

REINWARDTIA

BEING A CONTINUATION OF THE
BULLETIN DU JARDIN BOTANIQUE DE BUITENZORG
(*BULLETIN OF THE BOTANIC GARDENS, BUITENZORG*)

EDITORS

ANWARI DILMY
(Herbarium Bogoriense)

AND

C. G. G. J. VAN STEENIS
(Flora Malesiana)

Published by
HERBARIUM BOGORIENSE
KEBUN RAYA INDONESIA

Umbellularia Nutt. 195, 201, 202, 203,
216, 235; californica (Nees) Nutt. 202,
205, 235.
Urbanodendron Mez 195, 200, 207, 210,
217, 238; verrucosum (Nees) Mez 238.

Virola 220.
Volutella Forsk. 245.
Wimmeria Nees ex Meissn. 229.
Yushumà Kam. 234.

FLORAE MALESIANAE PRAECURSORES XVI
ON THE TAXONOMIC SUBDIVISION OF THE GLEICHENIACEAE,
WITH DESCRIPTIONS OF NEW MALAYSIAN
SPECIES AND VARIETIES

by

R. E. HOLTUM *

SUMMARY

A new subdivision is given of the fern family Gleicheniaceae. The genus *Platyzoma* R. Br is excluded from the family. The genus *Stromatopteris* from New Caledonia is arranged in a distinct subfamily. In the remainder of the family, subfamily Gleichenioideae, two genera are recognized, *Gleichenia* (with subgenera *Diplopterygium*, *Gleichenia*, and *Mertensia*) and *Dicranopteris* (with subgenera *Acropterygium* and *Dicranopteris*). The problem of subdividing the family is discussed with reference to former treatments and to new data, and a conspectus of the new system, with synonymy and key to the genera and subgenera, is given. A number of new species, new varieties, and new combinations is made both in *Gleichenia* and *Dicranopteris*.

In preparing a taxonomic revision of the family Gleicheniaceae for Flora Malesiana, I have reviewed the status of the genera proposed within the family by previous authors, and as a result have been led to take a position midway between the arrangement of Christensen (*Index Filicum* 1905) and of Copeland (*Genera Filicum* 1947). The present paper gives a summary of the facts on which this decision was reached; a fuller comparative treatment of the subject, with a discussion on morphology and growth-habit in this and other families of primitive ferns, will be published elsewhere.

The genus *Platyzoma* R. Br., which has usually be included in Gleicheniaceae (even in the genus *Gleichenia*), appears to me so different that it should be excluded. A statement on this subject has been published separately (Kew Bulletin 1956; 551); the genus will not be further mentioned in the present paper.

The genus *Stromatopteris*, confined to New Caledonia, is peculiar in various ways, but has superficial sori of sporangia which agree with

* Formerly Professor of Botany in the University of Malaya.

those of *Gieichenia*. In dermal appendages and growth-habit it is quite distinct from other members of the family, so that I would agree with Nakai in assigning it to a distinct subfamily. A summary of its important characters is given in the conspectus below.

The remainder of the family is clearly divisible into four groups, which are all given generic status by Copeland, as *Gieichenia*, *Hicriopteris*, *Sticherus*, and *Dicranopteris*. Many previous authors, from Willdenow onwards, were impressed by the difference between the genus *Gieichenia* and the other three. A main distinction (repeated by Presl, Hasskarl, Diels, Underwood and Nakai) is said to be that in *Gieichenia* proper the sori are terminal on the veins, in the other three groups the sori are not terminal. This statement is not true. The veins are short in *Gieichenia* proper, but the sorus is not terminal, as can be seen in cleared specimens (examined by me in *G. microphylla* R. Br., *G. vulcanica* Bl., and *G. dicarpa* R. Br.). If one looks for another distinction between *Gieichenia* proper and Copeland's genus *Hicriopteris*, the only one is the very small size of the lobes of the lamina of *Gieichenia*, and this is hardly a generic distinction. A basic division of the family is therefore not between *Gieichenia* proper and the rest.

As has been shown in various other groups of ferns, the nature of the dermal appendages is often significant as an indicator of relationships. In the present family it is usually stated that *Dicranoptens* (sensu Copeland) differs from the other three groups in having only hairs, the others having both hairs and scales. This is however an undue simplification, because the hairs of *Dicranopteris* are not like the hairs of the other genera of Copeland. In *Gieichenia*, *Hicriopteris*, and *Sticherus*, the hairs are all stellate, with subequal unicellular rays, and there is a gradual transition from such stellate hairs to peltate scales the marginal cells of which have outgrowths like the rays of the stellate hairs. In *Dicranopteris* most of the hairs consist of a row of cells, with one or more branches (unicellular or not) at the base, and often also outgrowths from the other cells of the hair; nothing like this occurs in Copeland's other three genera.

Dicranopteris differs from the other groups also in two other important ways. The sporangia in *Dicranopteris* are much smaller than in the other groups, and there are more sporangia in each sorus (see Bower, *The Ferns* 2, ch. XXIV); the sori also lack paraphyses which are usual in the other groups. The veins in *Dicranopteris* are always forked two or three (even four) times, whereas they are simple or once forked in the other groups.

Dicranopteris is therefore sharply distinct from the other groups, and in my opinion should rank as a separate genus. The other three groups agree in scales and hairs, in sori and sporangia, and (apart from the reduced condition of *Gieichenia* proper) in venation. *Gieichenia* proper is distinct only in the very small lobes of its lamina, and in its simple veins, which are clearly a consequence of the reduction of the lamina. The only important differences between the three groups are different modifications of the same basic habit of branching.

Hicriopteris (sensu Copeland) has the simplest branching-habit. It bears successive pairs of bipinnatifid pinnae; while such a pair of pinnae is developing, the apex of the main rhachis rests, resuming growth later, the whole frond being of indefinite growth in length. *Gieichenia* proper has at first an exactly similar method of branching, on a miniature scale, but in large fronds each primary rhachis-branch is again branched, bearing a pair of secondary branches (usually with a dormant apex between them), and strong plants may have ternary or even quaternary branches; in all cases the ultimate branches are bipinnatifid as in *Hicriopteris*. In *Sticherus* the same repeated branching occurs, with dormancy of the apex between each pair of branches, but the ultimate branches are simply pinnatifid, not bipinnatifid. I have however seen a monstrous specimen of *Gieichenia* (*Sticherus*) *milnei* Bak. in which the ultimate branches are bipinnatifid. This bridges the gap between *Sticherus* and Copeland's other two genera.

It also seems to me therefore that the differences between Copeland's *Gleich* *Hicriopteris*, and *Sticherus* are relatively unimportant as compared with their common differences from *Dicranopteris*, and I propose to recognize two genera, *Gieichenia* (with subgenera *Gieichenia*, *Diplopterygium*, and *Mertensia*) and *Dicranopteris*.

The name *Diplopterygium* was used by Diels as a sectional one, in his *Gieichenia* subg. *Mertensia*. I use it in place of *Hicriopteris* because the species originally called *Hicriopteris* by Presl (*H. speciosa*) was in my opinion a *Dicranopteris*. Presl's description is very detailed, and agrees closely with the very peculiar structure of *Gieichenia opposita* v.A.v.R., which is like that of no other member of the family (see my *Ferns of Malaya*, p. 70 and fig. 14 F).

The use of *Mertensia* as a subgeneric name in place of *Sticherus* is explained in a later section of the present paper.

The above discussion makes no mention of the most recent rearrangement of Gleicheniaceae, by Nakai, who attempted to use spore-form as a basic character for the subdivision of the family. He made

a mis-statement of fact in this respect; a rectification of this error completely upsets his scheme.

Having separated *Stromatopteris*, Nakai divided the rest of the family into two subfamilies, *Sticherioideae* with bilateral spores and *Gleichenioideae* with tetrahedral spores. In *Sticherioideae* he placed *Acropterygium* (*Dicranopteris* subgenus *Acropterygium* of the present scheme) and *Sticherus*; in *Gleichenioideae* he placed *Gleichenia* proper (subdivided into three genera), *Dicranopteris* (including only *D. linearis* and its near allies) and *Diplopterygium*. But within the group of *D. linearis* and its near allies, all supposed by Nakai to have tetrahedral spores, some have in fact bilateral spores. To remove these into the other subfamily would clearly be very unnatural. The scheme thus breaks down; and in fact all other evidence, which I have set forth above and summarize in the conspectus below, is against it, and in my view it is a completely unnatural arrangement.

CONSPECTUS OF THE FAMILY GLEICHENIACEAE

1. Fronds unbranched (apart from occasional true dichotomy), borne on erect branched stems arising from a creeping rhizome; stellate or branched hairs lacking on vegetative parts of plant; paraphyses in the form of small irregular scales with projecting marginal cells; frond-bearing stems partly covered with non-peltate scales and bearing long simple hairs.

