CYTOLOGICAL OBSERVATIONS ON FERNS FROM NEW GUINEA WITH DESCRIPTIONS OF NEW SPECIES

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In the month of August 1963 Holttum visited Lae in New Guinea, and through the generous cooperation of Mr J. S. Womersley, Head of the Division of Botany, Department of Forests, was able to send young plants of ferns to the Royal Botanic Gardens, Kew, where they have been studied cytologically by Roy. Holttum also collected herbarium specimens, some of which are here described in conjunction with observations on the living plants. Taxonomic description and opinion are in all cases due to Holttum. We wish to express our thanks to Mr Womersley, and to the Director and staff at Kew for their help in many ways, especially to Mr H. J. Bruty, under whose expert care the plants have grown so well.

The living plants were sent to Kew in four consignments, of which the introduction numbers are 525/63, 530/63, 545/63, and 578/63. The individual plants were later given serial numbers which are cited in the following notes; these numbers have no relevance to the chronological sequence in which the plants were collected. Specimens of all plants mentioned in this paper have been preserved in the Kew herbarium. In most cases the first cytological observations were on root-tips, before the plants bore fertile fronds; fixations of young sporangia were made later where possible.

Most of the cytological observations are the first records for the species concerned, but there are no new generic observations. The latter are to be published in separate papers, one on the genera of the *Lomariopsis* group (by Roy and Manton, in the Journal of the Linnean Society) and one on the genus *Cystodium* J. Sm. (Roy and Holttum in American Fern Journal). The most important observations in the present paper concern the family *Thelypteridaceae*, and provide opportunity for comments on R. C. Ching's recent revision of the genera of that family, and for description of new species in New Guinea. References to cytological observations published up to 1963 are to be found in the papers of Chiarugi (1960) and Fabbri (1963).

GLEICHENIACEAE

Gleichenia milnei Bak.; Holttum, Fl. Males. II, 1 (1959) 22.

525/63, no. 16; roadside in Markham valley near Lae. 2n = 68.

This species belongs to the genus *Sticherus*, as recognized in Copeland, Genera Filicum (1947). All previous observations of species of this genus, by Brownlie in New Zealand and New Caledonia, and by Walker in Jamaica, have shown a base number n = 34.

Dicranopteris linearis (Burm.) Bedd. var. **montana** Holttum, Fl. Males. II, 1 (1959) 36.

525/63, no. 18; Edie Creek, *c.* 2000 m. 2n = 78 (diploid).

525/63, no. 14; same locality. 2n = 156 (tetraploid).

All records for the genus give base number n = 39, and tetraploids of unspecified varieties of *D. linearis* have been reported in S. India and Ceylon, also in N. India. In

the present case, the diploid has the normal frond-form of the variety *montana*, and the tetraploid is abnormal (all branches larger, but accessory branches at ultimate forks of the frond rudimentary). The variety is widely distributed but has not previously been reported from New Guinea.

DENNSTAEDTIACEAE

Microlepia strigosa (Thunb.) Presl.

525/63, no. 25; in forest, near Wau, *c.* 1000 m. 2n = 84. Fig. 2.

This species is widely distributed from India to Japan, southwards to Ceylon, Malesia to Polynesia, and is somewhat variable. Fronds of the cultivated plant agree with most specimens from Borneo and the Philippines; the latter have larger fronds with larger pinnules than specimens from Japan (whence came the type of the species) and the lower pinnae are less reduced. A herbarium specimen collected in the Eastern Highlands of New Guinea, on limestone at 1500 m *(Millar & Holttum 18643)* agrees much better with Japanese specimens, and also with some from the Philippines. It may be that two species should be recognized. No chromosome count for *M. strigosa* has hitherto been reported, and the base number n = 42 is new in the genus (previous records mostly 43, one 44).

THELYPTERIDACEAE

R. C. Ching has recently published an important new conspectus of this family in Asia [Acta Phytotax. Sinica 8 (1963) 289—335] recognizing eighteen genera, some of them new. It appears that much more study of Malesian species is needed before it will be possible to decide on the status and scope of some of these genera. The following are, however, clearly distinguishable groups, and for them Ching's names are adopted as a provisional measure.

PSEUDOPHEGOPTERIS

Ching distinguishes this new genus from *Phegopteris* Fée (as delimited by Ching) by the following characters: castaneous shining stipe, oblong or lanceolate shape of fronds, pinnae not adnate to rachis, lack of fringed scales on lower surfaces, and veins not reaching the margin.

As regards scales, it is true that *Phegopteris*-like scales are lacking on lower surfaces, but the stipe-scales of *Pseudophegopteris* are exactly as in *Phegopteris*, being fringed with stiff spreading hairs. As regards shape of frond, *Pseudophegopteris oppositipinna* (v.A.v.R.) Ching almost exactly matches *Phegopteris decursivipinnata* (van Hall) Fée. However, in general one can recognize plants of *Pseudophegopteris* at a glance, and I have no doubt that they are a distinct group. Moreover, the basic chromosome number is 31, whereas in *Phegopteris* it is 30 *(P. hexagonaptera* Fée), the European *P. polypodioides* being an apogamous triploid with n = 90.

An important character in discriminating species in this genus is the form of the rhizome, whether erect or suberect with tufted fronds, or creeping with spaced fronds, and very few herbarium specimens include the rhizome; this has led to uncertainty in the application of the epithet *brunnea* in the genus. Collections from Malesia are not very numerous (apparently none hitherto from New Guinea) and have been referred to two species which have usually been named *Dryopteris brunnea* and *D. oppositipinna*, following Christensen's Index Filicum. These species were transferred to *Thelypteris* by

Ching in 1936, and were so named in Holttum, Rev. Fl. Malaya 2 (1954) 239, where it is noted that there are earlier names than *brunnea*. Three species are here reported from New Guinea, one being new.

