with all veins free (without costular areoles) and which agree with Forster's type (in British Museum, Natural History). In some specimens, the basal veins show a strong tendency to become united, and I am therefore nearly convinced that the more common *Tectaria Stearnsii* Maxon is the same species with pleocnemioid venation and without indusia. Not considering the venation, the two "species" are exceedingly similar. Both forms are intimately related, and it is wholly unnatural to place them in two genera. They belong to a well-defined group of Asiatic-Polynesian species which is intermediate between *Ctenitis* and *Tectaria* and of which R. C. Ching recently made a genus, *Ctenitopsis* (Fan. Mem. Inst. Bull. **8**: 304, 1938). I did not see the type of *D. pacifica* Christ from Upolu (Hochreutiner 3226, 3453). Most likely it is the common *Tectaria Stearnsii* but no mention being made of the venation, it is perhaps *D. dissecta* (see further remarks under *T. Stearnsii*). Between the free-veined species of *Dryopteris, D. dissecta* is sufficiently characterized in the key.

Aspidium funestum (Luerssen, Mitt. Bot. **1**: 181, 1874), Powell 59, not seen, may be a small form of *D. dissecta*. The genuine *A. funestum* is an American fern.

25. Dryopteris samoensis C. Christensen, Index Fil., 290, 1905.

Polypodium paleaceum Powell, Baker, Syn. Fil., 505, 1874 (non Hooker, fil., 1847).

Aspidium squamigerum (Hooker and Arnott) Luerssen, Mitt. Bot. **1**: 191, 385?, 1874.

Nephrodium intermedium Baker, Jour. Bot. **14**: 11, 1876.

Aspidium chrysotrichum Christ, Engler Bot. Jahrb. **23**: 352, 1897.

Fronds tufted. Stipe at base with a dense mass of silky, brown, linear, 2-3 cm. long, thin scales, which extend somewhat upward, 30-40 cm. long and for the greater part like the rachis, rather densely chaffy with appressed, small, ovate-acuminate scales, which fall with age. Lamina ample, probably 70-80 cm. long, broadly pentagonous-deltoid, herbaceous, brown when dried, quadripinnate. Pinnae at distances of 10-6 cm., the basal ones long petiolate and produced on the lower side, 30-40 cm. long with the basal basiscopic pinnule 15 cm. long by 8 cm. wide, the other pinnae equal-sided, diminishing in length upward; ordinary secondary pinnules short-stalked, the tertiary ones mostly sessile, the upper adnate and decurrent, mostly under 1 cm. wide, short-acuminate, cut nearly or quite to the costule into oblong, antrorsely acute or subtriangular lobes, the larger of which are more or less deeply crenate-dentate. All ribs rufo-tomentose above with articulated hairs, which also in some specimens occur sparsely on the upper surface and the margins, costae and costules beneath with several scales like those of the rachis and together with the veins more or less glandular with thick, cylindrical short glands, which usually are most crowded on the veins and which become whitish when old and dry. Veins mostly simple, 4-6-jugate in the ultimate segments. Sori medial on the veins, small, indusia small, brown, reniform with a few glands, falling early.

Without locality: *Powell 161* (type), *231, 238, 253; Whitmee 113* (all Kew).

Upolu: *Betche* (CC); *Reinecke 110* (B), *112* (B, W). Endemic?

D. samoensis belongs to a group of the subgenus *Ctenitis,* which is represented in tropical and east Asia and in Polynesia by several closely related species that are highly in need of revision. I am not at all sure that the Samoan form is different from others of this group, but rather identical with *D. fijiensis* (Hooker) C. Christensen and probably with *D. tenuifrons* C. Christensen (Copeland, B. P. Bishop Mus., Bull. **59**: 43, 1929), both from Fiji. Though it is considerably larger and more decompound than *D. fijiensis* and *D. tenuifrons* as originally described, I have a specimen from Fiji collected by Damell which exactly matches the Samoan ones. Furthermore, in size and division, our species is extremely like the east Asiatic *D. lepigera* (Baker) O. Kuntze of which the Himalayan *D. rhodolepis* (Clarke) C. Christensen (Index Filicum, part) is probably a form, but these species differ a little in scale characters and in nearly costular sori. *D. sciaphila* Maxon from Tahiti is another close ally and probably not specifically different. The same may be said of the two varieties *D. sciaphila* variety *raivavensis* from Austral Islands and variety *rapensis* from Rapa(?) (Brown, B. P. Bishop Mus., Bull. **89**: 32-33, 1931), which I formerly referred without hesitation to *D. fijiensis.*

D. fijiensis (Copeland, B. P. Bishop Mus., Bull. **59**: 44, 1929; Parks 20785) is certainly wrongly named. It differs manifestly from the forms mentioned, by the stipe, rachis, and partly by the costae being densely crinite

with spreading, acicular, blackish scales, thus very like *D. Eatoni* (Baker) O. Kuntze and especially *D. decurrenti-pinnata* Ching from Hainan and Tonkin.

26. Dryopteris decomposita (R. Brown) O. Kuntze. Copeland, B. P. Bishop Mus., Bull. **93**: 34, 1932.

Savaii: above Salailua, in wet forest, 1,400 m., *Christophersen 3099.*

From Tahiti and Samoa west to Australia and New Zealand. New to Samoa.

The only leaf seen agrees very well with the typical form from New South Wales, but somewhat less divided and less pubescent, being nearly glabrous. From all Samoan species it differs in the long stipe (up to 40 cm.) and the proportionally short deltoid, quinquangular, herbaceous lamina, about 25 cm. long and broad; it is bipinnate-pinnatifid or subtripinnate at base, the lower side of the basal pinnae much produced, pinnules unequal-sided and decurrent at base, incised one half to two thirds with broad segments, the larger with some short deltoid teeth; veins distant, very oblique, subpinnate or forked in the larger segments; sori small, supramedial on the basal acroscopical vein, rarely two or more to a segment; indusia subpersistent.

27. Dryopteris davallioides (Brackenridge) O. Kuntze. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**:128, 1924. Copeland, B. P. Bishop Mus., Bull. **59**: 44, 1929; Bull. **93**: 34, 1932.

Lastrea davallioides Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 202, 1854.

Nephrodium davallioides (Brackenridge) Baker. Powell, Jour. Bot. **6**: 340, 1868. Baker, Jour. Bot. **14**: 11, 344, 1876.

Aspidium davallioides (Brackenridge) Kuhn. Luerssen, Mitt. Bot. **1**: 178, 386, 1874. Christ, Engler Bot. Jahrb. **23**: 352, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 437, 1908.

Davallia dubia R. Brown. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 442, 1908.

Common and found on all larger islands, collected by all.

Savaii: above Letui, 800-900 m., *Christophersen 771;* above Matavanu, 1,300 m., *Christophersen 2165;* Le To above Salailua, 750 m., *Christophersen 2910; Rechinger 1091* (V, *Davallia dubia* Rechinger). Upolu: above Malololelei, 700 m., *Christophersen 243, 362.*

Samoa, Tahiti, Fiji, New Hebrides.

Judging from the description, *D. microtricha* Copeland (B. P. Bishop Mus., Bull. **59**: 10, 44, 1929) is *D. davallioides.* The costules and veins of most Samoan specimens are furnished beneath with small scattered scales and characteristic cylindrical, appressed, unicellular hairs, which usually are yellowish but sometimes ferruginous, sometimes few, sometimes so numerous that the veins appear under the lens as yellow stripes. This type of hair is characteristic of most species of the subgenus *Parapolystichum.* The rhizome is short

creeping, thick, and densely covered with castaneous, linear, long hair-pointed scales less than 0.5 mm. wide by 2 cm. long.

Genus **SPHAEROSTEPHANOS** J. Smith (Mesochlaena R. Brown)

A problematical genus agreeing with *Dryopteris* subgenus *Cyclosorus* in all characters but sori and indusium which are elongated, the indusium attached longitudinally at the middle to the vein, about as in *Didymochlaena.*

Sphaerostephanos polycarpa (Blume) Copeland, C. Christensen, Index Fil., Suppl. 3: 172, 1934.

Didymochlaena polycarpa (Blume) Baker. Powell, Jour. Bot. 6: 340, 1868.

Aspidium polycarpon Blume. Luerssen, Mitt. Bot. 1: 189, 387, 1874.

Mesochlaena polycarpa R. Brown. Christ, Engler Bot. Jahrb. 23: 356, 1897.

Without locality: *Powell 79* (Kew, W); *Weber 20* (B).

Upolu: *Graeffe 1128; Betche,* not seen.

Tropical Asia. In Polynesia known from Samoa only?

In general habit, size, texture, division and venation very similar to *Dryopteris transversaria,* differing in the sori and in all ribs and margins being softly hairy with long and very thin hairs and the under side and indusia densely dotted with small, sessile, yellowish glands. The few specimens seen lack all the basal portion of the leaf, which in the Malayan form is rather abruptly narrowed below with a large number of dwindling pinnae. The Samoan form is the pubescent one called *S. asplenioides* by J. Smith.

Genus **POLYSTICHUM** Roth

Copeland, B. P. Bishop Mus., Bull. 59: 51, 1929; Bull. 93: 40, 1932.

1. **Polystichum aculeatum** (Linnaeus) Schott. Copeland, B. P. Bishop Mus., Bull. 59: 51, 1929; Bull. 93: 40, 1932.

The very intricate group of *P. aculeatum sensu latissimo* is represented in Samoa by at least two, perhaps three distinct forms or species, but I agree with Copeland in finding it inadvisable to base species upon the meager material at hand before we have a modern critical revision of the group, as it is quite possible that these forms may be described as species from other localities. All Samoan forms were called *Aspidium aculeatum* var. *samoensis* (Luerssen, Mitt. Bot. 1: 174, 383, 1874) by all later authors (Baker, Jour. Bot. 14: 344, 1876; Christ, Engler Bot. Jahrb. 23: 349, 1897; Rechinger, Denkschr. Akad. Wiss. Wien 84: 432, 1908), but that name should be applied to the second of the following forms.

Polystichum aculeatum, var. 1.

Frond broadly lanceolate, bipinnate, subcoriaceous. Rachis and costae beneath densely chaffy with reddish scales, some small, woolly, and lacerated, some linear, from hairlike to

nearly 1 mm. wide and long hair-pointed and with ciliate base. Pinnae sessile, up to 20 cm. long and 2.5-3 cm. broad, from base nearly to the acuminate apex, with up to 20 pairs of subsessile secondary pinnules, which are 4-5 mm. broad, acroscopically auricled, acute and incised about halfway to the midrib into semiovate, aristate lobes, the basal acroscopic pinnule prolonged and more deeply incised. Sori small with small, peltate indusia, falling early.

Without locality: *Whitmee 203* (Kew).

Savaii: Maungaafi, 1,600 m., *Rechinger 643* (V), *?1055* (V); *Vaupel 313* (B).

This "variety" is not unlike the Malayan *P. mucronifolium* (Blume) Presl. Number 1055 is a sterile frond with very slightly scaly rachis and resembles more the Fijian form of *P. aculeatum*.

Polystichum aculeatum var. **samoense** (Luerssen) C. Christensen.

Polystichum aristatum var. *coniifolium* (Wallich). Lauterbach, Engler Bot. Jahrb. **41**: 219, 1908.

Frond broadly deltoid or deltoid-ovate, tripinnate, herbaceous, flaccid. The non-gemmiferous rachis chaffy with reddish, narrow, rather few scales, with age nearly naked. Pinnae subsessile, remarkably long acuminate, up to 15 × 4 cm., pinnules shortly petioled, about 1 cm. broad at the unequal, auricled base and gradually tapering toward the acuminate apex, fully pinnate at base with 1-3 pairs of slightly lobed tertiary pinnules, upwards pinnatifid with aristate lobes; the basal acroscopic pinnules prolonged with 6-7 pairs of free tertiary pinnules. Indusia subpersistent.

Without locality: *Powell 159, 214; Whitmee 224* (Kew).

Savaii: (*Graeffe 260,* type not seen). Olonono: *Vaupel 275* (B, W, small form). (Upolu: *Betche,* not seen). ?Manua: *Powell 220* (Kew). Doubtful, less incised.

This is certainly a distinct species but I am not sure that the name given it by Luerssen is the oldest one, for I find it extremely like Cuming 181 (*P. discretum* J. Smith, *P. acutifolium* Presl) from South Camarines, which Mettenius identified with *P. moluccense* (Blume) Moore.

2. **Polystichum (Rumohra) aristatum** (Forster) Presl. Copeland, B. P. Bishop Mus., Bull. **59**: 51, 1929; Bull. **93**: 40, 1932.

Aspidium aristatum (Forster) Swartz. Powell, Jour. Bot. **6**: 340, 1868. Luerssen, Mitt. Bot. **1**: 175, 384, 1874. Baker, Jour. Bot. **14**: 11, 1876.

Aspidium aristatum var. *affinis* (Wallich) Christ, Engler Bot. Jahrb. **23**: 350, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 433, 1908.

Without locality: *Powell 42; Whitmee 92* (Kew).

Savaii: Manase, *Vaupel 208* (B, Kew, W). Upolu: Mt. Tofua, *Graeffe 1086* (B); Falealili-Letogo, *Reinecke 97 b* (B, Kew, W); Apia, *Reinecke s. n.* (B); *Rechinger 1292* (W); Vailima, 300 m., *Eames 90.*

From Marquesas and Pitcairn west through Australia and Asia (north to Japan) to South Africa.

Among Samoan ferns easily recognized by the deltoid, papyraceous to subcoriaceous, somewhat glossy, tripinnate-pinnatifid or tripinnate fronds with aristate teeth, the basal pinnae produced basiscopically; rhizome creeping. The peltate indusia are very deciduous.

The Samoan form is, I think, typical *aristatum* and certainly not *Lastrea affinis* Beddome as believed by Christ.

Genus **TECTARIA** Cavanilles

Copeland, B. P. Bishop Mus., Bull. **59**: 48, 1929.

Key to the Species of Tectaria

Veins forming costal and costular areoles without included veinlets, otherwise free; exindusiate
- Medium-sized fern, subtripinnate at base, pinnules of middle pinnae at best, 3 × 1 cm.; no glandular hairs.....**1. T. Stearnsii.**
- Large, subarborescent (?) fern, bipinnate-pinnatifid, pinnules 15 × 4 cm., all ribs beneath with oblong yellow glandular hairs.....**2. T. chrysotricha.**

Veins anastomosing everywhere forming numerous small areoles often with included free veinlets
- Frond pinnatifid to a broad wing, the stipe winged.....**3. T. decurrens.**
- Frond pinnate
  - All pinnae simple.....**4. T. crenata.**
  - Basal pair of pinnae pinnate.....**5. T. Setchellii.**

1. **Tectaria Stearnsii** Maxon, Biol. Soc. Wash., Proc. **36**: 175, 1923. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 127, pl. 17, fig. A, 1924.

   Sagenia varia (Willdenow) Presl. Brackenridge, U.S. Expl. Exp. 1838-42, **16**: 183, 1854.

   Polypodium Cumingianum Hooker, part, Sp. Fil. **5**: 103, 1864.

   Phegopteris macrodonta Mettenius. Luerssen, Mitt. Bot. **1**: 383, 1874.