Subfamily *Stromatopteridoideae*: only genus *Stromatopteris*

1. Fronds of fully developed plants branched pseudo-dichotomously (forked), often many times, with dormancy (periodic or permanent) of the apices within the forks; fronds borne directly on a creeping rhizome; stellate or branched hairs, or fringed scales, or both, always present on vegetative part of plant.

Subfamily *Gleichenioideae*

2. Hairs stellate with rays consisting of single cells, or simple and very short; scales peltate, with fringe of outgrowths from marginal cells (in *G. laevissima* margins entire); sori of 2—4 large sporangia, with paraphyses; lateral veins in a lobe of the lamina simple or once forked *Gleichenia*
3. Ultimate branches pinnate with deeply lobed leaflets
 4. Dormancy confined to a periodic condition of the branch which will continue the main rachis of the frond; lobes of lamina each with costule and once-forked lateral veins; sori several on each lobe.

Subgen. 2. *Diplopterygium*

4. Dormancy often occurring, and persistent, on other branches of the frond; continue the main rachis of the frond; lobes of lamina each with costule and veinlets all simple; one sorus on each lobe. Subgen. 1. *Gleichenia*,
3. Ultimate branches bearing a deeply pinnatifid lamina, its lobes entire or slightly toothed. Subgen. 3. *Mertensia*
2. Hairs consisting of a row of cells, with one or more branches at the base and often outgrowths also from other cells; no scales; sori of 8—15 or more

sporangia, lacking paraphyses; lateral veins in a lobe of the lamina forked 2—4 times. *Dicranopteris*

5. An accessory branch, of same form as the ultimate branches, often present on the basiscopic side at the base of each branch from a fork; vascular system of rhizome a protostele. Subgen. 1. *Dicranopteris*

5. Accessory branches lacking; vascular system of rhizome a solenostele. Subgen. 2. *Acropterygium*

STATUS OF NAMES, AND IMPORTANT SYNONYMS

(for references to literature prior to 1933, see Christensen, Index Filicum)

Subfamily *Stromatopteridoideae* Nakai, Bull. Nat. Sc. Mus. Tokyo 29: 32. 1950.

Genus *Stromatopteris* Mettenius 1861

Only species: *S. moniliformis* Mett.

Subfamily *Gleichenioideae* Nakai, l.e. (non sensu Nakai)

Genus *Gleichenia* Smith 1793 (conserved name)

TYPE SPECIES.—*G. polypodioides* (L.) Sm. (*Onoclea* Linn. 1771)

Subgenus 1. *Gleichenia*

Calymella Presl 1836, Ching 1940 (*Sunyatsenia* 5: 285), Nakai l.e. 40

Gleicheniastrum Presl 1848, Nakai l.e. 42

Gleichenia subgenus *Eugleichenia* Diels 1900, Bower 1926

Subgenus 2. *Diplopterygium* (Diels) Holtt., stat. nov.

Gleichenia subgenus *Mertensia* sect. *Diplopterygium* Diels 1900

Dicranopteris sensu Underwood 1907, p.p.

Gleichenia subgenus *Dicranopteris*, p.p., Bower 1926

Hicriopteris sensu Ching l.e. 277, Copeland (Gen. Fil. 1947; p. 28), non Presl

Diplopterygium Nakai l.e. 47

TYPE SPECIES.—*G. glauca* (Thunb.) Hook. 1844 (*Polypodium* Thunb. 1784)

Subgenus 3. *Mertensia* (Willd.) Diels, p.p.

Mertensia Willd. 1804, p.p.

Sticherus Presl 1836, Ching l.e. 281, Copel. l.e. 27, Nakai l.e. 7

Gleichenia subgenus *Mertensia* sect. *Holopterygium* Diels 1900

Dicranopteris sensu Underwood 1907, p.p.

Gleichenia subgenus *Dicranopteris*, p.p. Bower 1926

TYPE SPECIES.—*G. truncata* (Willd.) Spr. 1827 (*Mertensia* Willd. 1804)

Genus *Dicranopteris* Bernhardt 1806, Copeland l.e. 28, Underwood 1907 (p.p.)

Gleichenia subgenus *Eudicranopteris* Bower 1926

TYPE SPECIES.—*D. dichotoma* (Thunb.) Bernh. (*Polypodium* Thunb. 1784)

(*Polypodium lineare* Burm. 1768 is an earlier name)

Subgenus 1. *Dicranopteris*

Gleichenia subgenus *Mertensia* sect. *Heteropterygium* Diels 1900

Hicriopteris Presl 1851 (non Ching nee Copel.)

Dicranopteris sensu Nakai l.e. 56, sensu Ching l.e. 272

Subgenus 2. *Acropterygium* (Diels) Holtt., stat. nov.

Gleichenia subgenus *Mertensia* sect. *Acropterygium* Diels 1900

Acropterygium Nakai, l.e. 5

Gleichenella Ching, l.e. 276

TYPE SPECIES.—*Mertensia pectinata* Willd. 1810.

GLEICHENIA

Subgenus 1. GLEICHENIA

In his revision of 1940 (Sunyatsenia 5: 269-288), Ching used the name *Calymella* Presl for this group of species, as the name *Gleichenia* is a later homonym (conserved in 1954). Ching subdivided his genus into two sections, *Eu-Calymella* and *Gleicheniastrum* (which latter Presl had regarded as a separate genus). The basis of the subdivision was that in *Eu-Calymella*, the sori are immersed, in *Gleicheniastrum* they are superficial. The species in Ching's *Eu-Calymella* have the margins of the leaflet-lobes so much reflexed that these lobes form pouches with only small apertures on the lower surface; the sporangia are superficial on the inner surface of the pouch. The lobes of the lamina of Ching's subgenus *Gleicheniastrum* are almost flat; but some of them have the sorus sunk in a distinct depression in the substance of the lamina; these sori are thus immersed in a different sense, not indicated by Ching.

Nakai in 1950 (I.e.) revived both Presl's genera *Calymella* and *Gleicheniastrum* as distinct from *Gleichenia* proper. The basic of the distinction was that in *Gleichenia* proper the sori are immersed in cavities in the substance of the lamina, in *Calymella* they are in pouches as above described, and in *Gleicheniastrum* they are on the surface of flat leaflet-lobes. But in one species of Nakai's *Gleicheniastrum* (*Gleichenia microphylla* R. Br.), each sorus is in a distinct cavity, though the edges of this are not raised as they are in the species included by Nakai in *Gleichenia*. The distinction between *Gleichenia* and *Gleicheniastrum* is thus not a sharp one; and indeed all these distinctions are relatively trivial, not of generic significance.

Among Malaysian representatives of *Gleichenia* subgen. *Gleichenia*, I have found one new variety which needs to be described.

GLEICHENIA PELTOPHORA Copel.

var. *schizolepis* C. Chr. ex Holtt., var. nov.

Paleae omnes ciliatae; segmenta laminae infra pilis stelliformibus, non paleis orbicularibus, instructa.

BORNEO. Sarawak, Mt Murud, 5000—6000 ft, *Mjoberg* 9 (P, type).

In the typical form of this species (both in New Guinea and in Borneo) there are almost entire circular peltate scales on the rhizome, and also smaller ones on the lower surface of the segments of the lamina; in this variety the rhizome-scales are fringed, the smaller scales of the

lamina are replaced by stellate hairs. The epithet "*schizolepis*" was given in sched. by Christensen.

Subgenus 2. DIPLOPTERYGIUM

The species of Malaysia fall very distinctly into two groups, which are distinguished by the nature of the scales on the dormant apex of the main rhachis. In the group of *G. longissima* Bl. the scales are broad, with long flexuous pale marginal hairs. This group includes few species, and *G. longissima* itself is distributed throughout almost the whole of Malaysia, and beyond Malaysia both northwards and into the Pacific. In the other group of species, of which *G. norrisii* Mett. was first described, the scales are narrower, with short, rigid, rather oblique marginal setae which are very dark, or concolorous with the rest of the scale. This group is polymorphic, with a number of local species and no species which is widely distributed. Five new species of this group are described below, and a species originally placed in the genus *Hicriopteris* is transferred to *Gleichenia*.

Gleichenia angustiloba Holtt., sp. nov.