Pseudophegopteris paludosa (Bl.) Ching, Acta Phytotax. Sinica 8 (1963) 315. — *Polypodium paludosum* Bl., Fl. Jav. Fil. (March 1851) 192, t. 90. — *Aspidium paludosum* Bl., Enum. Pl. Jav. (1828) 168, *non* Raddi 1825. — *Polypodium distans* Don, Prodr. Fl. Nepal (1825) 2, *non* Raddi 1824; Clarke, Trans. Linn. Soc. Bot. 1 (1880) 544. — *Phegopteris distans* (Don) Mett., Phegopt. & Aspid. (1858) 16; Beddome, Handb. Ferns Brit. India (1883) 292. — *Polypodium brunneum* Wall., Cat. no. 333 *(nom. nud.)*. — *Dryopteris brunnea* (Wall.) C. Chr., Ind. Fil. (1905); Backer & Posthumus, Varenfl. Java (1939) 46. — *Thelypteris brunnea* (Wall.) Ching, Bull. Fan Mem. Inst. Biol. 6 (1936) 269 *(p.p. ?)*; Holttum, Rev. Fl. Malaya 2 (1954) 240. — *Polypodium pyrrhorhachis* Kze, Linnaea 24 (1851, July or later) 257. — *Lastrea pyrrhorhachis* (Kze) Copel., Gen. Fil. (1947) 139; Fern Fl. Philip. (1960) 330. — *Pseudophegopteris pyrrhorhachis* (Kze) Ching, Acta Phytotax. Sinica 8 (1963) 315 *(p.p. ?)*. — *Dryopteris moussetii* Rosenst., Fedde Repert. 8 (1910) 278.

In his monograph of *Thelypteris* in 1936 Ching stated that the Chinese ferns he called *T. brunnea* had a creeping rhizome. But Clarke stated that the stipes of *Polypodium distans*, as seen by him in northern India, were tufted; Beddome stated the same of plants from southern India (whence came the type of *Polypodium pyrrhorhachis)*, and this is true also of a plant from Ceylon now in cultivation at Kew; Backer and Posthumus record an erect stock with tufted fronds for plants in Java, and Copeland the same for Philippine plants. The New Guinea specimen cited below had a short erect stock, and in characters of the frond does not differ significantly from specimens from Java. The plants of this species which I have seen growing in Malaya, Sumatra, and New Guinea were all in open places, not in the shade of forest, but Backer and Posthumus state that the species may grow in shade in Java. The New Guinea specimen is: *Millar & Holttum 18608*, Territory of New Guinea, Western Highlands District, Mt Hagen Subdist., Kundip, 7500 ft, edge of forest on logging road; fronds to 120 cm long, tufted.

Pseudophegopteris aurita (Hook.) Ching, Acta Phytotax. Sinica 8 (1963) 314. — *Gymnogramme aurita* Hook., Ic. Pl. (1854) t. 974, t. 989. — *Dryopteris aurita* (Hook.) C. Chr., Ind. Fil (1905) 253; Copel., Philip. J. Sci. 56 (1935) 473. — *Thelypteris aurita* (Hook.) Ching, Bull. Fan Mem. Inst. Biol. 6 (1936) 266; Tard.-Blot & C. Chr. in Lec. Fl. Gén. Indoch. 7, pt 2 (1941) 368.

578/63, no. 4; above Mt Hagen, Western Highlands, 2000 m, edge of forest. 2n = 124. No. 21, same locality, n = 62; fig. 3.

The only previous record of this species beyond the region from N.E. India to southern China and Tonkin is a collection by Clemens *(no. 40306)* from Mt Kinabalu, N. Borneo, at 1200 m 'on rocks in river bed'. The present cultivated plants from New Guinea agree with the Borneo specimen in having the sori less elongate than plants from India and China; in other respects (long-creeping rhizome, enlarged basal lobes of lower pinnae, and setose sporangia) they agree closely with the type of the species. Records of this species from Formosa are based on the distinct species *Dryopteris subaurita* Tagawa; neither this nor *Pseudophegopteris aurita* have been reported from the Philippines.

Pseudophegopteris cyclocarpa Holttum, *sp. nov.*

P. aurita (Hook.) Ching affinis, differt: ramis rhizomatis brevibus, suberectis; frondibus multo majoribus, bipinnatis-tripinnatifidis; soris plerisque rotundis.

Caudex branching, branches short, suberect, each with a tuft of fronds. *Stipes* 30 cm long, purple-castaneous, smooth apart from scattered minute warts, bearing scattered acuminate fringed scales to 6 × 1 mm. *Lamina* 60 cm or more long, 35 cm wide, bipinnate-tripinnatifid; pinnae opposite, *c.* 12 pairs below deeply lobed apical lamina; lower pinnae somewhat reduced, all pinnae with basal pair of pinnules longer than the next, basal basiscopic pinnules largest. *Middle pinnae c.* 20 cm long, horizontal, almost sessile, narrowly deltoid; pinnules all adnate to pinna-axis and connected by a narrow wing; lowest pair of pinnules almost free, basiscopic 4.5 × 1.4 cm, acroscopic 3.5 × 1.2 cm, lobed 2/3 towards the costa; next pair of pinnules *c.* 4 cm and 2.5 cm long, less deeply lobed; rest of pinna narrowed evenly to the apex. *Lamina* thin; veins pinnate in lobes of pinnules, raised towards their apices on upper surface, terminating well within the margin. *Main rachis* minutely hairy on upper surface, smooth and glabrous below; pinna-rachis copiously hairy on upper surface, glabrous below except near apex; costae of pinnules hairy on upper surface, sparsely below; lamina glabrous except for some slender hairs on distal parts of upper surface of lobes and on edges. *Sori* mostly circular, not at apices of veins; sporangia bearing slender needle-like hairs nearly as long as body of a sporangium.

