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STUDIES IN THE FERN-GENERA ALLIED TO TECTARIA. III. AENIGMOPTERIS AND ATAXIPTERIS, TWO NEW GENERA ALLIED TO TECTARIA CAV., WITH COMMENTS ON PSOMIOCARPA PRESL

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SUMMARY

Two new genera, *Aenigmopteris* and *Ataxipteris*, are established. *Aenigmopteris* resembles *Ctenitis* C. Chr. in its frond-form and venation but has scales and indusia like those of *Tectaria* Cav. and in its narrowly winged pinna-rachises approaches *Lastreopsis* Ching. Its type species (from Luzon) was originally named *Dryopteris dubia* Copel.; it includes also *Dryopteris pulchra* Copel. from New Guinea and three new species: *Aenigmopteris mindanaensis* from Mindanao, *A. elegans* from Sabah, and *A. katoi* from Indonesian Borneo. Its relationship to *Psomiocarpa* Presl is discussed. *Ataxipteris*, based on a single species of southern China and Japan originally named *Tectaria sinii* Ching, resembles *Tectaria* in frond-form and venation but has scales like those of *Ctenitis*. In both new genera there are thick hairs between veins on the upper surface as in many species of *Tectaria* but not in *Ctenitis*; both genera lack the cylindric glands which are characteristic of *Ctenitis*. In spore characters *Aenigmopteris* and *Psomiocarpa* resemble some species of *Tectaria*, and *Ataxipteris* resembles some species of *Ctenitis*.

INTRODUCTORY

In the process of making a survey of all species in the Old World which have been included in *Tectaria* and *Ctenitis*, I have found that these two genera have not been clearly distinguished from each other, and that there are some species which cannot be fitted into either. I also believe that the genera related to *Tectaria* can be distinguished as a group from those related to *Dryopteris*. I am planning a series of papers on *Tectaria* and its allies, of which this is the third. The first paper, to appear in the Fern Gazette, is a commentary on recent schemes of classification of ferns related to *Tectaria* and to *Dryopteris*, which are sometimes all included in a family named Aspidiaceae. The second paper, written jointly with P. J. Edwards and to appear in the Kew Bulletin, is a monograph of *Dryopteris*, a new genus comprising species of Southeast Asia which I believe to be more nearly related to *Dryopteris* than to *Ctenitis* but have been included in the latter. This third paper is written to distinguish two new genera which are certainly related to *Tectaria* and to *Ctenitis* but differ from both.

In general, *Tectaria* and *Ctenitis* agree in having peculiar hairs on the upper surface of the axes of fronds and of midribs of ultimate leaflets. These hairs consist of a few short cells; when living they are usually terete and colourless, but when dried their external walls collapse so that the hairs become distorted, and the cell contents become red and aggregated against the cross-walls. Christensen, dealing with American species, first observed the distinction between these hairs and the unicellular acicular hairs of Thelypteridaceae, also noting that in *Dryopteris* the principal hair-like structures intergrade with scales.

Christensen also noted (Monograph of *Dryopteris* I, 1913, 84) that *Ctenitis* differs from *Tectaria* in its free veins, but did not know that in the Old World there are species with free veins which in other characters agree with *Tectaria* rather than with *Ctenitis*. Though he noted that abundant scales on axes of the frond are characteristic of *Ctenitis*, and described these scales in detail, he did not compare *Ctenitis* with *Tectaria* in this character. When R.C. Ching later came to deal with the species of both genera in Asia he noticed that certain free-veined species differed from *Ctenitis* in their *Tectaria*-like scales and also in their venation, and for them he established a new genus *Ctenitopsis* which he thought to be nearer to *Ctenitis* than to *Tectaria*. The species of *Ctenitopsis* were later transferred to *Ctenitis* by Copeland (Gen. Fil. 1947: 123) who did not refer to their scales and also ignored the difference in venation specified by Ching. But the character of free veins does not sharply distinguish *Ctenitopsis* from those species of *Tectaria* which have anastomosis confined to narrow costal areoles; there are intermediates. Those species of *Ctenitopsis* which have been examined cytologically have the base chromosome number 40, as in *Tectaria*, whereas the number for *Ctenitis* is 41. Some species placed by Ching in *Ctenitopsis* have already been transferred to *Tectaria*, and I think that all should be so, except the type species (*Aspidium sagenioides* Mett.) and a second one allied to it which I believe belong to *Heterogonium* Presl, where I have placed them (Kalikasan 4, 1975, 205–231).