Rhizoma 7 mm diametente, primo paleis nitidis atrobrunneis 5—7 mm longis 1.5 mm latis vestitum, denique basibus palearum verrucosum; stipes 6—7 mm diam., basi primo modo rhizomatis paleaceus, denique verrucosus, parte superiore modo rhacheos paleis parvis yestitus, denique asperulus; rami rhacheos (pinnae) 100 cm vel ultra longi; foliola stipuliformia late deltoidea, ad 3 cm longa, pinnatifida, lobi infimi profunde anguste-lobati; paleae rhacheos atrobrunneae, nitidae, 3—4 mm longae, angustae, margine setis brevibus rigidis concoloribus obliquis instructae; rami costaeque utrinque (et costulae infra) paleis minoribus multiformibus et pilis stelliformibus rufo-brunneis plus minusve persistentibus vestiti; pinnulae ad 15 cm longae et 3 cm latae, inter se 2.0—2.5 cm distantes (i.e., pinnulae contiguae vel imbricatae); segmenta omnia laminae c. 2.5 mm lata, sinubus latis separata; segmenta plurima basi constricta, ala laminae 0.2 mm lata costae utrinque commissa; segmenta infima foliola disjuncta constituta; costulae 4 mm inter se distantes; venae utrinque prominentes; sori sporangiis 4 constituti, paraphysibus crispis longis rufo-brunneis instructi; venae frondis adultae praeter paraphyses glabrae.

EAST NEW GUINEA. Mt Tafa, 2400 m, Brass 4960 (BM, type; K).

This species is nearly allied to *G. novoguineensis* Brause (with which *Hicriopteris astrotricha* Copel. is identical), differing in the broader pinnules of which all the segments are narrow, separated by rather wide sinuses, several pairs of segments being constricted at the base and connected only by a very narrow wing of the lamina.

Gleichenia brevipinnula Holtt., *sp. nov.*

Rhachis primaria c. 5 mm diametente, apex dormitans paleis 5 mm longis, haud 0.5 mm latis, brunneis, margine nigra setiferis (setae breves, nigrae, obliquae) vestitus; rami c. 70 cm longi; foliola stipuliformia 3.5 cm longa, late deltoidea, profunde lobata, lobi omnes anguste caudati, lobi infimi profunde et oblique lobulati; segmenta pinnularum inferiorum similiter anguste caudata; pinnulae c. 2.0 cm inter se distantes, ad 10 cm longae et 2.0 cm latae, superiores non deflexae; costulae 3—3.5 mm inter se distantes, leviter obliquae; lamina usque 1 mm costae incisa: segmenta laminae supra basin haud angustata, sinubus angustissimis separata, rigida, apice late rotundata, apicibus venularum prominentibus leviter dentata, marginibus non reflexis, subtus pallide glauca; venae utroque prominentes; rami rhacheos utrinque pilis stelliformibus rigidis atrobunneis plus minusve persistentibus, paleis angustis paucis intermixtis, vestiti; costae et costulae infra pilis similibus praeditae; venae subtus pilos stelliformes ferentes; sori 3 vel 4 sporangiis constituti, paraphyses nullae.

BORNEO. Sarawak, Pueh (Poi) Range, summit ridge, 4400 ft, *P.R. Bell* 2042 (BM, type); Tinjar, Baram River, 3000—4000 ft, *Mjöberg* 8 (P); Bau, *Anderson SJf* (SING.). North Borneo, Kinabalu, Marei Parei Spur, *Topping-1872* (US); Kinabalu 8000 ft, *Clemens* 31994 (K); Kinabalu 8000 ft, *L.S. Gibbs* 4.256 (BM).

Gleichenia sumatrana Holtt., *sp. nov.*

Rhachis primaria c. 8 mm diametente, paleis parvis coarctis et paleis majoribus adpersis persistentibus vestita; rami rhacheos infra similiter vestiti; paleae maximae 10 mm longae, basi 0.5 mm latae, apice filiformes, margine atrobunneo setis rigidis atrobunneis instructae, medio pallidae; paleae minimae et pili stelliformes omnino pallide ferrugineae; rami rhacheos ad 150 cm longi; pinnulae maximae c. 15 cm longae, 2.5 cm latae, 2.5—3.0 cm inter se distantes; pinnulae superiores parvae, proximiores, rectangulariter patentem; costulae 4—4.5 mm inter se distantes; segmenta laminae c. 3.5 mm lata, inferiora 7—8-juga basi constricta ala laminae angustissima conjuncta; segmenta media sinubus haud 1 mm latis separata; lamina tenuis, infra in vivo non glauca, venulae utrinque prominentes; foliola stipuliformia 2.5 cm longa, 1.5 cm lata, bipinnatifida, lobi angustissimi; costae pinnularum infra modo ramorum rhacheos paleaceae (paleae minores), apicem versus glabrescentes, pallidae; costulae paleis parvis fimbriatis (fimbriae atrobunneae) persistentibus vestitae; venulae infimae pilos stelliformes ferentes, venulae superiores plerumque glabrae; costae supra leviter canaliculatae, pallidae, paleis parvulis atrobunneis fimbriatis sat dense vestitae.

N. SUMATRA. Near Parbuluan, south of Sidikalang (west of Toba Lake), 1500 m, *Alston* 14.84 (BM, type); G. Talamau, 1900 m, *Bunnemeyer* 884 (BO). Karo Plateau, *Bartlett* 8543 (US).

This species resembles most nearly *G. sordida* Copel. from Mindanao; the latter is larger, with fewer constricted basal lamina-segments, and has more small pale rusty stellate hairs or small scales on the rhachis and veins.

Gleichenia matthewii Holtt., *sp. nov.*

Apex dormitans rhacheos paleis haud 0.5 mm latis, margine atrobunneis, nitidis, setiferis, medio pallidioribus, vestitus; rami rhacheos 70 cm longi, praeter basis valde flexuosi; pinnulae omnes deflexae, superiores angulo 45° deflexae, supremae in lobos rectangulariter patentem laminae terminalis transgredientes; pinnulae inferiores inter se 4 cm distantes, c. 12 cm longae et 2.5 cm latae; costulae 4.5 mm inter se distantes; lamina usque 1—1.5 mm costae incisa; segmenta laminae oblonga, contigua, apice fere truncata (vulgo leviter retusa); foliola stipuliformia deltoidea, c. 2 cm longa, anguste lobata; lamina firma, infra glauca; venulae utrinque prominentes; costae basin versus paleas parvas paucas ferentes, folium cetera omnino glabra; sori non visi.

C. SUMATRA, G. Singgalang, *Matthew s.n.*, 31 Jan. 1912 (K, type); same locality at 1800 m. alt., *Schiffner P. H* (L).

This species agrees with *G. norrisii* in its almost glabrous lamina and in the deflexed pinnules, the latter character (and the strongly zig-zag rhachis) more pronounced than in *G. norrisii*. It differs from *G. norrisii* in its dark-edged scales, in the narrowly-lobed stipular leaflets, and in the almost oblong segments of the lamina which are almost or quite contiguous. The name *matthewii* commemorates Fleet-Surgeon C. G. Matthew, who collected ferns with discrimination during his travels in SE. Asia while on naval service and subsequently.

GLEICHENIA VOLUBILIS Jungh. var. *peninsularis* Holtt., *var. nov.*

Paleae ramorum rhacheos et costarum ferrugineae, ciliis concoloribus praeditae.

MALAY PENINSULA. Kedah-Perak boundary, G. Bintang, *F.M.S. Museum s.n.*, June 1917 (K, type).

In the typical form of the species (in Java and Sumatra) the scales are very dark, with pale fringes, and contrast with the dense felt of rusty stellate hairs with which they are mixed. In this variety, the scales and hairs are of about the same colour.

Gleichenia paleacea (Copel.) Holtt., *comb. nov.*

Hicriopteris paleacea Copeland in Philip. J. Sci. 81: 3. 1952.

Gleichenia papuana Holtt., *sp. nov.*

Var. PAPUANA

Apex dormitans rhacheos primarii paleis atrobrunneis nitidis 4 mm longis, 1 mm latis, margine pilis pallidis patentibus ad 0.5 mm longis ciliatis vestitus; rami rhacheos costaeque infra paleis numerosis similibus minoribus diu persistentibus praediti, tendem glabri et verruculosi (paleae costarum c. 1.5 mm longae, 0.5 mm latae); costulae infra paleis minutis fimbriatis multis vestitae; rami rhacheos supra paleis angustissimis pilisque ferrugineis sat dense vestiti; rami rhacheos 120 cm longi; pinulae rectangulariter patentem, 2.5 cm inter se distantes, maximae 12 cm longae, 2 cm latae; costulae 2.5—3 mm inter se distantes; lamina tenuis; venulae infra leviter prominentes, supra planae; sori vulgo sporangiis 3, paraphysibus crispatis brevibus intermixtis, constati.

NEW GUINEA. Papua. Milne Bay Distr., Mt Dayman, 2250 m, Brass 22597 (BM, type); scrambling 2—3 m; leaves grey below; forming dense tangles, edge of mossy forest.

GLEICHENIA PAPUANA Holtt. var. membranacea Holtt., *var. nov.*

Paleae apicis rhacheos margine pallidae tenuissimae, ciliis brevissimis praeditae; paleae ramorum rhacheos costarumque numerosiores, basin versus tantum atrobrunneae, cetera pallidae.