   Aspidium dissectum Desvaux. Christ, Engler Bot. Jahrb. **23**: 353 (part), 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 436, 1908.

   ?Dryopteris pacifica Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 186, 1912.

   Fronds tufted on a decumbent, paleaceous rhizome; stipe and rachises pubescent with short, septate hairs; lamina deltoid-pentagonous, 50-80 × 30-60 cm., firmly herbaceous, subtripinnate; basal pinnae with the lower side produced, the others equilateral; pinnules or segments broadly adnate and usually decurrent and confluent, the larger 3 × 1 cm. and deeply pinnatifid with oblong, obtuse lobes. Veins forming costal and costular areoles, beyond which they are free. Sori medial, exindusiate.

   Common in all islands, collected by all.

   Savaii: Vailima, 150 m., *Eames 105;* Salailua, *Christophersen 2588.* Upolu: near Apia, *Eames 66.* Tutuila: *Garber 927.* Tau: *Garber 542, 678.* Endemic?

As mentioned under *Dryopteris dissecta,* this is exceedingly like that species and perhaps an exindusiate form with pleocnemioid venation. If *D. pacifica* Christ is this species, the name has priority.

2. **Tectaria chrysotricha** (Baker) C. Christensen, Ind. Suppl. 3: 178, 1934.

Nephrodium chrysotrichum Baker, Ann. Bot. **5**: 328, 1891.

Plocnemia Leuzeana (Gaudichaud) Presl. Brackenridge, U.S. Expl. Exp., 1838-42, **16**: 184, 1854.

Aspidium Leuzeanum (Gaudichaud) Kunze. Luerssen, Mitt. Bot. **1**: 182, 387, 1874.

Aspidium Leuzeanum var. *alsophiloides* Christ, Engler Bot. Jahrb. **23**: 353, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 48, 1908.

Aspidium Betscheanum Kuhn apud Christ, Engler Bot. Jahrb. **23**: 353, 1897.

Nephrodium Leuzeanum (Gaudichaud) Hooker. Baker, Jour. Bot. **14**: 11, 1876.

(According to Rechinger, a tree fern with a trunk 10-12 m. high and leaves 5 m. long, but this is probably exaggerated.) Stipe thick and densely chaffy with linear brown scales, the lamina bipinnate-pinnatifid, herbaceous; pinnae up to 60 cm. or more long by 25 cm. wide, the pinnules 15 × 4 cm., pinnatifid to a broad wing to the costule into oblong, acute, serrated segments 5 mm. wide; veins forming a row of costular areoles and usually free in the segments, sometimes forming 1-2 areoles along their midrib, all covered beneath with yellow, oblong, glandular hairs. Sori inframedial in the segments, furnished with a more or less persistent, small, reniform indusium.

Without locality: *Powell, Whitmee 94* (type, Kew).

Savaii: *Reinecke 90 b* (B); Olonono, *Vaupel 217* (B, Kew, W); Salailua, 150 m., *Christophersen 3000, 3012.* Upolu: *Graeffe 1127* (B); *Reinecke 90, 90 b* (B), *105; Rechinger 1394, 1994* (V); *Safford 50* (W); above Malololelei, 600 m., *Christophersen 213.* Tutuila (*Graeffe,* reported by *Luerssen*).

Samoa, (Fiji?).

I doubtfully maintain this as a species different from *T. Leuzeana,* to which all writers referred it, at least as a variety. It differs from the Malayan *T. Leuzeana* chiefly in its large size with much broader pinnules and more deeply serrated segments, but specimens from the Philippines are nearly as large. The characteristic yellow hairs on the veins, sometimes few, are also found in some forms of *T. Leuzeana,* the form (or species?) described as *Pleocnemia Cumingiana* Presl and *Aspidium angilogense* Christ. The Fijian form of *T. Leuzeana* (Copeland, B. P. Bishop Mus., Bull. **59**: 48, 1929) is probably referable to *T. chrysotricha.* Christ misunderstood Baker's species; his *Aspidium chrysotrichum* (Engler Bot. Jahrb. **23**: 352, 1897), quoted by Setchell as *Dryopteris chrysotricha* (Dept. Marine Biol. Carnegie Inst. Wash. **20**: 128, 1924), is *D. samoensis.*

3. **Tectaria decurrens** (Presl) Copeland, Elmer's Leaflets **1**: 234, 1907. B. P. Bishop Mus., Bull. **59**: 50, 1929; Bull. **93**: 41, 1932.

Aspidium decurrens Presl. Luerssen, Mitt. Bot. **1**: 179, 388, 1874. Christ, Engler Bot. Jahrb. **23**: 354, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 430, 1908.

Nephrodium decurrens (Presl) Baker, Jour. Bot. **14**: 11, 1876.

Found in all islands and collected by all.

Savaii: above Tapueleele, *Vaupel 63* (Kew, V); above Matavanu, 900 m., *Christophersen 2021*. Upolu: Vaisingano Canyon, 500 m., *Christophersen 90;* ridge above Malololelei, 700 m., *Christophersen 958*. Tau: 600 m., *Garber 735*.

Tropical Asia and Polynesia, east to Tahiti.

4. **Tectaria crenata** Cavanilles. Copeland, B. P. Bishop Mus., Bull. **59**: 50, 1929.

Aspidium pachyphyllum Kunze. Luerssen, Mitt. Bot. **1**: 186, 388, 1874. Christ, Engler Bot. Jahrb. **23**: 354, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 191, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 430, fig. 8, 1908.

Upolu: *Reinecke 79* (B); *Rechinger 140, 984* (V); *Hochreutiner 3319* (G).

Tropical Asia and Polynesia, east to Samoa.

5. **Tectaria Setchellii** Maxon, Biol. Soc. Wash., Proc. **36**: 174, 1923. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 127, pl. 17, fig. B, 1924.

Nephrodium subtriphyllum (Hooker and Arnott) Baker. Powell, Jour. Bot. **6**: 340, 1868.

Aspidium subtriphyllum (Hooker and Arnott) Hooker. Luerssen, Mitt. Bot. **1**: 191, 388 (?), 1874.

Aspidium latifolium (Forster) J. Smith. Luerssen, Mitt. Bot. **1**: 182, 388, 1874. Christ, Engler Bot. Jahrb. **23**: 353, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 431, fig. 9, 1908.

Nephrodium latifolium (Forster) Baker, Jour. Bot. **14**: 11, 1876.

Aspidium cicutarium (Linnaeus) Swartz. Powell, Jour. Bot. **6**: 340, 1868. Luerssen, Mitt. Bot. **1**: 177, 389 (?), 1874.

Rhizome decumbent, short creeping, clothed at apex with dull-brown, lanceolate scales. Stipe 25-40 cm. long, unwinged, light colored (stramineous to cinnamon-brown), with many linear, long scales at base, upward naked and glabrous as is the whole frond. Lamina deltoid, in average 25-40 cm. long and broad, herbaceous, brown when dried, pinnate-bipinnate, the apex pinnatifid. Pinnae in 2-5 pairs, the basal ones the largest, usually fully pinnate with 1-2 pairs of free pinnules, the basiscopic ones the largest, petiolate and lobed, 5 cm. or more broad, the second pair of pinnae often also partly bipinnate but more often deeply pinnatifid, deltoid, the upper pinnae sessile, lobed or subentire. Veins reticulate with free, mostly forked veinlets in the areoles. Sori usually few, irregularly scattered, large, dorsal on the netted veins, often oblong, exindusiate, without paraphyses.

Referred by most writers to *T. latifolia* (Forster) Copeland from which it differs by its light-colored, not ebenous stipe and rachis and lack of indusia. Young plants have simple, cordate, more or less lobed leaves (see Rechinger's fig. 8).

Common on all islands, collected by all.

Savaii: Manase, *Vaupel 147* (B, Kew, W); Salailua, *Christophersen 2589.* Tau: *Garber 675.*

Samoa. A specimen from Tonga (Kew) probably belongs here.

Genus **BOLBITIS** Schott

C. Christensen, Index Fil., Suppl. **3**: 47, 1934. *Campium* Presl, Copeland; Philip. Jour. Sci. **37**: 341, ff., 1928; B. P. Bishop Mus., Bull. **59**: 95, 1929; Bull. **93**: 75, 1932.

Bolbitis lonchophora (Kunze) C. Christensen, Index Suppl. **3**: 49, 1934.

Campium lonchophorum (Kunze) Copeland, B. P. Bishop Mus., Bull. **93**: 14, 75 (description), 1932.

Cyrtogonium palustre Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 86, pl. 12, fig. 2, 1854.

Acrostichum repandum var. *palustre,* Baker and var. *lonchophorum* Baker. Powell, Jour. Bot. **6**: 341, 1868.

Chrysodium cuspidatum Kuhn. Luerssen, Mitt. Bot. **1**: 68, 358, 1874.

Achrostichum repandum Blume. Rechinger, Denkschr. Akad. Wiss. Wien. **84**: 415, 1908.

Acrostichum repandum var. *Quoyanum* (Gaudichaud). Baker, Jour. Bot. **14**: 13, 1876. Christ, Engler Bot. Jahrb. **23**: 361, 1897.

Leptochilus cuspidatus (Presl) C. Christensen, Index Fil. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 122, 1924.

Campium samoense Copeland, Philip. Jour. Sci. **37**: 372, fig. 26, pl. 19, 1928.

Bolbitis samoensis (Copeland) Christensen, Index Fil., Suppl. **3**: 50, 1934.

Seems rather common, collected by all, and reported by Christ as collected in all islands by Reinecke.

Upolu: *Safford 973, 974* (W); *Rechinger 783* (V); Vailima, *Eames 122;* near Malololelei, 600 m., *Christophersen 221.*

Tropical Polynesia, east to Rapa, west to New Caledonia and Queensland.

I doubtfully follow Copeland in maintaining this Polynesian form as a species different from the Malayan-Melanesian *B. Quoyana* (Gaudichaud) Ching (*Acrostichum repandum* Blume) to which most writers referred it as a variety marked by the equally cuneate base of the pinnae. *Campium samoense* was founded on a single specimen collected by Powell, but Copeland believed

later (B. P. Bishop Mus., Bull. **93**: 15, 1932) that it was an aberrant individual, to which I agree.

Genus **LOMARIOPSIS** Fée

Holttum, Gard. Bull. Straits Settlem. **5**: 264, ff., 1932. Copeland, B. P. Bishop Mus., Bull. **59**: 65, 1929; Bull. **93**: 51, 1932, *Stenochlaena* partly.

In many respects similar to *Stenochlaena sensu propia* but differing in several important characters, such as the lack of narrow costular areoles and the entire, not spinosely dentate, fertile pinnae (see Holttum).

1. **Lomariopsis Setchellii** (Maxon) Holttum, Gard. Bull. Straits Settlem. **5**: 276, 1932.

   Stenochlaena Setchellii Maxon, Univ. Calif. Pub. Bot. **12**: 23, pl. 1, 1924. Copeland, B. P. Bishop Mus., Bull. **93**: 51, 1932.

   Acrostichum sorbifolium Linnaeus. Powell, Jour. Bot. **6**: 341, 1868. Baker, Jour. Bot. **14**: 345, 1876. Christ, Engler Bot. Jahrb. **23**: 361, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 413, 1908, part.

   Chrysodium sorbifolium (cum var. *oleandrifolia*) Luerssen, Mitt. Bot. **1**: 71, 358, 1874.

   Without locality: *Powell 27; Whitmee 150* (Kew).

   Savaii: *Reinecke 61* (W, V); Olonono, *Vaupel 182* (Kew, V). Upolu: *Rechinger 741, 1274, 1342, 1930;* above Malololelei, 500-700 m., *Christophersen 199, 310.*

   Tahiti, Samoa.

   I know only one Samoan species of this genus, though Carruthers (Fl. Vit., 373) referred a specimen collected by Powell to his *L. Brackenridgei* and Luerssen another specimen also collected by Powell to *Stenochlaena oleandrifolia* Brackenridge. Both of these species are known from Fiji only, and the Samoan species differs from both but agrees with *L. Setchellii* from Tahiti in the very short-stalked pinnae with unequal base. I agree therefore with Holttum in referring the specimens to that species, at least as a form, though some resemble *L. Brackenridgei* in the very long acuminate pinnae and others resemble *L. oleandrifolia* in the rather coriaceous texture. It is not improbable that *L. Brackenridgei, L. Setchellii,* and *L. Seemanni* Carruthers are all geographical forms of one species. In Samoa the number of pinnae ranges from 1 to 15 pairs, and young fronds are quite undivided, resembling a pinna of the pinnate fronds. Such young fronds were described as *Gymnogramme* (*Syngramma*) *scolopendrioides* Baker from Fiji, mentioned by Copeland (B. P. Bishop Mus., Bull. **59**: 74, 1929).

   Rechinger (Denkschr. Akad. Wiss. Wien **84**: 413, 1908) believed that some finely dissected terrestrial plants belong to his *A. sorbifolium.* They are, however, young plants of *Asplenium marattioides.*

Genus **LOMAGRAMMA** J. Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 96, 1929; Bull. **93**: 51, 1932. Holttum: Gard. Bull. Straits Settlem. **9**: 190-221, 1937.

Holttum has shown in his recent interesting monograph of this genus that all of its species begin as creeping plants on rocks (and on the ground?). In this state the rhizome is slender, threadlike and the fronds (bathyphylls) are small and sterile, more or less different from the mature ones; if the rhizome does not succeed in reaching a tree trunk, this sterile state may remain unaltered for a considerable period. If a tree trunk is reached, the rhizome increases very quickly in thickness, becoming strong, climbing high, and bearing the full grown acrophylls or mature sterile and fertile fronds. Fertile fronds apparently appear only during favorable conditions. As the bathyphylls of some species, including the only known Samoan species, were not known to Holttum, I describe them below; though I cannot prove with absolute certainty, I have no doubt that the isolated herbarium specimens examined are the creeping form of the indigenous *Lomagramma.*

Lomagramma cordipinna Holttum, Gard. Bull. Straits Settlem. **9**: 202, 1937.

Polybotrya lomarioides Kuhn. Luerssen, Mitt. Bot. **1**: 74, 359, 1874.

Acrostichum lomarioides Blume. Christ, Engler Bot. Jahrb. **23**: 361, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 413, 1908.

Bathyphylls: stipe 10-12 cm., lamina thinly herbaceous, 10-15 × 5-7 cm., lanceolate, simply pinnate; rachis narrowly winged and, like the stipe, furnished with scattered, small, light brown, pellucid, ovate or subbullate, entire, and short-acuminate scales. Pinnae in 8-10 alternate pairs, sessile, about 3 × 1 cm. acute or obtuse, the base rounded or cuneate below, truncate above, the margins coarsely serrated with antrorse, subfalcate teeth, basal pinnae a little shortened; costae beneath with rather many subbullate scales; veins reticulated with usually two rows of areoles without included veinlets.

Upolu: on the ground in dense, primitive forest above Utumapu, *Rechinger 599* (V = *Asplenium resectum,* Rechinger, Denkschr. Akad. Wiss. Wien **84**: 43, 1908).