There remain some species which have the scales of *Tectaria* but do not have the venation specified by Ching for *Ctenitopsis*. They also have indusia like those of *Tectaria* and lack the cylindrical glands which are distinctive of *Ctenitopsis* and *Lastreopsis*. Thus I would regard them as nearer to *Tectaria* than to *Ctenitis*. Their pinna-rachises have a narrow wing, as in *Lastreopsis*, but its edges are not thickened. As noticed by Copeland, their distal sori have asymmetric indusia. They form a distinct group of species and I judge that they are best segregated as a genus separate from *Tectaria*; for them I here propose the new generic name *Aenigmopteris*, from the Greek *ainigma*, a riddle.

On the other hand, there is one very peculiar species which has exactly the frond-form of *Tectaria* and venation as described by Ching for *Ctenitopsis* but has on all frond-axes abundant scales which are thin and clathrate like those of *Ctenitis*, also massed thin scales at the base of the stipe. This species was named *Tectaria sinii* by Ching; later he transferred it to *Ctenitopsis* and then Ohwi placed it in *Ctenitis*. Its chromosome number is reported to be 41, as in *Ctenitis*. But it lacks the cylindric glands of *Ctenitis*; in view of this, and of its venation, I here propose for it the new

generic name *Ataxipteris*, from the Greek *ataxia*, disorder or confusion. Though its chromosome number is 41, I suggest that one need not consider it to be more nearly related to *Ctenitis* than to *Tectaria*. It seems to me probable that the aneuploid number 41 has arisen on more than one evolutionary line in this group of genera (see comment below on *Psomiocarpa*). Certainly *Dryopteris* and *Ctenitis*, both with 41 chromosomes, are not closely related. I also suggest that chromosome counts may need to be re-checked; it may not always be possible to distinguish 41 from 40 with certainty.

AENIGMOPTERIS Holttum, *gen. nov.*

Tectaria Cav. et Ctenitidis C. Chr. affinis; a Tectaria differt pinnulis multis subaequalibus profunde lobatis, venis infimis basiscopicis loborum pinnarum e costis loborum semper enascentibus; a Ctenitide differt squamulis pinnarum paucis, non clathratis, glandulis cylindricis deficientibus, lamina supra inter venas pilis crassis pluricellularibus praedita, soris semper ad apicis venarum sitis, indusiis crassiusculis fuscis interdum asymmetricis.

Type species: *Aenigmopteris dubia* (Copel.) Holttum.

Caudex suberect, bearing fronds radially arranged but sometimes not closely tufted, its apex covered with narrow stiff dark scales; stipes bearing scales like those of the caudex but smaller, never densely massed, also short hairs. *Lamina* much longer than wide, catadromous apart from the basal pinnae, bipinnate, the middle pinnae with many subequal deeply lobed pinnules or pinna-lobes, firm in texture; a bud sometimes present at the base of one or more pinnae; basal pinnae little longer than those next above them, their basal basiscopic pinnules longer than acroscopic ones; pinnules of middle pinnae decurrent at their bases to form a very narrow wing along the pinna-rachis but the veins in their basal basiscopic lobes not arising from the pinna-rachis; veins in the larger lobes of pinnules simply pinnate, the veinlets simple, not reaching the margin; scales on pinna-rachis and smaller axes few, linear or the smallest ovate, not thin nor clathrate; scattered thick hairs present on the upper surface between veins; small subspherical unicellular glands sometimes present on lower surfaces of veins but not cylindric glands. *Sori* at the apices of veins (distal ones sometimes apical on short lateral veins); indusia firm, dark, persistent, those of the sori near the bases of lobes reniform, those of distal sori variously asymmetric; sporangia sometimes bearing a short hair near the annulus (at least in *A. elegans*); perispore forming thin ridges with spinulose margins, the ridges forming a few irregular areoles, the surface within the areoles bearing irregular short slender projections.

This genus consists of five known species: the type from Luzon, a new species from Mindanao, two new species from Borneo and *Dryopteris pulchra* Copel. from New Guinea. The plants have nearly all the characters of *Tectaria* except that the ultimate leaflets of the frond are very small, the veins in basal basiscopic lobes of pinnules do not arise from the pinna-rachis, and the indusia of distal sori are asymmetric. The thick hairs between veins on the upper surface resemble those of many species of *Tectaria* but such hairs do not occur in *Ctenitis*. The indusia are also very different from the very fragile unpigmented indusia of all Old World species of

Ctenitis and lack marginal cylindric glands. In spite of these differences from *Ctenitis*, Copeland placed two of these species in that genus. Chromosome numbers are not recorded for any species.