NEW GUINEA. Papua. Milne Bay Distr., Goodenough I., 1600 m. Brass 24768 (BM, type); scrambling to 2—3 m, plentiful in openings in forest

This species is allied to the very widespread *G. longissima* BL, but is smaller and persistently scaly. The dark scales are quite different from those of *G. paleacea* (Copel.) Holtt. The variety *membranacea* differs only in the very thin translucent margins of the scales; these margins take the place of the long fringe of pale hairs in the typical form of the species.

Subgenus 3. MERTENSIA

The generic name *Mertensia* was proposed by Willdenow for all members of the family Gleicheniaceae other than *Gleichenia* subgenus *Gleichenia* of the present treatment. As argued above, it appears to me that this is an unnatural division of the family, the true division being between *Dicranopteris* and the rest. Diels used *Mertensia* as a subgenus in a sense exactly equivalent to its use by Willdenow as a genus. Here it is used in a restricted sense. As a generic name, *Mertensia* Willd. is antedated by *Mertensia* Roth (Boraginaceae) and is therefore illegitimate. If *Mertensia* is used as a subgeneric name in the restricted sense now proposed, it takes the place of *Sticherus* Presl of Copeland's treatment. The disappearance of *Sticherus* is not to be regretted, as Presl's descrip-

tion, based on published descriptions of specimens he had not seen, is partly erroneous and altogether unsatisfactory, as already pointed out by Copeland.

Only one species (*G. truncata*) is common and widely distributed in the lowlands of Malaysia. The others are all mountain plants; they sometimes form small thickets, but none are as large or as rampant as *G. truncata*. *Gleichenia hirta* (as here interpreted) is the most widely distributed; *G. hispida* and *G. vestita* have also wide distributions. A few species appear to occur only in New Guinea, and one only in Sumatra. Two species have been described from immature or stunted plants (*G. erecta* C. Chr. and *Sticherus pinnatus* Copel.); these are here united with other species.

In this subgenus the characters of the scales are always important for the discrimination of species. Fronds which are not yet fully expanded (immature fronds as distinct from immature plants) are always completely covered with scales and hairs for a time; the extent to which these scales and hairs persist on the various parts of a frond is characteristic of a species (or of varieties within a species), but this kind of character is not always easy to judge from dried specimens. Plants from higher altitudes or more exposed positions also may be more scaly than plants of the same species from lower elevations or more sheltered places.

The number of times a primary branch of a frond is forked may also be characteristic of a species, but again this is not easy to judge from dried specimens; more observations on variation of branching habit of plants in one locality is needed for a proper understanding of some species (notably of the varieties of *G. hirta*).

Gleichenia alstonii Holtt., *sp. nov.*

Rhachis primaria c. 4 mm diametente; rami primarii vulgo bis furcati, rami ultimi solum foliiferi; rami ordinis primi raro ultra furcam primam proliferati; paleae apicum dormitantium 4 mm longae, basi 0.7 mm latae, apice anguste acuminatae, brunneae, margine basin versus pilis multis patentibus brevibus pallidis, apicem versus setis raris obliquis atrobrunneis, ciliatae; costae infra paleis atrobrunneis 1.5 mm longis, 0.2 mm latis, margine sparse oblique ciliatis praeditae; rami ordinis primi 4—5 cm longi, ordinis secundi 6—7 cm longi; rami ultimi 30—35 cm longi, 3.5 cm lati, basis 10—15 mm longa interdum stipitifomis; costulae 4 mm inter se distantes, leviter obliquae; segmenta laminae c. 17 mm longa, supra basin 3 mm lata, tenuia, apice fere integra; venae utrinque leviter prominentes; costulae infra paleis pallidis angustissimis sparse instructae, venae pilos stelliformes laxos pallidos ferentes; sori 3 vel 4 sporangiis constituti.

N. SUMATRA. Res. Tapanuli, Lae Pondon, East of Sidikalang, *Alston 14981* (BM, type).

This has the general aspect of some varieties of *G. hirta*, but is larger, and differs in its scales and in the entire apices of the segments of the lamina; also in the lamina being confined to the ultimate branches in almost all cases (occasionally a penultimate branch bears a few scattered lamina-segments). There is apparently no near relative of this species in Sumatra.

GLEICHENIA ERECTA C. Chr.

Gleichenia erecta C. Christensen, in *Brittonia* 2: 269. 1937.

Sticherus habbemensis Copel. in *Philip. J. Sci.* 75: 355, pi. 3. 1941.

Copeland's species was based on much larger plants than the type of *G. erecta*, but as regards size every gradation between the two is represented in various collections. The only differences are that the original *G. erecta* had lamina-segments at a more acute angle to the costa, had fewer hairs on the veins and more sparsely fringed scales than the type of *Sticherus habbemensis*. Large plants, which have the main lateral branches of the frond twice forked, have small stipular leaflets at the bases of the primary branches (these leaflets at first protect the resting apex of the main rhachis); such leaflets are lacking on small plants which have the primary branches simple or once forked. Some little-branched plants have unusually long lamina-segments, and often these segments curve towards the costa when dried.

GLEICHENIA HIRTA Bl.

Gleichenia hirta Blume, *En. Pl. Jav.* 250. 1828.

The type of this species was collected by Reinwardt on the island of Tidore (Moluccas). Subsequent collections have shown that ferns of similar general character, differing in various details, occur on mountains almost throughout Malaysia (not in Java nor the Lesser Sunda Islands except Ban). Nine species have been based on these collections, but it seems to me preferable to regard all as varieties of *G. hirta*. Some are quite clearly distinguishable, but others, especially in the Moluccas and New Guinea, are much less easy to characterize, and I am not at all satisfied with the arrangement here proposed. More data about variation in growth habit in a single locality are needed in order that one may know how to interpret dried specimens.

GLEICHENIA HIRTA Bl. var. *amoena* (v.A.v.R.) Holtt., *stat. nov.*

Gleichenia amoena van Alderwerelt van Rosenburgh in *Bull. Jard. bot. Buit. II*, 23: 12. 1916. — *G. peninsularis* Copel. in *Univ. Cal. Publ. Bot.* 17: 387. 1931.

This variety occurs in Sumatra, the Malay Peninsula, and the Lingga Archipelago. It is characterized by large ultimate branches and sparse very narrow costal scales.

GLEICHENIA HIRTA Bl. var. *amboinensis* (v.A.v.R.) Holtt., *stat. nov.*

Gleichenia amboinensis van Alderwerelt van Rosenburgh in *Bull. D p. Agr. Ind. N erl.* 18: 3. 1908.

This variety agrees with the typical form of the species in scaliness, but has somewhat smaller ultimate branches. Its chief distinctive character is in the invariable proliferation of the primary branches beyond their first forking; but some plants of the typical form of the species (especially in the Philippines) occasionally show this character.

GLEICHENIA HIRTA Bl. var. *PALEACEA* (Bak.) C. Chr.

Gleichenia hirta Bl. var. *paleacea* (Bak.) C. Christensen in *Gard. Bull. Str. S.* 7: 212. 1934. — *G. vestita* var. *paleacea* Baker in *J. Bot.* 17: 38. 1879. — *G. hallieri* Chr. in *Ann. Jard. bot. Buit. II*, 5: 138. 1905. — *G. barbula* C. Chr. in *Dansk bot. Ark.* 9, 3: 67, 1937.

This variety, collected in various parts of Borneo at moderate elevations on the mountains, is more or less intermediate between var. *amoena* and the typical form of the species. The scaliness is confined to the costae of fully developed fronds, and old fronds are sometimes almost glabrous. The type collection of *G. barbula* C. Chr. was unusually large and much-branched; the frond also was not quite fully expanded, so that it does not show the final size of the segments of the lamina.

GLEICHENIA HIRTA Bl. var. *Candida* (Rosenst.) Holtt., *comb. nov.*

Gleichenia Candida Rosenstock in *Fedde Rep.* 5: 33. 1908. — *Sticherus hirtus* var. *candidus* Nakai in *Bull. nat. Sci. Mus. Tokyo* 29: 19. 1950.

In its almost glabrous mature fronds and in its usually persistent pale glaucous lower surface, this variety agrees with var. *amoena* of Western Malaysia, but is never so large as var. *amoena* and has broader scales.

GLEICHENIA HIRTA Bl. var. *omamentalis* (Rosenst.) Holtt., *stat. nov.*

Gleichenia omamentalis Rosenstock in *Nova Guinea* 8: 715. 1912. — *G. ornamentalis* var. *lanuginosa* v.A.v.R. in *Nova Guinea* 14: 23. 1924. — *Sticherus lamianus* Copel. in *Philip. J. Sci.* 75: 356, pi. 6. 1941.

