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# MALAYAN FERN ALLIES.

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## HANDBOOK

TO THE DETERMINATION

OF

THE FERN ALLIES

OF

## THE MALAYAN ISLANDS

(INCL. THOSE OF THE MALAY PENINSULA, THE PHILIPPINES  
AND NEW GUINEA).

BY

CAPT. G. R. W. K. VAN ALDERWERELT VAN ROSENBURGH.

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PUBLISHED BY

THE DEPARTMENT OF AGRICULTURE, INDUSTRY AND COMMERCE  
NETHERLANDS INDIA.

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BATAVIA  
LANDSDRUKKERIJ  
1915.

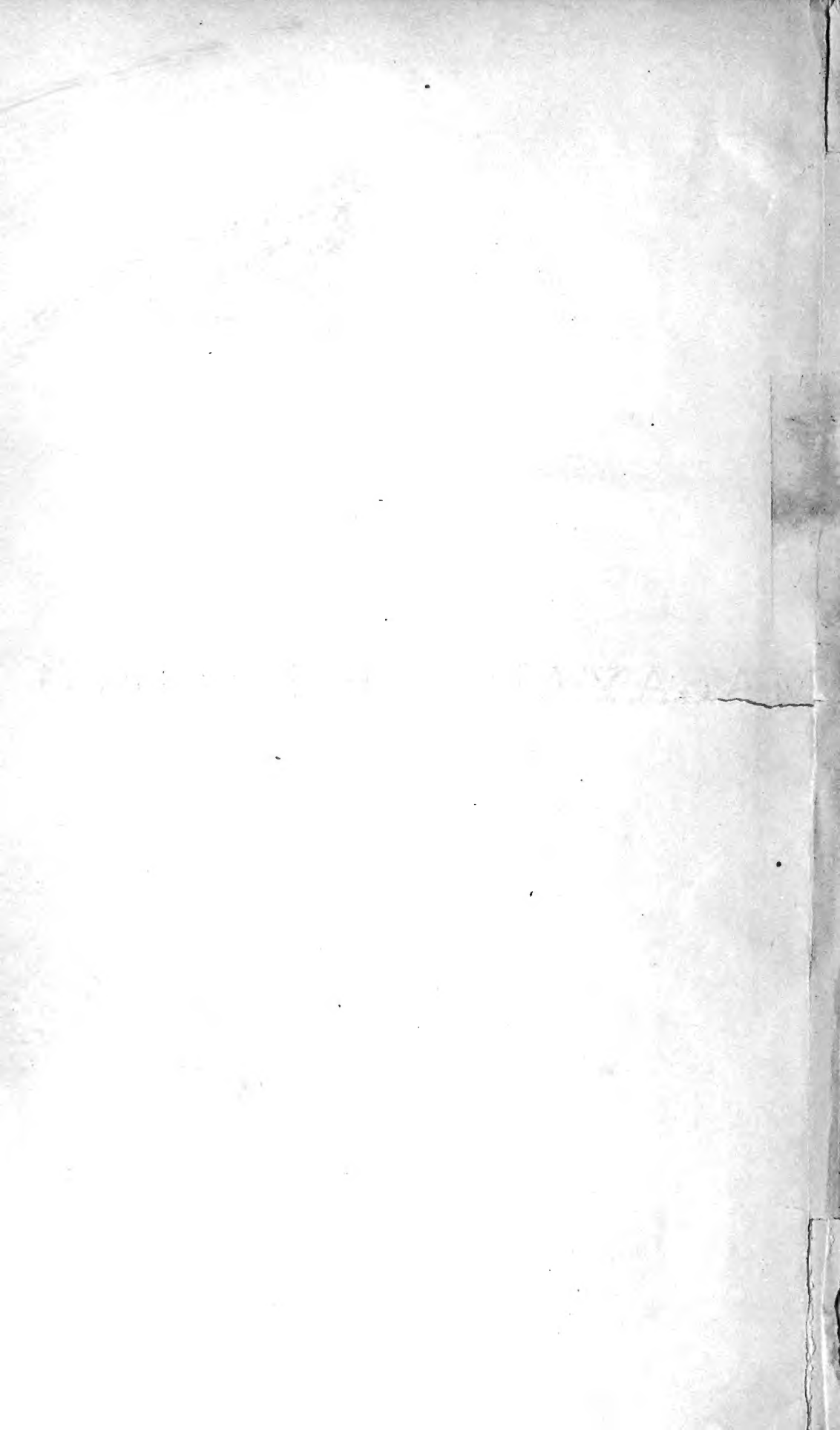
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A.

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## PREFACE.

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When I set about compiling my handbook *Malayan Ferns*, it was my intention to include some chapters on the Malayan fern allies. Want of time, however, prevented me from carrying out my plan, so that I had to defer the continuation of my work till after my return from Japan, where the botanical literature to my disposal did not meet my requirements.

As to the sources from which I have drawn, it is my pleasant duty to mention here my indebtedness especially to SPRING'S *Monographie de la Famille des Lycopodiacees*, BAKER'S *Fern Allies*, RACIBORSKI'S *Pteridophyten der Flora von Buitenzorg*, WARBURG'S *Monsunia I*, ENGLER & PRANTL'S *Natürliche Pflanzenfamilien I*<sup>4</sup> and HIERONYMUS' descriptions of new Selaginellae in *Hedwigia*, etc.

As regards the arrangement of families, genera and species, I have selected — separately or combined, with or without alterations — those which seemed to me to be most easy for determination, in doing which I have had to avail myself of the experience of others, considering that on several species I have never set eyes.

The present volume should be looked upon as a sequel to my *Malayan Ferns*, for which reason I have continued the numeration of the families and genera in the earlier work.

The supplements which may eventually be published will serve as such to both volumes.

The reasons why the diagnoses of some species are either incomplete or wanting altogether, are the same as those stated in *Malayan Ferns*; in good time I hope I shall be able to state them in a supplementary volume.

For the habitats I beg to refer the reader to the Preface to *Malayan Ferns*, and for the determination of the plants to my observation in the 2nd paragraph on page XL of the same work. The dimensions given in the keys and diagnoses are generally approximative only.

Like *Malayan Ferns*, the present volume makes no pretence of being either an exhaustive or a flawless work, and I shall feel greatly obliged for any communications tending to point out errors or wrong views not resulting from a difference of conception.

Finally I wish to express in this place my sincere thanks to Prof. Dr. G. HIERONYMUS, of Steglitz, for the kindness with which he assisted me in my *Selaginella* study.

BUITENZORG, July 1914.

v. A. v. R.

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## ABBREVIATIONS.

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A. Br.	= A. Braun.
Bau. & Hk.	= F. Bauer & W. J. Hooker.
Becc.	= O. Beccari.
Bernh.	= J. J. Bernhardi.
Bk.	= J. G. Baker.
Bl.	= C. L. Blume.
Bory	= J. B. M. Bory de Saint Vincent.
Bot. Jahrb. + Beibl.	= Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie + Beiblatt. — (Engl.).
Br. Ferns	= The British Ferns, or coloured figures and descriptions, etc. — (Hk., 1861).
Bull. Btz.	= Bulletin du Jardin Botanique de Buitenzorg.
Burm.	= N. L. Burmann.
Ces.	= V. Cesati.
Christ	= H. Christ.
Copel.	= E. B. Copeland.
Corda	= A. J. Corda.
Desf.	= R. Desfontaines.
Desv.	= A. N. Desvaux.
de Vr.	= W. H. de Vriese.
Engl.	= A. Engler.
Engl. & Prantl	= A. Engler & E. Prantl.
En. Jap.	= Enumeratio plantarum in Japonia sponte crescentium. — (Fr. & Sav., 1876—1879).
Enum.	= Enumeratio plantarum Javae et insularum adjacentium, II, Filices. — (Bl., 1828).
Enum. Fil.	= Enumeratio Filicum. — (Klf., 1824).
Fed.	= F. Fedde.

- Fel. Becc. Polin. = Prospetto delle Felci raccolte dal Signor O. Beccari nella Polinesia, etc. — Rend. Acad. Napoli, XVI. — (Ces., 1877).
- Fel. di Bor. = Felci e specie nei gruppi affini raccolte a Borneo dal Signor O. Beccari. — Atti Acad. Sci. fis. e mat. Napoli. — (Ces., 1876).
- Fern All. = Handbook of the Fern Allies. — (Bk., 1887).
- Fil. Exot. = Filices Exoticae or Figures and Descriptions of Exotic Ferns, etc. — (Hk., 1857—1859).
- Fil. Saras. = Filices Sarasinianae, in Verhandlungen der Naturforschenden Gesellschaft in Basel, XI. — (Christ).
- Flind. = M. Flinders.
- Flor. Btz., I. = Die Pteridophyten der Flora von Buitenzorg. — (Rac., 1898).
- Flor. deut. Sch.geb. + Suppl. = Die Flora der deutschen Schutzgebiete in der Südsee. — (Schum. & Laut., 1901). — Supplement (1905).
- Flor. Ind. = Flora Indica. — (Burm., 1768).
- Forschr. Gaz., IV, Farne. = Farne und Bärlappige Gewächse, in „Die Forschungsreise S.M.S. Gazelle“. — (1874—1876).
- Forst. = G. Forster.
- Freyc. = L. C. de Saulces de Freycinet.
- Fr. & Sav. = A. Franchet & L. Savatier.
- Gen. Fil. = Genera Filicum. — (Bau. & Hk., 1842).
- Griff. = W. Griffith.
- Hedwi. = Hedwigia. Organ für Kryptogamenkunde, etc.
- Herb. Berol. = Herbarium Beroliense.
- Hert. = W. Herter.
- Hier. (Hieron.) = G. Hieronymus.
- Hk. = W. J. Hooker.
- Hk. & Arn. = W. J. Hooker & G. A. Walker—Arnott.
- Hk. & Grev. = W. J. Hooker & R. K. Greville.

H.M.P.	= Herbarium Musei Parisiensis.
Hoffm.	= G. F. Hoffmann.
Ic. Fil.	= Icones Filicum, etc. — (Hk. & Grev., 1827—1831).
Icon.	= Icones Plantarum Asiaticarum. — (Griff., 1849).
Icon. Pl.	= Icones Plantarum. — (Hk.).
Journ. of Bot.	= Journal of Botany.
Krypt. Gew.	= Vier und zwanzigste Klasse des Linnéischen Pflanzensystems oder Kryptogamische Gewächse. — (Schk., 1804—1809).
Kuhn	= M. Kuhn.
Kze	= G. Kunze.
L. (Linné)	= Linnaeus (C. von Linné).
Lam.	= de Lamarck.
Mal.	= Malesia. — (Becc., 1886).
Milde	= J. Milde.
Mon.	= Monographie de la famille des Lycopodiées. — (Spring; I, 1842; II, 1849).
Mon. Eq.	= Monographia Equisetorum. — (Milde, 1865).
Mon. Prél.	= Monographie des Prêles, in Mémoires de la Société de Physique et d'Histoire Naturelle de Genève, I, 2e Partie. — (Vauch.).
Mons.	= Monsunia. — (Warb., 1901).
Nat. Pfl.Fam., I <sup>4</sup> .	= Die natürlichen Pflanzenfamilien, etc., Teil I, Abteilung 4, Pteridophyten. — (Engl. & Prantl, 1902).
Notizbl. Bot. Gart. Berlin	= Notizblatt des Königl. Botanischen Gartens und Museums zu Berlin.
Philipp. Journ.	= The Philippine Journal of Science; Section C, Botany.
Pl. Jungh.	= Plantae Junghuhnianae. — (ca 1850).
Poton.	= H. Potonié.
Pr.	= C. B. Presl.
Pritz.	= E. Pritzel.

Rac.	= M. Raciborski.
Rb. (Roxb.)	= W. Roxburgh.
R. Br.	= R. Brown.
Rel. Haenk.	= Pteridophyta, in Reliquiae Haenkeanae, etc. — (Pr., 1825).
Rep.	= Repertorium novarum specierum regni vegetabilis. — (Fed.).
Rhizos.	= Monographia Rhizospermarum et Hepaticarum. — (Corda, 1829).
Rst. (Ros.)	= E. Rosenstock.
Schk.	= C. Schkuhr.
Schleich.	= J. C. Schleicher.
Schum. & Laut.	= K. Schumann & K. Lauterbach.
Spec.	= Caroli a Linné Species Plantarum. — (Willd., 1810).
Spring	= A. Spring.
Sw.	= O. Swartz.
Syn.	= Synopsis Filicum. — (Sw., 1806).
Syst. Verz.	= Systematisches Verzeichniss, etc. — (Zoll., 1854).
Tijdschr. Nat. Gesch.	= Tijdschrift voor Natuurlijke Geschiedenis en Physiologie.
Vauch.	= J. P. E. Vaucher.
Vent.	= E. P. Ventenat.
Voy.	= A Voyage to Terra australis, etc. — (Flind., 1814).
Voy. Ur. Phys. Bot.	= Voyage autour du Monde, etc., sur l'Uranie et la Physicienne; Botanique. — (Freye., 1826—1829).
Wall.	= N. Wallich.
Warb.	= O. Warburg.
Willd.	= K. L. Willdenow.
Zoll.	= H. Zollinger.

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# COMPENDIUM

## OF THE ORDERS, SUBORDERS, FAMILIES AND GENERA.

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### ORDER FILICALES.

Mostly green plants with 2 distinct generations, a pro-embryonal and an embryonal one, the pro-embryonal generation consisting of a minute, tuberous or more commonly flat or filiform, white or green, simple, entire, incised or branched, not rarely rudimentary thalloid plant (prothallium) with hair-like roots and bearing 1 or more ♂ and (or) ♀ prominent, tuberculiform or immersed organs (antheridia, archegonia). The embryonal generation, i. e. the normal, cormophytical plant with a stem (rhizome, caudex) and true roots, stalks (stipes) and leaves (fronds) traversed by 1 or more fibro-vascular bundles (steles) and producing capsules (sporangia) with spores, develops when a ripe archegonium (♀) is fecundated by the spiral-shaped spermatozoids of a ripe antheridium (♂).

Stems short or elongate, solid, rarely tuberous or cavernous, not articulate, smooth or scaly, sometimes prickly, mostly less strongly developed than the fronds, simple or branched, if branched, the branches not placed in whorls, with the fronds circinate or folded in the bud.

Fronds seriate, aggregate or placed in spirals or whorls, not laterally connected, the fertile ones (sporophylla) neither gathered in terminal or lateral spikes, nor bearing solitary sporangia on the upper (inner) side at the base (in the axil).

#### **SUBORDER I. FILICES** (Isospore Filicales, True Ferns).

Fronds simple or variously divided, circinate in the bud; sporophylla normal-shaped, not rarely more or less contracted, not metamorphosed, bearing many to numerous sporangia on the

under side, the margin or the apex, rarely on both sides or on the upper side. Spores isomorphous, producing independent prothallia on which are developed both antheridia and archegonia. Terrestrial or epiphytic, rarely aquatic.

**FAMILIES I—X.** (See my handbook on Malayan Ferns).

GENERA 1—95. (Not treated with in this work).

**SUBORDER II. HYDROPTERIDES (Heterospore Filicales,** Water ferns). Leaves simple or 2-lobed to 4-foliolate, circinate or folded in the bud; sporophylla or their segments metamorphosed into sessile or stalked, globose, ellipsoidal, pyriform or bean-shaped sporocarps enclosing several to numerous sporangia and placed on, or at the base of, the stipes of the barren leaves. Spores heteromorphous, producing more or less rudimentary prothallia, those of the macrospores bearing archegonia, those of the microspores antheridia. Aquatic or subaquatic.

**FAMILY XI. MARSILEACEAE.** Stems creeping in the mud. Leaves without blade or with blades floating on the surface of the water or rising above it, circinate in the bud. Sporocarps bi- or plurilocular, each loculus containing both macrospores and microspores.

GENUS 96. MARSILEA. Normal leaves long-stalked, 4-foliolate; leaflets cruciate.

**FAMILY XII. SALVINIACEAE.** Small plants floating on the water. Leaves with a simple or deeply 2-lobed blade, folded in the bud. Sporocarps unilocular, containing either macrospores or microspores.

GENUS 97. SALVINIA. Leaves simple, borne in whorls of 3 of which 2 are floating, normal, and the 3rd submerged, dissected into many filiform segments, bearing the sporocarps on the basal segment.



GENUS 98. AZOLLA. Leaves in 2 opposite rows, deeply 2-lobed, the fertile ones bearing the sporocarps on the lowest lobe.

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## ORDER SPHENOPHYLLALES.

Contains a single extinct family only. (1)

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## ORDER EQUISETALES.

Differs from the Filicales in having the stems always elongate, more strongly developed than the leaves, articulate, mostly hollow, longitudinally ribbed or striated at least when barren, simple or branched, if branched, the branches often in whorls, originating from the bases of the internodations of the stem, with the leaves erected in the bud.

Leaves placed in whorls, the fertile ones (sporophylla) forming rather compact terminal spikes and bearing several to many sporangia round the under side of the margin.

### **SUBORDER I. EQUISETINEAE** (Isospore Equisetales,

Horse tails). Barren leaves connected so as to form distinctly toothed, tubular or funnel-shaped sheaths enclosing the bases of the internodations of the stem and branches. Sporophylla not connected, scale-like, peltate, stalked. Spores isomorphous, producing prothallia on which mostly are developed either antheridia or archegonia.

**FAMILY XIII. EQUISETACEAE.** Characters those of the suborder.

GENUS 99. EQUISETUM. Characters those of the family.

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(1) **Sphenophyllaceae.** — Poton., in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 515.

**SUBORDER II. CALAMARIINEAE** (Heterospore Equisetales). Contains extinct genera only. <sup>(1)</sup>

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ORDER LYCOPODIALES.

Differs from the Filicales in having the stems always solid, sometimes articulated, generally more strongly developed than the leaves, with the leaves erected in the bud.

Leaves seriate, aggregate, or placed in spirals or whorls, the fertile ones (sporophylla) forming close or lax terminal or lateral spikes, or placed in alternate cycles with the barren ones so as to form a dense rosette, with the sporangia placed singly in the axils.

**SUBORDER I. LYCOPODIINEAE** (Isospore Lycopodiales, Club mosses). Leaves without a ligula at the base. Sporophylla forming spikes or arranged all down the stem. Sporangia and spores isomorphous; spores producing independent prothallia on which are developed antheridia and archegonia.

**FAMILY XIV. PSILOTACEAE.** Leaves simple, either well-developed and crowded along a subcylindrical stem, or rudimentary and laxly 2—3-seriate along a flattened or angular, mostly branched stem. Sporangia 2—3-locular, on 2-foliolate or 2-dentate sporophylla.

GENUS 100. **TMESIPTERIS.** Stems rather cylindrical. Sporophylla stalked, 2-foliolate. Sporangia 2-locular, smaller than the sporophylla.

GENUS 101. **PSILOTUM.** Stems flattened or angular. Sporophylla sessile, deeply 2-dentate. Sporangia 3-locular, larger than the sporophylla.

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<sup>(1)</sup> With 2 families; the **Calamariaceae** and the **Protocalamariaceae**, the former the ancestral family of the **Equisetaceae**. — Poton., in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 551 & 558.

**FAMILY XV. LYCOPODIACEAE.** Leaves simple, crowded around the base of a short, naked stem or arranged along a much elongated and mostly branched stem. Sporangia 1-locular, on simple sporophylla.

GENUS 102. LYCOPODIUM. Stems elongated, copiously foliaceous everywhere or on the branches only.

**SUBORDER II. SELAGINELLINEAE (Heterospore Lycopodiales).** At least the younger leaves provided with a minute, decoloured tongue-shaped organ (ligula) on the upper side, at the base. Sporophylla forming lateral or (more generally) terminal spikes or placed with the barren leaves in a dense rosette forming alternate barren and fertile cycles. Sporangia heteromorphous, containing either macrospores or microspores; spores producing more or less rudimentary prothallia, those of the macrospores bearing archegonia, of the microspores antheridia.

**FAMILY XVI. SELAGINELLACEAE.** Leaves small, flat, without air-channels, arranged along a slender, elongated stem. Sporophylla aggregated in spikes; sporangia superficial, 1-locular.

GENUS 103. SELAGINELLA. Characters those of the family.