Acrophylls: stipe up to 30 cm., lamina 50 cm. or more long, sterile pinnae in about 12 pairs, thinly herbaceous, nearly sessile (petiole 2 mm.), oblong, the largest 17 × 3.5 cm., entire below the coarsely serrulate and abruptly acuminate apex, the base unequally truncate or subcordate; veins reticulate with about 4 rows of areoles, the outer very small. Fertile pinnae on rather longer petioles, about 11 × 1 cm., wholly covered with sporangia. Stipe, rachi, and costae at first furnished with several scales similar to those of the bathyphylls but soon naked.

Upolu: *Reinecke 55 a; Rechinger 1237, 5233* (V). Tutuila: *Safford* (reported by *Holttum*).

Samoa, Fiji.

Genus **TERATOPHYLLUM** Mettenius

Holttum, Gard. Bull. Straits Settlem. **5**: 277 ff., 1932; Bull. **9**: 355 ff., 1938.

Climbing, acrostichoid ferns, like *Lomagramma,* with bathyphylls and

acrophylls and with all pinnae articulated to rachis, but veins free and spores with perispore. The only Samoan species is rather different from the Malayan ones and belongs to Holttum's second group, *Polyseriatae,* characterized by thicker rhizome, fronds polyseriate and both the sterile and fertile acrophylls bipinnate.

Teratophyllum Wilkesianum (Brackenridge) Holttum, Gard. Bull. Straits Settlem. **9**: 359, pl. 29, 30, 1938.

Acrostichum Wilkesianum Hooker. Christ, Engler Bot. Jahrb. **23**: 361, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 414, 1908.

Lomagramma Wilkesiana (Brackenridge) Copeland, B. P. Bishop Mus., Bull. **93**: 51, 1932; Copeland, Philip. Jour. Sci. Bot. **3C**: 32, 1908. Maxon, Univ. Calif. Pub. Bot. **12**: 28, pls. 3, 4, 1924.

Savaii: *Reinecke 87 b* (Kew, W); *Rechinger 627* (V); above Letui, 1,000 m., *Christophersen 738.*

Tahiti, Samoa, Rarotonga, New Caledonia.

According to Holttum's elaborate description, the Samoan specimens are nearer to those of New Caledonia than to those of Tahiti where the species is extremely variable (see Maxon's plates cited).

Genus **SCLEROGLOSSUM** van Alderwerelt van Rosenburgh

Small tufts of thick, coriaceous, entire and sessile leaves a few centimeters long and about 5 mm. wide with irregularly forked and quite hidden veins, the rhizome erect or prostrate with soft, yellowish or brown, neither clathrate nor ciliate scales; sori in deep submarginal groove, about as in *Vittaria.*

A small Malayan-Polynesian genus, formerly wrongly united with *Vittaria* but in reality a close relative of *Grammitis.*

Scleroglossum sulcatum (Kuhn) van Alderwerelt van Rosenburgh. C. Christensen, Dansk. Bot. Arkiv. **6**(3): 28, pl. 2, fig. 5, 1929.

Vittaria sulcata Kuhn. Christ, Engler Bot. Jahrb. **23**: 361, 1897.

Savaii: *Reinecke* (B). Upolu: *Reinecke 117, 117 a, 126 a* (B); *Betche* (Herb. Bonaparte).

Ceylon to Tahiti, in Polynesia known from Samoa and Tahiti (*Taeniopsis mauruensis* Nadeaud, not mentioned by Copeland).

Genus **POLYPODIUM** Linnaeus

Dealing with a local fern flora I prefer to take this genus in the wide sense of Index Filicum, comprising nearly all ferns with round, rarely linear sori without indusium. Many workers, including (lately) Copeland and R. C. Ching, have tried to split it up into a number of smaller genera, several of which in my opinion are well founded. I made such an attempt in Verdoorn's

Manual of Pteridology, 1938. Many of these genera are represented in Samoa by one or a few species and they are briefly characterized in the following key; only Samoan species are considered.

Veins free
- Fronds simple; small epiphytic ferns ..... **I. Grammitis.**
- Fronds pinnatifid-bipinnatifid
  - Scales of rhizome not ciliate
    - One sorus to each of the upper segments; densely tufted ferns with fronds hardly 1 cm. wide
      - Fertile segments folded and thus protecting the sorus; rather thin leaved ..... **II. Calymmodon.**
      - Fertile segments twisted and forming a kind of pocket with the sorus within; rigidly coriaceous ..... **III. Acrosorus.**
    - More sori to each segment; fronds coriaceous, pectinato-pinnatifid, 1-4 cm. or more wide ..... **V. Ctenopteris.**
    - Fronds bipinnatifid with one sorus to each secondary segment ..... **VI. Themeleum.**
  - Scales of rhizome with long and thin marginal cilia; sori deeply immersed in "craters", the mouth of which is marginal in *Prosaptia* proper, superficial in *Cryptosorus* ..... **IV. Prosaptia.**

Veins anastomosing
- Veins forming 1-2 (3) large areoles, the costal ones with a free included vein with a sorus at the tip; sori uniseriate; large pinnate species, herbaceous ..... **VII. Goniophlebium.**
- Veins densely reticulate, usually indistinct, but with more or less raised main veins, areoles small and numerous with free included veinlets
  - Sori when young, covered by peltate, clathrate scales; leaves small, entire; rhizome threadlike, wide creeping ..... **VIII. Lepisorus.**
  - Sori without scales; large species
    - Fronds thin leaved, simple or pinnatifid, sori small, irregularly scattered, superficial ..... **IX. Microsorium.**
    - Fronds coriaceous or papyraceous, pinnatifid (simple ones occur); sori in 1-3 distinct rows, round, large (about 2 mm. diameter), usually immersed ..... **X. Phymatodes.**
    - Fronds coriaceous, entire; sori sometimes round and in a single oblique row between two main veins, or some or all confluent into linear coenosori reaching from the midrib to the margin ..... **XI. Selliguea.**

I. **GRAMMITIS** (Swartz)

Copeland: B. P. Bishop Mus., Bull. **93**: 70, 1932, as genus.

Fronds and soprangia glabrous
- Fronds sessile with thin margins ..... **1. P. graminellum.**
- Fronds stipitate with black sclerotic margins ..... **2. P. Vaupelii.**

Fronds with reddish hairs, sporangia with bristles
- Sori near midrib
  - Sori deeply immersed ..... **3. P. subspathulatum.**
  - Sori superficial or slightly impressed
    - Fronds subsessile, hairs extremely short ..... **4. P. conforme.**
    - Fronds stipitate, hairs 2 mm. or more long ..... **5. P. Hookeri.**
- Sori near margin
  - Sori uniseriate, fronds 15-25 × 1.5-2 cm ..... **6. P. Whitmeei.**
  - Sori biseriate, fronds 10-15 × 1 cm ..... **7. P. samoense.**

1. **Polypodium graminellum** C. Christensen, Index Fil., 530, 1906.
   Polypodium simplex Baker, Jour. Bot. **14**: 12, 1876 (non Swartz, 1801).
   Polypodium samoense Baker. Christ, Engler Bot. Jahrb. **23**: 358, 1897 (non Baker).
   Polypodium ligulatum Baker. Hieronymus, Hedwigia **44**: 78, 1905. Lauterbach, Engler Bot. Jahrb. **41**: 220, 1908 (an Baker?; non Copeland, B. P. Bishop Mus., Bull. **59**: 100, 1929).

   Fronds densely tufted on an erect, often somewhat elongated rhizome clothed with brown, lanceolate scales. Leaves up to 20 cm. long by 2-3.5 mm. wide, subsessile or with a short stipe, linear, and gradually attenuated to both ends, somewhat repand, firmly herbaceous, quite glabrous. Veins indistinct, once forked, the upper branch soriferous. Sori near the midrib, oblong to sublinear, distinctly immersed. Sporangia glabrous.

   Savaii: *Whitmee 123 ex parte* (Kew); *Powell 192* (Kew); *Reinecke 117, 117 a* (B); Maugaloa, 1,200 m., *Vaupel 436* (B).

   Fiji?

   Hieronymus identified this *Vittaria*-like species with *P. ligulatum* Baker and possibly he was right. That Fijian species is certainly indistinguishable from *P. graminellum* as to habit and size, but according to my notes the sori are superficial in the type at Kew. *P. ligulatum* listed by Copeland (B. P. Bishop Mus., Bull. **59**: 100, 1929), is certainly not the same; it is described as ciliate and the sori as very setose.

2. **Polypodium Vaupelii** Brause, Notizblatt bot. Gart. Berlin-Dahlem **8**: 140, 1922.
   Polypodium marginellum Swartz. Baker, Jour. Bot. **14**: 12, 1876.

   In general habit and size very like *P. graminellum* but rhizome-scale glossy reddish brown, the leaves more coriaceous with thick black margins, long attenuate below into a stipe 3-5 cm. long, the veins distinct and raised beneath, dense and very oblique, the sterile ones simple, the fertile with a short soriferous spur at the upper base. Sori confined to the central portion of the blade (the tip always sterile), superficial, close to the midrib, oblong, at least confluent. Sporangia glabrous.

   Savaii: Maugaloa, 1,200 m., *Vaupel 436* part (type, B) *Whitmee 123* part (Kew); Tuisivi Range, epiphyte, 1,600-1,700 m., *Christophersen 757*.

   An interesting species belonging to a small group of *Grammitis* distinguished by the dark and thick sclerotic margins. It has considerably longer leaves (up to 30 cm.) than its few relatives which are all African and American.

3. **Polypodium subspathulatum** Brackenridge, variety?
   Polypodium subspathulatum Brackenridge. Copeland, B. P. Bishop Mus., Bull. **93**: 70, 1932.

   Size and habit of *P. Hookeri,* but fronds coriaceous with hidden veins, the hairs shorter (1 mm.) and very few, soon abraded, and the sori immersed in rather deep pits, the sporangia with short bristles.

   Savaii: Mataana, 1,600 m., epiphyte, *Vaupel 451* (B).

   This may be a distinct species, differing from the genuine *P. subspathu-*

latum from Tahiti in the more deeply immersed sori, which are placed near the midrib, not medial between this and the margin, but having seen only one rather old plant, I prefer to refer it to that species. From the other species of Samoan *Grammitis* it is easily recognized by the immersed sori.

The type known from Tahiti only.

4. **Polypodium conforme** Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 4, pl. 1, fig. 2, 1854. Copeland, B. P. Bishop Mus., Bull. **59**: 100, 1929.
Polypodium samoense Baker. Rechinger, Denkschr. Akad. Wiss. Wien, **84**: 421, 1908.

Fronds tufted on a small rhizome clothed with brown scales. Leaves subsessile (longest stipe 0.5 cm. long) linear-lanceolate, 8-12 cm. long, 5-8 mm. wide, narrowed at both ends, light green, subcoriaceous, the margins densely ciliate with extremely short reddish hairs and midrib below with similar ones. Veins indistinct, the fertile ones forked. Sori round, superficial, forming a single row close to the midrib; sporangia setose.

Upolu: ridge above Malololelei, epiphyte, 700 m., *Christophersen 187;* Lanutoo, *Rechinger 1008* (V).

Known formerly from Fiji only, but I should refer here *P. Hookeri* var. *uapense* E. Brown (B. P. Bishop Mus., Bull. **89**: 86, 1931) from the Marquesas.

Often regarded as a form of *P. Hookeri,* from which it differs in smaller size, subsessile fronds, glabrous surfaces and especially by the very short marginal hairs. *P. Hookeri* Brackenridge, Christ (Engler Bot. Jahrb. **23**: 358, 1897) from Upolu, collected by Betche is probably *P. conforme.*

5. **Polypodium Hookeri** Brackenridge. Powell, Jour. Bot. **6**: 340, 1868. Copeland, B. P. Bishop Mus., Bull. **59**: 100, 1929 (vix Christ, Engler Bot. Jahrb. **23**: 358, 1897).
Polypodium setigerum Blume. Luerssen, Mitt. Bot. **1**: 100, 362, 1874.

Somewhat larger and thinner than *P. conforme,* the stipe 2-4 cm. long, the hairs of stipe, margins, midrib, and sori about 2 mm. long and some also found on the surfaces; the veins subdistinct, subpinnate.

Without locality: *Powell 96* (B, W).
Tutuila: without name of collector (Kew).
Hawaii, Fiji. Apparently very rare in Samoa.

6. **Polypodium Whitmei** Baker, Jour. Bot. **14**: 12, 1876. Christ, Engler Bot. Jahrb. **23**: 358, 1897.

Rhizome short-creeping, rather thick and densely clothed with linear-lanceolate brown scales, the fronds close. Stipe 1-3 cm. long with numerous reddish spreading hairs about 2 mm. long; lamina lanceolate or linear-oblong, shortly attenuate below, longer upwards, 15-25 cm. long, 1.5-2 cm. broad, subcoriaceous, margins and midrib beneath with rather few, deciduous reddish hairs, surfaces otherwise glabrous. Veins rather indistinct, forked with equal branches, which are sometimes forked again, the upper with a terminal sorus 1-2 mm. within the margin, sori thus uniseriate, somewhat impressed, at first oblong; sporangia with usually one stiff, lateral, cylindrical red hair mixed with some similar long ones.

Savaii: at higher altitudes. *Whitmee 124* (type), *100* (Kew); *Powell 111* part (Kew, B); above Maugaloa, 1,200 m., *Vaupel 437* (B, Kew); Tuisivi Range, 1,600-1,700 m., epiphyte, *Christophersen 823;* above Matavanu, 1,300 m., *Christophersen 2142.* Endemic.

7. **Polypodium samoense** Baker, Syn. Fil. 321, 1867. Luerssen, Mitt. Bot. **1**: 102, 362, 1874 (non Rechinger, Denkschr. Akad. Wiss. Wien **84**: 421, 1908; Christ, Engler Bot. Jahrb. **23**: 358, 1897).

   Polypodium savaiense Powell. Baker, Jour. Bot. **14**: 344, 1876.

   Polypodium pleiosorum Mettenius. Christ, Engler Bot. Jahrb. 23: 358, 1897 (non Mettenius).

   Rhizome short with linear-lanceolate, light brown scales. Stipe 2-3 cm. long, with many spreading red-brown hairs. Lamina papyraceous, oblong to oblanceolate, 15 × 1 cm. or smaller, acute and attenuated at the lower third or fourth, irregularly repand and ciliate (marginal hairs abraded with age); midrib with rather few short hairs beneath, the surfaces otherwise glabrous. Veins somewhat raised below, subpinnate with usually three branches, all of the middle and upper veins with a sorus at the tip. Sori all far from the midrib, forming an irregular, intramarginal band of two series, superficial, round; sporangia with 1-2 pale, rather stiff setae.

Savaii: *Powell 111,* part (type, Kew, B), *193* (Kew); *Whitmee 222* (type of *P. savaiense* Powell); above Matavanu, 900 m., *Christophersen 2096.* Tutuila: top of Pioa, epiphyte in scrub forest, *Christophersen 3543.*

Samoa: a Hawaiian plant referred by some authors to *P. samoense* was described in 1905 by Hieronymus as a new species, *P. Knudsenii.* I do not find any difference between Baker's two species.

II. **CALYMMODON** (Presl)

Copeland, B. P. Bishop Mus., Bull. **59**: 101, 1929, as genus.

8. **Polypodium latealatum** (Copeland) C. Christensen, Index Fil., Suppl. **3**: 151, 1934.