Type: Cult. Hort. Bot. Reg. Kew., 578/63, no. 57; origin above Mt Hagen, Western Highlands, New Guinea, *c.* 2000 m, coll. Holttum (K).

Cytology: 2n = 124; presumably tetraploid, as *P. aurita;* fig. 10.

PSEUDOCYCLOSORUS

Ching has established this genus with *Aspidium xylodes* Kze as type species [Acta Phytotax. Sinica 8 (1963) 322]. Undoubtedly a natural group of species allied to the type can be distinguished. A character omitted by Ching is provided by the scales, as noted below. The genus has the same chromosome-number, 36, as *Cyclosorus* and *Mesoneuron* (see below).

I found three species of this group in New Guinea; two of them are described below as new, with mention of two others which probably belong with them. Another Malesian species not mentioned by Ching is *Aspidium calcaratum* Bl., which is found beside streams in Java and Sumatra. It seems that most species of the group are streamside plants; this is certainly true of the species which occurs in the Malay Peninsula (described as *Thelypteris ciliata* in Holttum, Rev. Fl. Malaya 2, p. 250).

The essential characters of the genus are:

1. Scales on bases of stipes rather thin, their cells almost isodiametric, edges only bearing a few short needle-like hairs (in *Cyclosorus* scales are elongate, with needle-hairs all over surface);
2. A few irregular pairs of very small auricle-like basal pinnae present below normal pinnae;
3. Veins simple, not anastomosing; basal acroscopic vein usually running to a small translucent membrane in the base of the next sinus between lamina-lobes, basal basiscopic vein running towards margin above the base of a sinus.

Features common to the species known to me, perhaps not universal, are: stem short, erect, or suberect (not slender and creeping), where on the bank of a stream bearing stiff spreading roots, lamina rather firm, with prominent veins, lacking superficial glands, usually lacking hairs on surface between veins.

Ching stressed the importance of prominent dark pneumathodes at the bases of pinnae, giving these as contrasting with the lack of such organs in *Mesoneuron* and *Cyclosorus.*

But pneumathodes are present in all species of these genera; in *Mesoneuron* they are usually shrunken, not prominent, when dry, and this is the case also with my new species of *Pseudocyclosorus.*

Pseudocyclosorus caudatus Holttum, *sp. nov.*

Caudex erectus, frondes arcte fasciculatas ferens. Stipites pallidi, 15 cm vel ultra longi, pinnis minutis (2—3 mm longis) c. 2-paribus ornati, basin versus paleis fuscis ovato-acutis adpressis vix 1 mm longis praediti. Lamina 30 cm vel ultra longa, pinnata. Pinnae suprabasales maximae, sessiles, c. 8 cm longae, profunde pinnatifidae, apicibus caudatae (cauda ad 2.5 cm longa, 2 mm lata, marginibus leviter undulatis), basibus valde asymmetricae; lobi pinnarum obliqui, oblongi, integri, apicibus rotundati; lobus infimus basiscopicus minutus, lobus infimus acroscopicus fere liber, leviter reductus; rhachis costaeque utraque facie copiose pilis minutis erectis praeditae, costulae venaeque infra pilis minutis paucis praeditae; venae c. 9-jugatae, simplices, obliquae, marginem non attingentes, vena infima acroscopica ad sinum inter lobos protensa, vena infima basiscopica pleraque marginem versus supra sinum currens. Sori supramediales, indusiati; indusium glabrum vel pilis paucis erectis praeditum.

Type: Cult. Hort. Bot. Reg. Kew., 545/63, no. 12; origin near Lae, New Guinea, by stream in forest, coll. Holttum (K).

Cytology: 2n = 72; fig. 7.

Pseudocyclosorus excisus Holttum, *sp. nov.*

P. caudato affinis, differt: pinnis caudato-acuminatis, caudis valde serratis; lobis infimis basiscopicis pinnarum pluribus multo reductis, basibus pinnarum itaque excisis; lobis infimis acroscopicis non liberis; venis utraque facie pallidis, prominentibus, vena infima acroscopica pleraque ad marginem supra basin sinus protensa; indusio minuto, sporangiis maturis obtecto.

Type: Territory of New Guinea, Eastern Highlands Distr., Kerowagi Subdistr., 6300 ft, *Millar & Holttum 18623* (K).

It is only towards the apices of pinnae that the acroscopic basal veins run to the bases of the sinuses; towards the bases of the pinnae these veins, like the basiscopic basal veins, run to the edge just above the base of the sinus, but there is a distinct small sinus-membrane present.

Pseudocyclosorus petrophila (Copel.) Holttum, *comb. nov.* — *Dryopteris petrophila* Copel., Univ. Cal. Publ. Bot. 18 (1942) 220. — *Lastrea petrophila* Copel., Gen. Fil. (1947) 139.; Philip. J. Sci. 77 (1949) 424, pl. 18.

530/63, no. 28; Edie Creek, *c.* 2000 m. n = 36.