**FAMILY XVIa. LEPIDOPHYTACEAE.** Contains extinct genera only. <sup>(1)</sup>

**FAMILY XVII. ISOËTACEAE.** Leaves elongated, terete or semi-terete, with air-channels, crowded around a short, tuberous stem. Sporophylla occupying the outer leaf-cycles; sporangia imbedded, incompletely plurilocular. (Not in Malaya).

**FAMILY XVIIa. PLEUROMOIACEAE.** Contains extinct genera only. <sup>(2)</sup>

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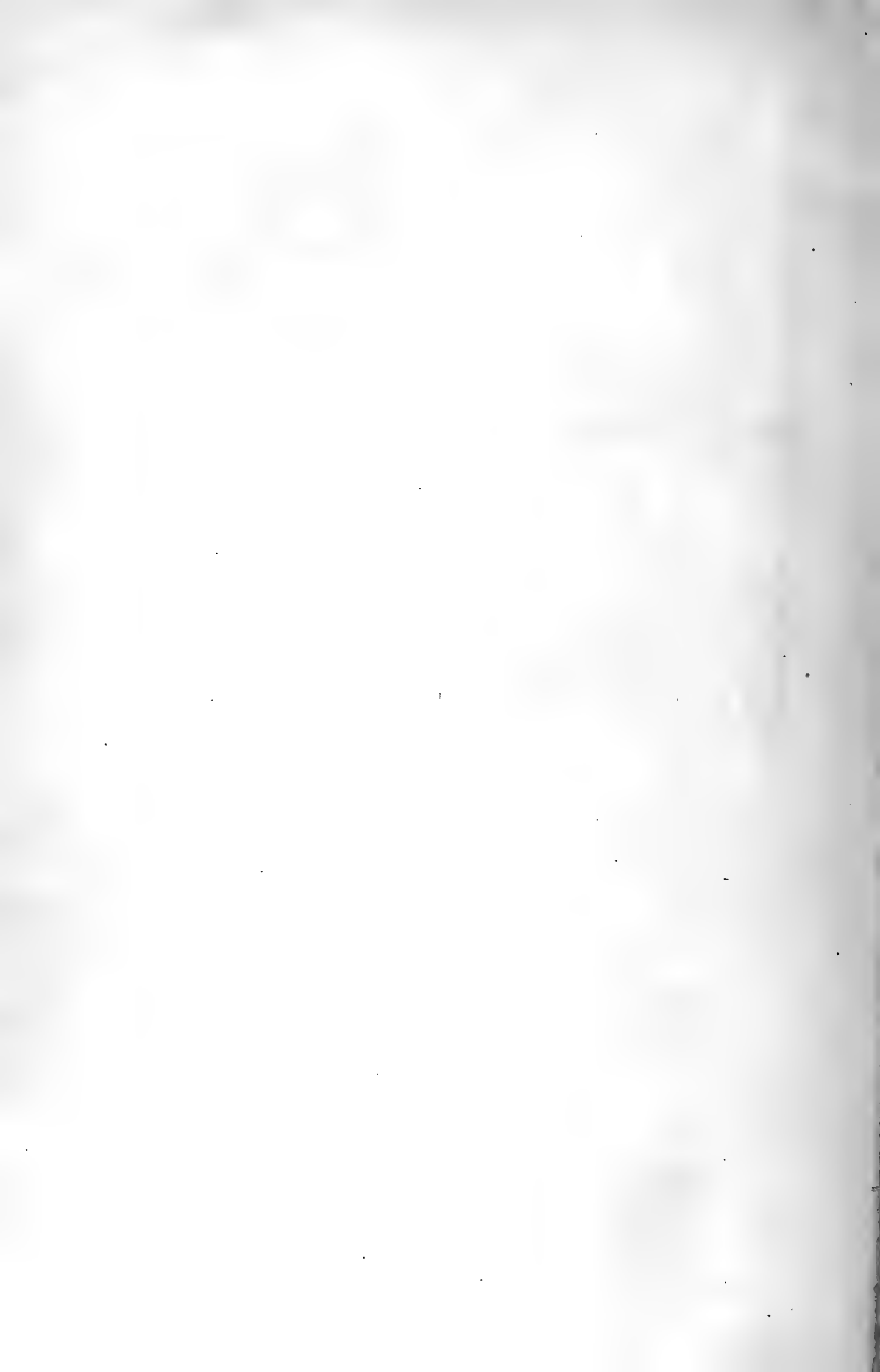
<sup>(1)</sup> With 3 subfamilies; the **Lepidodendraceae**, the **Bothrodendraceae** and the **Sigillariaceae**. — Poton., in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 717, 739, 740.

<sup>(2)</sup> The ancestral family of the **Isoëtaceae**. — Poton., in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 754.

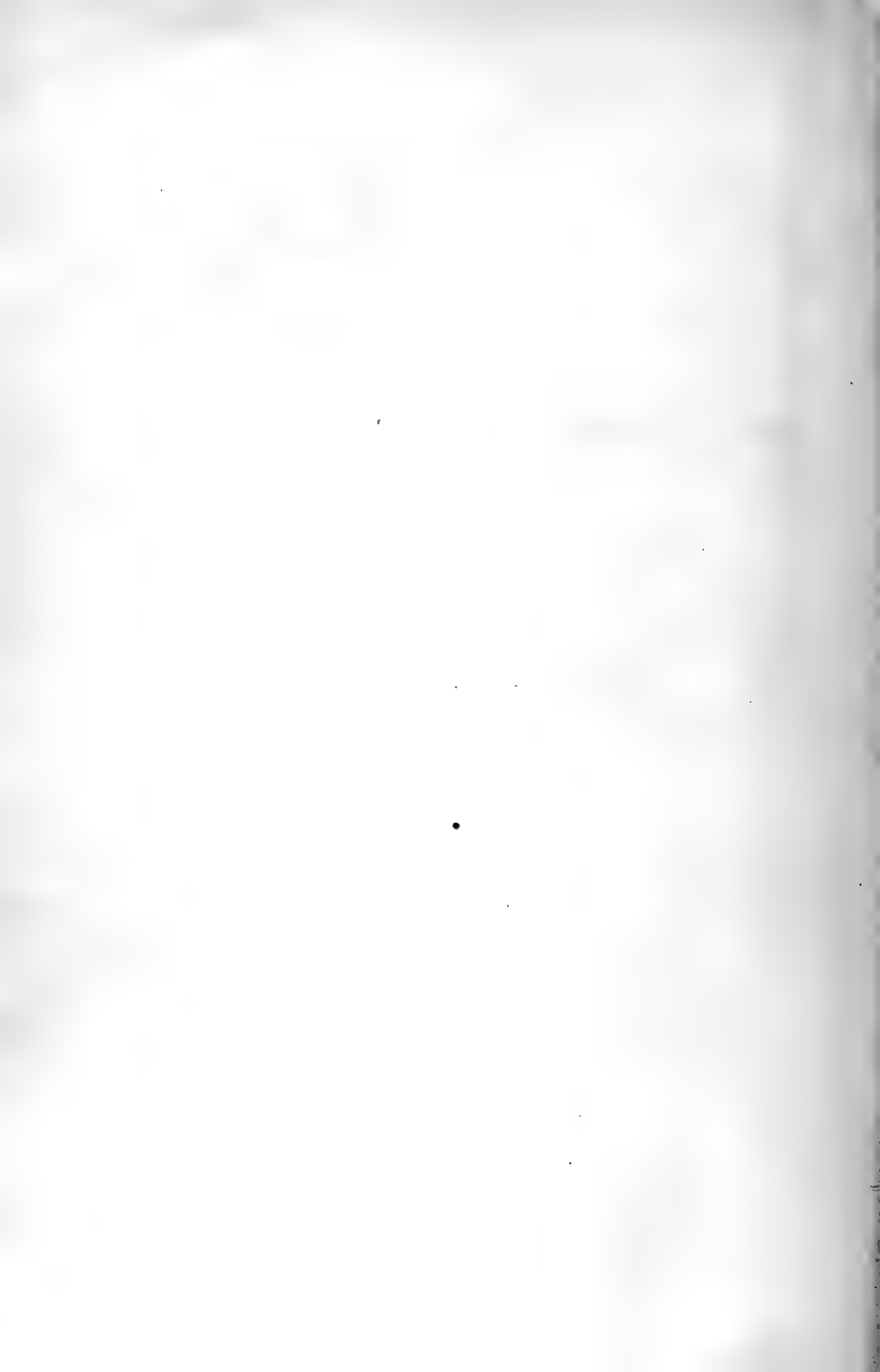
*Key to the families and genera.*

- a.** Floating aquatics. (XII. SALVINIACEAE).
- \* Leaves very minute, crowded, with simple venation. No. 98. **Azolla.**
  - \*\* Leaves small, though well-developed, in opposite rows, with anastomosing venation. No. 97. **Salvinia.**
- a.a.** Epiphytics or terrestrials, *or* no floating aquatics.
- b.** Rhizome or main stem creeping in the mud; leaves long-stalked, remote or in distant groups, with the fruit borne on, or at the base of, the petiole. (XI. MARSILEACEAE). No. 96. **Marsilea.**
  - b.b.** Rhizome or main stem not creeping in the mud, *or*, if so, the leaves not long-stalked.
  - c.** Barren leaves laterally connected so as to form remote, tubular or funnel-shaped sheaths encircling the stem; fertile leaves (sporophylla) free, peltate, forming terminal spikes and bearing the sporangia on the under side, along the margin. (XIII. EQUISETACEAE). No. 99. **Equisetum.**
  - c.c.** Barren leaves not laterally connected; fertile leaves (sporophylla) whether or not spicate, bearing the sporangia on the upper side, at the base.
  - d.** Both barren leaves and sporophylla placed in alternate cycles borne on a tuberous stem; sporangia imbedded. (XVII. ISOËTACEAE; not in Malaya).
  - d.d.** Sporophylla spicate, if alternate with the barren leaves, then not borne on a tuberous stem; sporangia superficial.
  - e.** Sporangia 1-locular.
    - † At least the younger leaves provided with a very minute decoloured ligula on the upper side, at the base. (XVI. SELAGINELLACEAE). No. 103. **Selaginella.**
    - †† Leaves without a ligula at the base. (XV. LYCOPODIACEAE). No. 102. **Lycopodium.**
  - e.e.** Sporangia 2—3-locular. (XIV. PSILOTACEAE).
  - f.** Leaves small, though well-developed; sporophylla 2-foliolate, petiolate; sporangia 2-locular. No. 100. **Tmesipteris.**
  - f.f.** Leaves rudimentary, tooth-like; sporophylla 2-dentate, sessile; sporangia 3-locular. No. 101. **Psilotum.**
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# HYDROPTERIDES.



FAMILY XI. MARSILEACEAE.





## XI. MARSILEACEAE.

Aquatic or subaquatic. Rhizome slender, creeping in the mud, provided with a single, central, tubular stele. Leaves without blade, or with blades floating on the surface of the water or rising above it, circinate in vernation. Fertile leaves or segments metamorphosed into bi- or plurilocular, globose, ellipsoidal, pyriform or bean-shaped, sessile or stalked sporocarps placed at the base of the petioles of the normal (barren) leaves, often close to the rhizome, containing spores of 2 kinds, both macrospores and microspores borne in the same sporocarp.

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### 96. MARSILEA, *Linneé*.

Sporocarps bilateral, round, oblong, quadrate or bean-shaped, 2-valved, plurilocular, horizontally veined, the locules (sori) oblong-cylindrical, horizontally arranged in 2 close vertical rows on a mucilaginous placental cord, the veins forked, with the fork-branches whether or not anastomosing, the base provided with 0—2 teeth.

Rhizome wide-creeping, the leaves produced singly or in tufts from its nodes. Barren leaves long-stalked, 4-foliolate; leaflets cruciate, cuneate, with the outer edge truncate or rounded, whether or not provided with translucent or yellow-brown, longitudinal spurious veinlets (streaks) between the true ones. — Engl. & Prantl, *Nat. Pfl.Fam.*, I<sup>4</sup>, fig. 225 A. (*Marsilia*).

Tropical, subtropical, and in temperate countries.

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#### *Arrangement of the sections.*

- § 1. **EUMARSILEA.** Fork branches of the veins of the sporocarps not anastomosing, or anastomosing near the apex only. — Engl. & Prantl, l. c., fig. 225 B.
- § 2. **ZALUSIANSKAYA.** Fork branches of the veins of the sporocarps anastomosing from the base. — Engl. & Prantl, l. c., fig. 225 D. (Not in Malaya).
-

## § 1. EUMARSILEA.

1. Leaflets with spurious veinlets between the real veins.

(1) *M. coromandelica*.

1.1. Leaflets without spurious veinlets.

2. Petioles densely tufted.

(2) *M. quadrata*.

2.2. Petioles not densely tufted, often remote.

3. Sporocarps ribbed and bordered.

(3) *M. minuta*.

3.3. Sporocarps neither ribbed nor bordered.

(4) *M. crenata*.

(1) ***M. coromandelica*, *Burm.***, Bk., Fern All., 147; *Burm.*, Flor. Ind., tab. LXII, fig. 3; Copel., Philipp. Journ., IV<sup>c</sup>, 13; *M. coromandelica*(*ana*), *Willd.*, Spec., V, 539.

Small, aquatic or subterrestrial, glabrous in all its parts. Petioles erect, 1¼—7½ cm. long. Leaflets cuneate, 2—8 mm. long, rounded and entire on the outer edge, with spurious veinlets of sclerenchyma showing as pellucid streaks between the real veins. Pedicels erect, free, unbranched, filiform, not more than 1 to a leaf, 1—2 cm. long, inserted at the middle of the base of the sporocarp. Sporocarps oblong, erect, 4 mm. long, distinctly bordered and ribbed, with distinct basal teeth; sori 8—12 in a sporocarp.

*Celebes* (t. Christ); *Brit. India*, *Socotra*.

(2) ***M. quadrata*, *A. Br.***, Bk., Fern All., 146; Copel., Philipp. Journ., IV<sup>c</sup>, 13.

Subterrestrial, densely tufted. Petioles 2½—7½ cm. long. Leaflets cuneate, 4—10 mm. long, rather silky, crenated on the slightly rounded outer edge. Pedicels in a tuft with the petioles, at best 1 to a leaf, free to the base, adnate to the whole base of the sporocarp, unbranched, erect, 6—8 mm. long. Sporocarps nearly square, 2 mm. long, glabrescent, unbordered, with 2 basal teeth, the upper one prominent, often long-conical; sori 5—6 in a sporocarp.

*Borneo*.

(3) ***M. minuta*, *L.***, Bk., Fern All., 140, p. p.; Copel., Philipp. Journ., IV<sup>c</sup>, 12; *Rac.*, Flor. Btz., I, 234, p. p.; *M. erosa*, *Willd.*, Spec., V, 540; — var. *Zollingeri*, *A. Br.*, Bk., l. c.; *Engl. & Prantl*, Nat. Ffl.Fam., I<sup>4</sup>, 418.

Subterrestrial or aquatic, both with a wide-creeping rhizome. Petioles 2½—15 cm. long. Leaflets cuneate, 2½—17½ mm. long, nearly or quite glabrous, the outer edge rounded, deeply and mostly irregularly toothed. Pedicels clustered, or connate at the base, often close to the base of the petiole but not adnate to it, erect or divaricating, somewhat (1½ ×) longer than the sporocarp, the apex adnate to the whole base of it. Sporocarps 3—4 (rarely more) to a leaf, horizontal with regard to the pedicels, a little longer than broad, 3—4 mm. long, truncate at the base, rounded at the apex, with distinct border and ribs, when young tomentose with yellowish or brownish, smooth, silky hairs, at length glabrescent, with 2 basal teeth of which the upper is the longest and often sharp, the lower the smallest, often obscure; sori 10—12 in a sporocarp.

Forma typica. — *Br. India*.

**Var. Zollingeri:** Like the type but the leaflets entire, crenulate or crenate on the outer edge, and the basal teeth often nearly as long. — *Java?*

(4) **M. crenata, Pr.**, Copel., Philipp. Journ., IV<sup>c</sup>, 12; Pr., Rel. Haenk., I, tab. XII, fig. 13; *M. crenulata, Desv.*, Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 418; *M. minuta, L.*, Bk., Fern All., 140, p. p.; *M. Mearnsii, Christ*, Philipp. Journ., III<sup>c</sup>, 276; — var. *timorensis*, v. A. v. R., Bull. Btz., 1911, I, 14.

Leaflets entire or more or less crenate on the outer edge. Sporocarps 2 to a leaf but 1 of these sometimes abortive, neither bordered nor ribbed, smooth but with the side walls sometimes more or less bulged out at the centre. Otherwise like *M. minuta L.*

Forma typica. — *Philippines, New Guinea*.

**Var. timorensis:** Sporocarps 3—4 or more (rarely 2) to a leaf. — *Timor, Java*.



FAMILY XII. SALVINIACEAE.

## XII. SALVINIACEAE.

Small plants floating on the water. Rhizome elongate, provided with a single central stele. Leaves folded in the bud, simple or deeply 2-lobed. Fertile leaves or segments metamorphosed into globose or ellipsoidal, unilocular sporocarps; spores of 2 kinds, macrospores and microspores borne in separate sporocarps.

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### 97. SALVINIA, *Adanson*.

Sporocarps borne on the basal segment of the water-leaves, provided with a central, columnar placenta bearing the sporangia; microsporangia long-stalked, the stalk consisting of 1 row of cells; macrospores provided at the apex with 3 free lobes; microspores gathered together in a single mass.

Leaves borne in whorls of 3, of which 2 are normal, simple, floating leaves, and the 3rd, lower one (water-leaf), is metamorphosed into many long, root-like segments to replace the roots, which are wanting. — Engl. & Prantl, *Nat. Pfl.Fam.*, I<sup>4</sup>, fig. 210 A—B.

Chiefly tropical.

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(1) *S. natans*, *Hoffm.*, Bk., *Fern All.*, 135; Copel., *Philipp. Journ.*, IV<sup>c</sup>, 14; Corda, *Rhizos.*, tab. II, fig. 1—11; *S. verticillata*, *Rb.*, *Calc. Journ.*, 1845, tab. XVIII—XX; Griff., *Icon.*, II, tab. CXXIII—CXXVIII; *S. Sprengelii*, *Corda*, l. c., tab. II, fig. 12—23.

Rhizome brownish-pubescent. Leaves horizontal or nearly so, oblong, 9—12½ mm. long, about ½ as broad, rounded at both ends or cordate at the base; upper surface bright-green; veins oblique, 15—20 on each side of the costa, each with 6—8 tufts of minute bristles on the upper side; under surface brownish-pubescent. Sporocarps 4—8 in a cluster.

*Java* (abundant); *Br. India*, *China*, *Japan*, *North Asia*, *Europe*.

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## 98. AZOLLA, Lamarck.

Sporocarps in groups of 2—4, placed at the base of a rhizome branch, provided with a central, columnar placenta bearing the sporangia; microsporangia long-stalked, the stalk consisting of 2 rows of cells; macrospores provided at the apex with 3 or 9 air-filled floats; microspores united in several separate, roundish or ovate masses (massulae) each of which containing 4—8 spores.

Leaves very small, borne in 2 opposite rows, alternate, deeply 2-fid, nearly 2-foliate; lobes heteromorphous, the lower one submerged, the upper floating, having at the inner side a cavity which is provided with fine moniliform files. Fine roots borne on the under side of the rhizome. — Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, fig. 208, 212 A.

Tropical, subtropical and in temperate regions.

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### *Arrangement of the sections.*

- § 1. **RHIZOSPERMA.** Macrospores with 9 floats; massulae not glochidiate.  
 § 2. **EU-AZOLLA.** Macrospores with 3 floats; massulae glochidiate. — Engl. & Prantl, l. c., fig. 215 B. (Not in Malaya).