Copeland (Gen. Fil. 1947: 125), dealing with the monotypic genus *Psomiocarpa*, regarded *Psomiocarpa* as closely allied to *Ctenitis*, and within *Ctenitis* nearest to *C. dubia*, type of *Aenigmopteris*. *Psomiocarpa* does agree with *Aenigmopteris dubia* in its scales and in the thick hairs between veins on the upper surface of its sterile fronds, but it differs in the venation of sterile fronds which is like that of *Tectaria*, also in the shape of sterile fronds which are almost deltoid with elongate basal pinnae. The fertile fronds of *Psomiocarpa* are much contracted and exindusiate. Thus I regard *Psomiocarpa* to be, like *Aenigmopteris*, nearly allied to *Tectaria*, not to *Ctenitis*; spore characters also support this relationship. But I would say that the species here segregated as *Aenigmopteris* could not be accommodated in an amplified *Psomiocarpa*.

KEY TO THE SPECIES OF AENIGMOPTERIS

1a. Upper surface of pinna-rachis, at least distally, prominent and lacking short hairs; scales on pinna-rachis broad at the base, tapering distally, not dark . **1. A. dubia**
b. Upper surface of pinna-rachis slightly grooved, the groove filled with many short hairs; scales on pinna-rachis narrow and dark 2
2a. Pinnules of middle pinnae c. 4 mm wide, their lobes c. 1 mm wide . **2. A. pulchra**
b. Pinnules of middle pinnae c. 7 mm wide, their lobes 2 mm wide 3
3a. Thick hairs to 1 mm long on lower surface of veins . . . . . **3. A. mindanaensis**
b. Thick hairs lacking on lower surface of veins 4
4a. Pinnule-lobes on first suprabasal pinnae deeply lobed; thick hairs between veins on upper surface rigid, more than 1 mm long, short hairs also present **4. A. katoi**
b. Pinnule-lobes on first suprabasal pinnae not deeply lobed; thick hairs between veins on upper surface not rigid, no other hairs present . . . . . **5. A. elegans**

1. Aenigmopteris dubia (Copel.) Holttum, *comb. nov.* – **Fig. 1a, Plate 1a.**

Dryopteris dubia Copel. in Elmer, Leafl. Philip. Bot. 1 (1907) 235. – *Ctenitis dubia* Copel., Fern Fl. Philip. (1960) 293. – Type: *Elmer 9016* (MICH; BO, K, L), Luzon, Tayabas Prov., Lucban.

Caudex suberect, bearing few fronds, its apex covered with dull brown scales 10 × 1 mm. Stipes to 30 cm long, dark castaneous, bearing ± persistent scales throughout, distal scales gradually smaller, also short ctenitoid hairs in the groove. *Lamina* to 55 cm long and 24 cm wide; free pinnae to 7 pairs, adnate pinnae to 7 or more pairs, the distal ones with very narrowly decurrent bases merging into the apical lamina of the frond the axis of which is very narrowly winged, also the greater part of every pinna-rachis; a bud sometimes present at the base of an upper pinna. *Basal pinnae* to 14 cm long, free pinnules c. 4 pairs, rest of pinna lobed to a very narrow wing along the rachis; basal basiscopic pinnule to 7.5 cm long, nearly 3 cm wide, bearing several