The cultivated plant is not yet quite so large as Copeland's description, but agrees in all details. I see no signs of an indusium. Pneumathodes at bases of pinnae are dark and slightly swollen. Stipe-scales are small, almost circular, with few marginal hairs.

It is probable that *Dryopteris keysseriana* Rosenst. and *D. brassii* C. Chr. also belong to the genus *Pseudocyclosorus. D. brassii* has the pinnae somewhat larger and more deeply cut than those of *P. petrophila;* the type was found 'on banks of a small stream flowing over debris of a landslip'.

MESONEURON

Ching has chosen the Malesian species *Aspidium crassifolium* Bl. as type of this genus [Acta Phytotax. Sinica 8 (1963) 325] which is distinguished by creeping rhizome, pinnae deeply lobed but with distinct sinus-membrane, basal veins of adjacent groups both running to the sides of the membrane, never uniting, the basal basiscopic vein of each group springing from the costa some distance below the base of the costule. This is a natural group of species, which shares the following characters with *Cyclosorus:* hairs on the surface of rhizome-scales, base chromosome number 36.

Mesoneuron wantotensis (Copel.) Holttum, *comb. nov.* — *Dryopteris wantotensis* Copel., Univ. Cal. Publ. Bot. 18 (1942) 220. — *Lastrea wantotensis* Copel., Gen. Fil. (1947) 140; Philip. J. Sci. 78 (1949) 436, pl. 24.

The living plant is larger than the type of Copeland's species, but not so large as a herbarium specimen from the Western Highlands *(Womersley & Millar 7622)* which agrees with the living plant in all characters except size.

578/63, no. 75, 102; near Nondugl, Western Highlands, *c.* 1500 m. 2n = 72, n = 36. The wild plants were growing on a steep earth bank above a stream, in shade.

CYCLOSORUS

Cyclosorus dentatus (Forsk.) Ching

This species has a very wide distribution in the Old World tropics (to West Africa). The Malesian form of it, which in recent years has usually been named *C. subpubescens* (Bl.) Ching, appears not to be distinguishable; plants from the Malay Peninsula have been shown to be tetraploid [see Panigrahi & Manton, Journ. Linn. Soc. Bot. 55 (1958) 729—743].

578/63, no. 108; from an unrecorded locality in the Highlands, where it is frequently seen on grassy banks by roadsides; n = 72 (tetraploid).

Cyclosorus confertus (Brause) Copel.

The cultivated plant agrees exactly with a specimen from the type collection. The sori are small, exindusiate, and the sporangia setose.

545/63, no. 97; from lowland forest near Lae. 2n = 72.

Cyclosorus heterocarpus (Bl.) Copel.

The cultivated New Guinea plant differs from specimens from the Malay Peninsula in being much less hairy (no hairs on lower surface of lamina or on indusia, but many glands on both); also in the pinnae of a fertile frond being much narrower than those of a sterile frond. As in Malaya, the New Guinea plant is diploid.

525/63, no. 13; origin forest near Wau, *c.* 1000 m. 2n = 72.

Cyclosorus beccarianus (Cesati) Copel.

This is a variable species, both in New Guinea and Fiji. The Kew specimen from Beccari's type collection (Andai, Papua) has a simple lamina 25 × 4.5 cm, with one pair of very small pinnae below it, and this is a common condition among other collections. The living plant, which is a tetraploid, has produced fronds with up to 7 pairs of small pinnae; the largest number seen on a herbarium specimen is 3 pairs on *Brass 31670*, from Eastern Highlands. A character of this species not mentioned in taxonomic works

is the presence of one or two yellow spherical glands on most sporangia; similar glands are also present as terminal cells of hairs on sporangium-stalks and on veins of the lower surface of the frond.

525/63, no. 46; origin forest near Wau. n = 72.

Cyclosorus deminuens Holttum, *sp. nov.*

Caudex erectus; stipites ad 15 cm longi, paleis tenuibus, brunneis, c. 6 × 1 mm metientibus vestiti. Lamina ad 150 cm longa, bipinnatifida; pinnae inferiores c. 14-jugatae parvae, hastatae, infimae 9 × 9 mm, superiores sensim ad 25 × 25 mm auctae, paribus paucis sequentibus subito multo auctis; pinnae maximae c. 17 × 2.5 cm; pinnae ceterae sensim, deinde abrupte, reductae; lamina terminalis pinniformis. Pinnae sessiles, basi aequaliter truncatae, 1/4 versus costam lobatae (sinubus membranis hyalinis dimidio versus costam protensis), apice abrupte et breve acuminatae, textura tenues. Venae c. 8-jugatae, paribus duobus infimis in vena ad sinum excurrente junctis, superioribus membranam sinus vel margines laminae attingentibus. Rhachis supra omnino dense hirsuta, paleisque multis praedita, infra pilis brevissimis erectis vestita; costae pinnarum supra dense antrorsim hirsutae; costulae venae laminaque supra pilis tenuibus adpressis praeditae; margines laminae pilis longioribus ornatae; costae, costulae, membranae sinuum infra omnino pilis brevissimis erectis vestitae; venae infra pilis erectis conspersis praeditae. Sori mediales; indusia parva, valde setosa; sporangia etiam setis brevibus rectis armata; sporae minute papillosae.

Type: *Brass 32106*, Territory of New Guinea, Eastern Highlands, Arau, 1400 m, in undergrowth of Castanopsis-Oak forest on creek flats (K).

A cultivated plant from New Guinea at Kew, no. 121, precise locality not recorded, agrees exactly with the type, though at present smaller; it gave a chromosome-count of 2n = 72.