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### § 1. **RHIZOSPERMA.**

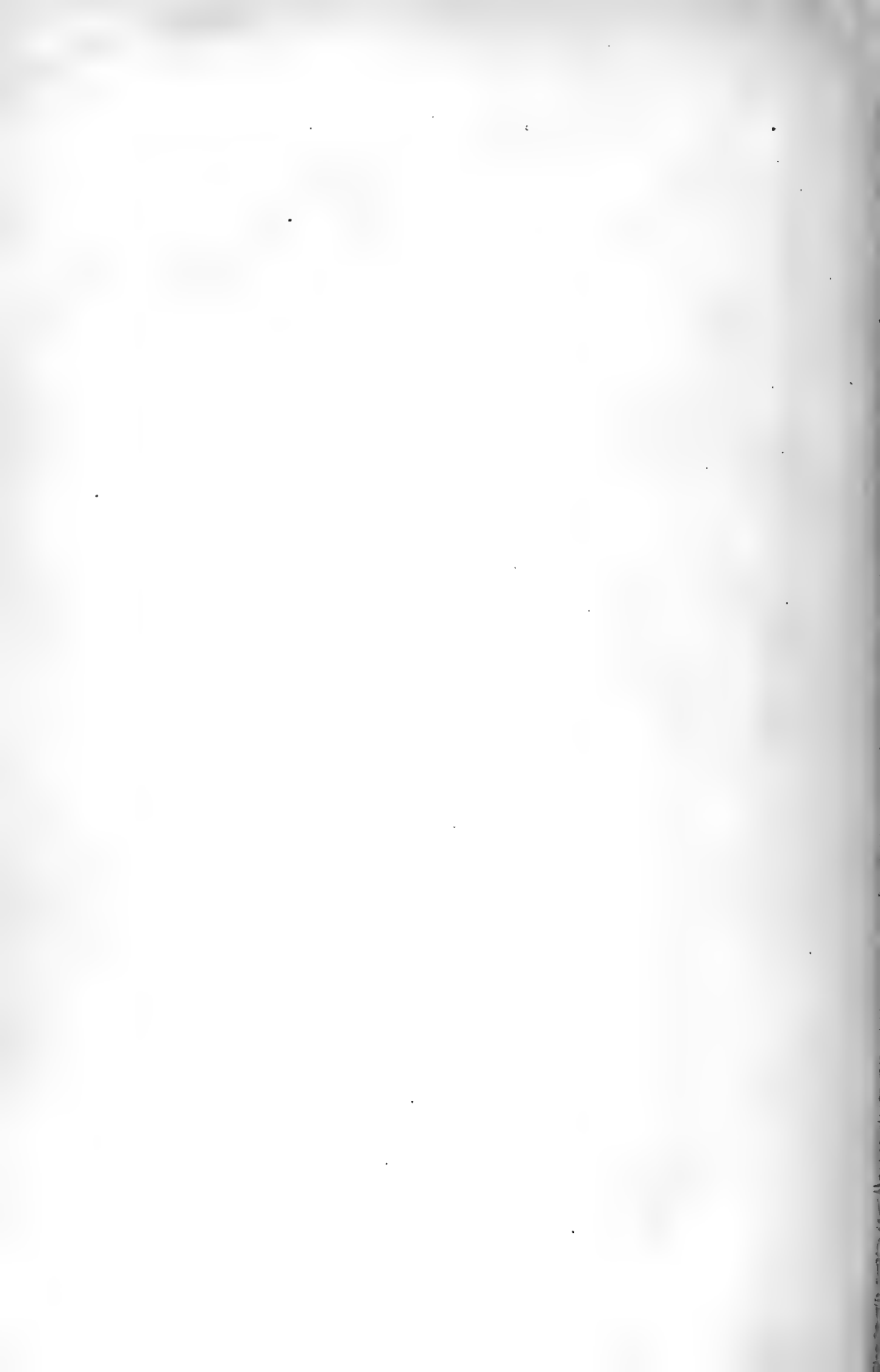
(1) **A. pinnata, R. Br.**, Bk., Fern All., 138; Flind., Voy., tab. X; — var. *africana*, Bk., l. c.; *A. africana*, Desv., Copel., Philipp. Journ., IVC, 14; *A. japonica*, Fr. & Sav., En. Jap., II, 195.

The whole plant oblong or deltoid in outline, 1½—2½ cm. long and broad, with regular, crowded branches; branches simple, or branched towards the tip; root-fibres fascicled and very feathery. Leaves red or green, with the lobes broadly ovate, at best a few mm. long.

Forma typica. — *Australia*.

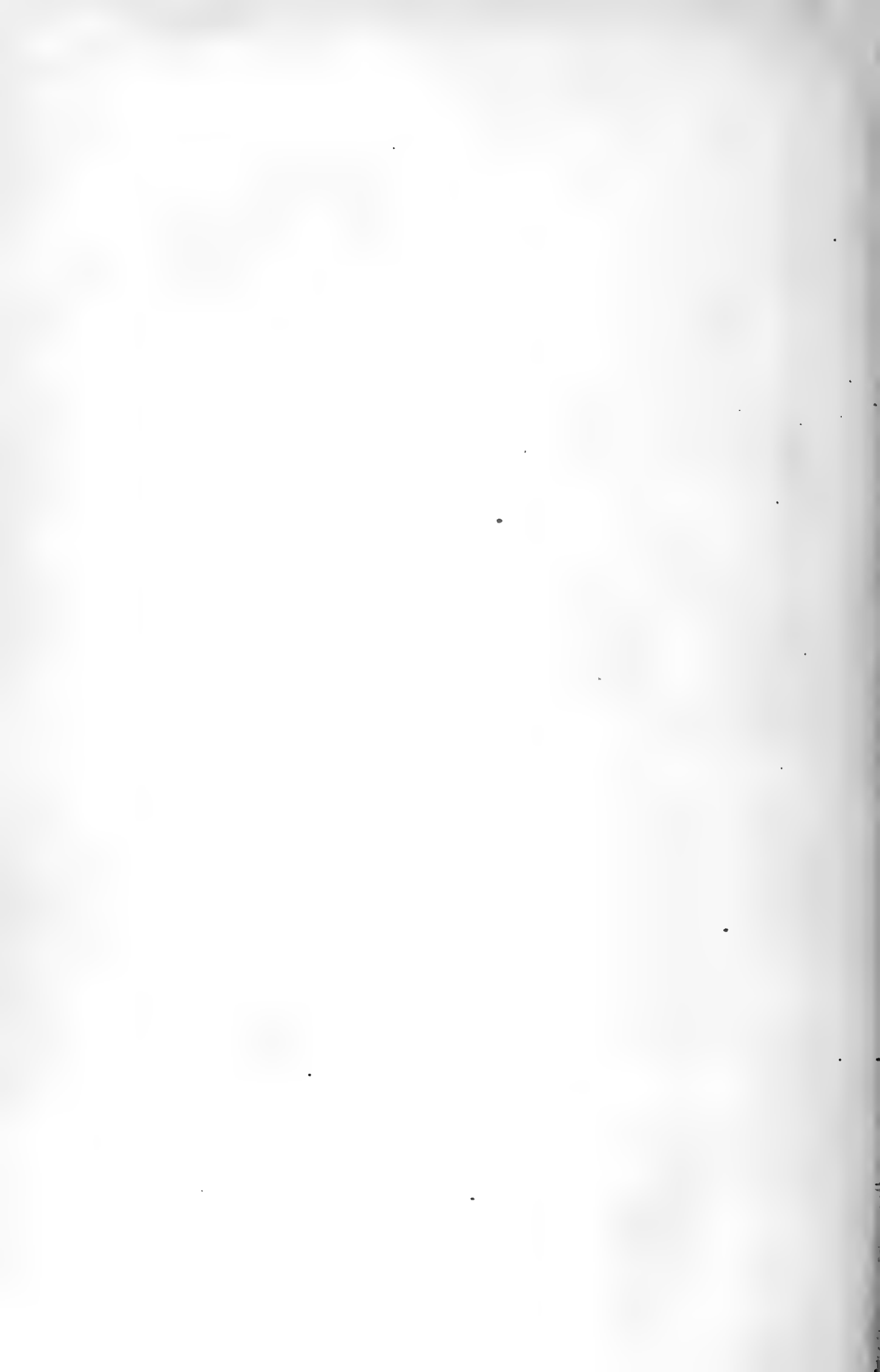
**Var. africana:** Plants smaller, 1 cm. long and broad, with rather irregular branches; root-fibres, at least usually, not feathery, not fascicled. — *Tropical Africa and Asia, Japan*.

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EQUISETINEAE.



FAMILY XIII. EUISETACEAE.

### XIII. EQUISETACEAE.

Terrestrial, rarely subaquatical. Stems originating from a true, subterraneous rhizome, elongate, articulate, mostly hollow, simple or branched, if branched, the branches usually placed in regular whorls at the bases of the internodations, longitudinally ribbed or striated at least when barren, the hollows closed over at the nodes; vascular bundles consisting of several free groups of tracheide bundles placed in a circle surrounding the central hollow, enclosed by a single or a double row, or an own row, of endodermal cells (which are recognizable in having the connecting walls provided with solitary, thickened points) <sup>(1)</sup>, surrounded by a circle of alternate, hollow tubes (vaseular canals). Leaves very small, whorled, laterally connected so as to form distinct, toothed, tubular or funnel-shaped sheaths enclosing the bases of the internodations of the stems and branches; sporophylla peltate, scale-like, forming terminal spikes, bearing 6—9 sporangia in a single row round the under side of the margin. Stomata on the leaves, and generally also on the stems and branches, arranged in 1 or more close lines forming 8—60 distant, longitudinal series. Spores of 1 kind, globose, provided with 4 relatively very long, filiform, cruciate, hygroscopic appendages (elaters) <sup>(2)</sup> which are clavate at the apex. — Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, fig. 321, 333, 343.

Cosmopolitan.

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#### 99. EQUISETUM, *Linneé*.

Characters those of the family.

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##### *Arrangement of the sections.*

§ 1. **HIPPOCHAETE.** Stomata with their aperture immersed beneath the epidermis, connected with an epidermal cavity recognizable by a

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(1) Visible by ca 200 times magnifying power. — Engl. & Prantl, l. c., fig. 327 A (e<sup>1</sup> & e<sup>2</sup>) and B (c).

(2) Stretched when dry, spirally involute when moist. — Engl. & Prantl, l. c., fig. 336 A.

roundish or suboblong, transversal, superficial pore. Tracheïde bundles enclosed by a common outer and a common inner endodermis (the inner endodermis sometimes wanting, but not in Malayan material). — Engl. & Prantl, l. c., fig. 329.

§ 2. **EU-EUISETUM.** Stomata with their aperture on the level of the epidermis, recognizable by a linear, longitudinal, superficial pore. Tracheïde bundles enclosed by a common outer endodermis, or rarely by an own endodermis. (Not in Malaya).

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§ 1. **HIPPOCHAETE.**

- *Ribs of the sheaths rounded.* (1) *E. ramosissimum.*
- \*\* *Ribs of the sheaths flattened, angular at the sides.* (2) *E. debile.*

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(1) ***E. ramosissimum, Desf.*** Milde, Mon. Eq., 428, tab. XXIV; Bk., Fern All., 4; *E. ramosum, Schleich.*, Schk., Krypt. Gew., I, tab. 172 b.

Barren and fertile stems alike, solitary to caespitose, varying from short to 3 m. or more long, 1—10 mm. diam., with a large central hollow ( $\frac{1}{2}$ — $\frac{2}{3}$  diam.), grooved, simple or irregularly branched; branches very different in length, few to numerous, simple or branched again; ribs 4—26, convex, narrower than the grooves, rough (transversely rugose or verrucose); grooves provided with 2 separate or contiguous series of stomata (each series consisting of 1—4 lines of pores). Sheaths loose, distinctly funnel-shaped, relatively long, the teeth deciduous, with a persistent, generally triangular-oblong base, the mouth of the sheaths therefore finally commonly toothed; ribs convex at least in the upper part, often striated with 1 or more fine and shallow furrows, the base passing gradually into a rib of the stem. Spikes to 2½ cm. long, acute or apiculate.

*Nearly cosmopolitan.*

(2) ***E. debile, Bb.*** Milde, Mon. Eq., 476, tab. XXVI; Bk., Fern All., 5; *E. Timoriamum, Vauch.*, Mon. Prél., 376, tab. X.

Barren and fertile stems alike, solitary to caespitose, varying from short to long, usually under 1½ m., rarely to 9 m. long, 2—15 mm. or more diam., with a large central hollow ( $\frac{1}{3}$  or more diam.), grooved,

simple or irregularly branched; branches solitary or in groups of 2—3, rarely 4—5, simple or slightly branched again; ribs 6—30 or more, convex, not rarely much narrower than the grooves, smooth or roughish (transversely and finely rugulose or furnished with a row of very minute pustules); grooves provided with 2 separate series of stomata (each series consisting of 1 line of pores). Sheaths often tight and tubular, or somewhat funnel-shaped, short or more or less elongated, the teeth persistent, or deciduous with a persistent, truncate, rounded or triangular base and then the mouth of the sheaths finally subentire, repand or serrate; ribs rather flattened at least towards the apex, angular and often acutely margined on each side, provided with a vaulted, prominent central ridge passing gradually into a rib of the stem in the lower part and disappearing towards the apex. Spikes to 2½ cm. long, acute or apiculate.

*Br. India and Ceylon eastwards to Fiji.*

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LYCOPODIINEAE.





FAMILY XIV. PSILOTACEAE.



#### XIV. PSILOTACEAE.

Terrestrial or epiphytical. Rhizome creeping, branched, the branches upcurved, sometimes terminating into foliate shoots. Shoots elongate, erect or pendulous, foliate, simple or more or less dichotomously branched, the stem traversed by free or united tracheide bundles. Leaves small, approximate or distant, heteromorphous, the barren ones simple; sporophylla 2-foliate or deeply 2-dentate. Sporangia placed singly in the axils of the sporophylla, 2—3-locular; spores of 1 kind, bilateral, i. e. bean-shaped or reniform.

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##### 100. *TMESIPTERIS*, *Bernhard*.

Sporangia longitudinally oblong, 2-locular, 2-lobate, with the septum across the slightly contracted narrow diameter.

Stems usually simple, terete or subterete, somewhat angled; tracheide bundles 3—5 or more, isolated or united in groups, the groups free, often circularly or radially arranged, enclosed in a tube consisting of 1 or more layers of red-brown cells. Leaves small, moderately loose, entire, sessile; sporophylla smaller, stalked, 2-foliate, forming terminal spikes or arranged down the stem or branches. — Engl. & Prantl, *Nat. Pfl.Fam.*, I<sup>4</sup>, fig. 381, 383 B.

Chiefly Australian.

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(1) *Tm. tannensis*, *Bernh.*, Bk., *Fern All.*, 30; Bau. & Hk., *Gen. Fil.*, tab. LXXXVI.

Shoots 7½—60 cm. long, the stem slender, nudate towards the base. Leaves lanceolate-oblong, 1¼—3 cm. long, to 1 cm. broad, obtuse or apiculate, with a distinct midrib and decurrent base. Sporophylla 2-foliate, the leaflets similar to the barren leaves but smaller.

*Philippines, New Guinea to Polynesia, New Zealand, Australia.*

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## 101. PSILOTUM, Swartz.

Sporangia globoso-triangular, 3-locular, 3-lobed, much larger than the sporophylla.

Stems flattened or angular, mostly copiously dichotomous in the upper half; tracheide bundles united in a single, irregularly stellate, 3—10-radiate group. Leaves minute, rather rudimentary, sessile, remote, triangular, arranged in 2—3 rows; sporophylla as large as the barren leaves, sessile, adnate, deeply and acutely 2-lobate-dentate, arranged all down the branches. — Engl. & Prantl, Nat. Ffl.Fam., I<sup>4</sup>, fig. 382, 383 A.

Chiefly tropical and subtropical.

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- \* *Stem and branches flattened; leaves in 2 rows.* (1) *Ps. complanatum*.
  - \*\* *Stem and branches triquetrous; leaves in 3 rows.* (2) *Ps. triquetrum*.
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(1) **Ps. complanatum**, Sw., Syn., 188, 414, tab. IV, fig. 5; Bk., Fern All., 30; Schk., Krypt. Gew., I, tab. 165 *b*; *Ps. Zollingeri*, Ces., Fel. di Bor., 36; — var. *flaccidum*; *Ps. flaccidum*, Wall.

Whole plant about 15—60 cm. long, pendulous, laxly branched, the ultimate branchlets flat, 2—4 mm. broad, and the leaves and sporangia arranged distichously.

**Var. flaccidum:** Branchlets broader.

*Tropical and subtropical.*

(2) **Ps. triquetrum**, Sw., Syn., 117; Bk., Fern All., 30; Schk., Krypt. Gew., I, tab. 165 *b*; Bau. & Hk., Gen. Fil., tab. LXXXVII; Hk., Fil. Exot., tab. LXIII; — var. *capillare*; *Ps. capillare*, Bl.

Whole plant about 15—60 cm. long, erect or nutant, many times dichotomously forked; branches triquetrous, the ultimate branchlets  $\frac{1}{2}$ — $1\frac{1}{2}$  mm. thick, and the leaves and sporangia placed on the angles of the branches.

**Var. capillare:** Branchlets fine, indistinctly triquetrous.

*Tropical and extra-tropical.*

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FAMILY XV. LYCOPODIACEAE.



## XV. LYCOPODIACEAE.

Terrestrial or epiphytical, rarely subaquatical. Primary axis (main stem, rhizome) short or elongate, rarely tuberous. Leaves simple, mostly small, rarely long-subulate, approximate or remote, not laterally connected, rarely tufted at the base of a short, unbranched, naked stem. Sporophylla consisting of unaltered leaves all down the stem and branches or more or less modified and aggregated in dense, terminal or rarely lateral spikes; sporangia 1-locular, 2-valved, placed singly in the axils of the sporophylla; spores of 1 kind, rarely 2-lateral, mostly globoso-tetrahedral, with the upper part broadly trigono-pyramidal with 3 ribs radiating from the apex and the lower part rounded and punctulate, foveolate, aculeate or reticulate.

### 102. LYCOPIDIUM, *Linné.*

Main stem not tuberous; secondary axes (stems, shoots) elongate, erect, ascending, scandent or pendulous, mostly branched; steles solitary, central, composed of few to many regularly or irregularly arranged, free or connected groups of tracheide bundles. Leaves not placed in a basal tuft, mostly occupying both stem and branches, sometimes more or less wanting in the older portions of the shoots, mostly multifarious (i. e. isomorphous and placed in more or less dense whorls or spirals), sometimes quadrifarious (i. e. isomorphous and arranged in 4 rectangularly decussate rows), rarely platystichous (i. e. heteromorphous and placed in 4—6 rows with those of the lateral rows more or less broadly spreading or erectopatent and those of the dorsal and [or] ventral rows smaller, linear, more or less adpressed, so as to form rather flattened or bilateral stems and branches). — Engl. & Prantl, *Nat. Pfl.Fam.*, I<sup>4</sup>, fig. 365, 368, 371.

♣ Cosmopolitan, except in large, dry, sandy or rocky regions.

#### *Arrangement of the sections and groups.*

- §. 1. **UROSTACHYS.** Monopodially branched main stem wanting, the shoots solitary or fascicled, dichotomous (i. e. 2-furcate, with the branches

simple or one or more times similarly forked again), rarely simple; sporophylla forming terminal spikes or the sporangia placed in the axils of unaltered leaves all down the stem or branches; spores foveolate or punctulate. — Engl. & Prantl, l. c., fig. 371 C—D.

a. **Selago.** Both barren leaves and sporophylla isomorphous or nearly so, if heteromorphous, then the latter forming terminal spikes and the barren region passing very gradually into the fertile spikes, with the intermedial zone much more than 2 cm. long.

1. **Euselago.** Sporangia placed in the axils of unaltered leaves all down the stem or branches, if aggregated in terminal spikes, then the sporophylla not or hardly different in shape from the barren leaves, though sometimes smaller. — Engl. & Prantl, l. c., fig. 372—374.

2. **Subselago.** Sporangia aggregated in terminal spikes, the higher sporophylla different from, and commonly much smaller than, the barren leaves, or distinctly ventricose and dilated at the base; lower sporophylla similar to the barren leaves. — Engl. & Prantl, l. c., fig. 375.

b. **Phlegmaria.** Both barren leaves and sporophylla conspicuously heteromorphous, the latter forming terminal spikes and the barren region narrowed more or less abruptly into the fertile spikes, with the intermedial zone very rarely more than 2 cm. long. — Engl. & Prantl, l. c., fig. 377.

1. **Phlegmariopsis.** Barren region not abruptly narrowed into the fertile spikes.

2. **Euphlegmaria.** Barren region rather abruptly narrowed into the fertile spikes.