GLEICHENIA HIRTA Bl. var. *virescens* (Hieron.) Holtt., *comb. nov.*

Gleichenia dolosa var. *virescens* Hieronymus in Brause Bot. Jahrb. 56: 209. 1920. — *Sticherus hirtus* var. *virescens* Nakai in Bull. nat. Sci. Mus. Tokyo 29: 19.1950.

In describing this variety, Brause cited two specimens, both from eastern New Guinea; these two specimens are not alike. I propose to rank the specimen first cited as the type (Ledermann 9935, in herb. Berlin). The second specimen (Schlechter 19842) agrees with others which I have included in *G. hirta* var. *Candida*. It should be noted that though Hieronymus gave the name *virescens*, the collector's note states that the under surface of the lamina was almost white (i.e. glaucous) when fresh; such a glaucous surface can be completely destroyed by heat during drying. This variety approaches the typical form of the species in scaliness, but the scales are more sparsely fringed. It is possible that var. *virescens* should be united with the typical form of the species.

GLEICHENIA HISPIDA Mett. ex Kuhn

Gleichenia hispida Mettenius ex Kuhn in Verh. K. K. zool.-bot. Ges. Wien 25: 600. 1875. — *G. koordersii* Chr. in Ann. Jard. bot. Buit. 15: 76, pi. 15 / 1. 1897. — *Sticherus caudatus* Copel. in Philip. J. Sci. 75: 354, pi. 2. 1941. — *S. pinnatus* Copel. in Philip. J. Sci. 83: 98, pi. 3. 1954.

I have seen specimens from the type collections of all three species cited as synonyms. *Sticherus pinnatus* was described from plants with simple fronds such as are produced in the early stages of growth by all species in this subgenus. Apart from small size and lack of branching, they only differ from typical plants of *G. hispida* in having less rigid lamina-segments which dry almost flat, not with edges recurved. In the characteristic scales, with long flexuous hair-tips, the type collection of *S. pinnatus* agrees exactly with *G. hispida*. Mr Alston found once-branched fronds of this species bearing sori in Sumatra, so that simple fertile fronds are not a sharply distinguishing feature.

GLEICHENIA MILNEI Bak.

Gleichenia milnei Baker, Syn. Fil. 449. 1874 — *G. warburgii* Chr. in Ann. Jard. bot. Buit. 15: 78 1897. (?) — *G. kajewskii* Copel. in Philip. J. Sci. 60: 102, pi. 6. 1936.

Gleichenia, milnei is closely related to *G. truncata* (see below), differing in its alternate unequal branching (in which it behaves like some varieties of *Dicranopteris linearis*), in its smaller size of ultimate branches, and in having additional stipular leaflets just above each main fork on the

outside. *Gleichenia kajewskii* Copel. certainly agrees with Baker's type of *G. milnei*, but I have not seen the type of *G. warburgii*, and Christ's description of it is not clear. Specimens from Amboina, named *G. warburgii* by v.A.v.R. in the Bogor herbarium are certainly like Baker's species, but I have also seen so named by Christ specimens which are one of the much-branched varieties of *Dicranopteris linearis*, so that it is possible that the original *G. warburgii* (from Celebes) was a *Dicranopteris*.

Gleichenia pulchra (Copel.) Holtt., *comb. nov.*

Sticherus pulcher Copeland in Philip. J. Sci. 75: 355, pi. 1f. 1941.

GLEICHENIA TRUNCATA (Willd.) Spr.

Gleichenia truncata (Willd.) Sprengel, Syst. Veg. ed. 16, 4: 25. 1827. — *Mertensia truncata* Willd. in Kongl. vet. Ak. Nya Handl. 25: 169, t. 5 f. a. 1804. — *M. laevigata* Willd., Sp. Pl. 5: 75. 1810. — *G. laevigata* Hook., Sp. Fil. 1: 10. 1844. — *S. myriapoda* Nakai in Bull. nat. Sci. Mus. Tokyo 29: 12, / 1. 1950. (?) — *G. attenuata* Wall. (*nom. nud.*, cited by Nakai *l.c.* 13).

Both *M. truncata* and *M. laevigata* were described from specimens from Java; I have seen photographs of these specimens, and do not doubt that they represent the same species, which is by far the commonest of this subgenus in Western Malaysia. The original specimen of *M. truncata* is immature, the segments of the lamina not fully expanded and so appearing truncate. The species has usually been known by the name *laevigata*, but *truncata* is earlier. *Gleichenia truncata* is a polymorphic species, and three varieties are here distinguished.

Sticherus myriapoda Nakai was described from a low elevation in the Riau Archipelago; in this region, near sea level, *G. truncata* is the only known species of this subgenus. Nakai's detailed description and drawing agree with *G. truncata* except that he describes and figures the main rhachis of the fronds as climbing by twining, an occurrence otherwise unknown in any member of the family. The main rhachis of high-climbing fronds of *G. truncata* is often rather regularly curved from one node to the next, and I suggest that perhaps Nakai mistook this for a twining of the rhachis, the drawing being made subsequently from memory.

GLEICHENIA TRUNCATA (Willd.) Spr. var. *bracteata* (v.A.v.R.) Holtt., *comb. nov.*

Gleichenia laevigata var. *bracteata* van Alderwerelt van Rosenburgh, Handb. Mai. Perns Suppl. 85. 1917. — *G. bracteata* Bl. ex Hk. & Bak., Syn. Fil. 14. 1865 (as synonym, with description).

This is a very distinct variety, apparently common at about 1000 m altitude in Java. It has shorter lamina-segments than the typical form of

the species (less than 2 cm long) and additional stipular leaflets about 1 cm below each main fork of the rhachis.

GLEICHENIA TRUNCATA (Willd.) Spr. var. *plumaeformis* (Presl)
Holtt., *stat. nov.*

Mertensia plumaeformis Presl in Abh. (K.) boh. Ges. Wiss. M.-N. Cl. 5: 338, 1848; Epim. Bot. 24, t. 15. 1851.

This agrees with typical *G. truncata* in size, in scales (as regards shape) and in the shape and nature of the lamina-segments; it differs in having each main rhachis-branch only twice forked, with long ultimate branches (25-35 cm long), and in the copious rather large scales of the costae. The original specimen came from Malacca (Mt Ophir, Cuming 377; in some herbaria erroneously labelled Luzon). Similar specimens have been found on other mountains in the Malay Peninsula and in Sumatra; perhaps also in Borneo, but the Bornean specimens do not have such large scales. Other Peninsula specimens are: *G. Tahan*, Ridley 15999; *G. Terbakar*, Henderson 10981.

GLEICHENIA TRUNCATA (Willd.) Spr. var. *involuta* Holtt., *var. nov.*

Rami ter furcati; rami ultimi interdum quam ceteros multo longiores; furcae ultimae angulos paulo infra 90° formantes; costae supra dense paleaceae, paleae persistentes, c. 1 mm longae, pallide ciliatae; costae infra paleis ferrugineis ciliatis 0.5 mm longis vestitae; margines segmentorum laminae in sicco multo revolutae.

N. SUMATRA. Batak lands. *J. Winkler* (Rosenst., *Fil. Sumatr. exsicc. no-182*) (L, type; BM, P).

GLEICHENIA LOHERI Chr.

Gleichenia loheri Christ in Bull. Herb. Boiss. II, 6: 1009. 1906. — *Sticherus perpaleaceus* Copel. in Philip. J. Sci. 81: 3. 1952.

The type collection of *S. perpaleaceus* differs from other specimens of *G. loheri* (all from Luzon) in slightly more abundant scaliness, and in having the primary rhachis-branches 3 times forked; the ultimate and penultimate branches together are about equal in length to the ultimate branches on some other specimens.

GLEICHENIA LOHERI Chr. var. *major* Holtt., *var. nov.*

Rami ultimi 20—30 cm longi, 2.5—3.5 cm lati.

N. BORNEO. Kinabalu. *Topping 1755* (SING, US).

PHILIPPINES. Negros. Canlaon Volcano, *Merrill 92U* (P, US).

SW. CELEBES. *G. Bonthain*, 2500 m, *Biinnemeijer 11965* (BO, K, L, type); 5500—7000 ft, *E. G. Smith 222U* (BM, K); 2000 m, *Biinnemeijer 12082* (BO).

This variety comes about half way between typical *G. loheri* and *G. brassii* C. Chr. from New Guinea. All agree in character of scaliness.