   Calymmodon latealatus Copeland, Philip. Jour. Sci. **34**: 265, pl. 4, 1927; B. P. Bishop Mus., Bull. **59**: 101, 1929.

   Polypodium cucullatum Nees. Powell, Jour. Bot. **6**: 341, 1868. Luerssen, Mitt. Bot. **1**: 102, 362, 1874. Christ, Engler Bot. Jahrb. **23**: 358, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 417, 1908.

   Without locality: *Horne; Powell* (Kew).

   Upolu: *Reinecke 127* (B); Lanutoo, *Rechinger 4498* (V).

   Samoa, Fiji.

A local representative of the Malayan *P.* (*Calymmodon*) *cucullatum* Nees and Blume, marked by the broad, triangular, blunt sterile segments and broader wings to the rachis. Young fronds are distinctly short-ciliate, the older quite glabrous. From the very similar *P. Reineckei* it differs in thinner texture, smaller size (leaves usually under 10 cm. long), in pubescence and shape of

the sterile segments and especially in the fertile ones being simply folded along the vein.

III. **ACROSORUS** (Copeland)

9. Polypodium Reineckei (Christ) C. Christensen, Index Fil., Suppl. prélim., 28, 1917.

Davallia Reineckei Christ, Engler Bot. Jahrb. **23**: 341, pl. 5, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 442, 1908.

Acrosorus Reineckei Copeland, Philip. Jour. Sci. Bot. **2**: 136, 1907.

Polypodium cucullatum Nees (variety). Baker, Jour. Bot. **14**: 345, 1876.

Fronds pendent, very numerous and tufted on a small rhizome with castaneous, lanceolate, entire scales. Leaves sessile, linear, 20-30 cm. long, 4-6 mm. wide, pale green, coriaceous, glabrous and naked, deeply pinnatifid, sterile in the lower third, fertile above. Sterile segments rectangular in shape with the outer margin truncate, retuse or deeply emarginate, oblique, rather close, 1.5 mm. wide, the fertile ones more distant, each with 1 sorus, which is somewhat immersed and hidden in a pocket formed by the twisting, conduplication, and partial concrescence of the sides of the 2 lobes of the segment.

Without locality: *Whitmee 185* (Kew).

Savaii: *Reinecke 186* (B, type, Kew, W); *Rechinger s. n.* (W). Upolu: *Rechinger 1821* (V); Malololelei-Lanutoo, 700 m., *Christophersen 414*. Endemic.

The only Polynesian species of *Acrosorus* as defined by Copeland. It has near relatives in Malaya-Melanesia.

IV. **PROSAPTIA** (Presl)

Copeland, B. P. Bishop Mus., Bull. **59**: 102, 1929, as genus.

10. Polypodium Emersonii (Hooker et Greville) C. Christensen, Ind. Fil., Suppl. **3**: 148, 1934.

Davallia alata Blume. Luerssen, Mitt. Bot. **1**: 209, 393, 1874.

Davallia Emersoni Hooker et Greville. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 240, 1854. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 341, 1897 (*D. Emersonii*). Rechinger, Denkschr. Akad. Wiss. Wien **84**: 441, 1908 (*D. Emersonii*). Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 126, 1924 (*D. Emersonii*).

Fronds subsessile, oblanceolate, 15-30 × 1.5-2.5 cm., deeply pinnatifid and narrowed below into wavy wings to the midrib, segments entire, oblong, obtuse.

Polypodium Emersonii var. **samoense,** var. nov. (pl. 4, *C*).

A typo malayense differt: crateribus extus dense ciliatis.

Common and found in all islands and collected by all.

Savaii: above Sili, 400 m., *Christophersen 3178*. Upolu: Malololelei-Lanutoo, 700 m., *Christophersen 27, 35;* Vaisingano Canyon, 500 m., *Christophersen 78*. Tutuila: Alava Ridge, 400 m., *Christophersen 1127;* top of

Pioa, 500 m., *Christophersen 1216.* Tau: *Garber 719, 726, 731, 747.* Olosega: top of Piumafua, 630 m., *Garber 1051.*

All of the numerous specimens seen differ from the well-known Malayan type by characters given above, and smaller differences may also be found; otherwise they resemble the type very closely.

The species is found from South India to the Philippines, not recorded from Polynesia where it is represented by the endemic variety *samoense.*

11. Polypodium contiguum (Forster) J. Smith.

Davallia contigua Swartz, Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 241, 1854. Luerssen, Mitt. Bot. **1**: 209, 393, 1874. Baker, Jour. Bot. **14**: 10, 1876. Christ, Engler Bot. Jahrb. **23**: 341, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 441, 1908.

Prosaptia contigua (Forster) Presl. Copeland, B. P. Bishop Mus., Bull. **93**: 69, 1932 (Bull. **59**: 102, 1929 = *Prosaptia pubipes* Copeland, Bull. **93**: 13, 1932).

Fronds up to 50 × 5 cm., pinnate to the rachis, the lateral sori immersed in short, oblique teeth.

Without locality: *Brackenridge* (W); *Whitmee 37* (Kew).

Savaii: *Reinecke 158; Rechinger 1090* (V); *Vaupel 304* (W).

Tropical Asia and Polynesia east to Marquesas.

A variable species with several geographical races, of which the Fijian *Prosaptia pubipes* Copeland is one. The specimens from Samoa are not that form, lacking the dense velutinous pubescence of the stipes; they are very large, the leaves up to 70 cm. long, according to Rechinger. *P. contiguum* is apparently rare in the islands.

12. Polypodium deltoideophyllum Baker, Jour. Bot. **14**: 345, 1876. Christ, Engler Bot. Jahrb. **23**: 358, 1897.

Rhizome short with fuscous, deciduously long-ciliate scales. Fronds nearly sessile (the pubescent stipe less than 1 cm.), oblanceolate, 20-30 cm. long by 2 cm. wide above the middle, long attenuate below, coriaceous, elastic, very sparsely and deciduously ciliate and very slightly hairy on the midrib beneath, pinnatifid at the middle nearly to the midrib with deltoid, obtuse segments which are considerably widened at the lower but nearly straight at the upper base, the lower ones gradually more rounded and the lowest forming a broadly crenate wing to the midrib. Veins hidden but very distinct when held against the light, pinnate in the segments with simple oblique veinlets. Sori a little nearer the margin than the midrib of the segment, deeply immersed, the mouth of the pits round, not raised, glabrous.

Without locality: *Whitmee 223* (Kew).

Upolu: upper Vaisigano River, *Betche 127* (B); Le pua, *Reinecke 1102* (B); Lanutoo, *Vaupel 277* (W). Endemic and rare.

One of the most distinct Samoan ferns. It belongs to the section *Cryptosorus,* which I do not hesitate to unite with *Prosaptia.* It is closely allied to several Malayan and Papuan species, such as *P. barathrophyllum* Baker, best

marked by the decidedly unequal-sided base of the middle segments. It has a superficial resemblance to the Fijian *P. stenopteron* Baker, which I think Copeland (B. P. Bishop Mus., Bull. **59**: 100, 1929) wrongly identified with *P. purpurascens* Nadeaud from Tahiti, but both of these have superficial sori.

V. **CTENOPTERIS** (Blume)

13. **Polypodium blechnoides** (Greville) Hooker. Copeland, B. P. Bishop Mus., Bull. **93**: 68, 1932 (not of Bull. **59**: 101, 1929, and not of authors of the following species).

Polypodium nutans Blume, ex parte. Luerssen, Mitt. Bot. **1**: 101, 362, 1874.

Polypodium decorum Brackenridge. Baker, Jour. Bot. **14**: 345, 1876. Christ, Engler Bot. Jahrb. **23**: 358, 1897. Rechinger Denkschr. Akad. Wiss. Wien **84**: 417, 1908. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 123, 1924.

Rhizome short-creeping with light brown, glossy, lanceolate and long acuminate scales. Leaves clustered, practically sessile, oblanceolate and long attenuate to both ends, often with a very slender apex, usually 10-20 cm. long, 1-1.5 cm. wide above the middle, coriaceous and pale green beneath, pinnate, the rachis blackish and furnished beneath with peculiar scattered hairs, consisting of a scale-like basal pale portion which bears 1-3 castaneous, cylindrical, rigid hairs. Segments numerous, contiguous, slightly oblique, the lower ones sterile and gradually diminishing into minute lobes, the upper ones linear-oblong, about 1 mm. wide, hardly widened at base, entire, obtuse, the margins somewhat revolute, the veins hidden. Sori oblong, subparallel to the margin, somewhat immersed, sporangia mixed with some rigid, castaneous hairs.

Without locality: *Powell 94, 94 b* (B); *Whitmee 130* (Kew).

Upolu: above Utumapu, 500 m., *Rechinger 588* (V). Tutuila: *Reinecke 176* (B); *Setchell 391* (W); below crest and top of South Pioa, 450-500 m., *Garber 787; Christophersen 1217, 3553;* Matafao Ridge, 500-600 m., *Christophersen 1054*. Olosina [Olosega]: *Reinecke s. n.*

Distribution uncertain. The types of both *P. blechnoides* and *P. decorum* Brackenridge came from the Society Islands, and I agree with Copeland in considering them identical. Very similar forms, usually called *P. decorum,* are found westwards to Malaya. The name *blechnoides* has been used by almost all writers for one or two quite different species, especially for *P. lepidum.*

14. **Polypodium lepidum** Brause, Notizblatt bot. Gart. Berlin-Dahlem, **8**: 139, 1922. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 123, 1924.

Polypodium nutans Blume, part? Luerssen, Mitt. Bot. **1**: 101, 362, 1874.

Polypodium blechnoides Hooker. Baker, Jour. Bot. **14**: 345, 1876. Christ, Engler Bot. Jahrb. **23**: 358, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 212, 1912.

Polypodium deltoideophyllum Baker (part?). Rechinger, Denkschr. Akad. Wiss. Wien **84**: 418, 1908.

Rhizome short-creeping, stout, with a mass of brown, lanceolate, entire scales, the fronds clustered. Stipe 3-6 cm. long, wiry, glabrous and indistinctly margined above. Lamina coriaceous, glaucous green beneath when fresh, with age brown, pinnately incised to the rachis, which is blackish, elastic and beneath with a few minute scales, which rarely bear cylindrical, castaneous hairs. Full grown fertile lamina divided into two distinctly separated halves, the lower one sterile, rather shortly attenuate below, the segments oblique, triangular, broadly adnate and contiguous, mostly 1.5-2 cm. long and 5-6 mm. wide at base, obtuse, the upper half fertile and often ending in a long tail-like, narrow, crenate-dentate apex, the segments patent linear from a broader base, up to 4 cm. long and 1-1.5 mm. wide. Sterile leaves throughout like the sterile half of the fertile ones but usually smaller, 15-20 × 1.5 cm., but intermediate leaves occur. They are like the sterile leaves in habit, but the uppermost fertile segments are not very different from the sterile ones. Sori superficial, ovate, large, at least confluent, without rigid hairs.

Without locality: *Powell 13* (W); *Whitmee 128* (Kew).

Savaii: *Vaupel 421* (type, B); above Matavanu, 900 m., *Christophersen 2062*. Upolu: *Reinecke 166, 166 c* (B); Lanutoo, *Rechinger 154* (V); *Hochreutiner 3384* (G). Tutuila: *Reinecke 166 b* (B); *Setchell 391 bis* (W); Matafao ridge, 500-600 m., *Christophersen 1055, 1072*. Olosina [Olosega]: *Reinecke 166 a* (B).

Samoa, apparently common; probably Fiji.

A very distinct and apparently common species, which almost all writers identified with *P. blechnoides* (Greville) Hooker. I doubtfully maintain it as distinct from the Fijian *P. Seemanni* (J. Smith) Copeland, and it might very well be regarded as a local variety of that species. The specimens of *P. Seemanni* (*Cryptosorus Seemanni* J. Smith; *Polypodium contiguum* Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 6, pl. 2, 1854; *P. blechnoides* Copeland, B. P. Bishop Mus., Bull. **59**: 101, 1929) differ from the Samoan form in broader and hardly oblique sterile segments, the lower of which are more gradually diminishing into rounded, confluent lobes, the stipe therefore sometimes short, by the fertile ones being more gradually narrowed from base to apex and by somewhat immersed and longer sori. Brackenridge's figure illustrates a form with slightly lengthened fertile segments corresponding to the intermediate form of *P. lepidum* mentioned above, but in other specimens [Seemann 821 (Kew), A. C. Smith 1898] they are prolongated just as in *P. lepidum*.

VI. **THEMELEUM** Kunze

15. Polypodium tenuisectum Blume. Christ, Engler Bot. Jahrb. **23**: 357, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 418, 1908.

Polypodium tamariscinum Kaulfuss. Powell, Jour. Bot. **6**: 341, 1868. Luerssen, Mitt. Bot. **1**: 102, 363, 1874.

Polypodium sertularioides Baker, Jour. Bot. **14**: 12, 1876.

Leaves tufted on the short-creeping rhizome with light-brown, ovate, entire scales, lanceolate, 15-20 × 3-4 cm., narrowed below into some small toothlike auricles, coriaceous, bipinnatifid, the stipe (2-5 cm. long) and rachis with deciduous, patent, thin brown hairs; largest pinnae 2.5 × 0.5 cm., sessile, decurrent, pinnately divided into 8-12 pairs of linear-oblong, decurrent oblique segments, about 0.5 mm. wide and furnished with 1-2 long hairs at the tip. One sorus to each segment of the upper pinnae, placed near its base, round and a little impressed.

Without locality: *Powell 95* (Kew, B, W); *Whitmee 129* (type of *P. sertularioides* Baker, Kew).

Savaii: *Reinecke 148* (B, Kew, W); Mataana, *Vaupel 305* (B, Kew); Maungaafi, *Rechinger 1046* (V).

Malaya to Melanesia.

The Samoan form (*P. sertularioides*) agrees in nearly every detail with specimens from the Philippines.

VII. **GONIOPHLEBIUM** (Blume)

Copeland, B. P. Bishop Mus., Bull. **59**: 99, 1929, as genus.

16. Polypodium subauriculatum Blume var. **serratifolium** (Brackenridge) Hooker. Luerssen, Mitt. Bot. 1: 103, 363, 1874.

Goniophlebium serratifolium Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 35, 1854.

Polypodium subauriculatum Blume. Christ, Engler Bot. Jahrb. **23**: 356, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 215, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 418, part?, 1912.

Goniophlebium subauriculatum (Blume) Presl. Copeland, B. P. Bishop Mus., Bull. **59**: 99, 1929.

A common epiphyte, found in all islands and collected by all.

The variety may be a distinct species. It differs from the typical Malayan species in the non-calcareous rhizome, which is densely covered with narrow, dark-brown, persistent scales, by its smaller size and by the base of the pinnae not being truncate or auriculate but shortly cuneate. The serration is variable.

The type found through Malaya and Melanesia to New Caledonia; the variety confined to Fiji and Samoa (?).

Savaii: Le To, 750 m., *Christophersen 2946*. Upolu: top of Fao, 680 m., *Christophersen 565*.