§ 2. **RHOPALOSTACHYS.** Monopodially branched main stem present, the branches remote, alternate, rarely simple, often compound, with the spikes terminal or lateral, or the main stem simple, with the spikes lateral; spores reticulate or aculeate. — Engl. & Prantl, l. c., fig. 371 A—B & E—H.

a. **Lepidotis.** At least the branchlets radially organized, with the barren leaves isomorphous, regularly polystichous.

1. **Lateralia.** Caudex (main stem) erect, at best creeping at the base, simple or branched; spikes lateral on the stem or branches. (Not in Malaya).



2. **Inundata.** Rhizome (main stem) short-trailing, branched; branches few, trailing, rooting; spikes lateral on the stem or branches. (Not in Malaya).
3. **Clavata.** Rhizome (main stem) wide-trailing, branched; branches several, ascending, not tree-like, nor scandent; spikes terminal on the branchlets.
4. **Cernua.** Rhizome (main stem) wide-trailing <sup>(1)</sup>; shoots several, erect with tree-like habit or scandent; spikes terminal on the branchlets, or forming compound panicles separate from the barren branches.
- b. **Diphasium.** At least the branchlets dorsiventral or complanato-bilateral, with the barren leaves heteromorphous, secund or platystichous.

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### § 1. UROSTACHYS.

#### a. **Selago.** 1. **Euselago.**

1. *Leaves serrulate or denticulate, at least towards the apex.*
  - a. *Leaves narrowed towards the base.*
    - b. *Texture not rigid.* (1) L. serratum.
    - b.b. *Texture rigid.*
      - c. *Leaves deflexed, to 1¼ mm. broad.* (2) L. goliathense.
      - c.c. *Leaves not deflexed, or more than 1½ mm. broad.* (3) L. Beccarii.
  - a.a. *Leaves not or hardly narrowed towards the base.* (4) L. miniatum.
- 1.1. *Leaves quite entire, at best obsoletely serrulate.*
  2. *Leaves obtuse.* (5) L. Hamiltonii.
  - 2.2. *Leaves not obtuse.*
    3. *Leaves under 10 mm. long.*
      4. *Leaves ascending.*
        5. *Leaves lax.* (6) L. Macgregorii.
        - 5.5. *Leaves dense.*

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(1) Generally wanting in the herbaria.

- †. Leaves rather capillary, to  $\frac{1}{2}$  mm. broad.  
(7) *L. verticillatum*.
- †.†. Leaves not capillary,  $\frac{1}{2}$  mm. or more broad.  
O. Leaves 3—4-farious, coriaceous.  
(8) *L. bolanicum*.  
O.O. Leaves 6—10-farious, or not coriaceous.  
(9) *L. setaceum*.
- 4.4. Leaves spreading or deflexed, the higher not rarely ascending.
5. Plants to 15 cm. long, the leaves to  $\frac{1}{2}$  mm. broad.  
(10) *L. Zollingeri*.  
(11) *L. Everettii*.
- 5.5. Plants more than 15 cm. long, or the leaves more than  $\frac{1}{2}$  mm. broad.  
6. Leaves entire,  $\frac{1}{2}$ —1 mm. broad at the base.  
(12) *L. australianum*.
- 6.6. Leaves often obsolete serrulate towards the apex, or more than 1 mm. broad.  
(4) *L. miniatum*.  
(13) *L. hippuris*.
- 3.3. Leaves 10—20 mm. long.  
(14) *L. caudifolium*.
- 3.3.3. Leaves 20—50 mm. long.

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(1) ***L. serratum***, *Thb.*, Spring, Mon., I, 39; Rac., Flor. Btz., I, 238; Hk. & Grev., Ic. Fil., tab. XXXVII; *L. javanicum*, *Sw.*, Spring, l. c., 40; *L. reflexum*, *Schk.*, Krypt. Gew., I, tab. 159.

Shoots erect, or ascending from a decumbent base, varying from simple to copiously dichotomous, 15—40 cm. long,  $1\frac{1}{4}$ —6 cm. diam. including the leaves, often bearing prolific buds near the apex. Leaves laxly disposed, spreading or deflexed, moderately thin, sessile or sub-petiolate, often very irregular in size but not in shape, lanceolate, to 3 cm. long and 4 mm. broad, acute or minutely apiculate, narrowed gradually to the base, the edge eroso-denticulate at least towards the apex, the midrib distinct, prominent. Sporangia in the axils of unaltered leaves all down the stem or branches. — Two distinct forms united by intermediates.

Forma typica: Leaves serrated throughout or nearly so.

Forma subintegerrima: Leaves serrated at the apex only, for the rest entire or obsoletely repand.

*Japan, China, North India, Trop. Asia, Polynesia, Sandwich Islands, Trop. America.*

(2) **L. gollathense**, *v. A. v. R.*, Bull. Btz., 1912, VII, 29.

Shoots erect, usually 2—3 times forked, 20 cm. long, 5—10 mm. diam. including the leaves, the stem opaque, wiry, the branches not rarely provided with prolific buds near the apex. Leaves crowded, 6—8-farious, reflexed, decurrent upon the stem, rigidly aceroso-coriaceous, fragile when dry, glossy, oblanceolate-ligulate, 4—7 mm. long and 1—1¼ mm. broad, acute or very minutely apiculate, very minutely serrulate, entire and somewhat narrowed towards the base, the midrib hidden. Sporangia in the axils of unaltered leaves all down the branches.

*New Guinea.*

(3) **L. Beccarii**, *v. A. v. R.*, Bull. Btz., 1912, VII, 29; *L. minutum*, *Bk.* (not *Spring*), Journ. of Bot., XVIII, 217.

Shoots erect, forked, to 30 cm. or more long, 1¼—1¾ cm. diam. including the leaves, provided with prolific buds near the apex. Leaves moderately dense, 6—8-farious, decurrent, horizontal, at best the lower reflexed, the higher more ascending, rigidly coriaceous, oblanceolate-ligulate, about 5—8 mm. long and 1½—2 mm. broad, acute or minutely apiculate, suberoso-denticulate, entire and narrowed towards the base, the midrib rather hidden. Sporangia in the axils of unaltered leaves all down the stem or branches.

*Sumatra.*

(4) **L. minutum**, *Spring*, Mon., I, 28; *Rac.*, Flor. Btz., I, 237; *L. rigidum*, *Bl.*, Enum., 271.

Shoots erect, simple or dichotomous, 20—50 cm. long, 1¼ cm. diam. including the leaves, often bearing prolific buds, the stem varying from green to bright-red. Leaves moderately dense but less so in the lower part, 6—8-farious, green or red, cartilagineous, reflexed or the higher more spreading, linear-lanceolate, about 6—9 mm. long, 1½ mm. broad and decurrent at the base, narrowed gradually to the acute or minutely mucronate apex, the edge entire, or obsoletely to very minutely

serrulate towards the apex, the midrib rather hidden. Sporangia in the axils of unaltered leaves all down the stem or branches.

*Java.*

(5) **L. Hamiltonii**, *Spring*, Mon., I, 35; Bk., Fern All., 10; *L. aloifolium*, *Wall.*, Spring, l. c., 36; Hk. & Grev., Ic. Fil., tab. CCXXXIII.

Shoots densely tufted, suberect, 2—4 times dichotomous, about 10—30 cm. long, 1¼—2½ cm. diam. including the leaves, the stem stout, woody. Leaves irregularly spreading, 5-farious, subcoriaceous, linear, oblong or linear-oblong, 6—12 mm. long, 2—4 mm. broad, obtuse, narrowed towards both ends, with a distinct midrib. Sporangia in the axils of unaltered leaves in the upper part of the stem. — *L. aloifolium* *Wall.* is a form with moderately thin leaves and a rather indistinct midrib.

*Java* (t. Warb.); *Ceylon*, *Br. India*, *Western China*.

(6) **L. Macgregorii**, *Bk.*, Journ. of Bot., XXVIII, 109.

Shoots pendulous, slender, copiously dichotomously branched, 30 cm. or more long. Leaves lax, ascending, lanceolate, 4 mm. long, acute, moderately firm, bright-green. Sporangia placed in the axils of the unaltered upper leaves.

*New Guinea.*

(7) **L. verticillatum**, *L.f.*, Spring, Mon., I, 46; Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, fig. 373 A—C; *L. setaceum*, *Lam.* (not *Hamilt.*), Rac., Flor. Btz., I, 239.

Shoots pendulous, several times dichotomously branched, about 15—60 cm. long, 4—10 mm. diam. including the leaves, the stem slender. Leaves ascending, dense, 4—8-farious, linear, subcapillary, 4—9 mm. long, at best ½ mm. broad, decurrent at the base, entire, no distinct midrib. Sporangia in the axils of unaltered leaves of the branches and branchlets. — Variable, with forms approaching *L. hippuris* *Desv.*

*Java and Borneo to Polynesia*, *Trop. America*, *South and East Africa*, *Mascarenes*.

(8) **L. bolanicum**, *Rst.*, in Fed., Rep., XII, 181.

Shoots pendulous, 2—3 times dichotomous, the branches 5—20 cm. long, 1 cm. diam. Leaves moderately crowded, 3—4-farious, ascending, linear-lanceolate, 6 mm. long by ¾ mm. broad, coriaceous, shortly

acuminate, entire, not keeled. Sporophylla similar, but a little dilated at the base.

*New Guinea.*

(9) **L. setaceum, Hamilt.**, Spring, Mon., I, 42; *L. subulifolium*, Wall., Hk. & Grev., Ic. Fil., tab. II.

Shoots pendulous, several times dichotomously branched, 10—50 cm. long, 5—10 mm. diam. including the leaves. Leaves ascending, crowded, 8—10-farious, linear-subulate, 5—10 mm. long,  $\frac{3}{4}$ — $1\frac{1}{4}$  mm. broad at the base, fine at the point, entire, subrevolute at the margin, decurrent upon the stem, with a decurrent midrib. Sporangia in the axils of unaltered leaves of the branches and branchlets.

*Borneo, Java; Ceylon, Br. India.*

(10) **L. Zollingeri, Hert.**, in Engl. Bot. Jahrb., XLIII, Beibl. 98, 48; *L. reflexum*, Lam., Rac., Flor. Btz., I, 238, p. p.

Shoots partly erect, partly (to 8 cm.) pendulous, to 12 cm. long, simple or once forked, ca 10 mm. diam. including the leaves. Leaves filiform, up to 6 mm. long, to  $\frac{1}{3}$  mm. broad, thin, horizontally spreading or incurved, deflexed at the base.

*Java.*

(11) **L. Everetti, Hert.**, in Engl. Bot. Jahrb., XLIII, Beibl. 98, 43; *L. reflexum*, Lam., Rac., Flor. Btz., I, 238, p. p.

Near *L. Zollingeri Hert.* — Shoots erect, repeatedly dichotomous. Leaves ascending, spreading or decurved, not incurved, up to 8 mm. long, about  $\frac{1}{2}$  mm. broad. — I cannot distinguish this and the preceding from the younger forms of the following, and plants gathered in Java (Burck) and Sumatra (Beccari No. 413) agree with this except that the leaves are to  $\frac{2}{3}$  mm. broad.

*Celebes, Java (?), Sumatra (?)*.

(12) **L. australianum, Hert.**, in Engl. Bot. Jahrb., XLIII, Beibl. 98, 42; *L. reflexum*, Lam., Rac., Flor. Btz., I, 238, p. p.

Shoots erect or ascending (always?), ca 15—60 cm. long, 2—4 times forked, the lower part 10—20 mm. diam. including the leaves, the ultimate, fertile branches elongated, nutant or jacent, 4—9 mm. diam.; prolific buds present. Leaves crowded, 8-farious, coriaceous, the higher

gradually ascending, the central spreading, linear-subulate, to 9 mm. long, 1 mm. broad at the base, shortly acuminate, entire, involute, the point often red, the lower larger, spreading or decurved, elliptical, not acuminate.

*Sumatra, Java, Borneo, Celebes; Australia, New Zealand.*

(13) **L. hippuris**, *Desc.*, Spring, Mon., I, 44; *L. dichotomum*, *Bl.*, Enum., 71; *L. Blumeanum*, *d. Vr.*, in Tijdschr. Nat. Gesch., 1844, 338; *L. squarrosum*, *Forst.*, *Rac.*, Flor. Btz., I, 240, p. p.

Shoots pendulous, or erect with nutant branches, simple or repeatedly dichotomous, 30—60 cm. long, 1½—3 cm. diam. including the leaves. Leaves 8-farious (arranged in alternate spurious whorls of 4), spreading, often thin, the lower often deflexed, the higher gradually ascending, subulate-lanceolate, straight or subfalcate, about 10—20 mm. long, 1½ mm. broad above the base, acute, entire, the edge often subrevolute towards the apex when dry, the costa hidden or obscurely prominent beneath and sulcate above, the base decurrent, the decurrent portion flat or provided with a few slightly prominent crest-like longitudinal rumples. Sporophylla similar in shape to the barren leaves, as long as these or the higher growing gradually smaller.

*Java and the Philippines to Samoa.*

(14) **L. caudifolium**, *v. A. v. R.*, Bull. Btz., 1911, I, 14.

Shoots pendulous, to 60 cm. or more long, simple or once forked, the lower part 2½—5 cm. diam. including the leaves, the upper part passing very gradually into the fertile spikes. Leaves erecto-patent, moderately close, 4—6-farious, firm but not rigid, about 2½—5 cm. long, with a distinct midrib, the lower part lanceolate-ovate, narrowed very gradually into the caudate-acuminate, filiform-subulate upper part, the base rounded, 4—6 mm. broad, the margin entire, involute but more conspicuously in the upper part. Spikes 1½—3 cm. diam. including the sporophylla; sporophylla similar to the barren leaves but smaller, 1½—3 cm. long, 3—5 mm. broad at the base.

*Borneo.*

a. **Selago.** 2. **Subselago.**

1. *Leaves to 15 mm. long; spikes to 5 mm. diam.*

2. *Leaves 4-farious.*

(15) *L. tetrastichum.*

**2.2.** Leaves 6—∞-farious (<sup>1</sup>).

**3.** Leaves 6—8 mm. long, mostly rigid.

•. Leaves canaliculate (involut-conduplicate). (16) *L. laxum*.

\*. Leaves flattened. (17) *L. günturense*.

**3.3.** Leaves 10—15 mm. long, thin to moderately firm.

**4.** Leaves ascending.

**5.** Leaves about 1—1¼ mm. broad. (18) *L. carinatum*.

**5.5.** Leaves about 1½—2 mm. broad. (19) *L. proliferum*.

**4.4.** Leaves horizontal or spreading. (20) *L. ulicifolium*.

**1.1.** Leaves 15—25 mm. or more long; spikes 7½—15 mm. diam.

(21) *L. Dalhousianum*.

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(15) ***L. tetrastrichum***, *Kae*; ? *L. carinatum*, *Desv.*, var. *laxum*, *Christ*, *Fil. Saras.*, IV, 447; *L. Sarasinorum*, *Christ*, l. c., I, 34; II, 217, tab. II, fig. 11—12.

Shoots pendulous, 40—60 long, mostly once or twice forked, the stem and branches square, 4—6 mm. diam. including the leaves. Leaves 4-farious, ascending, close, 5—8 mm. long, conduplicate, 3—4 mm. broad when flattened, acute, entire, firm but not rigid, broadly decurrent, with a decurrent keel. Spikes double, square, 5—20 mm. long, 2—3 mm. diam.; sporophylla triangular-ovate, acuminate, keeled, about ½ as long as, and relatively broader than, the barren leaves. — The description is taken from specimens occurring in the Buitenzorg Herbarium, the original diagnosis being unavailable to me.

*British India to Polynesia.*

(16) ***L. laxum***, *Spring*, *Mon.*, I, 60; *L. carinatum*, *Desv.*, *Rac.*, *Flor. Btz.*, I, 239, p. p.

Shoots pendulous, 35—100 cm. long, often 2—3 times dichotomously branched, the stem and branches 4—6 mm. diam. including the leaves. Leaves much ascending, 6—9-farious (arranged in spurious whorls of 3), imbricate, rigid, acerose, subulate, 6—8 mm. long, 1¼—2 mm. broad at the base, acute, entire, canaliculate-conduplicate above, distinctly keeled or costate beneath, the very base slightly narrowed, decurrent. Spikes

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(<sup>1</sup>) See also (24) ***L. squarrosus*** *Forst.* and (29) ***L. pinifolium*** *Bl.*

long, cylindrical or 4—8-angular, 2½—3 mm. diam.; sporophylla ovate, about ½ as long as the leaves, relatively broad, subacuminate or apiculate, rigid, keeled. — Related to *L. tetrastichum* *Kze* and *L. carinatum* *Desc.* but positively distinct.

*Br. India to Polynesia and Queensland.*

(17) ***L. guntureense*, v. A. v. R.**, Bull. Btz., 1911, I, 14.

Like *L. laxum* *Spring*, but the shoots 10 mm. diam. near the base, the branchlets 5 mm. diam. including the leaves, the leaves not canaliculate, flattened, the largest 1 mm. broad, keeled near the base only, the lower spreading, the higher ascending.

*Java.*

(18) ***L. carinatum*, Desc.** *Spring*, Mon., I, 59; *Rac.*, Flor. Btz., I, 239, p. p.; *L. flagellaria*, *Bory*, in *Freye.*, Voy. Ur. Phys., Bot., I, tab. XXVI; *L. acrostachyum*, *Wall.*, Hk. & *Grev.*, Ic. Fil., tab. CLXXXI.

Shoots pendulous, 20—80 cm. long, 2—3 times dichotomous, the branches 7—15 mm. diam. including the leaves. Leaves 6—8-farious, ascending, moderately close, lanceolate-subulate, 10—15 mm. long, 1—1¼ mm. broad, acute, firm, not rigid, entire, decurrent, distinctly costate or keeled, flat to conduplicate. Spikes long, 2½ mm. or more diam.; sporophylla ovate, acuminate, rigid, rather adpressed, about ½ as long as, and broader than, the barren leaves, sharply keeled. — Variable.

*Trop. Asia to Polynesia.*

(19) ***L. proliferum*, Bl.**, *Spring*, Mon., I, 34; *L. squarrosum*, *Forst.*, *Rac.*, Flor. Btz., I, 240, p. p.

Shoots pendulous, once or twice dichotomously branched, 15—45 cm. long, 2½ cm. diam. including the leaves. Leaves ascending, crowded, 6-farious (arranged in alternate spurious whorls of 3), thin or weak, linear-lanceolate, 10—15 mm. long, acute, entire, subrevolute at the edge, the costa obscurely prominent above or beneath, grooved on the other side, the base decurrent, the decurrent portion provided with a slender keel-like crest, the higher leaves growing gradually shorter; sporophylla about ½ as long as the barren leaves, similar to the barren leaves (conf. *Spring*), or ovate-lanceolate (conf. *Blume*). — Specimens received on loan from the Leiden Herbarium, gathered in Java (by *Blume*), have the shoots to 80 cm. long, the leaves 1½—2 mm. broad at the base, the



fertile spikes to 40 cm. long, simple or dichotomous, the lower sporophylla similar to the higher barren leaves, the following sporophylla passing gradually into the higher which are suberect, triangular-ovate, acuminate, hardly keeled, varying from  $\frac{1}{3}$ — $\frac{1}{2}$  as long as the barren leaves. — The specimen occurring in the Paris Herbarium, on which Spring based his diagnosis, may probably be an undeveloped plant, and a plant gathered in Java (by Backer) has the shoots repeatedly dichotomous with numerous (about 40—60) ultimate fertile branchlets.

*Java; Ceylon.*

(20) **L. ulicifolium**, *Vent.*, Spring, Mon., I, 50; Hk., Fil. Exot., tab. XXIII; *L. Hookeri*, *Wall.*, Hk. & Grev., Ic. Fil., tab. CLXXXV; *L. squarrosus*, *Forst.*, Bk., Fern All., 18, p. p.

Shoots 1—3 times dichotomously branched, about  $2\frac{1}{2}$ —3 cm. diam. including the leaves. Leaves crowded, spreading, the lower 8-farious, the higher gradually ascending and growing shorter, 4-farious, firm in texture, subulate-lanceolate, straight or falcate,  $12\frac{1}{2}$ —15 mm. long,  $1\frac{1}{2}$  mm. broad above the base, entire, acute, the base narrowed, decurrent, the decurrent portion strongly and sharply keeled in dried material. Spikes 5 mm. diam.; sporophylla suberect, subulate, dilated at the base, the lower passing gradually into the higher barren leaves. — *L. epicifolium* *Desv.*, from Madagascar, which is probably identical with this, is said to have the keel deeply grooved. — Differs from the intermedial forms between *L. hippuris* *Desv.* and *L. squarrosus* *Forst.* by the conspicuously prominent decurrent keel.