ASPIDIACEAE Copel. (excluding *Thelypteridaceae*)

Arachniodes aristata (Forst. *f.*) Tindale, Contr. N.S.W. Nat. Herb. 3 (1961) 89.

525/63, no. 2; Wau, in forest, *c.* 1000 m. n = 82; 2n = 164 (tetraploid).

This species has been reported as tetraploid from India and Ceylon, under the name *Rumohra aristata*. For comments on *Rumohra* see Holttum, Rev. Fl. Malaya 2 (1954) 484; Gard. Bull. Singap. 17 (1960) 361—367. For comments on *Arachniodes*, see Tindale, l.c.

Tectaria devexa (Kze) Copel.

578/63, no. 31; on limestone near Kundiawa, 1500 m. n = 80, 2n = 160.

This species occurs in Ceylon, Thailand to southern China, and widely in Malesia. A plant from the Malay Peninsula was found to be diploid by Manton. R. P. Roy and Pandey have reported a triploid from India; but as they give *Sagenia coadunata* as a synonym, the identity with the Malayan plant is doubtful. The fronds of the New Guinea plant are less deeply dissected than is usual in this species in Malaya, and anastomosis of veins is somewhat more copious.

Diplazium armatum (Copel.) Holttum, *comb. nov.* — *Lastrea armata* Copel., Gen. Fil. (1947) 138 *(nom. nov.)*; Philip. J. Sci. 78 (1949) 436, pl. 25. — *Dryopteris spinosa* Copel., Univ. Cal. Publ. Bot. 18 (1942) 219 (earliest name; not *Lastrea spinosa* Newm. 1844 nor *Diplazium spinosum* Bory).

578/63, no. 37; Eastern Highlands, Kerowagi, 2000 m; 2n = 82; fig. 4. Also the

following herbarium collections: *Millar & Holttum 18628*, Kerowagi; *Womersley 15290*, Western Highlands, Wabag-Laiagam Road, 8300 ft, in swamp; *Brass 30624*, Eastern Highlands, in grass edging forest, 3000 m.

This is an exindusiate species of *Diplazium*, as indicated by its rachis-structure; the chromosome number confirms this. Besides lack of indusium, it is distinguished by pale spreading multiseptate hairs on lower surfaces of pinna-rachises and costae. In other respects it is closely allied to *D. dielsii* (see below); both species have pale spiny stipe and rachis, and broad, thin, entire, dark scales at the base of the stipe. Spores of *D. armatum* have a thin, hardly folded, perispore.

Copeland (1949) compared *D. armatum* to *Lastrea leucolepis* Presl *(Macrothelypteris* Ching), but the latter species differs in rachis-structure and in the characters of scales and hairs.

Diplazium dielsii (Brause) Holttum, *comb. nov.* — *Alsophila dielsii* Brause, Bot. Jahrb. 56 (1920) 67; Holttum, Fl. Males. II, 1 (1963) 157. — *Cyathea dielsii* (Brause) Domin, Acta Bot. Bohem. 9 (1930) 111.

The type of this species (at Berlin) is an old frond, and most of the indusia have gone; fragments however remain. A dried specimen was collected at Kerowagi, with *D. armatum* (see above), which appears to be *D. dielsii (Millar & Holttum 18629)*. The sori are short, with broad thin indusia. On the under surface of costae are small scales to 2 × 1 mm, their edges near the base bearing hair-like projections from single marginal cells. These projections are not like the teeth found on the edges of many *Diplazium* scales; the latter are formed by the projection of a wall common to two marginal cells.

Diplazium stellatopilosum (Brause) Holttum, *comb. nov.* — *Dryopteris stellatopilosa* Brause, Bot. Jahrb. 56 (1920) 96. — *Lastrea stellatopilosa* (Brause) Copel., Philip. J. Sci. 78 (1949) 428.

545/63, no. 11, 35; lowland forest near Lae. n = 41, 2n = 82; fig. 5.

The characteristic features of this species are the long rather stiff but curved hairs on the edges of the scales (even of very small scales which are thus like stellate hairs), the shallowly lobed pinnae of which the upper ones are more or less adnate to the rachis, grading into the deeply lobed apical lamina, and the long exindusiate sori. The two cultivated plants are still much smaller than Brause's descriptions, but in essentials they match closely a specimen of the type collection at Kew *(Schlechter 16853*, distributed as *Dryopteris africana)*.

The small long-fringed scales are rather like those of *Cyathea cunninghamii* of New Zealand. I have seen nothing like them in any other species of *Diplazium*, but they occur in *Diplazium asterothrix* C. Chr. [Brittonia 2 (1937) 292] which has much larger fronds, and must be closely allied. The projecting hairs on these scales originate in the same way as the much shorter hairs on the scales on *D. dielsii* (see above).

Diplazium proliferum (Lam.) Kaulf. *(sensu lato)*

545/63, no. 78, 80; lowland forest near Lae. 2n = 82.

The plants are very large, and show little development of budding on the pinnae such as is common in some forms of this species which is very wide-ranging and variable. Plants from Malaya — under the name *Athyrium accedens* (Bl.) Milde — also were diploids, but were from an altitude of 1200 m.