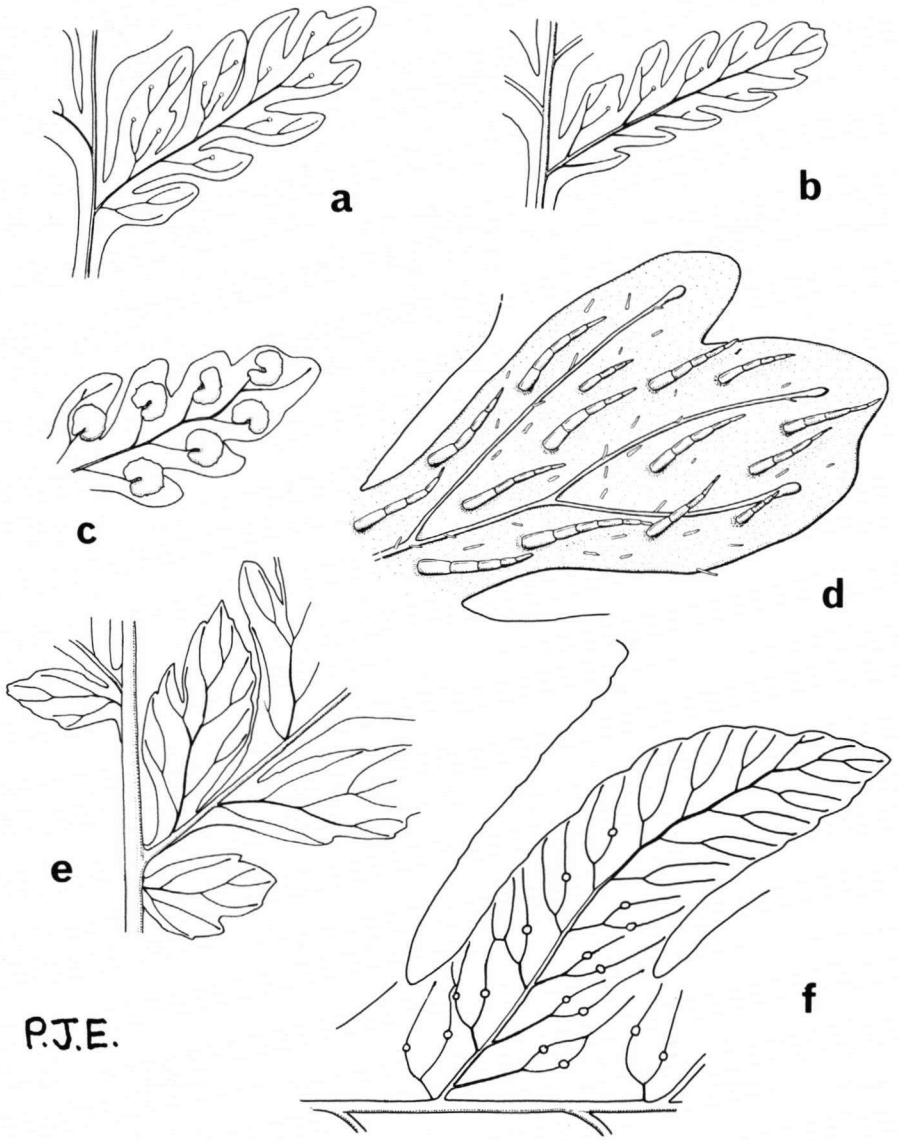

Fig. 1. Details of pinnules. – a. *Aenigmopteris dubia*, × 3.5 (*Elmer 9713*); b. *A. elegans*, × 3.5 (*Parris & Croxall 8612*); c. *A. elegans*, × 7.5 (*Parris & Croxall 9135*); d. *A. katoi*, adaxial surface, × 18 (*Kato et al. B3820*); e. *Psomiocarpa apiifolia*, × 3 (*Loher 812*); f. *Ataxipteris sinii*, × 3 (*Tagawa & Iwatsuki 3479*).