VIII. **LEPISORUS** (J. Smith)

Rhizome thin, wide-creeping, with fuscous, clathrate, ciliate scales. Leaves simple with reticulate venation. Sori in a row at either side of the midrib, superficial; when young covered with peltate, clathrate scales.

17. Polypodium accedens Blume. Powell, Jour. Bot. **6**: 341, 1868. Luerssen, Mitt. Bot. **1**: 105, 364, 1874. Baker, Jour. Bot. **14**: 12, 1876. Christ,

Engler Bot. Jahrb. **23**: 357, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 211, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 419, 1908.

Phymatodes accedens Blume. Copeland, B. P. Bishop Mus., Bull. **59**: 91, 1929.

Drynaria acuminata Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 42, 1854.

Without locality: *Brackenridge; Powell 93; Whitmee 133* (Kew).

Savaii: *Reinecke 94 a;* Olonono, *Vaupel 187* (B, Kew); above Matavanu, 800 m., *Christophersen 2277*. Upolu: *Reinecke 94* (Kew); *Rechinger 730* (V, W); Malololelei, 700 m., *Christophersen 31, 40, 93, 184*. Tutuila: (*Graeffe 459,* reported by *Luerssen*).

Malaya east to Samoa.

This is a genuine *Lepisorus* with the characteristic clathrate scales, which cover the young sori but usually have fallen in the old ones. The form occurring in Fiji and Samoa (*Drynaria acuminata* Brackenridge) differs somewhat from the Malayan type by more clathrate scales (very easily abraded) on the under surface, by the partially fertile leaves gradually tapering from the ovate base toward the fertile tip, and by fully fertile, lanceolate-linear leaves 5-6 mm. wide.

IX. **MICROSORIUM** (Link)

[*Polypodium punctatum* (Linnaeus) Swartz. Luerssen, Mitt. Bot. **1**: 364, 1874. Copeland, B. P. Bishop Mus., Bull. **59**: 92, 1929. *Microsorium punctatum* (Linnaeus) Copeland, B. P. Bishop Mus., Bull. **93**: 73, 1932. *Drynaria polycarpa* (Swartz) Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 44, 1854.

Fronds simple, oblanceolate, up to 90 × 8 cm., with numerous small, scattered superficial sori.

According to Brackenridge, the species is found in Tutuila, but is not mentioned by later authors and I have seen no specimens; possibly the locality is false. It is remarkable if this wide-spread species is lacking in Samoa, for Copeland reports it as common in Fiji and Tahiti.]

18. Polypodium polynesicum C. Christensen, nom. nov.

Polypodium expansum Baker, Jour. Bot. **14**: 12, 1876 (non Poiret 1804).

Drynaria acuminata Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 47 (not 41) 1854.

Drynaria sylvatica Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 343, 1854.

Polypodium sylvaticum Mettenius, Novara Reise Bot. **1**: 215, 1870 (not Schkuhr 1806).

Polypodium dilatatum Wallich. Powell, Jour. Bot. **6**: 341, 1868. Luerssen, Mitt. Bot. **1**: 111, 366, 1874. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 420, 1908 [*P. dilatatum* var. *expansum* (Baker) Christ, Engler Bot. Jahrb. **23**: 356, 1897].

Polypodium euryphyllum C. Christensen, Index Fil., part.

Polypodium vitiense Baker. Copeland, B. P. Bishop Mus., Bull. **59**: 93, 1929; Bull. **93**: 73, 1932. C. Christensen, Index Fil., Suppl. **3**: 161, 1934 (non Baker).

In general habit resembling *P. nigrescens,* but very much larger; stipe 50 cm. or more thick, lamina 1 m. × 40-50 cm., decurrent below in a wing to the upper part of the stipe, thin, pinnatifid to a wing 1.5-2 cm. wide, the segments numerous with broad spaces between, up to 25 × 5 cm., the main veins flexuose, not reaching the margin, the smaller densely reticulated veins distinct; sori numerous, small, scattered, a little impressed.

Without locality: *Powell 55; Whitmee 137* (Kew); *Safford 14* (W).

Savaii: Olo, 700 m., *Christophersen 2294;* Aopo, *Vaupel 40* (Kew). Upolu: Utumapu, *Rechinger 1009* (V). Tau: *Garber 578* (*maga maga?*). Olosega: *McMullin 50* (W); *Garber 1039.*

Polynesia: Fiji, Rarotonga, Tahiti, Marquesas, Rapa.

Usually united with the Asiatic *P. dilatatum* Wallich = *P. euryphyllum* C. Christensen (Index Fil.) = *P. Hancockii* Baker (C. Christensen Index Fil. Suppl. 3), but considerably larger, with many more segments, the basal wing shorter and the sori fewer. The Samoan specimens are larger than those from Fiji and Rarotonga, which Copeland wrongly identified with *P. vitiense* Baker (see *P. Powellii*).

P. Wilkesii C. Christensen (Copeland, B. P. Bishop Mus., Bull. **59**: 94, 1929), collected by Betche, was recorded from Upolu under the name of *P. alatum* Hooker by Christ (Engler Bot. Jahrb. **23**: 357, 1897). Judging from his remarks, the specimen probably belongs to *P. polynesicum* and if so, his *P. dilatatum* var. *expansum* (Reinecke 83) may be a form of *P. scolopendria.*

X. **PHYMATODES** (Presl)

Key to the Species of Phymatodes

Sori immersed, appearing as pustules on the upper side. Fronds sometimes simple, but usually pinnatifid with 1-10 pairs of segments
- Fronds coriaceous, pustules low, sori in 1-3 rows.....**19. P. scolopendria.**
- Fronds thinner, pustules high, sori uniseriate.....**20. P. nigrescens.**

Sori superficial or a little impressed, uniseriate; up to 20 pairs of segments.....**21. P. Powellii.**

19. Polypodium scolopendria Burmann. Setchell, Dept. Marine Biol. Carnegie Inst., Wash. **20**: 122, 1924. C. Christensen, Index Fil., Suppl. **3**: 158, 1934.

Phymatodes scolopendria Burmann. Copeland, B. P. Bishop Mus., Bull. **59**: 93, 1929; Bull. **93**: 73, 1932.

Polypodium Phymatodes Linnaeus. Luerssen, Mitt. Bot. **1**: 108, 365, 1874. Baker, Jour. Bot. **14**: 13, 1876. Christ, Engler Bot. Jahrb. **23**: 356, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 214, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 419, 1908.

Drynaria vulgaris J. Smith. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 53, 1854.

Polypodium longipes (Link) Kunze. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 35, 1908.

Very common on all islands, and collected by all.

Savaii: below Matavanu crater on lava, 200 m., *Christophersen 615;* rocky bluff, Safotu-Manase, 2-20 m., *Christophersen 2445.* Upolu: Malololelei, roadside, 650 m., *Christophersen 147;* Mulinuu swamp, Apia, on *Bruguiera, Christophersen 443.* Tutuila: Goat Island, *Garber 804.* Tau: *Garber 685;* Anuu at mud lake, *Diefenderfer, Christophersen 1248.*

Perhaps the commonest and most wide-spread fern in Polynesia, extending east to Easter Island, west through Malaya to Africa.

As usually construed, *P. scolopendria* is an aggregate of more or less distinct forms, which are highly in need of revision. The specimens from Samoa are quite different, especially in size and length of stipe. Simple lanceolate fronds sometimes occur with pinnatifid ones, these with from 1 to 10 pairs of segments 2-4 cm. wide. The large sori are somewhat immersed, sometimes uniseriate, but more often in 2 or 3 rows at either side of the midrib. Most specimens seen belong to the form with long stipes, exceptionally up to 50 cm., which Rechinger separated from *P. phymatodes* as *P. longipes* Link.

20. Polypodium nigrescens Blume? Powell, Jour. Bot. **6**: 135, 1868. Baker, Jour. Bot. **14**: 13, 1876. Copeland, B. P. Bishop Mus., Bull. **59**: 93, 1929; Bull. **93**: 74, 1932.

Polypodium longissimum Blume. Luerssen, Mitt. Bot. **1**: 110, 365, 1874. Christ, Engler Bot. Jahrb. **23**: 356, 1897. (Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 123, 1924). Rechinger, Denkschr. Akad. Wiss. Wien **84**: 420, 1908.

Like *P. scolopendria,* but texture much thinner and the smaller veins distinct, the uniseriate sori deeply immersed and marked by more raised pustules on the upper side. The Samoan form is rather constant, the lamina simple (20 × 3 cm.) or pinnatifid to a broad wing with 1 or usually 2-5 pairs of segments with a broad space between.

Without locality: *Powell 14; Whitmee 135* (Kew).

Savaii: Maungaafi, 1,000 m., *Rechinger 1944.* Upolu: *Betche;* Lanutoo, *Reinecke 25* (B, Kew). Tutuila: above Naval Station, 200-300 m., *Christophersen 997.* Tau: *McMullin 49* (W).

Tropical Asia, Australia and Polynesia, east to Marquesas.

I follow Copeland in referring this Polynesian fern to *P. nigrescens,* but I am not at all sure that he is right, and I do not believe it to be a form of *P. longissimum* Blume. It resembles more *P. ithycarpum* Copeland from Borneo.

21. Polypodium Powellii Baker. Powell, Jour. Bot. **6**: 341, 1868. Luerssen, Mitt. Bot. **1**: 109, 365, 1874. Baker, Jour. Bot. **14**: 13, 1876. Christ,

Engler Bot. Jahrb. **23**: 356, 1897; Conserv. Jard. bot. Genève, Ann. **15-16**: 215, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 420, 1908.

In general appearance like a large form of *P. scolopendria* but with 20 or more pairs of segments usually 1.5-2 cm. wide and up to 25 cm. long, grass-green, and of thinner texture, the sori always uniserial and a little or not immersed.

Without locality: *Powell 135* (type, Kew, B); *Whitmee 136* (Kew).

Savaii: *Reinecke 25 b* (B); Maugaloa, 1,200 m., *Vaupel 350* (B); above Salailua, 1,200-1,300 m., *Christophersen 2752.* Upolu: Mount Tofua, *Graeffe 1143* (B); Apia, *Betche;* Lanutoo, *Reinecke 25 a; Rechinger 1952* (V); *Hochreutiner 3291* (G).

Samoa, Fiji (? see below), and a very similar plant from New Guinea.

After examination of the type of *P. vitiense* Baker from Fiji (Horne 950, Kew) I am rather sure that it is a small form of *P. Powellii* and identical with *Phymatodes parksii* Copeland (B. P. Bishop Mus., Bull. **59**: 16, 92, pl. 5, 1929), which figure perfectly matches Baker's type. Copeland misunderstood *P. vitiense,* referring to it specimens with pluriseriate sori, which are better referred to *P. polynesicum,* which see.

XI. **SELLIGUEA** (Bory)

Copeland, B. P. Bishop Mus., Bull. **59**: 94, 1929, as genus.

22. **Polypodium feeioides** (Copeland) C. Christensen, Index Fil. Suppl. **3**: 149, 1934.

Selliguea feeioides Copeland, B. P. Bishop Mus., Bull. **59**: 17, 94, 1929; Bull. **93**: 74, 1932.

Selliguea plantaginea Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 58, 1854.

Gymnogramme caudiformis Hooker. Baker, Jour. Bot. **14**: 345, 1876.

Polypodium caudiforme Blume. Christ, Engler Bot. Jahrb. **23**: 357, 1897; Rechinger, Denkschr. Akad. Wiss. Wien **84**: 419, 1908.

Polypodium vulcanicum Blume. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 419, 1908.

I hesitatingly follow Copeland in separating this Polynesian *Selliguea* from the Malayan *P. Feei* Mettenius and its variety *P. caudiforme* Blume. He says that "it differs from all Malayan and Papuan specimens seen in the much narrower and redder paleae and in the conspicuous minor venation." The minor venation is manifest in specimens from Fiji but hardly extant in those from Samoa and Tahiti. In Samoa, two apparently very different forms occur, which correspond to *P. Feei* and *P. caudiforme* but presumably belong to the same species.

Form 1. Fronds dimorphous, sterile ones 5-7 cm. broad, bluntly rounded, cuneate at base, fertile ones lanceolate, 2-3 cm. broad, on longer stipes; the sori confluent into a thick coenosorus.

Without locality: *Whitmee 187, 188* (Kew).

Upolu: Malololelei-Lanutoo, on tree, 700 m., *Christophersen 415.*

Form 2. Fronds uniform or nearly so, the sterile ones up to 9 cm. wide, suddenly narrowed below into an oblique base, the fertile ones somewhat smaller; sori round or 2-3 confluent.

Without locality: *Powell 194* (Kew).

Savaii: *Reinecke 153* (B); Mataana, 1,600 m.; *Vaupel 314* (B); Maungaafi, *Rechinger 1963* (V); above Matavanu, 1,300 m., *Christophersen 825.* Upolu: *Rechinger 1694* (V).

Polynesia from New Hebrides to Marquesas.

Selliguea plantaginea Brackenridge from Tahiti was overlooked by Copeland. It was doubtless this species as found by Mettenius long ago. The specific name is preoccupied in *Polypodium* but available in *Selliguea* which should be remembered by those who maintain *Selliguea* as a genus and *S. plantaginea* as a good species.

Genus **DRYNARIA** (Bory) J. Smith

Copeland, B. P. Bishop Mus., Bull. **59**: 96, 1929.

Drynaria rigidula (Swartz) Beddome. Copeland, B. P. Bishop Mus., Bull. **59**: 96, 1929.

Polypodium rigidulum Swartz. Christ, Engler Bot. Jahrb. **23**: 357, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 420, 1908.

Polypodium diversifolium Swartz. Baker, Jour. Bot. **14**: 345, 1876.

Without locality: *Whitmee 189* (Kew).

Savaii: *Reinecke 137* (Kew, W); *Rechinger 1724* (V); Le To, 750 m., *Christophersen 2949.* Upolu: Lanutoo (reported by *Rechinger*).

From India through Malaya, east and south to Samoa and New Caledonia.

Rarely collected in Samoa, perhaps because it grows high up on trees where it collects humus by means of dry, brown, lobed, oak-like leaves. The fertile green leaves are erect according to Rechinger, pinnate, with long linear pinnae about 1 cm. wide, with densely reticulated veins and uniserial, round sori.

Genus **DIPTERIS** Reinwardt

Copeland, B. P. Bishop Mus., Bull. **59**: 90, 1929.

Dipteris conjugata Reinwardt. Copeland, B. P. Bishop Mus., Bull. **59**: 90, 1929.

Polypodium Horsfieldii R. Brown. Powell, Jour. Bot. **6**: 341, 1868.

Polypodium conjugatum Kaulfuss. Luerssen, Mitt. Bot. **1**: 107, 365, 1874.

Polypodium Dipteris Blume. Christ, Engler Bot. Jahrb. **23**: 357, 1897.

Without locality: *Powell* (Kew).

Tutuila: top of Pioa, 500 m., top of Matafao, 650 m., *Reinecke 173* (Kew). *Garber 784* (*vaotianiu lautele*); *Christophersen 1034, 3564.*

Through tropical Asia east and south to Samoa and New Caledonia, usually forming thickets at higher altitudes. In Samoa it seems to be found only on the peaks of Tutuila. A specimen collected by Graeffe (Kew) is labelled Upolu, but is not mentioned by Luerssen.