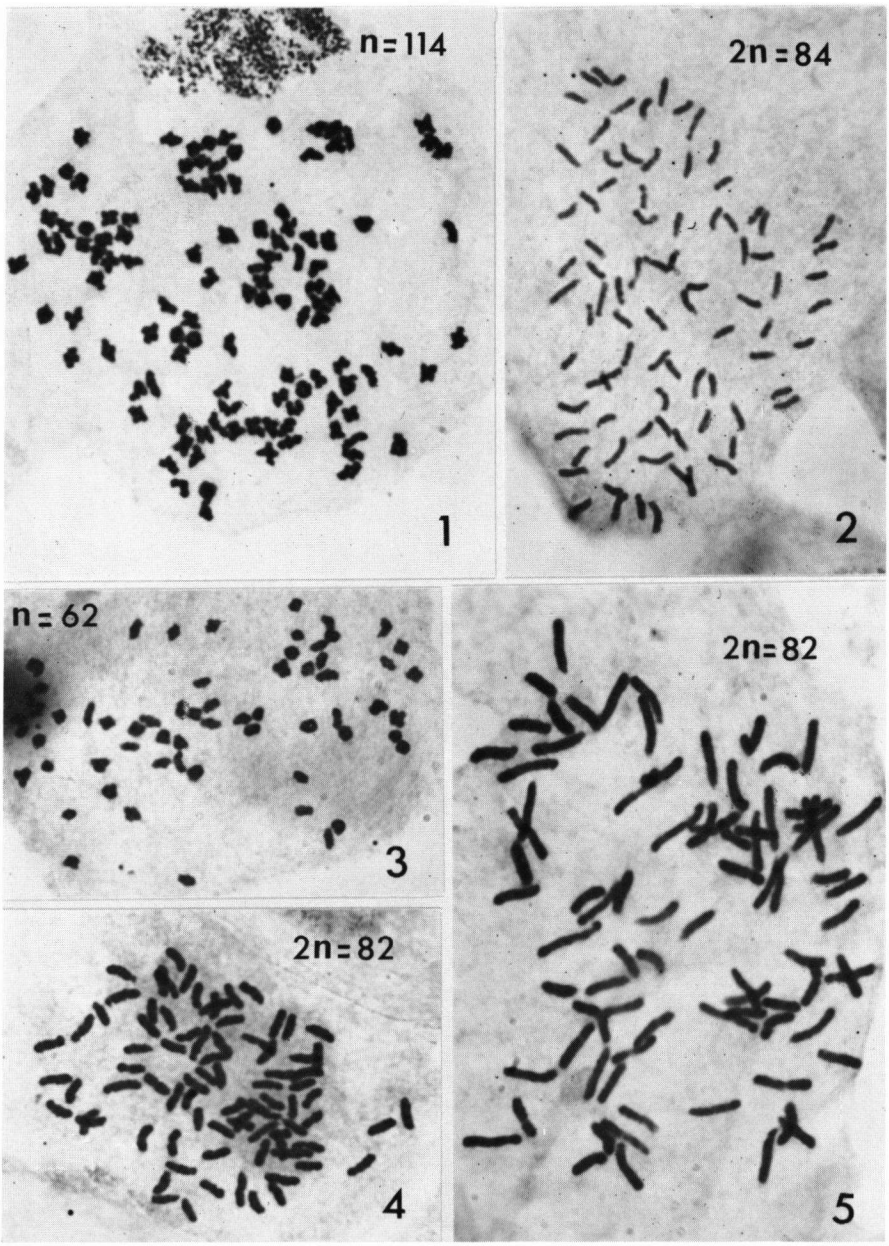

Fig. 1. *Adiantum diaphanum.* — Fig. 2. *Microlepia strigosa.* — Fig. 3. *Pseudophegopteris aurita.* — Fig. 4. *Diplazium armatum.* — Fig. 5. *Diplazium stellatopilosum.* All × 1000.

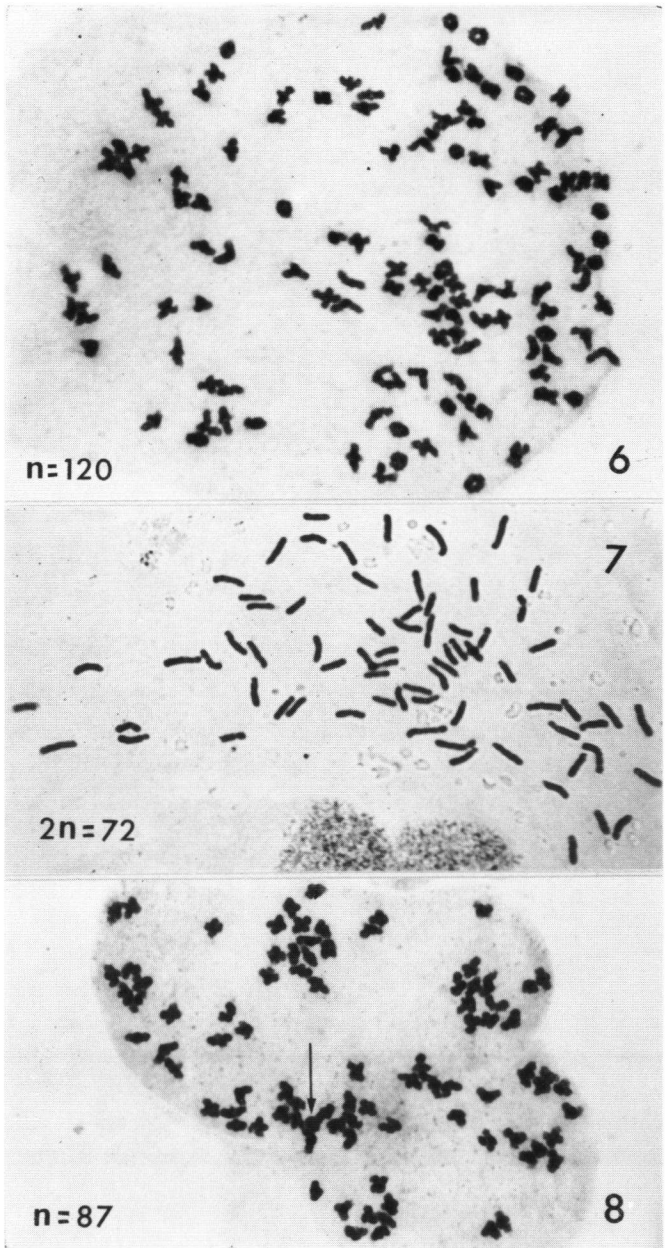

Fig. 6. *Lunathyrium japonicum.* — Fig. 7. *Pseudocyclosorus caudatus.* Fig. 8. *Pteris orientalis* (fresh acetocarmine, arrow showing nucleolus). All × 1000.