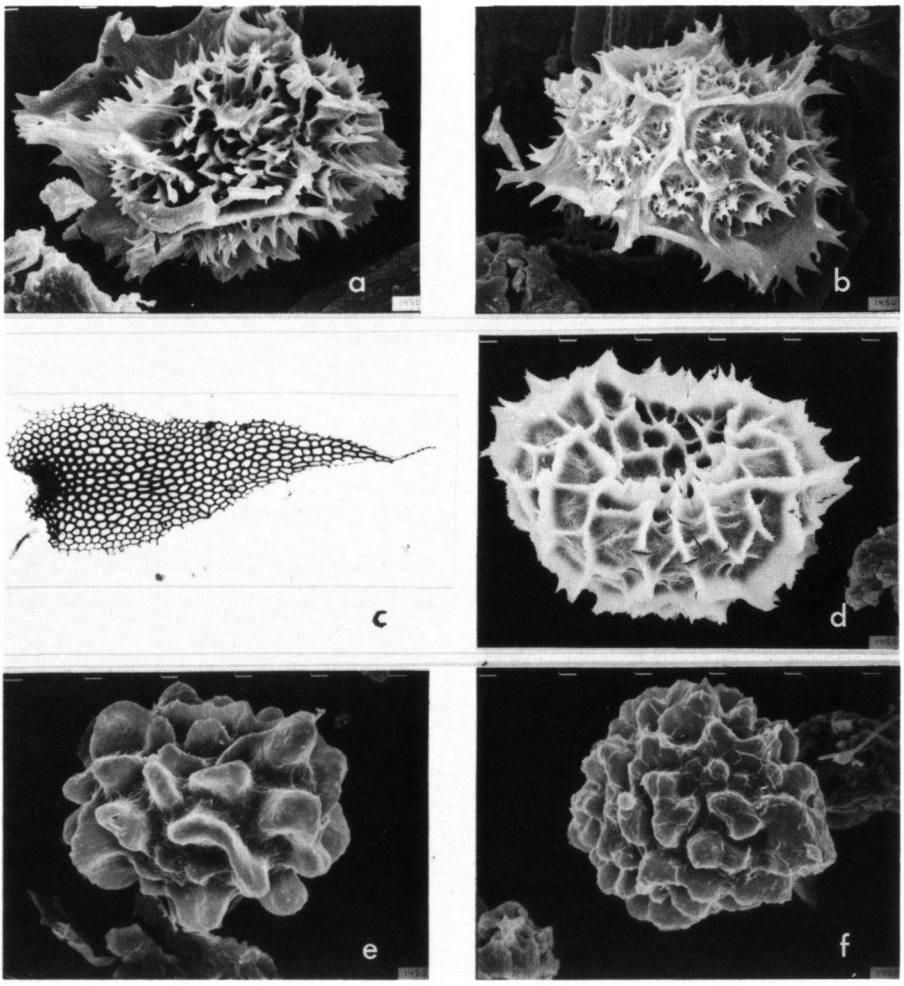

Plate 1. a, b, d, e, f. S.E.M. photographs of spores, all × 725. – a. *Aenigmopteris dubia (Price 2629)*; b. *A. elegans (Parris & Croxall 9135)*; c. stipe-scale of *Ataxipteris sinii*, × 22 *(Tagawa & Iwatsuki 3479)*; d. *Psomiocarpa apiifolia (Price 1543)*; e, f. *Ataxipteris sinii (Tagawa & Iwatsuki 3479)*.

pairs of well-spaced tertiary leaflets, all deeply obliquely lobed with narrowly decurrent bases, the basal acroscopic tertiary leaflets longer than the basiscopic ones; basal acroscopic pinnule to 3.5 × 1.1 cm, only its basal lobes lobulate; second pinnae to 11 cm long with 1 pair free subequal pinnules and others adnate; pinnules and larger pinna-lobes of middle pinnae like tertiary leaflets of basal pinnae. *Lower surface* of

pinna-rachis bearing thick ctenitoid hairs 0.5–1 mm long and a few ovate-acuminate scales formed of cells with very thick walls, the smallest scales ovate; lower surface of pinna-lobes bearing a few thick hairs on costules and veins. *Upper surface* of pinna-rachis prominent, glabrous, of lamina between veins and of rachis-wing bearing scattered very thick pluricellular acute hairs 0.5–1 mm long. *Sori* in lobules of pinna-lobes, apical on veins; indusia firm, reniform, glabrous, except some distal ones which are obliquely semicircular or asymmetric.

Distribution. Luzon, Negros, Leyte, Camiguin de Mindanao, in forest at recorded altitudes of 850–1200 m.

2. Aenigmopteris pulchra (Copel.) Holttum, *comb. nov.*

Dryopteris pulchra Copel., Univ. Cal. Publ. Bot. 18 (1942) 219. – *Ctenitis pulchra* Copel., Gen. Fil. (1947) 124; Philip. J. Sc. 78 (1951) 410, pl. 14. – Type: *Brass 13455* (MICH, BM, BO, L, UC), W. New Guinea, Idenburg River, on banks of a stream in forest, 850 m.

Stipe c. 30 cm long, dull-castaneous, bearing long hairs in the groove; basal scales 13 mm long, less than 1 mm wide, very firm, dark brown; scales above base gradually smaller; rachis bearing rather sparse scales abaxially, adaxially hairs more than 1 mm long. *Lamina* to 45 cm long and 24 cm wide, firm; free pinnae c. 15 pairs, contiguous, the distal ones grading into the apical lamina. *Basal pinnae* to 13.5 cm long; free pinnules 1 pair, then several with narrowly decurrent bases grading into an apical lamina, all acuminate and deeply lobed with well-spaced narrow oblique lobes which are deeply and obliquely lobulate; basal basiscopic pinnule 5.2 × 1.6 cm, acuminate, its lobulate lobes 9 × 3.5 mm, their bases 4 mm apart, their lobules 1 mm wide; basal acroscopic pinnule 3.4 × 1.4 cm; second pair of pinnae with subequal basal pinnules; fourth pair of pinnae 12 × 3.5 cm; pinnules of middle pinnae 4 mm wide, their lobes 1 mm wide. *Lower surface* of pinna-rachis bearing many thick ctenitoid hairs and sparse narrow scales; of costae of pinnules similarly but more sparsely hairy, scales rare; of costules of pinnule-lobes and on veins a few smaller hairs and sometimes small spherical glands. *Upper surface* of pinna-rachis bearing many small ctenitoid hairs and scattered very thick ones more than 1 mm long; similar long thick hairs present on pinnule-lobes between the veins, no other hairs nor glands present. *Sori* as in *A. dubia*; indusia sometimes bearing small papillae near the centre.