Genus **CYCLOPHORUS** Desvaux

Copeland, B. P. Bishop Mus., Bull. **59**: 97, 1929.

Cyclophorus adnascens (Swartz) Desvaux. Christ, Conserv. Jard. bot. Genève, Ann. **15-16**: 216, 1912. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 122, 1924.

Niphobolus adnascens Kaulfuss. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 38, 1854.

Polypodium adnascens Swartz. Luerssen, Mitt. Bot. **1**: 103, 363, 1874. Baker, Jour. Bot. **14**: 12, 1876. Christ, Engler Bot. Jahrb. **23**: 357, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 418, pl. 1, 1908.

The commonest epiphytic fern, especially on palms and *Artocarpus,* found in all islands, and collected by all.

Savaii: below Matavanu crater in cracks in lava, 300 m., *Christophersen 604, 1885.* Upolu: Malololelei, 540 m., *Christophersen 110;* Apia, Mulinuu swamp on *Bruguiera, Christophersen 445, 446.* Tutuila: Goat Island, *Garber 803.* Tau: *Garber 558, 560, 561.*

Tropical Asia and Polynesia east to Samoa (Tahiti?).

Very variable as usually construed. Some of the Samoan specimens with broad and long lanceolate sterile and long, narrower fertile fronds with larger sori belong to the form described as *Niphobolus caudatus* Kaulfuss which perhaps should be maintained as a species.

Genus **LOXOGRAMME** (Blume) Presl

Copeland, B. P. Bishop Mus., Bull. **59**: 102, 1929.

Loxogramme Parksii Copeland, B. P. Bishop Mus., Bull. **59**: 18, 102, 1929; Bull. **93**: 72, 1932.

Selliguea involuta (Don) Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 58, 1854.

Polypodium Loxogramme Mettenius. Luerssen, Mitt. Bot. **1**: 105, 364, 1874. (*Polypodium involutum* Mettenius. Luerssen, p. 364.)

Gymnogramme lanceolata Hooker. Powell, Jour. Bot. **6**: 341, 1868. Baker, Jour. Bot. **14**: 13, 1876. Christ, Engler Bot. Jahrb. **23**: 359, 1897.

Loxogramme lanceolata Presl. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 417, 1908.

Polypodium (*Loxogramme*) *scolopendrinum* (Bory) C. Christensen. Lauterbach, Engler Bot. Jahrb. **41**: 220, 1908.

Without locality: *Powell 97* (Kew, W); *Whitmee 141* (Kew).

Savaii: *Reinecke 159* (B); Maungaafi, 1,500-1,600 m., *Rechinger 11* (V, W); near Tiavi, 300 m., *Rechinger 394* (V, W). Upolu: Malololelei-Lanutoo, 700 m., *Christophersen 116, 128.*

Fiji, Samoa, Tahiti.

I well understand that Copeland "reluctantly" described this Polynesian *Loxogramme* as a distinct species, for it seems difficult to distinguish it from some Malayan forms. I follow him in maintaining it because he, as the monographer of the genus, has a deeper knowledge of the forms of the difficult genus than I have. Among Samoan ferns it is easily recognized by the clustered, subsessile, lanceolate, entire, uniform fronds with reticulate venation, but without distinct main veins and with very oblique, linear coenosori. Size about 30-40 × 1.5-2.5 cm.

Genus **HYMENOLEPIS** Kaulfuss

Copeland, B. P. Bishop Mus., Bull. **59**: 98, 1929.

Hymenolepis Vaupelii Hieronymus. C. Christensen, Dansk Bot. Arkiv. **6**(3): 65, 1929.

Hymenolepis spicata (Linnaeus fil.) Presl. Christ, Engler Bot. Jahrb. **23**: 362, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 421, 1908.

Without locality, probably Savaii: *Powell 196; Whitmee 190* (Kew).

Savaii: *Vaupel 321* (type, B, Kew); Maungaafi, *Rechinger 2, 1978* (V); Tuisivi Range, 1,600-1,700 m., *Christophersen 811;* 1902 lava field above Aopo, 1,200-1,400 m., *Christophersen 887;* above Matavanu, 1,500 m., epiphyte, *Christophersen 2208;* in swampy crater bottom, *Christophersen 2224.*

A remarkable endemic species, very much larger than others found in Polynesia, the fronds up to 60 × 4 cm., the spike up to 15 × 8 cm.

Genus **ELAPHOGLOSSUM** Schott

Copeland, B. P. Bishop Mus., Bull. **59**: 97, 1929.

[**Elaphoglossum samoense** Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 68, pl. 9, fig. 1, 1854. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 122, 1924. Copeland, B. P. Bishop Mus., Bull. **93**: 67, 1932.

Acrostichum samoënse Baker. Luerssen, Mitt. Bot. **1**: 66, 356, 1874.

The only specimen said to be collected in Samoa (Tutuila, reported by Setchell) is Brackenridge's type (W). It is not probable that it was overlooked by the many later collectors, and as the type perfectly matches specimens from Tahiti, I am fairly convinced that the locality given is false and that the type in reality was collected in Tahiti, where the species probably is endemic; its name therefore is inappropriate. This species differs from the others in the much thinner texture and in the stipe, margins and underside being furnished with reddish, acicular scales.]

The following "species" are very closely related and belong to the group of *E. conforme*. They agree in essential characters: the short-creeping, stout rhizome with reddish-brown, lanceolate scales, the coriaceous leaves with cartilaginous margins, the thickened vein-tips, and the under side dotted with minute, peltate, somewhat lacerate scales, which usually are abraded in old specimens. V. Krajina has recently described seven new Polynesian species of this group (Studia Botanica Čechoslovaca **1**: 61, ff., 1938), most of them from Fiji and one, *E. Christophersenii* from Samoa, which is considered below. I am afraid that not all these species are good ones, being founded on rather weak characters. Krajina informs me in a letter that he ascribes four species to Samoa besides the doubtful *E. samoense*, but I can at best distinguish three only, and there are perhaps only two.

1. **Elaphoglossum feejeense** Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 72, 1854. Copeland, B. P. Bishop Mus., Bull. **59**: 98, 1929.
   Acrostichum feejeense (Brackenridge) Hooker. Powell, Jour. Bot. **6**: 341, 1868. Christ, Engler Bot. Jahrb. **23**: 361, 1897?
   Acrostichum conforme Swartz. Luerssen, Mitt. Bot. **1**: 356, part?, 1874.

   Sterile lamina rather short-stalked, oblanceolate, very gradually and long attenuate downward, up to 25 cm. long by 2.5-3, rarely 4 cm. wide; when young, rather densely dotted beneath with small scales, the free veins visible against the light. Fertile lamina on longer (up to 15 cm.) stipe, about 15 × 1-1.5 cm.

   Without locality: *Powell 121* (Kew).
   Tutuila: top of South Pioa, *Christophersen 1204, 1210, 3489, 3520*.
   Fiji, Samoa.

   Krajina informs me that he considers Powell 121 typical *feejeense*, and I follow him therefore in naming these specimens thus, but some of the larger ones are very near *E. Reineckei*, and older, sterile fronds are in reality hardly distinguishable from it.

2. **Elaphoglossum Reineckei** Hieronymus et Lauterbach, Engler Bot. Jahrb. **41**: 220, 1908.
   Acrostichum conforme Swartz. Christ, Engler Bot. Jahrb. **23**: 361, 1897; Conserv. bot. Genève, Ann. **15-16**: 217, 1912. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 413, 1908.

Elaphoglossum Christophersenii Krajina, Studia Botanica Čechoslovaca, **1**: 76, 1938.

Larger than *E. feejeense*, thickly coriaceous with hidden veins. Stipe of sterile fronds 12 cm., lamina broadly lanceolate-oblong, 25 × 4-6 cm. (some smaller), shortly cuneate at base, scales few beneath and often abraded, the vein-ends thickened and free. Fertile lamina on longer stipe, 25 × 4 cm., often equalling the sterile in size.

Savaii: Mataana, *Vaupel 452* (B, type, W); *Reinecke s. n.* (B). Upolu: *Rechinger 1693* (W), *1788* (V); *Hochreutiner 3393* (G); top of Fao, 680 m., *Christophersen 566*.

Fiji(?).

The characters ascribed to *E. Christophersenii* and a photograph of the type (collected by Horne, Kew, not seen) received from Krajina seem to show that the proposed new species is only a form of *E. Reineckei*. It is said to differ by thinner rhizome, longer stipe, linear 3-3.5 cm. broad sterile lamina and scales of rhizome "usually" without cilia (*E. Reineckei* "usually" with several cilia).

Typical *E. Reineckei* closely resembles *E. savaiiense* and it is probable that it is a free-veined form of that species. The vein ends of the type, on soaking, are seen to be capitately thickened within the cartilaginous margin, but those of otherwise identical specimens are bent upward, sometimes with a small spur parallel to the margin, thus tending to fuse with the next vein.

3. Elaphoglossum savaiense (Baker) Diels.

Acrostichum savaiense Baker, Ann. Bot. **5**: 494, 1891.

Like a large *E. Reineckei*, more elliptic in outline, sterile lamina 25 × 8 cm., the fertile 25 × 4 cm., differing chiefly by all veins anastomosing within the broad cartilaginous margin (the character of the group *Aconipteris*).

Savaii: *Powell 197* (Kew, type).

Specimens only found once. This may be natural if it is an abnormal form of the more common *E. Reineckei*, but Krajina is of the opinion that it is a good species rather common in Tahiti (*E. gorgoneum* in Copeland, B. P. Bishop Mus., Bull. **93**: 67, 1932) and also found in other islands.

LYCOPODIACEAE

Genus **LYCOPODIUM** Linnaeus

Key to the Species of Lycopodium

Fertile leaves (sporophylls) not very different from the sterile
  Leaves serrate, long cuneate at base, 2-3 × 0.5 cm. ..... **1. L. serratum.**
  Leaves entire, broadest at base, rarely over 1 mm. wide
    Stem including leaves hardly 1 cm. broad, leaves about 0.5 mm. wide, soft, adscending ..... **2. L. verticillatum.**
    Stem with sterile leaves 2 cm. or more broad, the sterile leaves squarrose, about 1 mm. wide, often coriaceous ..... **3. L. squarrosum.**

Fertile and sterile leaves different but passing gradually one into another, fertile leaves 1-2 mm. long, ovate, carinate, sterile leaves lanceolate, about 10 × 1 mm. usually very coriaceous and imbricated, in var. *laxum* thinner and more divaricating.....**4. L. carinatum.**
Fertile leaves sharply separated from the sterile; aggregated in distinct "spikes"
Spikes long and slender, forked; leaves 2-10 cm. wide; usually epiphytic
Leaves 2-4 mm. wide
Spikes 1 mm. wide, leaves usually spreading.....**5. L. Phlegmaria.**
Spikes 2 mm. wide, leaves erect, often imbricate.....**6. L. phlegmarioides.**
Leaves 6-10 mm. wide.....**7. L. phyllanthum.**
Spikes short, not forked, leaves less than 1 mm. wide; terrestrial species
Spikes 1-1.5 cm. long, sessile at the apex of the branches.....**8. L. cernuum.**
Spikes 3-4 cm. long, 2-6 together on an erect stem (peduncle) with small appressed leaves.....**9. L. venustulum.**

1. **Lycopodium serratum** Thunberg. Baker, Jour. Bot. **14**: 13, 1876. Lauterbach, Engler Bot. Jahrb. **41**: 221, 1908.

Without locality: *Powell 232; Whitmee 170* (Kew).

Savaii: Tuisivi Range, Mataana, 1,600-1,700 m., *Vaupel 432* (B, Kew, W); *Christophersen 758, 824.*

From Samoa, Fiji, and Hawaii to New Caledonia and Himalaya, (Mexico).

The Samoan specimens differ somewhat from the East Asiatic typical form by larger size and fewer, less sharp teeth.

2. **Lycopodium verticillatum** Linnaeus (sens. lat.), Baker, Jour. Bot. **14**: 345, 1876.

Without locality: *Whitmee s. n.* (Kew).

Pantropical.

I am not sure that Baker's determination is right, but it is not improbable that the only specimens seen may be a very slender form of *L. squarrosum.*

3. **Lycopodium squarrosum** Forster, and all authors. Copeland, B. P. Bishop Mus., Bull. **93**: 79, 1932.

Commonly found in all islands, collected by all.

Savaii: Maugaloa, *Vaupel 349* (B, Kew, W); Safune, on lava flow of 1905, 600 m.; *Bryan 131;* Matavanu, 800 m., on tree, *Christophersen 644;* 650 m., on old lava, *Christophersen 654, 1967;* Sili-Lataiuta, 50 m., epiphyte, *Christophersen 3140.* Tutuila: top of Le Pioa, on tree, 500 m., *Christophersen 1218.* Tau: *Garber 732.*

Polynesia, west to Africa.

The extreme epiphytic and terrestrial specimens look very different, but as intermediates occur I do not believe that we have two species. The epiphytes are rather soft in texture with leaves less than 8 mm. wide, the terrestrial specimens much more robust with coriaceous, broader and longer, nearly pungent leaves, and with the fertile branches usually nodding as in *L. nutans* Brackenridge.

4. **Lycopodium carinatum** Desvaux. Luerssen, Mitt. Bot. 1: 268, 402, 1876. Christ, Engler Bot. Jahrb. 23: 365, 1897. Rechinger, Denkschr. Akad. Wiss. Wien 84: 447, 1908.

   Without locality: *Powell 54* (Kew).

   Savaii: Maugaloa, *Reinecke 13 a;* Matautu, *Vaupel 270* (W); below Matavanu Crater in depressions in lava, 400 m., *Christophersen 594;* Manase Plantation, 100 m., *Christophersen 2376;* Salailua-Lataitai, epiphyte in mangrove swamp, *Christophersen 2645.* Upolu. Tutuila: near old radio station, on rocks, *Garber 924,* var. *laxum;* Atua-Vatia trail, in forest, 2,000-3,000 m., *Christophersen 1824,* var. *laxum* (Presl).

   Polynesia west to India.

   The variety, *L. carinatum* var. *laxum* (Presl) Christ, differs from the type in the dark green and less appressed leaves.

5. **Lycopodium Phlegmaria** Linnaeus, and all authors. Copeland, B. P. Bishop Mus., Bull. 93: 80, 1932.

   Common, found on all islands, collected by all.

   Savaii: Matavanu, epiphyte, 800 m., *Christophersen 2087;* Salailua, epiphyte, 100 m., *Christophersen 2608;* above Sili, 450 m., *Christophersen 3218, 3274.* Upolu: swamp near Tiavi, epiphyte, 720 m., *Christophersen 176,* part; Malololelei, 700 m., *Christophersen 16;* ridge to Mount Vaitou, 750 m., *Christophersen 261.* Tutuila: Alava Ridge, 500 m., *Christophersen 1125, 1830;* Atua-Vatia trail, *Christophersen 1, 1823.* Tau: *Garber 631, 640, 728.*

   Tropics of the Old World.

   Extremely variable. The specimens cited were all epiphytic and more or less typical with green or dark green, divaricating and often rather distant leaves, the spikes hardly more than 1 mm. wide with ovate, wrinkled sporophylls, the lower ones sometimes subcuspidate.