*Malayan; Br. Indian and East African.*

(21) **L. Dalhousianum**, *Spring*, Mon., II, 25; Bk., Fern All., 18; *L. glaucum*, *Ces.*, Fel. di Bor., 35 (t. Bk.).

Shoots robust, pendulous, about 45—100 cm. long, the stem  $2\frac{1}{2}$  cm. diam. including the leaves, the branches more slender. Leaves crowded, 6-farious (arranged in alternate spurious whorls of 3), ascending, glaucous-green, very rigidly coriaceous, acerose, more or less incurved, lanceolate-subulate, 15—25 mm. long, 3—4 mm. broad near the base, canalliculate above, the edges conspicuously involute (in dried material), the midrib prominent above, grooved beneath, the base rather rounded. Spikes simple or forked, to 60 cm. long,  $7\frac{1}{2}$ — $12\frac{1}{2}$  mm. or more diam. including the sporophylla; sporophylla crowded, ascending, more or less incurved,

ovate or ovate-lanceolate, about  $\frac{1}{2}$  as long as the barren leaves or shorter, relatively broad, acuminate.

*Malacca, Lingga Islands, Borneo, New Guinea.*

b. **Phlegmaria.** 1. **Phlegmariopsis.**

- 1.** *Leaves under  $4\frac{1}{2}$  mm. long.* (22) *L. flagellaceum.*
- 1.1.** *Leaves more than  $4\frac{1}{2}$  mm. long.*
- 2.** *Sporophylla suberect, subsubulate, proportionally long and narrow.*
- 3.** *Spikes 4—6 mm. diam.*
- 4.** *Leaves  $7\frac{1}{2}$ —10 mm. long, 2—3 mm. broad.* (23) *L. Lauterbachii.*
- 4.4.** *Leaves 10—20 mm. long, or 1—2 mm. broad.* (24) *L. squarrosium.*
- 3.3.** *Spikes 7—9 mm. diam.* (25) *L. Magnusianum.*
- 2.2.** *Sporophylla spreading, subtriangular, proportionally short and broad.* (26) *L. rupicolum.*

(22) **L. flagellaceum**, *Kuhn*, *Forsch. Gaz.*, IV, Farne.

Shoots pendulous, pale-green, about 16 cm. long, dichotomous towards the base, equally trichotomous towards the apex, the stem copiously grooved in the lower part. Leaves minute, ascending, sessile, thick, the lower 12-farious, linear-lanceolate, 2—3 mm. long, acute, entire, slightly narrowed at the base, the higher 6-farious, passing gradually into the sporophylla. Spikes square, dichotomous, to 3 cm. long; sporophylla ovate-lanceolate, about  $\frac{1}{4}$ — $\frac{1}{3}$  as long as the leaves, keeled.

*New Guinea.*

(23) **L. Lauterbachii**, *Pritz.*, in *Schum. & Laut., Flor. deut. Sch.geb.*, 149.

Shoots simple or 1—2 times dichotomously branched, pendulous, to 30 cm. or more long, the branches  $1\frac{1}{2}$ — $1\frac{3}{4}$  cm. diam. including the leaves. Leaves crowded, 6—8-farious, horizontally spreading, rigid, ovate-subulate,  $7\frac{1}{2}$ —10 mm. long, 2—3 mm. broad near the base, entire, acute, the edge somewhat revolute, the base rounded or rather abruptly

rotundate-truncate. Sporophylla  $\frac{1}{2}$  as long, subulate, when young adpressed, forming a single spike 4 mm. diam. — Readily distinguished from *L. squarrosum* *Forst.* by its relatively shorter and broader leaves.

*New Guinea.*

(24) ***L. squarrosum*, Forst.**, Spring, Mon., I, 52; Rac., Flor. Btz., I, 240, p. p.; Pritz., in Engl. & Prantl., Nat. Pfl.Fam., I<sup>4</sup>, fig. 376.

Shoots pendulous, or erect with nutant branches, 1—3 times dichotomously branched, about 30—100 cm. long, 2—3 cm. diam. including the leaves. Leaves firm, not rarely rigidly coriaceous, lanceolate-subulate and often more or less falcate, about 10—20 mm. long, 1—2 mm. broad above the base, acute, entire, the edge not or obscurely revolute, the base rotundate-cuneate, decurrent, the decurrent portion flat or longitudinally rugulose when dry. Spikes elongated, not rarely to 30 cm. long, simple or dichotomous; sporophylla subulate, dilated at the base. — Very variable. — Two ultimate forms united by intermediates between which it is impossible to draw the limit.

Forma typica: Spikes moderately suddenly contracted from the higher barren region, string- or cord-shaped, 5 mm. diam.; sporophylla erect, subadpressed, 4—6 mm. long, the lower passing somewhat gradually into the higher barren leaves.

Forma hippuroides: Spikes not contracted, resembling in shape the higher barren region, though somewhat narrowed towards the apex; sporophylla subspreading. — The figure quoted above is this form, which, like the intermediates, is often confounded with *L. hippuris* *Desv.*

*Tropical Africa and Asia to Polynesia.*

(25) ***L. Magnuslanum*, Hert.**, Hedwi., XLIX, 91.

Shoots erect or subflexuose, twice or thrice forked, rigid, about 30—40 cm. long, the lower part 10—15 mm. diam. including the leaves. Leaves crowded, multifarious, spreading, incurved or decurved, lanceolate, 10—12 mm. long, 2 mm. broad, long-acute, entire, glossy, rigid but not thick, not keeled. Spikes 8 mm. diam.; sporophylla crowded, erecto-patent, 6—10 mm. long, 1 mm. broad, nearly keeled. — A plant gathered in Java by Raciborski, determined as *L. squarrosum* *Forst.*, differs from this only in having the shoots broader, the leaves longer, and the barren region narrowed somewhat more gradually into the fertile spikes.

*Mindanao, Java (?)*.

(26) **L. rupicolum**, *v. A. v. R.*, Bull. Bot., 1914, XVI, 39.

Shoots probably erect or nutant, about 25—50 cm. long, 2—3 times dichotomously branched, the central branches 2—2½ cm. diam. including the leaves. Leaves crowded, 8-farious, horizontal or spreading, or the lower deflexed, rigidly coriaceous, acerose, lanceolate-subulate, 12½ mm. long, 2 mm. broad above the base, entire, acute, the edge somewhat revolute, the base slightly rotundate-cuneate, decurrent, the decurrent portion often 2-costate when dry. Spikes solitary or double, simple or forked, the branches 5—6 mm. diam.; sporophylla spreading, triangular-ovate, subulate-acuminate, 3—4 mm. long, the lower a little longer. — Readily distinguished from *L. squarrosum* *Forst.* by its proportionally shorter and broader, spreading sporophylla.

*New Guinea.*

b. **Phlegmaria**. 2. **Euphlegmaria**.

**1.** *Leaves relatively long and narrow, at least about 6 × as long as broad, if proportionally shorter, then at best about 2 mm. broad, sessile, rather decurrent.*

**a.** *Leaves not horizontal.*

**b.** *Leaves to 7 mm. long* <sup>(1)</sup>. (27) *L. Vrieseanum*.

**b.b.** *Leaves 7—20 mm. or more long.*

**c.** *Leaves rigidly coriaceous, acerose.* (28) *L. apiculatum*.

**c.c.** *Leaves not rigidly coriaceous, not acerose.*

**d.** *Leaves 1—2 mm. broad.* (29) *L. pinifolium*.

**d.d.** *Leaves ½—¾ mm. broad.* (30) *L. setifolium*.

**a.a.** *Leaves horizontal.* (31) *L. horizontale*.

**1.1.** *Leaves relatively short and broad, at best about 5 × as long as broad, if proportionally longer, then at least about 2½ mm. broad, mostly subpetiolulate, rarely subdecurrent.*

**2.** *Spikes slender, with the branchlets 1—2½ mm. diam.*

**3.** *Leaves orbicular or broadly oblong, obtuse.*

(32) *L. nummularifolium*.

**3.3.** *Leaves ovate or lanceolate, acute.*

(<sup>1</sup>) See also (29) **L. pinifolium** *Bl.*

4. Leaves 4-farious, at best 5—6-farious in the lower part of the stem. (33) *L. phlegmarioides*.  
 (34) *L. pseudo-phlegmaria*.
- 4.4. Leaves 6—∞-farious, at best 4—5-farious on the ultimate branchlets.
5. Large, pendulous (or nutant) plants.
6. Leaves more or less erected. (35) *L. coralium*.  
 6.6. Leaves more or less horizontal.  
 (36) *L. phlegmaria*.  
 5.5. Small or erected plants. (37) *L. divergens*.
- 2.2. Spikes stout, with the branchlets 3—5 mm. diam.
9. Leaves to about 10 mm. long. (38) *L. Hellwigii*.
- 9.9. Leaves 12½—25 mm. long.
- ‡. Leaves horizontally spreading. (39) *L. pachystachyum*.  
 ‡.‡. Leaves ascending. (40) *L. phyllantum*.

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(27) ***L. Vrieseanum*, Spring**, Mon., II, 33; Bk., Fern All., 20; *L. pinifolium*, Bl., Rac., Flor. Btz., I, 241, p. p.

Shoots stiff, suberect, or the longer pendulous, 15—30 cm. long, once to thrice forked, the branchlets moderately slender, 4—7 mm. diam. including the leaves. Leaves rather crowded, 8-farious, erecto-patent or nearly erect, rarely more spreading, lanceolate, 4—7 mm. long and 1—1½ mm. broad, acute, entire, firm or rigid, the base decurrent, keeled. Spikes 2½—12½ cm. long, once or twice forked, the branchlets 2—3 mm. diam.; sporophylla rather crowded, broadly ovate, often shortly apiculate-acuminate, rarely about twice as long as the sporangia, keeled, the blade not hiding the sporangium. — I think this to be hardly more than a variety of *L. pinifolium* Bl.

*Java.*

(28) ***L. apiculatum*, Spring**, Pl. Jungh., 272; Bk., Fern All., 22; *L. pinifolium*, Bl., Rac., Flor. Btz., I, 241, p. p.

Shoots pendulous, 30—60 cm. long, mostly twice or thrice dichotomously branched, the branchlets 12—15 mm. diam. including the leaves. Leaves moderately close, spreading or suberecto-patent, 10—12½ mm. long, 2 mm. broad at the base, subulate-lanceolate, rigid, acrose, acute,

entire, subrevolute at the edge, with a distinct midrib, narrowed and decurrent at the base. Spikes 5—15 cm. long, dichotomous, the branchlets 3 mm. diam.; sporophylla moderately close, ascending, ovate, long-apiculate-acuminate, 3—4 mm. long, the blade hardly hiding the sporangium. — Hardly more than a rigid form of *L. pinifolium* *Bl.*

*Malaya to Polynesia.*

(29) ***L. pinifolium*, *Bl.***, Spring, Mon., I, 58; Rac., Flor. Btz., 241, p. p.; *L. Vrieseanum*, Spring, var. *majus*, Spring, Pl. Jungh., 273.

Shoots pendulous, 15—45 cm. long, once to thrice dichotomously branched, the branchlets 10—20 mm. diam. including the leaves. Leaves moderately crowded, 6-farious (arranged in alternate spurious whorls of 3), ascending or spreading, subulate-lanceolate, 7—15 mm. long, 1—2 mm. broad, acute, entire, moderately firm, not rigid, with a distinct midrib, narrowed and decurrent with a keel at the base. Spikes single or double, simple or dichotomous, the branchlets 2—4 mm. diam.; sporophylla ascending, moderately lax, long-acuminate, the blade ovate. — Very variable, with small-leaved and narrow-spicate forms and with forms approaching *L. proliferum* *Bl.* but united to the type by intermediates. — The description is taken from specimens determined by Raciborski. — Blume distinguishes forms with short-acuminate and forms with long-acuminate sporophylla.

*Malaya to Papua.*

(30) ***L. setifolium*, *v. A. v. R.***, Bull. Btz., 1914, XVI, 40.

Near *L. pinifolium* *Bl.* but the leaves subsetiform, straight or subfalcate, 7—10 mm. long,  $\frac{1}{2}$ — $\frac{3}{4}$  mm. broad, the lower horizontal, the following gradually ascending.

*Borneo.*

(31) ***L. horizontale*, *v. A. v. R.***, Bull. Btz., 1912, VII, 30.

Shoots pendulous, about 30—45 cm. long, repeatedly dichotomously branched. Leaves firm, moderately close, 6—10-farious, horizontally spreading, sessile, rather decurrent, linear-lanceolate, 8—10 mm. long,  $1\frac{3}{4}$ —2 mm. broad above the rotundate-cuneate base, acute, entire, with a distinct midrib. Spikes many, simple or once or twice forked, to 10 cm. long, the branchlets 2—3 mm. diam.; sporophylla moderately close, acuminate, long-apiculate from a broadly ovate base, distinctly exceeding the sporangia

but not hiding them. — The young plants have the leaves more equally narrowed towards both ends.

*Borneo.*

(32) **L. nummularifolium**, *Bl.*, Spring, Mon., I, 68; Rac., Flor. Btz., I, 240; Hk. & Grev., Ic. Fil., tab. CCXII; *L. rotundifolium*, *Wall.* (not *Roxb.*), Cat., No. 2183.

Shoots pendulous, 30—100 cm. long, often 3—4 times dichotomously branched, the stem slender, both stem and branches flattened, 2-lateral (the leaves apparently 2-farious). Leaves lax or approximate, more or less ascending, subpetiolate, suborbicular to broad-oblong, to 9 mm. long, to 7 mm. broad, obtuse at both ends, entire, firm, glossy, with a distinct midrib. Spikes very slender, one or more times dichotomous, the branchlets to 2 mm. diam.; sporophylla moderately dense, ascending, rather deltoid, very small, not much exceeding the sporangia.

*Malaya across Papua to the New Hebrides.*

(33) **L. phlegmaroides**, *Gaud.*, in Freyc., Voy. Ur. Phys., Bot., I, tab. 23; Bk., Fern All., 20; v. A. v. R., Bull. Btz., 1914, XVI, 39, fig. *b*.

Shoots pendulous, 15—45 cm. long, one or more times dichotomously branched. Leaves lax, ascending, 4-farious, elongate-ovate, 6—16 mm. long, about  $\frac{1}{2}$  as broad, rather acute, entire, narrowed and adnate at the base, glossy, rigid, with a distinct midrib, the ventral ones larger than the dorsal. Spikes slender, to 10 cm. long, once or twice forked, the branchlets 1—1½ mm. diam.; sporophylla broad-ovate, equalling or but little exceeding the sporangia.

*Borneo, Amboina, New Guinea, Aru Islands.*

(34) **L. pseudo-phlegmaria**, *Kuhn*, Forsch. Gaz., IV, Farne.

Shoots suberect, soon pendulous, often thrice forked, to 45 cm. long, the stem obtusely quadrangular, 4-sulcate. Leaves glossy, coriaceous, 4-farious, ascending, subpetiolate, ovate-lanceolate, equal, 1—1½ cm. long and 5 mm. broad, narrowed at both ends, obtuse, entire, decurrent, the midrib grooved above, subprominent beneath. Spikes slender, once or twice forked, moniliform, 4—8 cm. long; sporophylla broadly ovate, shortly acuminate, keeled, equalling the sporangia. — Probably a form of the preceding.

*New Guinea (?); Samoa, Fiji.*

(35) **L. corallium**, *Spring*, Pl. Jungh., 273; *L. pinifolium*, *Bl.*, *Rac.*, *Flor. Btz.*, I, 241, p. p.; — var. *minutifolium*.

Shoots pendulous, to 30—60 cm. or more long, two or more times dichotomously branched. Leaves moderately close, 6—8-farious, suberect or erecto-patent, sessile or subpetiolate, firm, elliptical or ovate-lanceolate, about 8—16 mm. long and 2½—4 mm. broad, acute, entire, rounded or narrowed at the base, with a distinct midrib. Spikes slender, moniliform, flexuose, 5—10 cm. long, once to thrice forked, the ultimate branchlets 1—2 mm. diam.; sporophylla rigid, ovate, to 2 mm. long, apiculate, keeled. — Hardly more than a variety of *L. phlegmaria* *L.*

**Var. minutifolium:** Leaves similar but much smaller, and the sporophylla rather longer apiculate.

*Malaya to Polynesia.*

(36) **L. phlegmaria**, *L.*, *Spring*, *Mon.*, I, 63; *Rac.*, *Flor. Btz.*, I, 241; *Engl. & Prantl*, *Nat. Pfl.Fam.*, I<sup>4</sup>, fig. 377; — var. *brachystachyum*, *Rst.*, *Fed.*, *Rep.*, XII, 530; — var. *laxum*, *Bl.*, *Enum.*, 262; *Spring*, l. c., 65; — var. *longifolium*, *Spring*, l. c., 65; *L. mirabile*, *Willd.*, *Spec.*, V, 11; — var. *filiforme*; var. *rigidum*, *Bl.*, l. c.; var. *furcatum*, *Spring*, in *Pl. Jungh.*, 272; *L. filiforme*, *Rb.*, *Rac.*, l. c.; — var. *ovatum*; var. *parvifolium*, *Spring*, *Mon.*, I, 65; var. *pellucidum* & *gracilescens*, *Bl.*, l. c.; — var. *latifolium*.

Shoots pendulous, 15—60 cm. long, dichotomously branched. Leaves moderately approximate or loose, 6—8-farious, rather horizontal, subpetiolulate, triangular to lanceolate, 4—20 mm. long, 2½—6 mm. broad, acute, entire, with a distinct midrib. Spikes often numerous, mostly repeatedly forked, the ultimate branchlets slender, 1—2 mm. diam.; sporophylla lax or crowded, short or elongated, roundish-triangular to ovate-lanceolate. — Very variable, with the leaves varying from close to loose, broad to narrow, flaccid to rigid, thin to thick. The type and the varieties are passing into each other by forms which are often very difficult of determination.

Forma typica: Leaves rather triangular, about 9 mm. or more long, relatively (often more than 4 mm.) broad, cordate or subcordate-truncate at the base; stem mostly robust (rope-like) in the lower part; spikes not short.

**Var. brachystachyum:** Spikes very short, at best 1½ cm. long, 3—4-furcate.

**Var. laxum:** Leaves lanceolate, about 9 mm. or more long, relatively narrow, cuneate or rotundate-cuneate at the base.



**Var. longifolium:** Leaves ovate-lanceolate, about 9 mm. or more long, relatively narrow, broadly rounded at the base.

**Var. filiforme:** Leaves rather triangular, to 8 mm. long, relatively broad, cordate or subcordate-truncate at the base; stem mostly slender, subfiliform (string-like).

**Var. ovatum:** Leaves elongate-ovate, to 8 mm. long, at best about  $\frac{1}{2}$  as broad as long, cuneate or rounded at the base.

**Var. latifolium:** Leaves broadly ovate or oblong, to 8 mm. long, more than  $\frac{1}{2}$  as broad as long, cuneate or rounded at the base.

*Paleotropical, extending to North India, Queensland and New Zealand.*

(37) **L. divergens, v. A. v. R.;** *L. phlegmaria, L., var. divaricatum*, Bl., Enum., 262.

Shoots rather short, suberect, dichotomous; branches divaricating, subnutant. Leaves small, relatively short and broad, ovate to subcordate, erecto-patent or suberect. Spikes short, divaricating-dichotomous. — Otherwise like *L. phlegmaria* *L.*

*Java.*

(38) **L. Hellwigii, Warb.,** Mons., I, 97.

Shoots pendulous, simple, or forked towards the apex. Leaves generally 3-farious, lanceolate, to 10 mm. long, 2—3 mm. broad near the base, acute, thin but firm, hardly glossy, nearly horizontally spreading. Spikes 6—10 cm. long, thick, 4 mm. diam., commonly double, rarely simple, or forked at the middle; sporophylla rather close, subacuminate, distinctly longer than the sporangia, the lower twice as long, 3—4 mm. long and 2 mm. broad.