DICRANOPTERIS

The Malaysian plants of *Dicranopteris* have usually all been regarded as varieties of a comprehensive species *D. linearis* (Burm.) Und., and few of these varieties have been clearly distinguished. I have found that two of the most distinct of them have bilateral spores instead of the tetrahedral spores of typical *D. linearis*. These are the varieties named var. *tenera* and var. *pubigera* long ago by Blume, and I now regard them as separate species. There is also another species, at present only known from Mount Kinabalu in North Borneo, which has bilateral spores. The rest of Malaysian *Dicranopteris* I prefer still to regard as varieties of *D. linearis*, and here describe some of them for the first time.

Some varieties are very distinct, others much less so; some of the former will probably be regarded as distinct species when they are better known. The varieties which come nearest to the typical form of the species are var. *subferruginea* (Hieron) Nakai and var. *alternans* (Mett.) Holtt., the former in New Guinea and the latter in Sumatra and the Malay Peninsula. The important characters distinguishing these and other varieties are the nature of pubescence and the pattern of branching. Both these characters need more study in the field, especially the latter; a herbarium specimen can never show a whole frond of one of these plants.

Dicranopteris speciosa (Presl) Holtt., *comb. nov.*

Hicriopteris speciosa Presl, Epim. bot. 27. 1851. — *Gleichenia opposita* v.A.v.R. in Bull. Jard. bot. Buit. II, 11: 13. 1913; Holtt., Rev. PI. Malaya 2: 70, f. Iuf. 1955. — *G. parallela* Ridl. in J. Mai. Br. Roy. As. Soc. 4: 3. 1926.

Presl stated that his species had pinnate branching like that of the subgenus *Diplopterygium*, but that alternate pinnae had buds in their axils and that at the apex there were two equal pinnae with a bud between them. This is exactly the condition of *G. opposita* v.A.v.R. (see my figure cited above) and of no other member of the family. Presl also stated that the veins of his specimen were twice forked and that the scales were piliform; these two statements are true of *Dicranopteris* and of no other section of the family. Presl appears to have considered important his observation that the veins anastomose at the margin of the lamina. In fact the raised veins run to join a thickened margin which is not vascular.

By courtesy of the Director of the Botanical Institute of the Charles University, Praha, I have been able to examine the type specimen of

Presl's species. It agrees exactly with *Gleichenia opposita* v.A.v.R., of which I have also seen the type. The locality of origin of Presl's specimen is stated to be Pendschab (Punjab), but that must be wrong, as no member of the family grows in that region. Probably the specimen came from Penang, the only locality at present known where the species is at all common; several early collectors visited Penang.

DICRANOPTERIS PUBIGERA (Bl.) Nakai

Dicranopteris pubigera (Bl.) Nakai in Bull. nat. Sci. Mus. Tokyo 29: 68. 1950. — *Gleichenia hermannii* var. *pubigera* Bl., En. Pl. Jav. 249. 1828.

This species, which occurs abundantly on mountain in Sumatra and Java, and as far eastwards as Flores, has bilateral spores. It differs from *D. curranii* Copel in its smaller size and in its usually persistent hairiness; from *D. clemensiae* in its shorter more coriaceous and differently hairy ultimate branches. There appear to be two forms of this species, but I cannot see that a sharp line can be drawn between them. One form has very thick coriaceous fronds (drying very rigid with reflexed margins), the veins when dry distinctly grooved on the lower surface; old fronds of this are often almost glabrous though younger ones are copiously hairy on the costules of the lower surface. The other form has smaller ultimate branches with a thinner lamina which dries nearly flat, the veins not grooved on the lower surface and the costules more persistently hairy. Some specimens however are intermediate between these two extremes.

Mettenius (in Ann. Mus. bot. Lugd.-Bat. 1: 50. 1863) confused the thick rigid form of this species with *G. hermannii* var. *rigida* Bl., which has tetrahedral spores, veins not grooved and a quite glabrous lamina. See below for a further note on this variety.

DICRANOPTERIS CURRANII Copel.

Dicranopteris curranii Copeland in Philip. J. Sci. 81: 4. 1952. — *Gleichenia hermannii* var. *tenera* Bl., En. Pl. Jav. 249. 1828. — *G. hermannii* var. *venosa* Bl., l.e. — *G. dichotoma* var. *malayana* Chr. in Ann. Jard. bot. Buit. 15: 77. 1898. — *G. linearis* var. *malayana* v.A.v.R., Handb. Mai. Ferns 59. 1907; Holtt., Rev. PL Malaya 2: 70. 1955.

This very large species, common throughout the lowlands of Western Malaysia and occurring also in the Philippines, has bilateral spores like those of *D. pubigera*; this fact has not hitherto been reported. *Gleichenia weatherbyi* Fosb. described from the Caroline Islands (in Am. Fern Journ. 40: 140. 1950), is rather like *D. curranii* but even larger; it also has bilateral spores.

Dicranopteris clemensiae Holtt., sp. nov.

Habitu et sporis bilateralibus *D. curranii* Copel. congruens, differt ramis ultimis angustioribus, costis infra copiose pilis rigidis nitidis atrorubris vestitis. Rhachis primaria 7 mm vel ultra diametro; rami primarii bis aequae furcati, prope furcas pilis rigidis atrorubris persistentibus vestiti; rami ultimi 50—55 cm longi, 5—6 cm lati, segmenta infima exteriora interdum elongata et plus minusve lobata; rami adjuncti furcarum penultimarum 16—18 cm longi et 5 cm lati; foliola stipuliformia furcarum rhacheos primariae 3 cm longa, lobi 3 mm lati; costulae ramorum ultimorum 5—6 mm inter se distantes; segmenta laminae c. 3.5 mm lata, tenuia, in sicco fragilia; venae vulgo ter furcata (ramus primus basi ipse venae egrediens) utrinque leviter prominentes; costae infra pilis crassis atrorubris nitidis pluricellularibus 1—1.5 mm longis basi ramos breves ferentibus primo omnino vestitae, denique glabrescentes et basibus pilorum asperulae; costulae infra pilis ferrugineis (non nitidis) leviter crispis et implicatis basi solum pauciramosis instructae; sori sporangiis 10—15 constati; vena unica ramosa saepe soros duos ferens (sori in ramulis extremis sedentes); sporae bilaterales, c. 32 x 16 μ .

N. BORNEO, Mt Kinabalu, Tenompok, alt. 5000 ft (1600 m), *Clemens* 28745 (BM, type; K, L, US).

Only known from one collection.

DICRANOPTERIS LINEARIS (Burm.) Und.

Dicranopteris linearis (Burm.) Underwood in Bull. Torr. bot. Club. 34: 249. 1907. — *Polypodium lineare* Burman, Fl. Ind. 235, t. 67 f. 2. 1768.

The following are new varieties which I have recognized during my revision of the family for Flora Malesiana, and varieties recognized by former authors for which name-changes are necessary. A special group of such varieties are distinguished by having always accessory branches at the ultimate forkings of the frond. Though these varieties agree in this particular character, they differ so much in other ways that they must be regarded as having arrived at this form of branching on different evolutionary lines.

DICRANOPTERIS LINEARIS (Burm.) Und. var. *demota* Holtt., var. nov.

Furcae ramorum frondium alterne inaequales; furcae ultimae ramis adjunctis praeditae; rami adjuncti furcarum infimarum infra furcam egredientes; rami ultimi ad 18 cm longi, 6 cm lati, apicem versus sensim angustati; costulae inter se 5 mm distantes; lamina tenuis, venae supra distincte, infra leviter prominentes; costae, costulae, laminaeque infra glabrae.

N. BORNEO. Mt Kinabalu, 5000 ft, *Clemens 29535* (BM, K, type; L, US); *Holtum S.F. 25US8* (K, SING); *Topping 1821* (US). — NEW GUINEA. Dutch North N. G. Bernhard Camp, Idenburg River, 1700 m, *Brass 12319* (BM, L). Papua. Boridi, 6000 ft, *Carr U57U* (BM, K, L, SING).

The accessory branches, especially the lower ones, are attached distinctly below the forks.

DICRANOPTERIS LINEARIS (Burm.) Und. var. *montana* Holtt., var. nov.

Rami primarii plurime aequae furcati; rami ultimi 15—25 cm longi, 3.5—6 cm lati, apicem versus sensim angustati; furcae ultimae ramis adjunctis, quam ramos ultimos duplo minoribus, praeditae; costulae 6—7 mm inter se distantes; lamina coriacea, subtus glabra et glauca; venae utrinque prominentes.

MALAYA PENINSULA. Perak, Maxwell's Hill, 4000 ft, *Molesworth Allen 2720* (SING, type).

This variety was described in English in my *Ferns of Malaya*, but the description did not validate publication of the name. The variety is very widely distributed, occurring in Sumatra, Java, Borneo, Ternate, Ceylon and S. India, and in Sikkim. Some specimens from outside Malaya are smaller than the type, with costules only 5 mm apart, and somewhat less coriaceous.

DICRANOPTERIS LINEARIS (Burm.) Und. var. *altissima* Holtt., var. nov.