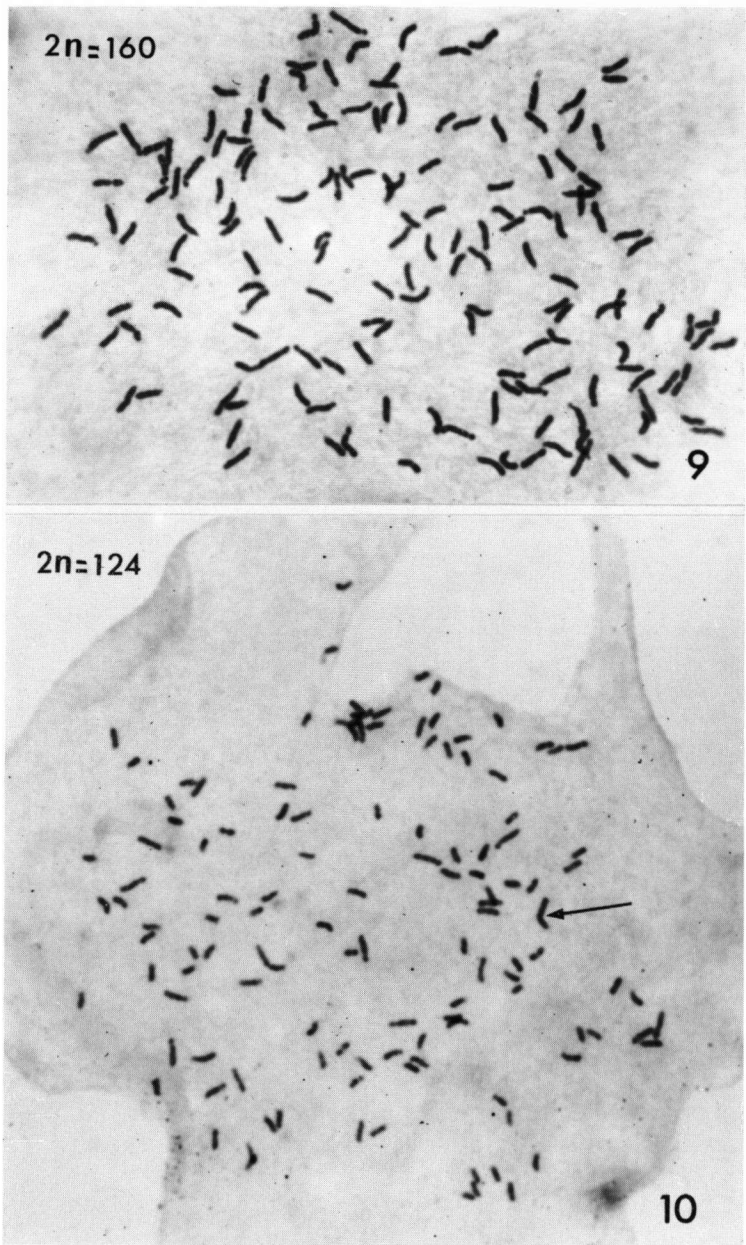

Fig. 9. *Lunathyrium japonicum*. — Fig. 10. *Pseudophegopteris cyclocarpa* (arrow showing two chromosomes touching end to end). All × 1000.

Lunathyrium japonicum (Thunb.) Kurata, J. Geobot. 9 (1961) 99. — *Asplenium japonicum* Thunb., Fl. Jap. (1784) 334. — *Athyriopsis japonica* (Thunb.) Ching, Acta Phytotax. Sinica 9 (1964) 65.

525/63, no. 30; on bare earth by stream near Wau, 1000 m; n = 120 (fig. 6), 2n = 240 (hexaploid). No. 135, 136; locality not recorded; 2n = 160 (tetraploid; fig. 9).

This very wide-ranging species establishes itself in open places, and adapts itself to changing conditions of the surface by means of its creeping rhizome. It was locally abundant on banks by pathsides at 1200—1600 m. Previous cytological records (as *Diplazium* or *Athyrium)* are: Ceylon, hexaploid; Malaya (Manton) n = 82; India (Bir) n = 40, 80, 200; New Zealand (Brownlie) n = 82; Japan (Kurita) n = 120. It will thus be seen that both 40 and 41 have been reported as base number.

It is clear that this species is not a true *Diplazium*. It belongs to a complex group of species, allied to *Diplazium* and *Athyrium*, the generic status of which seems not yet to have been well established.

DAVALLIACEAE Copel.

Nephrolepis lauterbachii Christ, Bull. Herb. Boiss. II, 1 (1901) 456.

578/63, no. 52; near Nondugl, Western Highlands, *c.* 2000 m, covering the trunk of a small tree in rather open place; n = *c.* 40.

Nephrolepis saligna Carr. in Seem., Fl. Vit. (1873) 361.