*New Guinea.*

(39) **L. pachystachyum** (*pachystachyon*), **Spring,** Mon., I, 66; *L. phyllantum, Hk. & Arn., Bk., Fern All., 22, p. p.*

Shoots stout, suberect, 30—45 cm. long, once or twice forked. Leaves 4-farious, elongate-lanceolate,  $1\frac{1}{4}$ — $2\frac{1}{2}$  cm. long,  $2\frac{1}{2}$ —5 mm. broad, acute, entire, narrowed at the base, rigidly coriaceous, horizontally spreading, decurrent, with revolute edges and a distinct midrib. Spikes  $7\frac{1}{2}$ —25 cm. long, twice to thrice forked, the branchlets thick, 3—5 mm. diam.; sporophylla ascending, short, broadly ovate, acute or acuminate, keeled, not hiding the sporangia.

*Br. India to Polynesia.*

(40) **L. phyllantum** (*phyllanton*), **Hk. & Arn.**, Bk., Fern All., 22, p. p.; *L. pachystachyon*, *Spring*, var. *phyllanton*, *Spring*, Mon., II, 29.

Shoots stout, suberect or pendulous, about 30—50 cm. long, once or twice dichotomously branched. Leaves dense, moderately ascending, 4-farious, ovate-lanceolate, about 1¼—2½ cm. long, 3—6 mm. broad, acute, entire, rigidly coriaceous, with a distinct midrib, more or less keeled towards the base, the base rather rounded, the keel decurrent. Spikes 7½—25 cm. long, once to thrice dichotomously branched, the branchlets thick, 3—5 mm. diam.; sporophylla ovate, acute, keeled, much exceeding and hiding the sporangia.

*Borneo, Sumatra.*

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## § 2. RHOPALOSTACHYS.

### a. **Lepidotis.** 3. **Clavata.** ●

‡. *Leaves 4-farious on the branchlets.*

\*. *Spikes 1—2 on a simple or forked peduncle from the apex of a branchlet.* (48) *L. Wightianum.*

\*.\*. *Spikes 2—16 on a branched peduncle from the axis of a branch.* (47) *L. complanatum.*

‡.‡. *Leaves ∞-farious everywhere.* (41) *L. clavatum.*

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(41) **L. clavatum**, **L.**, *Spring*, Mon., I, 88; Bk., Fern All., 26; Schk., *Krypt. Gew.*, I, tab. 162; Hk., *Br. Ferns*, tab. XLIX; — var. *divaricatum*, *Rac.*, *Flor. Btz.*, I, 244; var. *Wallichianum*, *Spring*, l. c., 90; *L. trichiatum*, *Bl.*, *Enum.*, 263; *L. divaricatum*, *Wall.*, *Cat.*, No. 131; — var. *tamariscispica*, Bk., l. c.; *L. tamariscispica*, *Ces.*, *Fel. Becc. Polin.*, 6, 8.

Main stem (rhizome) wide-trailing, copiously branched; lower branches often 15—30 cm. long, copiously compound; secondary branches rather dichotomous. Leaves multifarious, subulate, 3—5 mm. long, flat or somewhat convolute-canaliculate, decurrent, with a distinct midrib, entire, or the lower more or less denticulate, at least the younger ones terminating into a deciduous scariose apex or decoloured hair. Spikes 2½—5 cm.

long, 4—5 mm. diam., rarely solitary, mostly 2 or more (even to 15) on a long, branched, common peduncle provided with distant, erect or somewhat spreading, lanceolate-subulate, minutely denticulate bracts; sporophylla broadly ovate, imbricate, eroso-fimbriate, with the apex scarioso-acuminate or hair-pointed. — Very variable, with forms between which it is difficult to draw the precise limit.

Forma typica: Secondary branches rather crowded, erect or suberect; leaves entire or those of the main stem obsoletely denticulate, those of the ultimate branchlets erect or suberect, straight or somewhat incurved, crowded. — *Cosmopolitan in the temperate zones and in the cool alpine regions of the tropics.*

**Var. divaricatum:** Like the type but the secondary branches and the leaves more divaricating or spreading, more loose. — *Java, Philippines; Br. India.*

**Var. tamariscispica:** Secondary branches rather divaricating; leaves of the main stem distinctly denticulate, those of the ultimate branchlets entire, relatively short and thick, conspicuously incurved. — *New Guinea.*

#### a. **Lepidotis.** 4. **Cernua.**

†. *Tree-like shoots erect; spikes simple.*

\* *Spikes relatively slender, 2—3 mm. diam.* (42) *L. cernuum.*

\*\* *Spikes relatively stout, 3½—5 mm. diam.* (43) *L. curvatum.*

†.†. *Tree-like shoots scandent, or the spikes compound.* (44) *L. cassuarinoides.*

(42) **L. cernuum, L.**, Spring, Mon., I, 79; Rac., Flor. Btz., I, 243; — var. *capillaceum*, Spring, l. c., 80; var. *laxum*, Bl., Enum., 266; *L. marianum*, Desv., H.M.P.; *L. capillaceum*, Willd., MS.; — var. *salakense*; *L. salakense*, Treub, Rac., l. c., 242; — var. *crassifolium*, Spring, l. c.; var. *marianum*, Bk., Fern All., 23; *L. marianum*, Willd., MS.; *L. curvatum*, Bl. (not Sw.), l. c.; *L. ericinum*, Ces., Fel. Becc. Polin., 9; — var. *pendulum*, Bk., l. c.; *L. pendulum*, Hk., Icon. Pl., I, tab. XC; *L. pendulinum*, Pritz., in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 602.

Shoots erect, or subscaudent in the longest forms, springing from a wide-trailing hypogeous rhizome, 10—250 cm. long, the lower part simple, the upper part more or less copiously branched, the stem and rachises naked or pubescent, foliate; branches short or elongated, mostly copiously branched again, bi- or plurifarious, ascending, the lowest not rarely elongated, nutant, and proliferous at the apex; ultimate branchlets 2—5 mm. diam. including the leaves. Leaves more or less crowded, linear-subulate, 2—3 mm. long, rather terete, often angular and grooved when dry, entire, arcuate-ascending, subsigmoidal <sup>(1)</sup> or uncinata <sup>(2)</sup>. Spikes sessile at the end of the branchlets, cylindrical, oviform or ellipsoidal, sometimes subglobose, 3—20 mm. long, 2—3 mm. diam.; sporophylla crowded, erect, or somewhat spreading in age, sharply long-acuminate to subcuspidate from a rather broadly ovate base, copiously fimbriate-ciliate. — Very variable.

Forma typica: Leaves firm, not capillary, all subsigmoidal, rather approximate; spikes cernuous.

Forma erecta: Like the type, but the spikes erect.

**Var. capillaceum:** Leaves flaccid, nearly capillary, subsigmoidal, rather loose, those of the stem and main rachis rather horizontal.

**Var. salakense:** Leaves flaccid, fine, rather loose, uncinata, of stem and main rachis erected, adpressed; ultimate branchlets very slender, to 2 mm. diam., loose, erecto-patent; spikes slender, 1½ mm. diam.

**Var. crassifolium:** Leaves rigid, thick, those of the ultimate branchlets rather crowded, conspicuously uncinata; ultimate branchlets ascending; spikes rather thick, 2—3 mm. diam. — Two forms: Leaves of the stem and main rachis squarrose (forma squarrosa); leaves of the stem and occasionally those of the main rachis erected, adpressed (forma appressa).

**Var. pendulum:** Like the preceding, but the ultimate branchlets nutant or pendulous.

*Tropical and extra-tropical.*

(43) **L. curvatum**, *Sic.*, Rac., Flor. Btz., I, 243; *L. vulcanicum*, *Bl.*, Enum., 266; *L. cernuum*, *L.*, var. *curvatum*, *Bk.*, Fern All., 23.

Like the preceding but more robust, the branchlets stouter, the

(1) Nearly S-shaped, the apex outward bent.

(2) Nearly J-shaped, the apex inward bent.

leaves thicker, very rigid, those of the ultimate branchlets conspicuously uncinatate, the spikes somewhat larger, to 20 mm. long,  $3\frac{1}{2}$ —5 mm. diam.

*Malaya to Polynesia, Central America, West India.*

(44) **L. casuarinoides**, *Spring*, Mon., I, 94; Bk., Fern All., 24; Hk., Icon. Pl., X, tab. CMLXVIII.

Shoots wide-scandent, the branches copiously compound; ultimate branchlets sometimes 15—25 cm. long, pendulous, very slender. Leaves of the stem scattered, peltate near the base, with the basal portion similar to the apical but shorter; of the branchlets variable, conspicuously decurrent, firm, green or reddish, sometimes remote, with only a minute, persistent, free blade with a long, subulate, hyaline, deciduous or persistent, membranaceous, entire, toothed or lacerated apex, sometimes closer, with a lanceolate-aristate, arcuate free blade 3 mm. long. Spikes by themselves on special branchlets, paniced, cylindrical,  $2\frac{1}{2}$ — $7\frac{1}{2}$  cm. long, 4 mm. diam.; sporophylla broadly ovate, ascending, cuspidate-acuminate, with scariose cusp and edges.

*Malaya; North India, South China, Assam, Bhotan.*

### b. **Diphasium.**

**1.** *Main stem decumbent, copiously foliate, with few short, simple, decumbent branches.* (45) *L. carolinianum.*

**1.1.** *Main stem creeping, erect or scandent, sparsely foliate, with several to many elongated, decompound, erected or ascending branches.*

**2.** *Leaves with a long, subcapillary, scariose apex.*

(46) *L. penicilliferum.*

**2.2.** *Leaves without a long, subcapillary, scariose apex.*

**3.** *Barren and fertile regions not separate, the latter springing from the former.*

**4.** *Leaves 4-farious, the largest laterally, the smallest dorsally and ventrally arranged.*

**5.** *Spikes 1—2 on a simple or forked peduncle from the apex of a branchlet.* (48) *Wightianum.*

**5.5.** *Spikes 2—16 on a branched peduncle from the axis of a branch.* (47) *L. complanatum.*

**4.4.** *Leaves in 2 planes, the largest laterally, the smallest dorsally (not ventrally) arranged.* (49) *L. scariosum*.

**3.3.** *Barren and fertile regions separate, the latter forming panicles apart from the former.* (50) *L. volubile*.

(45) ***L. carolinianum*, L.**, Spring, Mon., I, 98; Bk., Fern All., 28; Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, fig. 378.

Main stem trailing and rooting, 5—30 cm. long, bearing distant, short, simple, spreading, decumbent branches. Leaves secund or nearly so, crowded, dimorphous, 4—6 mm. long, acute, the lateral (posterior) ones more or less spreading and falcate, the intermedial (anterior) ones rather ascending, straight. Fertile spikes 1 or few, cylindrical, 2½—7½ cm. long, solitary on a simple, stiffly erected, stramineous peduncle 5—30 cm. long and provided with lax, ascending or adpressed, rigid, acute bracts; sporophylla broad-ovate, toothed, with a long, ascending or spreading cusp.

*Tropical and subtropical.*

(46) ***L. penicilliferum*, v. A. v. R.**, Bull. Botz., 1914, XVI, 40, tab. X.

Main stem erect (scandent?), to 85 cm. long or longer, terete, pinnately branched; primary branches ascending, 10—15 cm. long, provided on the lower side near the base with a short-stalked, white, brush-like coma consisting of numerous crowded, scarioso, subulate leaves subsimilar to those of the main stem; higher branches dichotomous, lower pinnately branched, dichotomous at the apex, the secondary branches dichotomous; ultimate branchlets rather flattened, 2—10 cm. long and 3—4 mm. broad including the lateral leaves. Leaves of the main stem scattered, isomorphous, passing gradually into those of the ultimate branchlets, erected, linear-subulate, coriaceous at the base, otherwise white-scarioso and not rarely eroso-denticulate; leaves of the branchlets heteromorphous, placed in 3 parallel planes, the lower ½ coriaceous, green, distinctly decurrent, separated from the white-scarioso upper ½ by a narrow, brown or rufous transversal band; lateral leaves (those of the central plane) laxly placed in 2 opposite rows, arcuate-ascending, 3—5 mm. long, subfiliform- or capillary-subulate from a rather broad, involuto-canalicate base; ventral leaves (those of

the lower plane) very distant, placed apparently in a single row, erected, subulate, nearly flattened; dorsal leaves (those of the upper plane) placed alternately in 2 close rows, in shape intermediate between the lateral and ventral ones. Spikes unknown.

*Celebes.*

(47) ***L. complanatum*, L.**, Spring, Mon., I, 101; Rac., Flor. Btz., I, 244; Schk., Krypt. Gew., I, tab. 163; *L. thuyoides*, Bl., Enum., 263.

Main stem wide-trailing and rooting, sparsely leafy; branches rather flattened, ascending, copiously flabellato-dichotomous, bilateral, the ultimate ones 2½—10 cm. long, 2 mm. broad including the lateral leaves. Leaves of the main stem uniform, shortly subulate, adpressed, decurrent; of the branches generally distinctly dimorphous, sometimes resembling those of *L. Wightianum* Wall., 4-farious, green, rigid; lateral leaves broadly decurrent, 2 mm. long, subulate, ascending, the upper (inner) side conduplicate-canaliculate; dorsal and ventral leaves smaller, linear, adpressed, the dorsal the largest, more or less imbricate, the ventral the smallest, remote. Spikes cylindrical, 2½—5 cm. long, several (2—16) on a common, branched peduncle from the axis of a branch, the peduncle foliate with sparse, ascending or spreading, radially arranged, subulate bracts; sporophylla broadly ovate, ascending, shortly acuminate. — *L. thuyoides* Bl. is the form with the longest ultimate branchlets and the most copiously branched fertile peduncles.

*North temperate zones and cool alpine regions of the tropics.*

(48) ***L. Wightianum*, Wall.**, Spring, Mon., I, 103; Rac., Flor. Btz., I, 245; *L. sabinifolium*, Bl., Enum., 263.

Main stem (rhizome) wide-trailing, rooting, wiry, terete, sparsely leafy, the leaves minute, scale-like, subulate, adpressed; branches ascending, simple and sparsely leafy at the base, copiously and more or less flabellately compound in the upper part, 5—20 cm. long, the branchlets rather compressed, relatively short, crowded, often spreading or nutant. Leaves of the branches 4-farious, erect, to 2½ mm. long, acute, entire, distinctly canaliculate on the inner side, densely imbricated, rigid, not rarely somewhat dimorphous and then the lateral leaves falcate, ascending, canaliculate. Spikes terminal on the branchlets, cylindrical, 2½—5 cm. long, sessile on a simple or sometimes forked peduncle 5—10 cm. long and provided with lax, subulate or lanceolate, acute bracts to 4 mm.

long; sporophylla ovate-acuminate, subscariose, lacerate, nearly keeled, with a squarrose cusp. — Closely allied to *L. complanatum* *L.*

*Java, Celebes; Ceylon, North India.*

(49) ***L. scariosum*, Forst.**, Spring, Mon., I, 108; Bk., Fern All., 29.

Main stem wide-trailing or ascending; branches ascending, irregularly dichotomous, reaching a length of 15—30 cm.; branchlets flattened, dorsiventral, 3—4½ mm. broad including the lateral leaves. Leaves rigidly coriaceous; those of the main stem isomorphous, scattered, erected, adpressed, sublanceolate, at length scariose at the apex; leaves of the branchlets heteromorphous, placed in 2 parallel planes; lateral leaves (of the lower plane) laxly placèd in 2 opposite rows, arcuate-ascending, lanceolate, 3—4½ mm. long, entire, acute, keeled, distinctly decurrent; intermedial leaves (of the upper plane) closely placed in 2 close rows, erect, adpressed, sublinear-oblong or sublanceolate, very small, entire, often scariose at the apex. Spikes single or rarely double, 2½—5 cm. long, cylindrical, thick, sessile or stalkèd at the end of the branchlets, often several to many to a branch, the stalks provided with remote, subulate, minute bracts; sporophylla broadly ovate, apiculate, the apex and margin finally lacerato-scariose.

*Mindanao; Australia, New Zealand.*

(50) ***L. volubile*, Forst.**, Spring, Mon., I, 105; Rac., Flor. Btz., I, 245; Hk., Icon. Pl., X, tab. CMLXVI; Hk. & Grev., Ic. Fil., tab. CLXX; Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, fig. 380; *L. spectabile*, Bl., Enum., 264.

Main stem wide-scandent, wiry, stramineous, copiously branched, bearing radially arranged, uniform, ascending, subulate leaves ca 3—5 mm. long; barren branches flattened, dorsiventral, erecto-patent, compound, the ultimate branchlets divaricating, 5—10 cm. long. Leaves of the branches heteromorphous, pale-green, thin but firm, placed in 3 parallel rows; lateral leaves (of the central plane) arcuate-ascending, 3—6 mm. long, acute, entire, with a decurrent base 2 mm. broad; dorsal leaves (of the upper plane) smaller, linear, acute, approximate, adpressed, in 2 close planes; ventral leaves (of the lower plane) very small, spine-like, distant, placed in 1 row. Spikes very abundant, pendulous or nutant, cylindrical, 1½—7½ cm. long, terminal and lateral on copiously branched, bracted peduncles forming panicles apart from the barren branches; sporophylla ascending, imbricated, broadly ovate, small, acuminate, toothed below the cusp.

*Malaya to Polynesia, New Zealand, New Caledonia, North Australia.*



SELAGINELLINAE.



FAMILY XVI. SELAGINELLACEAE.



## XVI. SELAGINELLACEAE.

Terrestrial, exceptionally epiphytical. Shoots elongated, creeping, ascending or erect, sometimes scandent, branched, often proliferous at the base or springing from a creeping or scandent main stem, or the branches growing out to new shoots, with the root fibres confined to the base or to the nodes of the lower half or extending to the higher nodes; steles 1—5, rarely more, if solitary then central, if double then one ventral and the other dorsal, if triple then a central one placed between the dorsal and ventral, if 4—5 then the ventral or (and) dorsal one double, if more than 5 then often irregularly arranged but nearly always placed in parallel lines. Leaves <sup>(1)</sup> simple, mostly very small, isomorphous or heteromorphous, occupying both stem and branches, rarely multifarious (i. e. isomorphous and placed in more or less compound whorls or spirals), sometimes tetrastichous (i. e. isomorphous and placed in 4 rectangularly deussate rows, so as to form perfectly square stems and branches), more commonly platystichous (i. e. heteromorphous and arranged in 2 parallel planes, those of the lower plane [lateral leaves] larger, more or less spreading to erecto-patent and placed in 2 opposite rows, those of the upper plane [intermedial leaves] erect or suberect and placed in 2 contiguous rows, so as to form rather flattened dorsiventral stems and branches), those of the stem often distant, of the branches generally more contiguous, at least the younger leaves provided with a very minute decoloured appendix or ligula <sup>(2)</sup> on the upper (inner) side at the base, the margin and the aligular surface not rarely provided with groups or longitudinal rows of sclerotic cells, so as to form sharply bounded, pale, decoloured or pellucid edges and (or) intramarginal to subcostal spurious veinlets <sup>(3)</sup>. Spikes terminal on the branchlets or rarely placed

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<sup>(1)</sup> The description of the leaves must be understood (unless it is otherwise stated) to refer to those of the branchlets excluding the sporophylla, not to those of the stem, which, especially in the species with heteromorphous leaves, often differ widely from those of the branchlets in shape, size and direction.

<sup>(2)</sup> Visible by high magnifying power only.

<sup>(3)</sup> Often a valuable specific character. The pale, pellucid or decoloured edge should not be confounded with the hyaline acroscopic base of the lateral leaves,

in the axils of the higher fork branches, either tetrastichous and often sharply square, or platystichous on the same plan as the leaves, but then mostly resupinate (i. e. with the smaller sporophylla on the same plane as the larger leaves; and vice versa); sporangia of 2 kinds, macrosporangia and microsporangia, placed singly in the axils of the sporophylla, mostly monocious, rarely diocious, 1-locular, 2-valved; macrospores rather large, subglobose, 1—4 in a macrosporangium, the basal side rounded, smooth, verruculose, aculeate, rugulose or reticulate, the apical side generally trigono-pyramidal and furnished with 3 ribs radiating from the summit, rarely flattened and without ribs; microspores similar but very minute, dust-like, very numerous in a microsporangium. — Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, fig. 401—408.

Cosmopolitan.

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### 103. SELAGINELLA, *Spring.*

Characters those of the family.

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*Arrangement of the subgenera, sections and groups* <sup>(1)</sup>.

- A. **HETEROPHYLLUM** (*Subselaginella*). Leaves very heteromorphic at least in the branched portion of the shoots, the branches therefore conspicuously dorsiventral.