   From these epiphytic forms, the variety differs considerably in general aspect, but the spikes are similar. It may perhaps be variety *coralium* Spring (Christ, Engler Bot. Jahrb. 23: 366, 1897).

   Coriaceous, yellowish green, the leaves imbricated and erect except in the upper branches, spikes short. A terrestrial form with erect stem.

   Savaii: slopes of Matavanu crater, on lava, 650 m., *Christophersen 655, 1962.*

6. **Lycopodium phlegmarioides** Gaudichaud. Baker, Fern Allies, 20, 1887. Copeland, B. P. Bishop Mus., Bull. 93: 81, 1932.

   Lycopodium aqualupianum Spring. Baker, Jour. Bot. 14: 345, 1876, variety.

   Without locality: *Powell 109* (W).

   Upolu: swamp near Tiavi, 720 m., *Christophersen 176,* part.

   "Malay and Polynesian Islands."

A critical form, very near *L. Phlegmaria* but quite distinct in the double, thick (about 2 mm.) and quadrangular spikes, thus agreeing with Copeland's description of *L. phlegmarioides*. It differs, however, from this species in the leaves, all being practically alike, and in the sporophylls. The lower sporophylls are twice as long as the sporangia, acute, not keeled, and somewhat spreading, the upper ones become gradually shorter, the uppermost hardly longer than the sporangia, short acute and keeled. It may be a distinct species, not identical with *L. pseudophlegmaria* Kuhn as believed at first. I have now examined the type of that Fijian species (B) which comes very near to *L. Phlegmaria,* with similar slender spikes, but with obtuse leaves.

7. **Lycopodium phyllanthum** Hooker and Arnott, Bot. Beechey's Voy. 102, 1832.

Lycopodium pachystachyon Spring, Monogr. Lycop. **1**: 66, 1842.

Lycopodium macrostachys Hooker and Greville. Baker, Jour. Bot. **14**: 345, 1876.

Much more robust than *L. phlegmarioides,* with divaricating leaves 6-10 mm. broad, sharply acute, subpungent, usually thick, coriaceous, the lower ones often reflexed, the sporophylls cuspidate and keeled.

Without locality: *Powell s. n.; Whitmee 169* (Kew).

Savaii: Maugaloa, *Vaupel 497* (B).

Malaya-Polynesia.

The specimens, referred with some doubt to this species, differ in the more slender spikes, about 2 mm. wide, from the Hawaiian type, with spikes 3-5 mm. wide.

8. **Lycopodium cernuum** Linnaeus, and all authors. Copeland, B. P. Bishop Mus., Bull. **93**: 81, 1932.

Common and found in all islands, collected by all.

Upolu: crater rim of Lanutoo, 700 m., *Christophersen 119.* Tutuila: top of Matafao, 650 m., *Christophersen 1033;* top of Pioa, 500 m., *Christophersen 3548.* Tau: 600-700 m., *Garber 751.*

Pantropic.

9. **Lycopodium venustulum** Gaudichaud. Copeland, B. P. Bishop Mus., Bull. **93**: 81, 1932.

Lycopodium clavatum Linnaeus. Baker, Jour. Bot. **14**: 345, 1876.

Without locality: *Whitmee 173* (Kew).

Savaii: Safune, on lava flow of 1905-1911, 600 m., *Bryan 132;* inside Matavanu Crater, 700 m., *Christophersen 628;* Tuisivi Range, open place in forest, 1,600-1,700 m., *Christophersen 790;* 1902 lava field above Aopo, 1,200-1,400 m., *Christophersen 883.*

Hawaii, Samoa, Tahiti.

The specimens growing on lava are yellowish-green with subappressed, rigid leaves and agree closely with the typical form from the volcanoes of Hawaii, while those growing in forests have thinner, bright green, and divaricating leaves on the prostrate, wide-creeping, and much branched stems, resembling those of *L. cernuum,* but distinguished at once by the long, pale bristle at the leaf tip. This species is regarded by most authors as a Polynesian variety of the cosmopolitan *L. clavatum* Linnaeus.

PSILOTACEAE

Genus **TMESIPTERIS** Bernhardi

Copeland, B. P. Bishop Mus., Bull. **93**: 82, 1932.

Tmesipteris tannensis Bernhardi. Christ, Engler Bot. Jahrb. **23**: 366, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 447, 1908. Copeland, B. P. Bishop Mus., Bull. **93**: 82, 1932.

Tmesipteris Forsteri Endlicher. Baker, Jour. Bot. **14**: 345, 1876.

Without locality: *Whitmee 33* (Kew).

Savaii: Maugaloa, *Reinecke 1* (B); above Matavanu, epiphyte in wet forest, 1,300 m., *Christophersen 2135.*

Polynesia, from the Marquesas west and south to the Philippines, Australia and New Zealand.

Genus **PSILOTUM** Swartz

Copeland, B. P. Bishop Mus., Bull. **93**: 82, 1932.

1. **Psilotum nudum** (Linnaeus) Grisebach. Luerssen, Mitt. Bot. **1**: 403, 1874. Copeland, B. P. Bishop Mus., Bull. **93**: 82, 1932.

   Psilotum triquetrum Swartz. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 319, 1854. Luerssen, Mitt. Bot. **1**: 271, 1874. Baker, Jour. Bot. **14**: 345, 1876. Christ, Engler Bot. Jahrb. **23**: 366 (excl. var.) 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 448, 1908.

   Without locality: *Powell 51; Whitmee 218* (Kew).

   Savaii: *Reinecke 2* (Kew); Matavanu, 300 m., *Christophersen 598;* Falealupo and near Sili, 25-50 m., *Christophersen 2799, 3244.* Upolu: (*Graeffe 1135,* reported by *Luerssen*).

   Pantropical.

2. **Psilotum complanatum** Swartz. Baker, Jour. Bot. **14**: 13, 1876. Copeland, B. P. Bishop Mus., Bull. **93**: 82, 1932.

   Psilotum flaccidum Wallich. Luerssen, Mitt. Bot. **1**: 271, 403, 1874. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 448, 1908.

Psilotum triquetrum var. *complanatum* (Swartz). Christ, Engler Bot. Jahrb. **23**: 366, 1897.

Without locality: *Powell 50; Whitmee 163* (Kew).

Savaii: *Reinecke 5* (Kew); back of Vaipouli, 150 m., *Christophersen 1908.*

Upolu: (*Graeffe 1107,* reported by *Luerssen*); Vailima, 300 m., *Eames 130.*

Tau: *Garber 716.*

Pantropical.

SELAGINELLACEAE

Genus **SELAGINELLA** Beauvois

By A. H. G. Alston

Key to the Species of Selaginella

Stems prostrate; leaves everywhere dimorphous; sporophylls strongly dimorphous ..... **1. S. laxa.**

Stems erect; leaves uniform at base of stem; sporophylls uniform or slightly dimorphous

Lateral leaves ovate-lanceolate

Lateral leaves entire; median leaves acuminate; species growing on rocks in streams ..... **2. S. Whitmeei.**

Lateral leaves ciliate or ciliolate; species growing in mountain forests

Median leaves aristate ..... **3. S. Reineckei.**

Median leaves acuminate ..... **4. S. Vaupelii.**

Lateral leaves oblong-lanceolate

Lateral leaves up to 4 mm. long; median leaves aristate ..... **5. S. Hochreutineri.**

Lateral leaves up to 5 mm. long; median leaves acuminate ..... **6. S. Christii.**

1. **Selaginella laxa** Spring, Acad. Sci. Belg., Bull. **10**: 233, 1843.

Selaginella nana (Desvaux) Spring. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 336, 1854. Luerssen, Mitt. Bot. **1**: 273, 407, 1874 (not Spring).

Selaginella tenera Spring. Powell, Jour. Bot. **6**: 342, 1868. Luerssen, Mitt. Bot. **1**: 274, 407, 1874. Christ, Engler Bot. Jahrb. **23**: 368, 1897 (not Spring).

Selaginella samoensis Baker, Jour. Bot. **23**: 177, 1885; Fern Allies, 110, 1887. Christ, Engler Bot. Jahrb. **23**: 368, 1897. Hieronymus, Denkschr. Akad. Wiss. Wien **89**: 706, 1913. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 120, 1924.

Selaginella Weberi Warburg, Monsunia **1**: 111, 128, 1900. Lauterbach, Engler Bot. Jahrb. **41**: 221, 1908.

Selaginella Harveyi Baker, Jour. Bot. **23**: 156, 1885 (Tonga).

Selaginella vitiensis Baker, Jour. Bot. **23**: 177, 1885 (Fiji).

Selaginella Brackenridgei Baker, Jour. Bot. **23**: 178, 1885. (*Selaginella ciliaris,* in Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 335, 1854, not Spring, Fiji).

Selaginella stenostachya Warburg, Monsunia **1**: 109, 120, 1900.

Without locality: *Powell; Whitmee* (Kew); *Safford 55* (W).

Savaii: Vaipouli River, *Reinecke 29* (W). Upolu: R. Vaisingano, near Lung, *Weber* (B); near Magaui, *Weber 42* (B); Vailele coast, *Reinecke 29 a* (BM, Kew, W); Falefa, *Reinecke 73* (W); Canyon of Vaisingano River, 500 m., *Christophersen 103.* Tutuila: *Brackenridge* (W); *Reinecke s. n.* (Kew, W); *Veitch* (Kew); *Meebold 21358* (BM); *Setchell 107, 152* (W).

Samoa, Tahiti, Tonga, Fiji.

2. **Selaginella Whitmeei** Baker, Jour. Bot. **23**: 24, 1885; Fern Allies 95, 1887. Hieronymus, Denkschr. Akad. Wiss. Wien **89**: 705, 1913. Lauterbach, Engler Bot. Jahrb. **41**: 221, 1908.

Selaginella scoparia Christ, Engler Bot. Jahrb. **23**: 367, 1897. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 449, 1908.

Selaginella Menziesii Spring. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 64, 1908 (not Spring).

Stems erect from a creeping base, dull straw-colored, terete, simple below and branched above. Branched frondlike part ovate in outline. Branches pinnate or bipinnate, rather stiff; ultimate branchlets 1-5 cm. long. Leaves of main stem erect, uniform, acuminate, distant, adpressed. Lateral leaves of branches obliquely ovate, upper half semiovate, entire, rounded at base, with translucent elongated cells toward the base; lower half entire, semioblong, truncate at base. Axillary leaves ovate, median leaves obliquely oblong-elliptic, entire, acuminate; exterior base slightly auricled. Midrib obscure. Strobili tetragonous. Microspores saffron-yellow.

Without locality: *Whitmee 177, 221* (Kew, type, BM); *Janssen 4* (P).

Savaii: Lealeatele, *Reinecke 61* (Kew, W, type collection of *S. scoparia*); *Vaupel 418* (P, W); dry river bed above Patamea, *Rechinger 1121* (BM); above Matavanu, river bed, 850 m., *Christophersen 2282;* above Sili, islands in river, 400 m., *Christophersen 3149;* Sili, 50 m., *Christophersen 3204.* (Upolu: *Reinecke 61 a,* reported by *Christ.*) Tau: *Powell 38* (Kew); *Garber 625.* Endemic.

This species seems to be characteristic of stream beds.

3. **Selaginella Reineckei** Hieronymus. Engler und Prantl, Nat. Pflanz. **1** (4): 678, no. 83, 1902. Hedwigia **41**: 175, 1902; Denkschr. Akad. Wiss. Wien **89**: 702, 1913. Setchell, Dept. Marine Biol. Carnegie Inst. Wash. **20**: 120, 1924.

Selaginella Menziesii Spring. Brackenridge, U. S. Expl. Exp., 1838-42, **16**: 333, 1854, part. Powell, Jour. Bot. **6**: 341, 1868. Luerssen, Mitt. Bot. **1**: 273, 1874 (not Spring). Christ, Engler Bot. Jahrb. **23**: 367, part, 1897.

Selaginella atroviridis Spring. Luerssen, Mitt. Bot. **1**: 272, part, 1874 (not Spring).

Selaginella inaequalifolia Spring. Baker, Jour. Bot. **14**: 13, 1876 (not Spring).

Selaginella flabellata Spring. Luerssen, Mitt. Bot. **1**: 407, part, 1874. Baker, Fern Allies, 98, part, 1887. Christ, Engler Bot. Jahrb. **23**: 366, 1897, part.

Stems erect from a creeping base, bright straw-colored, usually compressed, simple below and branched above. Branched frondlike part triangular in outline. Branches bipinnate or rarely tripinnate, flexuous; ultimate branchlets 1-1.5 cm. long. Leaves of main stem subequal, somewhat oblique, ovate, acuminate, somewhat auriculate, adpressed toward the base, spreading in the upper part of the stem. Lateral leaves obliquely ovate, upper half semiovate, ciliolate, rounded at base, with translucent elongated cells toward the base; the lower half entire, semi-oblong, truncate at base. Axillary leaves ovate, ciliolate. Median leaves oblong-elliptic, slightly oblique, aristate, denticulate, exterior base auricled; midrib conspicuous. Strobili tetragonous. Microspores reddish.

Without locality: *Brackenridge* (Kew); *Powell 8* (Kew, BM); *Whitmee 157 a* (BM), *159* (Kew); *Fasken 221* (BM); *Safford 979*. Savaii: above Matavanu, medium wet forest, 900 m., *Christophersen 993;* Papafu, low forest, on ground, 1,500 m., *Christophersen 2718*. Upolu: Tafua, *Powell 143* (Kew); Mount Fagaloa, 600 m., *Reinecke 45* (B, Kew, W); Lanutoo, 700 m., *Christophersen 400;* Vailima, *Eames 91*. Tutuila: *Reinecke 62* (W); *Stearns* (W); *Setchell 49, 71, 183, 223, 277* (W); *Garber 845, 923; Bryan 77; Christophersen 1215, 1812, 1813, 1814, 1816;* top of Pioa, wet scrub forest, 500 m., *Christophersen 3502, 3524, 3544*. Tau: *Garber 618, 713*. Endemic and common.

4. Selaginella Vaupelii Hieronymus, Denkschr. Akad. Wiss. Wien **89**: 483, 1913.

Savaii: Aopo-Gagamalae, wet forest, slope of crater, 1,500 m., *Christophersen s. n.* Upolu: Lanutoo, 700 m., *Rechinger 746* (B, V). Endemic.

This is an obscure species, stated by Hieronymus to be somewhat intermediate between *S. Hochreutineri* and *S. Reineckei,* but nearer *Hochreutineri.* It differs from both species in the acuminate median leaves and honey-colored microspores. The lateral leaves are denticulate. It is perhaps only a form of *S. Hochreutineri* with the aristae of the median leaves broken off.

5. Selaginella Hochreutineri Hieronymus, Conserv. Jard. bot. Genève, Ann. **15-16**: 228, 1912; Denkschr. Akad. Wiss. Wien **89**: 703, 1913.

Selaginella atro-viridis Spring, part. Luerssen, Mitt. Bot. **1**: 272, 1874.

Selaginella flabellata Spring. Luerssen, Mitt. Bot. **1**: 407, part, 1874. Rechinger, Denkschr. Akad. Wiss. Wien **84**: 448, 1908.

Selaginella latifolia Spring. Christ, Engler Bot. Jahrb. **23**: 367, 1897.