Ehachis primaria interdum alte scandens, ad 10 mm diametiente; rami primarii aequae quater vel quinquies furcati, rami ultimi c. 3 mm supra basin ramis adjunctis praediti; rami ultimi ad 15 cm longi et 3 cm lati; lamina tenuis, subtus glauca et pilos ferrugineos paucos ferens; costulae inter se 3.5—4.5 mm distantes; venae supra prominentes, subtus fere planae.

MALAY PENINSULA. Johore, Mawai (Sungei Sedili), Corner *S.F. 31W* (K, L, SING, type).

I refer also to this variety specimens from Palawan, Luzon, New Guinea, Talud Islands, and Solomon Islands. Among them are specimens distributed by Cuming under his number 270; one of these received the MS name *Gleichenia dichotoma* var. *divaricata*, published as a nomen nudum by Moore (Index, p. 377). Cuming also distributed under number 270 specimens of the typical form of *D. linearis* and apparently one of these was the type of *Mertensia pteridifolia* Presl (figured in Epim. Bot. t. 14). The name var. *altissima*, with description in English, was published in my *Ferns of Malaya*.

DICRANOPTERIS LINEARIS (Burm.) Und. var. *rigida* (Bl.) Holtt., comb. nov.

Gleichenia hermannii R. Br. var. *rigida* Blume, En. Pl. Jav. 249. 1828. — *Mertensia crassifolia* Presl in Abh. (K.) böhm. Ges. Wiss. M.-N. Cl. V, 5: 339. 1848. — *G. dichotoma* var. *rigida* Mett. in Ann. Mus. bot. Lugd.-Bat. 1: 50. 1863, p.p.

The type of Blume's variety was a specimen from Tidore (Reinwardt). In my opinion it does not differ from the specimens of Cuming number 136, from Luzon, one of which was the type of *Mertensia crassifolia* Pr. Mettenius also ascribed specimens from Java to this variety, but I think he confused it with *D. pubigera*.

DICRANOPTERIS LINEARIS (Burm.) Und. var. *latiloba* Holtt., var. nov.

Rami primarii ad quater furcati; rami ultimi ad 25 cm longi et 9 cm lati, segmenta exteriora laminae interdum elongata et deflexa sed non pinnatifida; costulae 7—8 mm inter se distantes; segmenta laminae 4—5 mm lata, tenuia, subtus glabra, margines in sicco leviter reflexae; venae utrinque paulum prominentes; rami adjuncti ad 20 cm longi et 6—8 cm lati; foliola stipuliformia furcarum infimarum 4 cm longa, late lobata.

PHILIPPINES. Luzon. Benguet Subprov., *Merrill 975* (US, type).

This appears to be a distinct variety, occurring throughout the Philippines; specimens from N. Celebes (Alston 15797) and from the Caroline Islands (Ledermann 13609a) also appear referable to it. The distinct features are the very wide spacing of the costules, the broad ultimate and accessory branches, and the glabrous rather thin lamina.

DICRANOPTERIS LINEARIS (Burm.) Und. var. *dichotoma* (Thunb.) Holtt., stat. nov.

Potypodium dichotomum Thunberg, Fl. Jap. 338, t. 37. 1784.

The specimens of *D. linearis* which I have seen from Japan, and some from China, differ from the typical form of the species (described from Ceylon) in the thinner lamina with the veins distinctly prominent on the upper surface. I can see no other clear difference, and believe that the Japanese fern should rank as a variety of *D. linearis*. It appears that the fronds die in the winter, whereas in typical *D. linearis* they persist indefinitely; the texture of the lamina is perhaps related to this behaviour.

DICRANOPTERIS LINEARIS (Burm.) Und. var. *subpectinata* (Chr.) Holtt., comb. nov.

Gleichenia subpectinata Christ in Bot. Tidsskr. 24: 111. 1901. — *G. pteridifolia* Ridl. in 3. Mai. Br. Roy. As. Soe. 4: 4. 1926. (non Cesati). — *G. linearis* var.

alternans sensu Holtt., Rev. Fl. Malaya 2: 70. 1954 (*non* Mett.). — *D. ivarburgii* sensu Nakai in Bull. nat. Sci. Mus. Tokyo 29: 70. 1950 (*non* Chr.).

DICRANOPTERIS LINEARIS (Burm.) Und. var. **ferruginea** (Bl.)
Holtt., *comb. Tiov.*

Gleichenia ferruginea Blume, En. Pl. Jav. 249. 1828. — *D. ferruginea* Copel. in Philip. J. Sci. 75: 349. 1941. — *G. linearis* var. *ferruginea* Racib., Fl. Buit. Pterid. 13. 1898.

DICRANOPTERIS LINEARIS (Burm.) Und. var. *subspeciosa* Holtt., *var. nov.*

Habitu var. *alternante* (Mett.) congruens; costulae subtus pilis tenuissimis pallidis implicatis persistentibus vestitae, pili crassiores nulli; venae supra prominentes, confertae.

N. BORNEO. Mt Kinabalu, Kiau, *Topping 1516* (SING, US, type).

This variety agrees exactly in characters of lamina and pubescence with *Gleichenia opposita* v.A.v.R. (*Hicriopteris speciosa* Presl), but in branching it agrees with var. *alternans* (Mett.) Holtt. and var. *subpectinata* (Chr.) Holtt. It has been found in the Malay Peninsula, Sarawak, North Borneo, Luzon, Mindoro and Mindanao, and possibly in New Guinea.

DICRANOPTERIS LINEARIS (Burm.) Und. var. **inaequalis** (Rosenst.) Holtt.,
comb. nov.

Gleichenia linearis var. *inaequalis* Rosenstock in Fedde, Rep. 13: 212. 1915.

DICRANOPTERIS LINEARIS (Burm.) Und. var. **alternans** (Mett.) Holtt.,
comb. nov.

Gleichenia dichotoma var. *alternans* Mettenius in Ann. Mus. bot. Lugd.-Bat. 1: 51. 1863. — *G. linearis* var. *alternans* v.A.v.R., Handb. Mai. Ferns Suppl. 84. 1917.

INDEX TO GLEICHENIACEAE

New published names are in bold face type; synonyms are in *italics*; pages where descriptions are given, are in bold face type.

Acropterygium Nakai 260, 261.

Calymella Presl 261, 262; *sect. Eucalymella* Ching 262; *sect. Gleicheniastrum* (Pr.) Ching-262.

Dicranopteris Bernhardt 258, 259, 260, 261, 266; *sub gen.* *Acropterygium*

(Diels) Holtt. 261; *subgen.* *Dicranopteris* 261; *clemensiae* Holtt. 274, 275; *curranii* Copel. 274, 275; *dichotoma* (Thunb.) Bernh. 261; *ferruginea* Copel. 278; *linearis* (Burm.) Und. 260, 270, 271, 273, 275, 276, 277, *var. alternans* (Mett.) Holtt. 273, 278, *var. altissima*

Holtt. 276, *var. demota* Holtt. 275, *var. dichotoma* (Thunb.) Holtt. 277, *var. ferruginea* (Bl.) Holtt. 278, *var. inaequalis* (Rosenst.) Holtt. 278, *var. montana* Holtt. 276, *var. latiloba* Holtt. 277, *var. pubigera* Bl. 273, *var. rigida* (Bl.) Holtt. 277, *var. subferruginea* (Hieron.) Nakai 273, *var. subpectinata* (Chr.) Holtt. 277, 278, *var. subspeciosa* Holtt. 278, *var. tenera* Bl. 273; *pubigera* (Bl.) Nakai 274, 277; *speciosa* (Presl) Holtt. 273; *warburgii* sensu Nakai (*non* Christ) 278.

Dicranopteris sensu Nakai 261.

Dicranopteris sensu Underw. 261.

Diplopterygium Nakai 260, 261.

Gleichenella Ching 261.