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which is often gradually decoloured from the midrib towards the margin. In order to ascertain in dry material the presence of sclerotic cells, it is necessary to boil the leaflets in a saturated chloral-hydrate solution; by about 100 times magnifying power the cells will then be easily visible. In unprepared material, when magnified less, they often resemble long and fine (pale or shining) streaks at the margin or on the under surface of the leaflets. — For the characters of these cells, see Hieron. in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 649.

<sup>(1)</sup> I don't follow Hieronymus' natural arrangement given in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, p. 669—712, it being too intricate and too difficult for practical use, but at any rate it may be decidedly advisable to consult it besides mine as well as that given in Warb., Mons., I, p. 100—112.

It is to be observed that several species are difficult of determination because of incomplete description. Furthermore the sections and groups are passing more or less gradually into each other so that it is impossible to draw the precise limits between them, and the characters given in both sections and groups are, for the greater part, those of the typical forms.

§ 1. **MONOSTELICAE.** Stems traversed by 1—2 steles.

a. **Homoeostachys.** Sporophylla rather isomorphous, the spikes therefore quadrangular (tetrastichous), as broad as thick.

1. **Rosulantes.** Small or middle-sized species with densely tufted or radiating branches liable to curl up in drought and placed at the apex of a short or elongated trunk-like main stem rooting at the base only.
2. **Decumbentes.** Small species, often densely caespitose; shoots trailing, or ascending from a decumbent base or main stem; stems mostly under  $\frac{3}{4}$  mm. thick, *not pubescent*; root-fibres often extending to the higher nodes.
3. **Radicantes.** Large or middle-sized species; shoots more or less decumbent or ascending from a decumbent base, branched down nearly or quite to the base; stems mostly more than  $\frac{3}{4}$  mm. thick, *not pubescent*; root-fibres extending to the central and often to the higher nodes; leaves heteromorphous on both stem and branches.
4. **Ascendentes.** Large or middle-sized species; shoots erect, or ascending from a decumbent base, branched down nearly or quite to the base, or the lower part unbranched, stipitiform; stems more than  $\frac{3}{4}$  mm. thick, *not pubescent*; root-fibres confined to the base or extending to a little beyond the place where the branching begins; leaves heteromorphous on both stem and branches (<sup>1</sup>).
5. **Caulescentes.** Large or middle-sized species; shoots erect, or ascending from a decumbent base, sometimes springing from a divaricating-scandent main stem, the upper part branched, the lower  $\frac{1}{4}$ — $\frac{2}{4}$  part simple, stipitiform; stems more than  $\frac{3}{4}$  mm. thick, *not pubescent*; root-fibres confined to the unbranched portion, often to the base only; at least the leaves of the lower half of

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(<sup>1</sup>) This group is intermediate between the preceding and the following, and it is often very difficult to determine whether a species of this group would not be better treated as belonging to, or has not been erroneously placed in, the former or the latter; the species with stipeless or short-stalked shoots differ from the preceding group in having radially organized subterraneous nodes with rather isomorphous leaves (conf. Hieron.).

the unbranched portion isomorphous or nearly so, those of the branches heteromorphous.

6. **Pubescentes.** Mostly large or middle-sized species; shoots commonly ascending or erect, often branched in the upper part only; stems as a rule more than  $\frac{3}{4}$  mm. thick, more or less distinctly *pubescent*; root-fibres rather confined to the lower nodes, often to the base only.

b. **Heterostachys.** Sporophylla heteromorphous, the smaller, more ascending ones commonly in the same plane as the larger, spreading leaves, and vice versa, the spikes therefore distinctly flattened (platystichous), often much broader than thick.

1. **Intertextae.** Small species, often densely caespitose; shoots decumbent, at best ascending towards the apex; rachises to 6 mm. broad including the lateral leaves; root-fibres often extending to the higher nodes.

2. **Bisulcatae.** Large or middle-sized species; shoots decumbent, at best ascending towards the apex; rachises 6—10 mm. broad including the lateral leaves; root-fibres often extending to the higher nodes.

3. **Suberosae.** Small or middle-sized species; shoots erect, or ascending from a decumbent base; stems less than 1 mm. thick, or the root-fibres confined to the lowest portion.

4. **Brachystachyae.** Large or middle-sized species; shoots erect, or ascending from a decumbent base; stems more than 1 mm. thick, the root-fibres not confined to the lowest portion.

§ 2. **PLEIOSTELICAE.** Stems traversed by 3—9 steles.

B. **ISOPHYLLUM** (*Boreoselaginella*). Leaves isomorphous or nearly so, subdecussate, the branches therefore more or less dorsiventral. (Not in Malaya).

C. **HOMOEOPHYLLUM** (*Euselaginella*). Leaves isomorphous, decussate or radiate, the branches therefore rather regularly square or cylindrical. (Not in Malaya).



*Key to the Malayan sections and groups.*

- 1.** Stems 1—2-stelical. A<sup>1</sup>. **MONOSTELICAE.**
- 2.** Sporophylla isomorphous or nearly so, the spikes therefore rather square, as broad as thick. A<sup>1</sup>. a. **Homocostachys.**
- 3.** Shoots (stems, branches) densely tufted or radially arranged at the apex of a short, or elongated and erected, trunk-like main stem. A<sup>1</sup>. a<sup>1</sup>. **Rosulantes.**
- 3.3.** Shoots (stems, branches) independent or springing from a short or elongated and creeping rhizome-like main stem.
- 4.** Stems not pubescent.
- 5.** Leaves heteromorphous on both stems and secondary branches, the intermedial ones erect, the lateral ones spreading, or rarely erect in group **7.7.**
- 6.** Small or middle-sized species, the ultimate branchlets to 4 mm. broad, and the stem at best  $\frac{3}{4}$  mm. thick. A<sup>1</sup>. a<sup>2</sup>. **Decumbentes.**
- 6.6.** Large or middle-sized species, the ultimate branchlets 4 mm. broad or broader, or the stem more than  $\frac{3}{4}$  mm. thick.
- 7.** Shoots branched down nearly or quite to the base; root-fibres extending to considerably beyond the place where the branching begins, often to the higher nodes. A<sup>1</sup>. a<sup>3</sup>. **Radicantes.**
- 7.7.** Shoots branched down quite to the base, or the lower part simple, stipitiform, with the lateral leaves sometimes erect; root-fibres confined to the base or extending to a little beyond the place where the branching begins. A<sup>1</sup>. a<sup>4</sup>. **Ascendentes** <sup>(1)</sup>.
- 5.5.** At least the leaves of the lower half of the stipitiform lower part of the shoots isomorphous or nearly so, erect. A<sup>1</sup>. a<sup>5</sup>. **Caulscentes.**
- 4.4.** Stems more or less distinctly pubescent. A<sup>1</sup>. a<sup>6</sup>. **Pubescentes.**

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<sup>(1)</sup> See the information on page 59.

**2.2.** Sporophylla heteromorphous, the spikes therefore flattened, broader than thick. A<sup>1</sup>. b. **Heterostachys.**

**a.** Shoots decumbent, at best ascending towards the apex; root-fibres generally extending to the higher nodes.

**b.** Small species; rachises under 6 mm. broad including the lateral leaves; stems at the utmost 1 mm. thick.

A<sup>1</sup>. b<sup>1</sup>. **Intertextae.**

**b.b.** No small species; rachises more than 6 mm. broad including the lateral leaves, or the stems at least 1 mm. thick.

A<sup>1</sup>. b<sup>2</sup>. **Bitulcatae.**

**a.a.** Shoots erect, or ascending from a trailing base; root-fibres mostly confined to the lower nodes.

‡. Small or middle-sized species; stems under 1 mm. thick, or the root-fibres confined to the lowest portion.

A<sup>1</sup>. b<sup>3</sup>. **Suberosae.**

‡.‡. Large or middle-sized species; stems more than 1 mm. thick, the root-fibres not confined to the lowest portion.

A<sup>1</sup>. b<sup>4</sup>. **Brachystachyae.**

**1.1.** Stems 3—9-stelical.

A<sup>2</sup>. **PLEIOSTELICAE.**

## A<sup>1</sup>. MONOSTELICAE.

### a. **Homoeostachys.** 1. **Rosulantes.**

**1.** Leaves proportionally shortly cuspidate.

(1) *S. convolvens.*

**1.1.** Leaves proportionally long-cuspidate.

(2) *S. tamariscina.*

(1) **S. convolvens**, *v. A. v. B.*, Bull. Botz., 1913, XI, 23; *S. involvens*, Spring (not Hieron.), Mon., II, 63; Bk., Fern All., 87; (not *Lycopodium involvens*, Sw.).

Main stem short or elongate, erect; branches erect, densely tufted, cuneate in outline, 5—15 cm. long, branched down nearly or quite to the base, the branching of all grades between flabellate and 2—3-pinnate. Leaves heteromorphous; of the lower plane crowded, ascending, broadly

ovate, to 2½ mm. long, cuspidate-apiculate, thick and rigid, more or less distinctly denticulate or serrulate, at length scarioso on the upper edge; of the upper plane nearly as long, ovate, cuspidate-apiculate, with a distinct midrib, the margin rather serrulate, subcartilagineous, the cusp straight, spine-like. Spikes square, to 17½ mm. long and 2 mm. diam.; sporophylla ovate, cuspidate, keeled, the margin pale-membranaceous, subscarioso, denticulate; macrospores pale-yellow, nearly smooth, with a few hardly elevated verruciform projections; microspores minium-red, often very different in size, the largest distinctly, densely, finely punctulated, encircled by an equatorial ring consisting of more prominent elevations. — For particulars about the nomenclature see Hieron. in Hedwi., L, 3.

*Java, Celebes, Philippines; Formosa, Japan, Korea, China to Br. India.*

(2) **S. tamariscina**, *Spring*, Mon., II, 64; *S. bryopteris*, *Bk.*, *Fern All.*, 87, p. p.; *Lycopodium tamariscinum*, *Desv.*, Enc. Bot., Suppl., III, 540; *L. circinale*, *Lam.*, Enc. Bot., III, 651.

Differs from the preceding in having the branches spreading and radiating, so as to form a dense rosette, linear in outline, pinnate, the pinnae short, slightly pinnate again, the leaves long-cuspidate, those of the upper plane without a distinct midrib, with the cusp often recurved or flexuose.

*Philippines; Br. India.*

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a. **Homocostachys.** 2. **Decumbentes.**

1. *Main stem trailing, with the root-fibres extending to beyond the central nodes.*
  2. *Lateral leaves spaced on the branchlets.* (3) *S. torricelliana.*
  - 2.2. *Lateral leaves not spaced on the branchlets.*
  3. *Lateral leaves entire, not ciliate.* (4) *S. caespitosa.*
  - 3.3. *Lateral leaves more or less denticulate to ciliate.*
  4. *Lateral leaves blunt.* (5) *S. serpens.*
  - 4.1. *Lateral leaves acute to acuminate.* (6) *S. Schumanni.*
  - 1.1. *Main stem ascending or erect, rooting in the lower part only.*
  - (7) *S. ceratocaulos.*
-

(3) **S. torricelliana**, **v. A. v. R.**, Bull. Btz., 1911, I, 15.

Main stem very slender,  $\frac{1}{4}$  mm. thick, trailing; branches erect, caespitose,  $1\frac{1}{4}$ —3 cm. long, little branched; branchlets 1—3 on a side, to 2 mm. long, simple. Leaves firm, dimorphous; leaves of the lower plane spaced even on the branchlets, oblong, blunt or bluntish, nearly equal-sided, the upper side rounded and sparingly piloso-denticulate at the base, the lower side entire, somewhat narrower, those of the main stem the largest, 1 mm. long,  $\frac{1}{2}$  mm. broad, subspreading, those of the branchlets more ascending; leaves of the upper plane  $\frac{2}{3}$  as long, ovate, subacute, minutely denticulate on the inner side, rather entire on the outer side, keeled. Spikes square or nearly so, short, to 4 mm. long, 1 mm. diam.; sporophylla erecto-patent, broadly ovate, subacute, minutely and sparingly denticulate, those of the upper plane to 1 mm. long, of the lower plane hardly smaller; macrospores yellowish, smooth; microspores orange-coloured, smooth.

*New Guinea.*

(4) **S. caespitosa**, **Spring**, Mon., II, 90; Bk., Fern All., 36; *Lycopodium caespitosum*, Bl., Enum., 270.

Shoots decumbent, densely caespitose, 4—7 $\frac{1}{2}$  cm. long, pinnately branched, the stem very slender, quadrangular, matted; branches slightly compound, forked. Leaves dimorphous; of the lower plane close, suborbicular or obovate, horizontal, 1—1 $\frac{1}{4}$  mm. long, nearly as broad, obtuse, entire, flat, pale-green, soon yellowish, rigid in texture, subdecurrent on the upper side at the base, with a distinct midrib, of the upper plane much smaller,  $\frac{1}{2}$ — $\frac{1}{4}$  as long, roundish-ovate or obovate, obtuse, parallel, with a distinct midrib, the base narrowed, subdecurrent. Spikes unknown.

*Java.*

(5) **S. serpens**, **Spring**, Mon., II, 102; *Lycopodium serpens*, Desv., Enc. Bot., Suppl., III, 553, p. p.

Shoots trailing, dichotomous, densely caespitose, the secondary shoots 4—12 cm. long, pinnate, the stem  $\frac{3}{4}$  mm. thick, somewhat compressed, convex on the back, angled on the face (when dry more or less deeply 2-sulcate down the face, slightly so beneath), 3—4 mm. broad including the lateral leaves; pinnae varying from subspreading to erecto-patent, approximate to remote, the higher the shortest, simple or forked, the lower or central the largest, 2—3 cm. long, pinnate again; pinnulae

simple or forked; ultimate branchlets to 5 mm. long, 2—3 mm. broad including the lateral leaves. Leaves heteromorphous; leaves of the lower plane subspreading or more or less ascending, more or less involute in drought, somewhat remote on the stem, imbricated on the branchlets; of the stem short-oblong, 1¾—2 mm. long, nearly as broad near the base, blunt at the apex, rounded or somewhat cordate at the base, nearly equal-sided, with the upper edge obsolete denticulate towards the apex, ciliolate in the lower part, the lower edge obsolete denticulate towards the apex, ciliolate at the base; of the branchlets similar but smaller and relatively narrower; leaves of the upper plane erect, adpressed; of the stem remote, oblong or subovate, 2 mm. long, shortly apiculate-acuminate, very obliquely (nearly longitudinally) attached at the base, both sides very narrowly pellucid-margined, minutely piloso-denticulate, the inner base rotundate-cuneate, the outer base produced, cordate, ciliolate; of the branchlets similar, smaller. Spikes erect, square, terminal or lateral, single or double, 3—6 mm. long, 1 mm. diam.; sporophylla ascending, isomorphous, cordate-oblong, to 2 mm. long, acute, subacuminate, the lower more laxly disposed, irregularly and sparingly striolated with longitudinal rows of dark-green cells, both edges minutely piloso-denticulate; macrospores ivory-white, smooth; microspores pale or orange, provided with scattered, nearly regularly placed, obtusely conical or shortly cylindrical projections which are sometimes more or less thickened at the apex. — The description is taken from a cultivated specimen determined by Hieronymus.

*In cultivation.* — *Orig. loc.:* West Indian Islands.

(6) **S. Schumannii**, *Hieron.*, Engl. Bot. Jahrb., L, 26.

Shoots creeping, the loose branching between dichotomous and pinnate; main rachis 5 mm. broad including the lateral leaves; ultimate branchlets 2—3 mm. broad. Leaves heteromorphous; lateral leaves somewhat obliquely ovate, spreading, shortly acuminate, the upper side minutely denticulate towards the apex, gradually shortly ciliate towards the rounded base, the lower side minutely denticulate towards the apex, sparingly ciliolate at the subtruncate-cuneate base, the leaves of the main rachis the largest; somewhat remote, 2½ mm. long by 1¼ mm. broad, those of the branchlets close, to 1½ mm. long; intermedial leaves obliquely ovate, long-aristate-acuminate, minutely denticulate on both sides, the outer base rounded, the inner base rotundate-cuneate, the largest leaves 1½ mm. long; the

cusps  $\frac{1}{2}$ — $\frac{1}{2}$  as long as the blade. Spikes 5—6 mm. long, square,  $1\frac{1}{2}$  mm. diam.; sporophylla nearly isomorphous, ovate, aristate-acuminate, minutely denticulate, keeled, the largest  $1\frac{3}{4}$ —2 mm. long; macrospores cream-yellow, provided with moderately thick rumples on the basal side; microspores yellow, provided with sparingly scattered, sessile, capitate projections on the basal side.

*New Guinea.*

(7) **S. ceratocaulis**, *v. A. v. R.*, Bull. Bot., 1914, XVI, 41.

Shoots ascending from a short-creeping base, to 10 cm. long, dichotomous at the base, the stem  $\frac{3}{4}$  mm. thick, compressed when dry; branches pinnate, with the rachis  $3\frac{1}{2}$ —5 mm. broad including the lateral leaves; pinnae remote, ascending, to  $1\frac{1}{2}$  cm. long, simple or forked, or the largest sparingly subpinnate; ultimate branchlets to 1 cm. long, to  $3\frac{1}{2}$  mm. broad. Leaves heteromorphous; lateral leaves nearly equal-sided, oblong, hardly falcate, shortly acuminate, minutely denticulate on both sides, obliquely rotundate or rotundate-cuneate at the base; of the main rachises 2— $2\frac{3}{4}$  mm. long, to  $1\frac{1}{4}$  mm. broad, somewhat remote, spreading; of the branchlets to 2 mm. long and  $\frac{1}{2}$  as broad, more ascending, subcontiguous to imbricate; intermedial leaves erect, oblong, acuminate, narrowly pellucid-margined and minutely denticulate on both sides, the inner base more or less cuneate, the outer base producto-rotundate and provided with 0—3 short ciliae; of the main rachises somewhat remote,  $1\frac{1}{2}$  mm. long; of the branchlets imbricate, shorter. Spikes terminal, solitary, square, 1—2 mm. diam.; sporophylla triangular-ovate, acute, keeled, minutely denticulate and pellucid-margined, at length spreading, the largest  $1\frac{1}{2}$  mm. long; macrospores numerous, white, smooth; microspores . . . . .

*Java.*

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a. **Homocostachys**. 3. **Radicantes**.

**1.** *Lateral leaves entire, at best obsoletely denticulate at the base.*

• *Ultimate branchlets under  $7\frac{1}{2}$  mm. broad.* (8) *S. uncinata*.

•• *Ultimate branchlets more than  $7\frac{1}{2}$  mm. broad.* (9) *S. alopecuroides*.

**1.1.** *Lateral leaves more distinctly denticulate or ciliate, at least on one side at the base.*

**2.** *Intermedial leaves blunt or acute, at best shortly acuminate.*

+ *Blunt or bluntyish.* (10) *S. Brooksii.*

++ *Acute or shortly acuminate.*

× *Lateral leaves remote on the main stem.* (11) *S. remotifolia.*

×× *Lateral leaves contiguous or subcontiguous on the main stem.* (12) *S. confertissima.*

**2.2.** *Intermedial leaves long-acuminate to cuspidate.*

**3.** *Lateral leaves to 2 mm. long on the branchlets.*

× *Lateral leaves of the main stem cuneate or rounded on the upper side at the base.*

+ *Lateral leaves ciliate or ciliolate, at least at the base.*

♂ *Intermedial leaves entire, at best denticulate.*  
(13) *S. rugulosa.*

♂♂ *Intermedial leaves ciliate or ciliolate, at least on one side at the base.* (14) *S. acutangula.*

++ *Lateral leaves not ciliate, at best denticulate.*

♀ *Intermedial leaves shortly cuspidate.*  
(15) *S. repens.*

♀♀ *Intermedial leaves long-cuspidate.*  
(16) *S. longirostris.*

×× *Lateral leaves of the main stem cordate or truncate on the upper side at the base.*

△ *Intermedial leaves of the stem rounded or truncate on the outer side at the base.* (17) *S. langirensis.*

△△ *Intermedial leaves of the stem auriculate-cordate on the outer side at the base.*

□ *Macrospores 4 in a macrosporangium, with the apex provided with 3 radiating ribs.*  
(18) *S. brachyblepharis.*

□□ *Macrospores 1—2 in a macrosporangium, the apex without radiating ribs.*  
(62) *S. sungemagneana.*

**3.3.** *Lateral leaves more than 2 mm. long on the branchlets.*

**4.** *Lateral leaves at best serrulate-ciliolate.*

△ *Macrospores 1—2 in a macrosporangium, the apex without radiating ribs.*

□ *Pinnulae simple or forked.* (19) *S. Springiana.*

□□ *Pinnulae 1—2-pinnate.* (54) *S. Grabowskyi.*

△△ *Macrospores 4 in a macrosporangium, with the apex provided with 3 radiating ribs.*

○ *Lateral leaves without spurious veinlets.*

◇ *Intermedial leaves of the principal rachises with the produced basal auricle, if present, not incurved.* (20) *S. Dielsii*.