545/63, no. 23; lowland forest near Lae, epiphytic; 2n = 82.

PTERIDACEAE Copel.

Pteris orientalis v.A.v.R., Bull. Dép. Agr. Ind. Néerl. 18 (1908) 12.

578/63, no. 62, 66; Highlands (locality unrecorded); n = 87 (triploid); fig. 8.

This species is so close to *P. vittata* L. that specimens lacking the basal part of the frond could not easily be distinguished; in *P. vittata* the lower pinnae are gradually reduced to a small size and the stipe is short, but in *P. orientalis* the lowest pinnae are slightly reduced and the stipe is long. *P. orientalis* was described from the Moluccas; there are a few specimens from New Guinea in Kew herbarium. *P. vittata*, which is common in New Guinea, is distributed throughout the tropics of the Old World; most reports of it, in several countries, have been tetraploid, with a var. *brevipinna* as diploid in N. India.

Pteris cretica L.

578/63, no. 59; on limestone near Kundiawa, 1500 m; 2n = 87 (triploid).

Sterile pinnae are rather irregularly and sharply toothed all along their edges. Triploid forms of this species have been reported from N. India.

Pteris tripartita Sw.

530/63, no. 27; Edie Creek, *c.* 2000 m; n = 29 (diploid).

This has venation typical of *P. tripartita*, but lobes of pinnae are closer together than in the lowland form of the species which is common in Malaya. The species, in its broad sense, occurs throughout the tropics of the Old World, and all plants so named hitherto examined cytologically have been tetraploid.

Pteris warburgii Christ.

545/63; by stream in forest, near Lae; 2n = 58 (diploid).

This species has pinnatifid fronds and a reticulate venation exactly as in *Acrostichum aureum*.

Adiantum aneitense Carr. in Seem., Fl. Vit. (1873) 346.

578/63, no. 56, 61, 118; Eastern Highlands, above Goroka; 2n = 116.

The plants were collected on a steep bank by the roadside in limestone country. There are several specimens from previous New Guinea collections in Kew herbarium; they are somewhat variable but agree in essentials with specimens from Aneiteum (New Hebrides, type locality).

Adiantum diaphanum Bl.

525/63, no. 9, 10; in forest near Wau, on steep bank by stream; n = 114; fig. 1.

This very wide-ranging species has previously been reported as tetraploid by Manton and Sledge in Ceylon (n = 58), and as octoploid by Brownlie in New Zealand (n = 116).

Coniogramme intermedia Hieron., Hedwigia 57 (1916) 301.

578/63, no. 63, 120; Eastern Highlands, near Kerowagi, in forest on steep ground, limestone area, *c.* 2000 m; 2n = 120 (tetraploid). This species has been reported as diploid in India, tetraploid in Japan, with base number 30.

POLYPODIACEAE Copel.

Goniophlebium subauriculatum Bl.

530/63, no. 43; epiphytic in open place, near Wau; n = 37.

The plant at present is small, with dark rhizome-scales, and does not show the white covering under the scales which is normal in this species. There are no previous records for *G. subauriculatum*, but several for other species of the genus (some under *Polypodium)*; most are n = 37, but *G. argutum* and *G. lachnopus* have both been recorded as both 36 and 37.

Microsorium commutatum (Bl.) Copel.

578/63, no. 51, 65; Highlands, locality unrecorded; n = 36, 2n = 72.

The lobes of fronds of these plants are narrower than those of one recently introduced from Sarawak (from a lower altitude) but do not otherwise differ.

LITERATURE CITED

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FABBRI, F. 1963. Primo Supplemento alle Tavole Chromosomiche delle Pteridophyta di Alberto Chiarugi. Caryologia 16: 237—335.

SUMMARY OF CYTOLOGICAL DATA

	n	2n	
Gleichenia milnei Bak.		68	diploid
Dicranopteris linearis var. *montana* Holtt.		78	diploid
abnormal		156	tetraploid
Microlepia strigosa (Thunb.) Presl		84	diploid
Pseudophegopteris aurita (Hk.) Ching	62	124	tetraploid
cyclocarpa Holttum		124	tetraploid
Pseudocyclosorus caudatus Holttum		72	diploid
petrophila (Copel.) Holttum	36		diploid
Mesoneuron wantotensis (Copel.) Holttum	36	72	diploid
Cyclosorus dentatus (Forsk.) Ching	72		tetraploid
confertus (Brause) Copel.		72	diploid
heterocarpus (Bl.) Copel.		72	diploid
beccarianus (Cesati) Copel.	72		tetraploid
deminuens Holttum		72	diploid
Arachniodes aristata (Forst.) Tindale	82	164	tetraploid
Tectaria devexa (Kze) Copel.	80	160	tetraploid
Diplazium armatum (Copel.) Holttum		82	diploid
stellatopilosum (Brause) Holttum	41	82	diploid
proliferum (Lam.) Kaulf.		82	diploid
Lunathyrium japonicum (Thunb.) Kurata	120	240	hexaploid
		160	tetraploid
Naphrolepis lauterbachii Christ	*c.* 40		diploid
saligna Carr.		82	diploid
Pteris orientalis v.A.v.R.		87	triploid
cretica L.		87	triploid
tripartita Sw.	29		diploid
warburgii Christ		58	diploid
Adiantum aneitense Carr.		116	tetraploid
diaphanum Bl.	114		?
Coniogramme intermedia Hieron.		120	tetraploid
Goniophlebium subauriculatum Bl.	37		diploid
Microsorium commutatum (Bl.) Copel.		72	diploid