Gleichenia Sm. 258, 259, 260, 261, 262; *subgen.* *Dicranopteris* (p.p.) Bower 261; *subgen.* *Diplopterygium* (Diels) Holtt. 259, 261, 262; *subgen.* *Eudicranopteris* Bower 261; *subgen.* *Eugleichenia* Diels 261; *subgen.* *Gleichenia* 259, 261, 262, 266; *subgen.* *Mertensia* (Willd.) Diels 259, 261, 266, *sect.* *Acropterygium* Diels 261, *sect.* *Diplopterygium* Diels 261, *sect.* *Heteropterygium*. Diels 261, *sect.* *Holopterygium* Diels 261; *alstonii* Holtt. 267; *amboinensis* v.A.v.R. 269; *amoena* v.A.v.R. 269; *angustiloba* Holtt. 263; *attenuata* Wall, ex Nakai 271; *barbula* C. Chr. 269; *bracteata* Bl. ex Hook. & Bak. 271; *brassii* C. Chr. 273; *brevipinnula* Holtt. 263, 264; *Candida* Rosenst. 269; *diarpa* R. Br. 258; *dichotoma* var. *alternans* Mett. 278, *var. divaricata* Moore MS. 276, *var. malayana* Chr. 274, *var. rigida* Mett. 277; *dolosa* var. *virescens* Hieron. 270; *erecta* C. Chr. 267, 268; *ferruginea* Bl. 278; *glauca* (Thunb.) Hook. 261; *hal-heri* Chr. 269; *hermannii* var. *pubigera* Bl. 274, *var. rigida* Bl. 274, 277, *var. tenera* Bl. 274, *var. venosa* Bl. 274; *hirta* Bl. 267, 268, *var. amboinensis* (v.A.v.R.) Holtt. 269, *var. amoena* (v.A.v.R.) Holtt. 269, *var. Candida* (Rosenst.) Holtt. 269, 270, *var. orna-*

mentalis (Rosenst.) Holtt. 269, *var. paleacea* (Bak.) C. Chr. 269, *var. virescens* (Hieron.) Holtt. 270; *hispida* Mett. ex Kuhn 267, 270; *kajewskii* Copel. 270, 271; *koordersii* Chr. 270; *laevigata* (Willd.) Hook. 271, *var. bracteata* v.A.v.R. 271; *linearis* var. *alternans* (Mett.) v.A.v.R. 278, *var. ferruginea* Racib. 278, *var. inaequalis* Rosenst. 278, *var. malayana* v.A.v.R. 274; *loheri* Chr. 272, 273, *var. major* Holtt. 272; *longissima* Bl. 263, 266; *matthewii* Holtt. 265; *microphylla* R.Br. 258, 262; *milnei* Bak. 259, 271, 272; *norrisii* Mett. 263; *novoguineensis* Brause 263; *opposita* v.A.v.R. 273, 274, 278; *ornamentalis* Rosenst. 269, *var. lanuginosa* v.A.v.R. 269; *paleacea* (Copel.) Holtt. 265, 266; *papuana* Holtt. 266, *var. membranacea* Holtt. 266, *var. papuana* 266; *parallela* Ridl. 273; *peltophora* Copel. *var. schizolepis* C. Chr. ex Holtt. 262; *peninsularis* Copel. 269; *polypodioides* (L.) Sm. 261; *pteridifolia* sensu Ridl. (*non* Cesati) 277; *pulchra* (Copel.) Holtt. 271; *sordida* Copel. 265; *subpectinata* Chr. 277; *sumatrana* Holtt. 264; *truncata* (Willd.) Spr. 261, 267, 270, 271, 272, *var. bracteata* (v.A.v.R.) Holtt. 271, *var. involuta* Holtt. 272, *var. plumaeformis* (Presl) Holtt. 272; *vestita* Bl. 267, *var. paleacea* Bak. 269; *volubilis* Jungh. *var. peninsularis* Holtt. 265; *vulcanica* Bl. 258; *warburgii* Chr. 270, 271; *weatherbyi* Fosb. 274.

Gleichenastrum Presl 261.

Subfam. *Gleichenioideae* Nakai 261.

Hicriopteris (*non* Presl) Ching, Copel. 259, 261.

Hicriopteris Presl 258, 259, 261; *astrotricha* Copel. 263; *paleacea* Copel. 265; *speciosa* Presl 259, 273, 278.

Mertensia Roth 266.

Mertensia Willd. 261, 266; *crassifolia* Presl 277; *laevigata* Willd. 271; *pectinata* Willd. 261; *plumaeformis* Presl

272; *pteridifolia* Presl 276; *truneata* Willd. 261, 271.

Platyzoma R. Br. 257.

Polypodium dichotomum Thunb. 261, 277; *glaucum*, Thunb. 261; *lineare* Burm. 261, 275.

Subfam. Sticherioideae Nakai 260.

Sticherus Presl 258, 259, 260, 261, 266;

caudatus Copel. 270; *habbemensis* Copel. 268; *hirtus* var. *candidus* Nakai 269, var. *virescens* Nakai 270; *laminatus* Copel. 269; *myriapoda* Nakai 271; *perpaleaceus* Copel. 272; *pinnatus* Copel. 267, 270; *jmlcher* Copel. 271.

Stromatopteris Mett. 257, 260, 261; *moniliformis* Mett. 261.

Subfam. Stromatopteroideae Nakai 261.

ADDENDUM

In *Gleichenia* subgenus *Diplopterygium* the following species must be placed:

Gleichenia deflexa Holtt., *sp. nov.*

Rami rhacheos 120 cm vel ultra longi, maximi 35 cm lati, rami minores (steriles) interdum 18 cm lati; pinnulae omnes angulo c. 75° deflexae; pinnulae maximae 16—20 cm longae, 3.5—3.8 cm latae, costae 4—5 cm inter se distantes (costae ramorum minorum sterilium 2.5—3.5 cm inter se distantes); costulae 4—5 mm inter se distantes, medii rectangulariter patentes, infimae interdum leviter deflexae; lamina tenuis, segmenta c. 20 paria basi leviter constricta (i.e., supra basin ampliata), ala angustissima laminae conjuncta, segmentum infimum foliolum disjunctum constat; venae utroque basi prominentes, cetera planae; sori sporangiis 3—5 constati; f. oliola stipulif. ormia. ad 4 cm longa, bipinnatifida, segmenta 1 mm lata. Paleae apicis rhacheos c. 10 mm longae, haud 1 mm latae, pallidae, margine brunneo setis brevibus obliquis nitidis praeditae; rami rhacheos costaeque utroque primo paleis parvis et pilis stelliformibus coarctis paleis elongatis angustis intermixtis vestiti, demum plus minusve glabri et verruculosi; venae infra pilis stelliformibus pallidis adspersis praeditae.

NEW GUINEA. Papua. Fergusson Island, 800 m, climbing to 6 m in rather open rain forest in steep ravine, *Brass* 27171 (L, typs). Normanby Island, Mt Palinama, 850 m, scrambling to 7 m in tall mossy forest, *Brass* 25736 (L).

THE GENUS *FIRMIANA* MARSILI (Sterculiaceae)

A. J. G. H. KOSTERMANS *

SUMMARY

1. *Firmiana* Marsili and *Erythropsis* Lindley are congeneric.
2. *Firmiana* Marsili links *Sterculia* L. and *Scaphium* Schott & Endl.
3. Eight species are recognized: *Firmiana eolorata* (Roxb.) R. Br.; *F. diversifolia* A. Gray; *F. fidgens* (Wall, ex King) Corner; *F. hainanensis* Kosterm.; *F. major* Hand.-Mazz.; *F. papuana* Mildbr.; *F. philippinensis* Kosterm.; *F. simplex* (L.) W. F. Wight.
4. Seventeen binomials are referred to other genera.

While a paper on *Firmiana* was in the press, I received some additional, important information from the Kew Herbarium and from Mr. J. E. Dandy of the British Museum. These "Additional Notes" were placed at the end of the article.

In a subsequent letter that reached me when the article already had been printed and issued**, the problem of *Firmiana simplex* was solved, thanks to the tenacity of Mr. Dandy. Moreover, *F. fulgens* came into flower in the Bogor Botanical Garden, which enabled me to add some field notes and photographs.

We had in mind to incorporate the paper in "Reinwardtia" in its original form, but due to the additions, mentioned above, it was considered better that it should be rewritten to this new, separate publication.

FIRMIANA*** Marsili

Firmiana Marsili in *Saggi Scientifici e Letterari dell' Accademia Padova* 1: 106-116, *tab. 1 & 2*. 1786; Lamarck-Podret, *Encycl. meth.* 7: 432. 1806 (as a syn. under *Sterculia platanifolia* L.f.; excl. syn. *Culhamia* Forsk.); Steudel (*Firmiana* Medic.), *Nomencl.* 343. 1821; ed. 2, 1: 642. 1840 (as a syn. cf. *Sterculia* L.); DC, *Prodr.* 1: 481. 1824 (as a syn. of *Sterculia* L.); Bartling, *Ordin.* 340. 1831 (as a syn. of *Sterculia* L.); Schott & Endlicher, *Melet. bot.* 33. 1832; Spach, *Hist. Veg. phan.*

* D. Sc.j Botanist, Forest Service of Indonesia; cooperator Herbarium Bogoriense.
* Published under the title "The Genus *Firmiana* Marsili" as Communication no. 54 of the Forest Research Institute, Indonesia, in December 1956, p. 3-33.

*** Named for count K. J. von Firmian, born 1716 at Deutsch-Metz in Tirol, died 1782 Milan, an Austrian statesman who was Governor of Lombardy under Maria Theresia.