Stems erect from a creeping base, dull straw-colored, subterete, simple below and branched above. Branched frondlike part pentagonal or oblong. Branches tripinnate, flexuous, ultimate branchlets about 1 cm. long. Leaves of main stem subequal, scarcely oblique, ovate, acuminate, not auriculate, adpressed even above the lowest branches, spreading toward the apex, entire or denticulate, rounded at base, with few or no translucent basal cells; the lower half entire, semi-oblong, truncate at base, broadest above the middle.

Axillary leaves oblong. Median leaves ovate-elliptic, somewhat oblique, long aristate, entire, slightly auricled, midrib conspicuous. Strobili tetragonous. Microspores orange-yellow.

Without locality: *Brackenridge* (W); *Whitmee 157 a,* part (BM, Kew), *157 b* (Kew); *177,* part (Kew).

Savaii: Salailua, rain forest, 300 m., *Bryan 163;* above Matavanu, medium wet forest, 800 m., *Christophersen 639, 2289, 2290;* above Salailua, wet forest, 750-1,300 m., *Christophersen 2748, 2914;* above Sili, 400 m., *Christophersen 3211;* Siuvao-Auala, 600 m., *Christophersen 3290;* above Siuvao, 300 m., *Christophersen 3304;* Maugaloa, *Vaupel 71 a* (W). Upolu: *Graeffe 393* part (BM); *Reinecke 42* (W); *Rechinger 1277* (BM, W), *1906* (W); Vailima, *Eames 92;* Malololelei-Lanutoo, 500-700 m., *Christophersen 25, 224.* Endemic.

6. **Selaginella Christii** Hieronymus, Hedwigia **41**: 176, 1902; Denkschr. Akad. Wiss. Wien **89**: 705, 1913.

Selaginella latifolia Spring. Baker, Jour. Bot. **14**: 13, 1876; Fern Allies, 98, part, 1887.

Selaginella Menziesii Spring. Christ, Engler Bot. Jahrb. **23**: 367, part, 1897.

Selaginella viridangula Spring. Warburg, Monsunia **1**: 106, part, 1900.

Stems erect from a creeping base, greenish or brownish yellow, subterete, simple below and branched above. Branched frondlike part pentagonal in outline. Branches pinnate or rarely bipinnate, very flexuous; ultimate branchlets 1.5-5 cm. long. Leaves of main stem subequal, scarcely oblique, ovate-oblong, subacute, exauriculate, adpressed, spreading in the branched part. Lateral leaves oblong, somewhat falcate, upper half semi-oblong-lanceolate, denticulate toward the base, with a few elongate, translucent cells; the lower half entire, semi-oblong, abruptly truncate at base, broadest above the middle. Axillary leaves lanceolate. Median leaves ovate, slightly oblique, acuminate, denticulate, exterior base auricled; midrib broad and depressed. Strobili subtetragonous. Microspores reddish orange.

Without locality: *Whitmee 158* (BM).

Tutuila: Utumoa, *Reinecke 62 b* (B). Endemic.

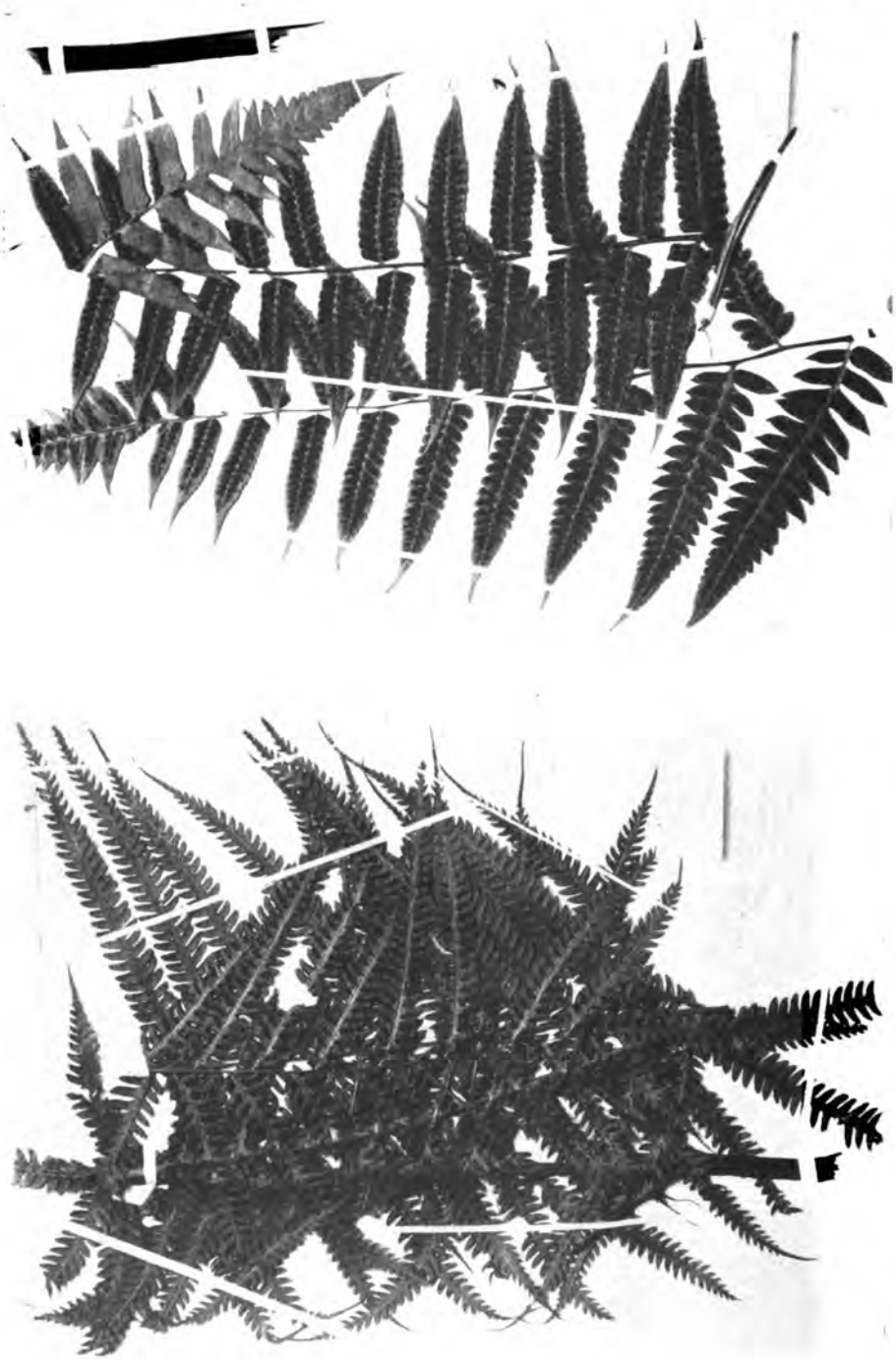
INDEX

Synonyms and native names are in italic.

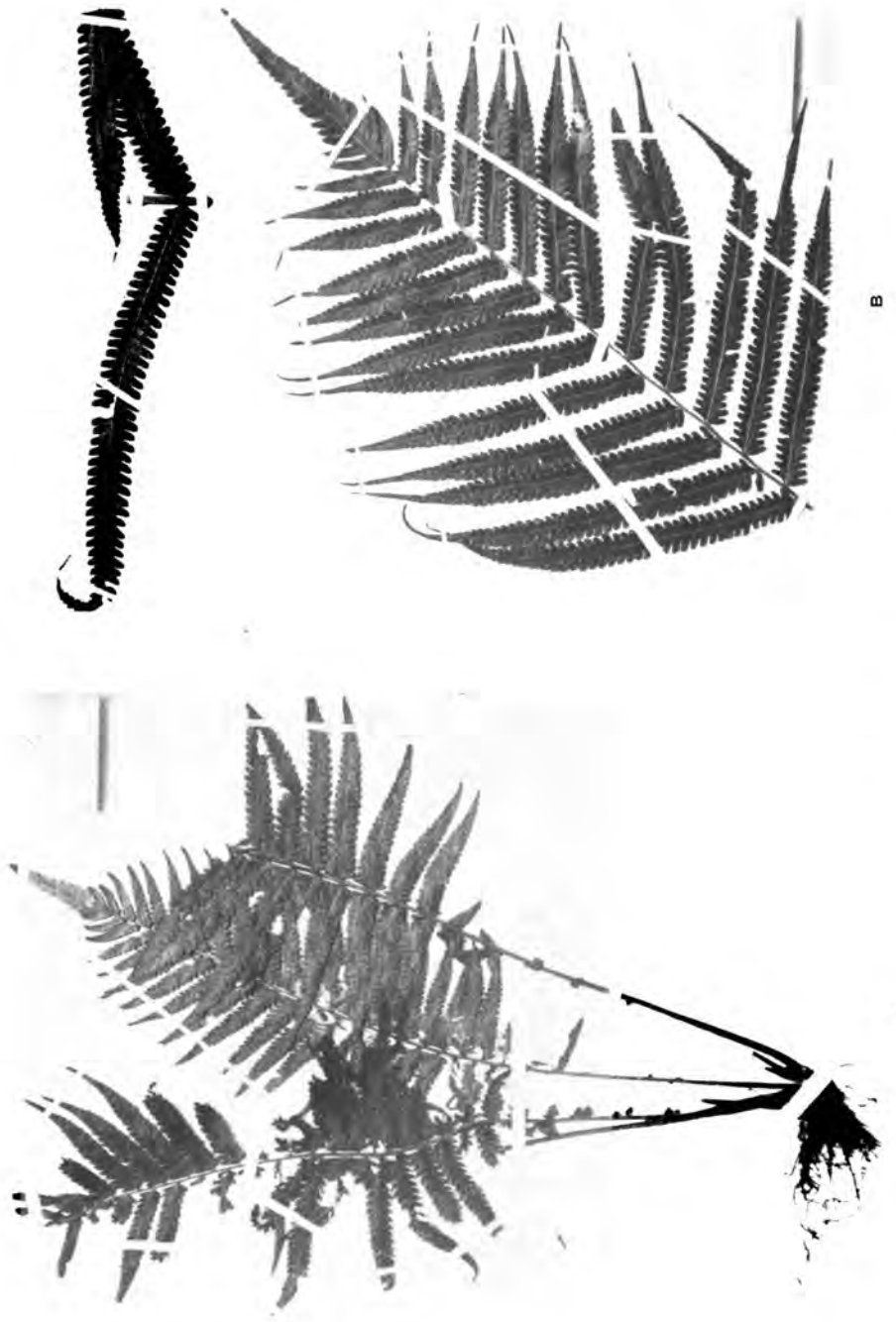
A

B

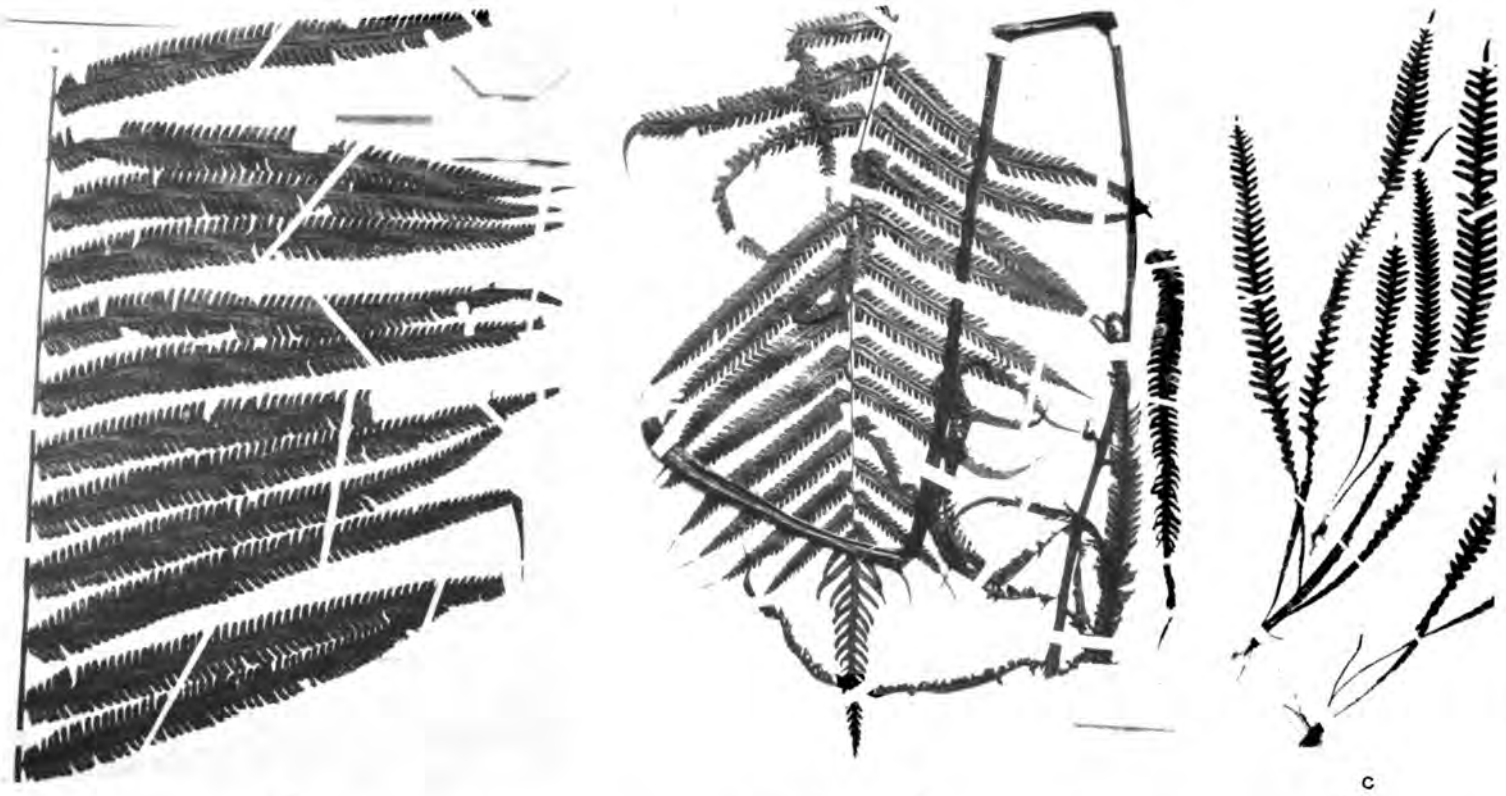
A, *OPHIOGLOSSUM RETICULATUM* VAR. *PACIFICUM,* VAR. NOV. **B,** *OLEANDRA CHRISTOPHERSENII,* SP. NOV.



A, *PTERIS WALLICHIANA* AGARDH VAR. *SAMOENSIS*, VAR. NOV. B, *DIPLAZIUM ECHINATUM*, NOM. NOV.



A, *DRYOPTERIS CHRISTOPHERSENII*, SP. NOV. (TYPE). B, *DRYOPTERIS VAUPELII*, SP. NOV.



A, *DRYOPTERIS BRYANI*, SP. NOV. B, *DRYOPTERIS REINECKEI*, SP. NOV. C, *POLYPODIUM EMERSONII* VAR. *SAMOENSE*, VAR. NOV.