Distribution. Known only from the type collection and *Brass 12848*, also from the Idenburg River, at 1150 m.

Note. Copeland described the segments of pinnules as membranous, but they are very firm and not translucent.

3. Aenigmopteris mindanaensis Holttum, *spec. nov.*

A. dubiae similis, ab ea differt: lobis pinnularum confertis, minus profunde lobatis; paleis rhachidum pinnarum angustis, fuscis, minoribus, non ovatis; rhachidibus pinnarum costisque pinnularum supra vix prominentibus, pilis brevibus multis praeditis. – Typus: *Ramos & Edaño BS 39139* (BO; US), Mindanao, Bukidnon Subprov., June-July 1920.

Stipe 30 cm long; lamina 35 cm long, agreeing in shape with that of *A. dubia* but with pinnules or pinna-lobes more closely placed and the pinna-lobes less deeply lobulate; upper surface of pinna-rachis slightly grooved and covered with very short hairs, long thick hairs like those between the veins of leaflets also occurring on the wing of the pinna-rachis and sometimes on the margins of the rachis itself with the very short hairs; scales on pinna-rachis few, all linear.

Note. The specimens of the type collection were distributed from Manila as *Dennstaedtia sp.* Mr. M.G. Price informs me that there is a duplicate in US; I know of no others. It agrees with the two Bornean species here described in the small hairs on the upper surface of pinna-rachises and in the narrow scales but differs from them in other ways.

4. Aenigmopteris katoi Holttum, *spec. nov.* – Fig. 1d.

A. mindanaensi affinis, ab ea differt: pilis inter venas supra crassioribus, rigidis, usque 1 mm longis, sex-cellularibus, pilis minutis suberectis intermixtis; venis subtus glabris. – Typus: *S. Kato, Gen Murata & J. Mogea B3820* (K), Kalimantan Selatan, Gunung Besar, 800–1400 m, in forest, in humus-rich soil, 17-2-1979.

Caudex c. 8 mm diameter, bearing stipes in a lax spiral; shape of pinnae and pinnules as in *A. mindanaensis*; hairs on upper surface of leaflets between veins very thick, rigid (cell-walls not collapsing on drying), tapering to an acute apex, to 1 mm long and consisting of 5–6 cells, short suberect hairs also present; no long hairs on lower surface of costules and veins.

Distribution. Known only from the type collection.

5. Aenigmopteris elegans Holttum, *spec. nov.* – Fig. 1b, c; Plate 1b.

A. dubiae affinis, ab ea differt: pinnulis basi fere symmetricis, earum lobis infimis crenatis, non lobatis; paleis rhachidum pinnarum basi non dilatatis; rhachidibus pinnarum supra leviter canaliculatis, pilis brevibus multis praeditis; costules venisque subtus pilis longis destitutis, glandulis globosis minutis praeditis; sporangia pilis brevissimis praeditis. – Typus: *B.S. Parris & J.P. Croxall 9135* (PARRIS), Mt Kinabalu, Bukit Tupai Trail, on bank in ridge slope in forest at 1600 m.

Stipe 32 cm long, dark castaneous, bearing throughout narrow dark scales and sparse rather thin hairs to 1 mm long; basal scales to c. 12 mm long, less than 1 mm wide; rachis similarly scaly. *Lamina* c. 40 cm long; free pinnae c. 4 pairs, then c. 10 pairs with adnate decurrent bases, the upper ones grading into the apical lamina in which the deeply lobed lobes are connected by a narrow wing along the rachis; a bud sometimes present at the base of one or more pinnae. *Basal pinnae* 12–13 cm long including stalk of 5 mm; basal basiscopic pinnule to 6.5 × 2 cm, lobed to a narrow wing throughout, the costules of its lobes (or tertiary leaflets) 5 mm apart, the lobes oblique with obtuse apex, to 11 × 4 mm, deeply lobulate with 3–4 pairs of very oblique lobules 1 mm wide; the successive basiscopic lobes of basal pinnae gradually smaller and with less deeply lobulate lobes; basal acroscopic pinnule c. 3.3 × 1.2 cm;

middle pinnae sessile, c. 10 × 3 cm, lobed throughout to a narrow wing, the lobes almost all deeply and obliquely lobulate, those of acroscopic and basiscopic sides nearly equal, the basal acroscopic lobules of the largest lobes only slightly crneate. *Lower surface* of pinna-rachis bearing many short hairs and a few narrow dark scales; of costae of pinna-lobes sparsely short-hairy; of costules of lobules bearing minute spherical glands. *Upper surface* of pinna-rachis shallowly grooved and bearing many short hairs with a few long ones; of surface of lobes between veins bearing thick flaccid hairs consisting of up to 8 cells. *Sori* as in *A. dubia*; sporangia sometimes bearing a very short hair consisting of a few cells, near the annulus.

Distribution. Mt Kinabalu, Sabah, at 1400–1600 m. Additional specimens are: *Parris & Croxall 8604 & 8613* from Sungei Liwagi Trail, and *Clemens 32386* from the Marei Parei Ridge, Gigisan Creek (MICH; SING).

PSOMIOCARPA Presl – Fig. 1e; Plate 2d

This genus was established by Presl in 1851 (Epim. Bot.: 161), based on a Philippine species first described and excellently illustrated by Kunze as *Polybotrya apiciflora* (Farnkr. 1844: 142, t. 62). Presl also added three other species from tropical America which are now recognized as allied to the type of *Polybotrya* Willd. and not to the Philippine species; they were in effect excluded from *Psomiocarpa* by Mettenius in 1856 (Fil. Hort. Lips.: 23). The Philippine species was however returned to *Polybotrya* by later authors and was so ranked in Christensen's Index Filicum (1905). It was again recognized as a distinct monotypic genus by Copeland in 1907 (Philip. J. Sc. 2: Bot. 64). In his Genera Filicum (1947: 125) Copeland wrote of it: 'in every respect except its dimorphism *Psomiocarpa* is a typical *Ctenitis* .... in *Ctenitis* the species most suggestive of *Psomiocarpa* is *C. dubia*, like it in most vegetative characters but with no suggestion of an indusium.' T.G. Walker (J. Linn. Soc. Bot. 67, 1973, Suppl. 109) has reported that its chromosome number is 41.

The fertile fronds have comparatively long stipes and pinnules of greatly reduced size covered by sporangia. The pinnules are almost circular, about 2 × 2 mm; they were stated by Presl to have sporangia on both surfaces, a statement recently repeated by Zamora & Chandra (Kalikasan 8, 1977, 217). I find it difficult to understand the structure of these small pinnules by examination of dried specimens, but believe that the upper surface is very small, with its margins curved upwards, and the lower surface, bearing the sporangia, greatly swollen. Sections of fresh material need to be made.

Mr. M.G. Price, who collected specimens and sent them to Kew, informs me that there are two forms of this species; a larger one with erect sterile fronds and a smaller one with horizontal sterile fronds. He further states that the spores of the small form are larger and somewhat irregular in shape, and have a more finely reticulate perispore with an equatorial flange formed by hyaline projections; this I have not seen. Kunze's original drawing shows that he had a specimen of the larger form, and the plant cultivated at Kew (sent by Mr. Price) from which the spores for the S.E.M.

photograph here reproduced were obtained, is similar. The species occurs in southern Luzon, Negros, Samar, Leyte and Camiguin de Mindanao.

Psomiocarpa agrees with *Aenigmopteris* and with *Tectaria*, and differs from *Ctenitis*, in its scales and in the presence of thick pluricellular hairs between the veins on the upper surface of sterile fronds; its spores are also nearer to those of *Tectaria*. In the absence of cylindric glands, it differs from both *Ctenitis* and *Lastreopsis*. In the form of its sterile fronds and in the position of basal veins in pinnae it is nearer to *Tectaria* than to *Aenigmopteris*, but in chromosome number it agrees with *Ctenitis*, another indication that the difference between 40 and 41 in chromosome number does not provide a distinction between natural groups of species in Aspidiaceae sensu Pichi Sermolli.

ATAXIPTERIS Holttum, *gen. nov.*,

ambitu et forma frondis et venatione Tectaria Cav. congruens; caudex et axes omnes frondis paleis copiose vestiti, paleis eis Ctenitidis C. Chr. similibus; lamina frondis pinnis c. 6-jugatis cum lamina lobata deltoidea terminale constitutis; pinnae infimae pinnulis 1–3-jugatis praeditae, cetera profunde pinnatifidae, pinnulis infimis basiscopicis elongatis et lobatis; pinnae suprabasales basi fere symmetricae; venae plerumque liberae, interdum irregulariter leviter anastomosantes; sori ad venas mediales, exindusiati.

Species typica et unica: *Ataxipteris sinii* (Ching) Holttum.

Ataxipteris sinii (Ching) Holttum, *comb. nov.* – **Fig. 1f; Plate 1c, e, f.**

Aspidium sp., Y.C. Wu et al., Bull. Dep. Biol. Coll. Sci. Sunyatsen Univ. no 3 (1932) 70, pl. 26. – *Tectaria sinii* Ching, Bull. Dep. Biol. Coll. Sci. Sunyatsen Univ. no 6 (1933) 22. – *Ctenitopsis sinii* (Ching) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8 (1938) 319; Tagawa, Acta Phytotax. Geobot. 14 (1950) 46; Col. Illus. Jap. Pterid. (1959) fig. 224. – *Ctenitis sinii* (Ching) Ohwi, Fl. Jap. Pterid. (1957) 92; Nakaike, New Fl. Jap. Pterid. (1982) 333. – Type: *S. S. Sin 706*, Kwangsi, Yaoshan, Lo-shiang, 1000 m (not seen).

Stipe to 60 cm long (Ching), its base covered by a mass of thin medium brown scales 20 mm long, hardly 1 mm wide, similar scales decreasing upwards for a length of 15 cm, rest of stipe and rachis covered both sides with overlapping thin wholly clathrate scales which have slightly cordate bases with a crescent-shaped attachment. *Lamina* to 60 cm long (Ching), very firm, opaque; free pinnae c. 3 pairs and 3 pairs gradually more adnate to the rachis; apical lamina c. 20 cm long, lobed almost to the rachis, the basal lobes c. 10 × 1.5 cm, shallowly lobulate, distal lobes gradually shorter and less lobed. *Basal pinnae* 25 cm or more long including stalk 2 cm, consisting of 2–3 pairs of adnate pinnules and a deeply lobed apical lamina similar to that of the frond; basal basiscopic pinnule 15 cm long, acuminate, deeply lobed, lobes obtuse, crenate to entire, the other basiscopic pinnules and pinna-lobes gradually shorter; basal acroscopic pinnule 7 × 1.2 cm, narrowly acuminate, less deeply lobed than the basiscopic one; suprabasal pinnae gradually smaller and less deeply lobed, their bases

symmetric. *Lower surface* of costae of pinnae and costules of lobes slightly prominent, concolorous with the lamina, hairless, bearing a few scales; costules of pinna-lobes similar; veins at most faintly prominent, most of them not detectable on the surface, bearing a few small hair-tipped scales grading to slender hairs, a few similar scales also between veins. *Upper surface* of costae of pinnae covered with scales near the base, the rest densely covered with reddish ctenitoid hairs 0.3–0.4 mm long; more sparse similar hairs on costules of pinna-lobes and sparsely between veins (especially near sinuses between lobes). *Veins* in pinna-lobes mostly forked, the acroscopic branch sometimes forked again, adjacent lower veins sometimes irregularly anastomosing, the basal basiscopic vein usually springing from the costa of the pinna, not from the costule of its lobe; veins not reaching the margin, their basiscopic branches sometimes ending far from it. *Sori* in the middle of the acroscopic vein-branches, or on both branches near the bases of pinna-lobes, lacking indusia; perispore forming irregular short thick ridges with rounded crests, usually not inter-connecting; chromosome number 41 (Kurita, J. Jap. Bot. 40, 1965, 237, fig. e).

Distribution. China, Kwangsi Province at about 500 km north of Hainan; Japan, in southern Kyushu.

Notes. The above description was prepared from a specimen of *Tagawa & Iwatsuki 3479* from Kyushu in Herb. Kew, which agrees closely with the original description but is a little smaller; it agrees also well with the illustrations published by Wu et al. and by Tagawa. The Chinese and Japanese localities are about 2000 km apart; the species must surely occur at other localities in southern China. Tagawa (l.c. 1950) reports that in southern Kyushu the species occurs in 'rather dry thickets'; the firm opaque lamina of the fronds suggests an adaptation to such a habitat.

The rachis-scales of this species are similar in cell-arrangement to those of *Ctenitis subglandulosa* (Hance) Ching and allied species but differ in their basal attachment. The spores are somewhat similar to those of the other group of species of *Ctenitis* in Southeast Asia and Malesia, of which *Ctenitis eatonii* (Bak.) Ching is an example, but in the latter the thick ridges of the perispore are often connected to form an irregular network. The scales at the bases of stipes are like those of species in both groups of *Ctenitis*.

A characteristic feature of all species of *Ctenitis* in Southeast Asia and Malesia is the presence of unicellular cylindric glands, usually pallid and opaque, on indusia and variously on both surfaces of the lamina. Such glands are lacking in *Ataxipteris*.

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