◇◇ *Intermedial leaves of the principal rachises with the produced basal auricle hamate-incurvate.* (21) *S. lonko-batu*.

○○ *Lateral leaves provided with spurious veinlets consisting of rows of sclerotic cells.*

(22) *S. atroviridis*.

(23) *S. sumatrana*.

**4.4.** *Lateral leaves more distinctly ciliate, at least on one side at the base* <sup>(1)</sup>.

**5.** *Intermedial leaves of the main stem not ciliate, at best minutely denticulate.* (24) *S. sarawakensis*.

**5.5.** *Intermedial leaves of the main stem ciliate or ciliolate, at least on one side at the base.*

**6.** *Lateral leaves of the main stem rather close.*

(25) *S. auriculata*.

**6.6.** *Lateral leaves of the main stem rather spaced.*

(26) *S. longaristata*.

(8) ***S. uncinata*, Spring**, Mon., II, 109; Bk., Fern All., 48; *S. caesia*, hort.; *Lycopodium uncinatum*, Desv., Enc. Bot., Suppl. III, 558; *L. caesium*, hort.

Shoots caespitose, trailing to a length of 30—60 cm., often dichotomous from the base, with a long-excurrent, caudiform tip and alternate, short, pinnately arranged, compound, pinnato-dichotomous, more or less ascending or spreading branches, the stem slender, pale-stramineous, 2-sulcate down the face; ultimate branchlets 4—6 mm. broad. Leaves dimorphous, firm, the lateral ones crowded on the branchlets, very remote on the stem, horizontal, bright-green, blue-iridescent on the upper side, ovate-oblong, 2—3 mm. long,  $\frac{1}{2}$ — $\frac{2}{3}$  as broad, subacute, entire, subequilateral, pellucid-

(<sup>1</sup>) See also (19) ***S. Springiana*** v. *A.* v. *R.*



margined, rounded or subcordate at the base, those of the stem the largest; leaves of the upper plane  $\frac{1}{2}$  as long, oblique-oblong, erect, entire, shortly acuminate to cuspidate, pellucid-margined, subcordate at the base, the outer base hardly produced. Spikes square, 6—12 $\frac{1}{2}$  mm. long, 2 $\frac{1}{2}$  mm. diam.; sporophylla crowded, ascending, ovate-lanceolate, 2 $\frac{1}{2}$  mm. long, keeled; macrospores yellowish-white, irregularly verruculose with free or connected tuberculiform projections; microspores provided with minute crest-like projections on the basal side and encircled by an equatorial belt consisting of spiniform or dilated, truncated, bacilliform protuberances.

*In cultivation, and gone wild.* — *Orig. loc.: China.*

(9) ***S. alopecuroides*, Bl.**, Fern All., 77.

Shoots ascending, above 30 cm. long, with several ascending, simple or 2—3-furcate branches. Leaves of the lower plane crowded, oblique-lanceolate, 8—10 mm. long, produced on the upper side at the base, with a large cordate auricle imbricated over the rachis, moderately firm in texture, bright-green, not ciliated; leaves of the upper plane ovate, ascending, much imbricated, 3—3 $\frac{1}{2}$  mm. long, not cuspidate. Spikes square, 1 $\frac{1}{4}$ —2 $\frac{1}{2}$  cm. long, 4—4 $\frac{1}{4}$  mm. diam., 2—3-nate from the tip of the branches; sporophylla rigid, ovate, acuminate, erecto-patent, strongly keeled.

Specimens occurring in the Buitenzorg Herbarium are distinguished by the following characters not mentioned in Baker's diagnosis: Shoots ascending from a probably creeping base, pinnate quite to the base; pinnae to 20 or rarely to 30 cm. long, simple, forked, dichotomous or slightly pinnate, the lowest pinnae whether or not elongated, rooting and growing out to new shoots; main and secondary rachises terete or obtusely quadrangular. Leaves of the lower plane horizontal or subspreading, falcate, sublinear, rather bluntish, spuriously nerved, pale-glittering beneath, with the upper side pellucid-margined, entire, obsoletely denticulate at the broadly rotundate-subcordate or rotundate-cuneate base, the lower side entire except towards the very minutely denticulate apex; leaves of the upper plane 3—5 mm. long, more or less acuminate, pellucid-margined, minutely denticulate, rotundate-cuneate at the base, those of the main rachis not or hardly imbricate. Spikes 1—6 cm. long, 3—4 $\frac{1}{2}$  mm. diam.; sporophylla ovate-subulate, pellucid-margined, minutely serrulate; macrospores yellowish-white, rather coarsely rugose with flexuose, branched

or connected rumples, the apical ribs encircled by a ring-shaped crest; microspores dirty-yellow or pale-orange, provided with bacilliform or stipitate-capitate projections on the basal side. — Two distinct forms:

Forma angustior: Stem and branches 10—15 mm. broad including the lateral leaves which are 5—7½ mm. long and 2—3 mm. broad; leaves of the upper plane much acuminate.

Forma latior (typica): Stem and branches 16—20 mm. broad including the lateral leaves which are 8—10 mm. long and 3—4 mm. broad; leaves of the upper plane slightly acuminate.

*Borneo.*

(10) **S. Brooksii**, *Hieron.*, Hedwi., LI, 252.

Shoots decumbent, subascending towards the apex, 20—45 cm. long, simple or one or more times forked above the base, otherwise pinnate, the stem compressed, 2-sulcate down the face, flattened on the back, the pinnae erecto-patent, simple or branched again, the branching between simply pinnate and copiously dichotomous, very regularly foliate, as are the stem and main rachis, the ultimate branchlets rather suberect, 2—6 cm. long, 8—16 mm. broad, the stem, rachis and penultimate rachises broader, even to 20 mm. broad including the lateral leaves. Leaves of the lower plane conspicuously crowded, contiguous or slightly remote on the stem and primary branches, imbricate on the branchlets, horizontally spreading, the higher rather erecto-patent; of the main stem sometimes somewhat deflexed, unequal-sided, oblong, hardly falcate, to 9 mm. long, to 4 mm. broad at the base, blunt or subacute at the apex, dilated and cordate on the upper side at the base, rounded on the lower side, the upper surface dark-green, the lower pale-glittering and distinctly spuriously nerved on both sides of the midrib, the upper side pellucid-margined and very minutely denticulate, the lower side entire, but obsoletely denticulate at the apex and the base; those of the ultimate branchlets similar but smaller, 4—8 mm. long, 1½—2½ mm. broad, less cordate on the upper side, rotundate-cuneate on the lower side at the base; leaves of the upper plane much smaller, imbricated, obovate, the largest 3½—4½ mm. long, rounded or bluntish at the apex, the edge very minutely denticulate, the outer base produced, cordate-auriculate, subhamate-incurvate, the inner base rounded or slightly cordate. Spikes solitary or 2—3-nate, nearly square, 1—3½ cm. long, 2½—3 mm. diam.; sporophylla uniform but those of the lower plane somewhat larger, triangular-ovate, erecto-patent, imbri-

cate, acute or acuminate, minutely denticulate, pellucid or pale-margined, the largest  $2\frac{1}{2}$ —3 mm. long; macrospores yellowish-white, strongly regulose, the projections free, flexuose, branched or reticulate, the apical ribs encircled by a ring-shaped crest; microspores dirty-yellow or pale-orange, provided with needle-like or stipitate-capitate projections on the basal side.

*Borneo, ? Sumbawa (Colfs).*

(11) **S. remotifolia**, *Spring*, Pl. Jungh., 276; *S. involucreta*, *Warb.*, *Mons.*, I, 113.

Shoots wide-trailing, or ascending towards the apex, pinnate, the main stem (rachis)  $1$ — $1\frac{1}{2}$  mm. thick, stramineous, irregularly angled or grooved when dry, 7—8 mm. broad including the lateral leaves; pinnae remote, oblique, to 10 cm. long, or longer and growing out to new shoots, the longest 2—3-pinnate; branchlets to 1 cm. long or longer, 3—5 mm. broad. Leaves heteromorphous; lateral leaves remote on the stem, approximate to imbricate on the branchlets; of the stem horizontal or subdeflexed, obliquely ovate, bluntish, the upper side very minutely denticulate, broadly rounded at the base, the lower side very minutely denticulate in the upper part, entire towards the more narrowly rounded or rotundate-subtruncate base, the largest leaves 3— $3\frac{1}{2}$  mm. long by 2 mm. broad; of the branchlets nearly similar but rather elongate-oblong, less unequal-sided, submucronulate, rotundate-cuneate at the base, the largest leaves  $2\frac{1}{2}$  mm. long by 1 mm. broad; intermedial leaves erect; of the stem remote, ovate, rather acuminate, slightly keeled, the inner side more or less obscurely denticulate, rotundate or rotundate-subcordate at the base, the outer side subentire, much produced and auriculate-cordate at the base, the largest leaves  $3\frac{1}{2}$  mm. long; of the branchlets rather imbricate, smaller, the inner side more distinctly denticulate, rotundate-cuneate at the base. Spikes short, square,  $1$ — $1\frac{1}{2}$  mm. diam., with a few sterile bracts at the base, bearing a single macrosporangium and several microsporangia; lower sporophylla largest, to 3 mm. long, ovate-lanceolate, denticulate, higher smaller, hardly  $1\frac{1}{2}$  mm. long, lanceolate, acute, keeled, minutely denticulate; macrospores rather large, reticulate, the apical ribs encircled by a ring-shaped crest; microspores provided with scattered or closely seriated, deciduous or persistent, tuberculiform or subglobose projections on the basal side.

*Java, Sumatra; Japan.*

(12) **S. confertissima**, *v. A. v. R.*, Bull. Bot., 1913, XI, 23.

Shoots more or less decumbent to subascending, ascending towards the apex, 15—30 cm. long, branched from the base, the stem flattened, 2-sulcate on both sides, the branching between pinnate and dichotomous, more or less erecto-patent to suberect, the ultimate branchlets 1—7 cm. long, 5—7 mm. broad, the main rachis to 10 mm. broad including the lateral leaves. Leaves dimorphous on both stem and branches; lateral leaves horizontally spreading or nearly so, contiguous and imbricated on the branches, slightly remote or contiguous on the stem, pale-glittering beneath, oblong, bluntish or subacute, hardly falcate, rather straight, hardly dilated near the base, the base rotundate-cordate on both sides, or rotundate-truncate on the lower side, the upper edge minutely denticulate throughout, the lower edge entire but indistinctly denticulate towards the apex and the base; of the stem 4—5 mm. long, to 2 mm. broad; of the ultimate branchlets  $2\frac{1}{2}$ — $3\frac{1}{2}$  mm. long,  $1$ — $1\frac{1}{4}$  mm. broad near the base; intermedial leaves erected, imbricate, oblong-ovate or -obovate, to 2 mm. long, unequal-sided, rather suddenly acuminate or shortly cuspidate at the apex, minutely denticulate on both sides, the base oblique, narrowly rounded or retundate-cuneate on the inner side, produced and auriculate-cordate, slightly hamato-incurvate on the outer side. Spikes single or double, terminal or axillar, to  $1\frac{1}{2}$  cm. long, subquadrangular, 2 mm. diam.; sporophylla isomorphous, ovate, acute, keeled, minutely denticulate, erecto-patent, those of the lower plane somewhat larger,  $1\frac{1}{4}$  mm. long, the lower finally somewhat spreading; macrospores yellowish-white, verruculose-rugulose, the projections free, branched or connected, the apical ribs encircled by a ring-like crest; microspores dirty-yellow or pale-orange, sparingly provided with subcylindrical projections.

*Borneo.*

(13) **S. rugulosa**, *Ces.*, Fel. di Bor., 35.

Shoots decumbent, 30 cm. long, sometimes forked in the lower part, the upper part pinnately compound, the main rachis  $5\frac{1}{2}$  mm. broad including the lateral leaves; ultimate branchlets  $3\frac{1}{2}$ —4 mm. broad. Leaves of the lower plane very unequal-sided, oblong, the largest  $2\frac{1}{2}$  mm. long, hardly  $1\frac{1}{4}$  mm. broad near the base, subfalcate, subobtusate or subacute, rather dark-green, minutely denticulate on both sides towards the apex, the upper side the broadest, subspinuloso-ciliate in the lower half, much produced and rounded at the base, the lower side narrower, entire or

nearly so and cuneate at the base; of the upper plane ovate or oblong-ovate, the largest 2 mm. long,  $\frac{3}{4}$  mm. broad in the lower half, the outer base produced, auriculate-cordate, the edges more or less sparingly denticulate, the apex long-cuspidate, the cusp  $\frac{1}{3}$ — $\frac{1}{2}$  as long as the blade. Spikes 3—5 mm. long, 2 mm. diam.; sporophylla slightly dimorphous, subdeltoid, equal-sided, shortly aristate, piloso-denticulate; those of the lower plane nearly pale-green, the largest  $1\frac{1}{2}$  mm. long,  $\frac{3}{4}$  mm. broad near the base; of the upper plane somewhat darker, shorter and narrower; macrospores nearly orange-coloured, slightly rugulose, the projections whitish, sometimes reticulate, the apex without radiating ribs, encircled by a crown-like ring; microspores probably wanting.

*Borneo.*

(14) **S. acutangula**, *Spring*, Mon., II, 206; Bk., Fern All., 75.

Shoots procumbent, 15 cm. long, closely pinnate, the stem unequally quadrangular; pinnae ascending, copiously pinnate; pinnulae short, once or twice forked. Leaves heteromorphous; leaves of the lower plane rather spaced on both stem and branches; of the stem spreading, moderately firm, unequal-sided, rhomboidal-oblong, 2— $2\frac{1}{2}$  mm. long and  $\frac{1}{2}$  as broad, rather spuriously veined and somewhat pellucid-margined, the upper side sparingly denticulate or even entire towards the apex, remotely ciliated towards the rather rounded base, the lower side entire, narrowly truncate-cuneate at the base; of the branchlets similar, subacute, less unequal-sided, more rotundate-cuneate at the base, the largest  $1\frac{1}{2}$  mm. long; leaves of the upper plane  $\frac{1}{3}$ — $\frac{1}{2}$  as long, broadly oblong, long-cuspidate, rather pellucid-margined, sparingly denticulate towards the apex, remotely ciliate towards the base, the outer base produced, cordate, the inner base cordate or rotundate. Spikes copious, square,  $1\frac{1}{2}$ —2 mm. diam.; sporophylla ovate, acute, keeled, denticulate, rather pellucid-margined. — Probably identical with *S. plumea* *Spring*.

*Malacca.*

(15) **S. repens**, *v. A. v. R.*, Bull. Botz., 1914, XVI, 42.

Shoots trailing, sometimes forked in the lower part, otherwise pinnate, the main rachis  $\frac{3}{4}$ —1 mm. thick,  $4\frac{1}{2}$ — $5\frac{1}{2}$  mm. broad including the lateral leaves; pinnae compound, to  $7\frac{1}{2}$  cm. long, the branching partly pinnate, partly dichotomous, with crowded suberect branches; ultimate branchlets to 2 cm. long,  $2\frac{1}{2}$ — $3\frac{1}{2}$  mm. broad. Leaves heteromorphous; leaves of

the lower plane remote on the main rachis, contiguous on the branchlets; of the main rachis more or less spreading, oblong, 3 mm. long,  $\frac{1}{2}$  as broad, blunt or bluntish, entire or subentire towards the apex, minutely denticulate on the upper side in the lower part, obliquely rotundate to cuneate at the base; of the secondary rachises similar but more falcate, somewhat narrower, more or less indistinctly spuriously veined, more narrowed at the base; of the branchlets similar, more ascending, smaller, to 2 mm. long; leaves of the upper plane erect, shortly cuspidate, somewhat keeled; of the main rachis subremote, broadly oblong, to 2 mm. long, very minutely denticulate, obliquely rotundate-cordate at the base; of the branchlets similar, smaller, oblong, entire or nearly so, the outer base cordate and somewhat produced, the inner base rotundate-cuneate. Spikes solitary, square, to 2 cm. long,  $1\frac{1}{2}$  mm. diam.; sporophylla erectopatent, ovate, acuminate, minutely denticulate, keeled, the largest  $1\frac{1}{2}$  mm. long; macrospores . . . . ? microspores yellowish, provided with tuberculiform, subconical, capitate or stipitate-capitate projections on the basal side. — Largest secondary shoots of the dichotomous forms whether or not flagellate at the apex of both sterile and fertile ultimate branchlets and growing out to new shoots.

*Borneo.*

(16) **S. longirostris**, *v. A. v. R.*, Bull. Bot., 1913, XI, 25.

Shoots decumbent, 20 cm. more or less long, pinnately compound, whether or not forked at the base, the stem 5—6 mm. broad including the lateral leaves, the ultimate branchlets  $2\frac{1}{2}$ —3 mm. broad. Leaves heteromorphous; lateral leaves somewhat remote on the stem, contiguous on the branchlets; of the stem varying from spreading to slightly deflexed, unequal-sided, lanceolate-oblong,  $2\frac{1}{2}$ —3 mm. long, 1 mm. broad, bluntish, the upper side entire or subentire towards the apex, denticulate in the lower part, whether or not ciliolate at the broadly rounded or subcordate base, the lower side entire, or minutely and sparingly denticulate at the narrowly rounded base; of the branchlets similar but smaller, the largest  $1\frac{1}{2}$ — $1\frac{3}{4}$  mm. long, more ascending, less unequal-sided, rather narrowly rotundate-cuneate at the base; intermedial leaves erect; of the stem remote, oblong,  $2\frac{1}{2}$ —3 mm. long, cuspidate, denticulate, obliquely cordate at the base or the inner base rotundate to rotundate-cuneate, the outer base produced, the cusp as long as the blade or somewhat longer; of the branchlets similar but smaller, imbricate, more narrowly rotundate-cuneate

on the inner side at the base. Spikes solitary or double, 1½—2 mm. diam.; sporophylla ovate-oblong, acute or acuminate, minutely denticulate, ascending, at length spreading; macrospores 2 in a macrosporangium, whitish, more or less rugulose on the basal side, the apex flattened, without radiating ribs, encircled by a ring-shaped crest; microspores probably wanting.

*Borneo.*

(17) **S. langirensis**, *v. A. v. R.*, Bull. Botz., 1913, XI, 26; *S. longaristata*, *v. A. v. R.* (not *Hieron.*), Bull. Botz., 1911, I, 16.

Shoots ascending from a decumbent base, 15—20 cm. long, rather copiously pinnate, the stem 1—2 mm. thick, sulcate or convex on the face, convex on the back, 6—7 mm. broad including the lateral leaves; pinnae to 10 cm. long, pinnately compound; ultimate branchlets 3 mm. broad. Leaves of the lower plane spaced on the stem, subcontiguous on the branchlets; of the stem spreading or deflexed, very unequal-sided, oblong, bluntish, indistinctly spuriously veined, the upper side serrulate, obsoletely denticulate towards the apex, gradually spinuloso-ciliolate towards the broadly cordate base, the lower side entire, obsoletely denticulate towards the apex, rotundate or subcordate at the base, the upper surface sparingly minutely spinulose towards the lower edge, the largest leaves 3—4 mm. long and ½ as broad; of the secondary rachises similar but the ciliae longer; of the ultimate branchlets nearly equal-sided, blunt, more distinctly spuriously veined, for the rest similar to those of the stem but the upper side rather spuriously margined, rotundate-cuneate at the base, the lower side rather rounded at the base, the upper surface not invariably spinulose near the lower edge, the largest leaves 2 mm. long; leaves of the upper plane erect, spaced on the stem, imbricate on the ultimate branchlets; of the stem oblong, cuspidate-acuminate, remotely spinuloso-serrulate, obliquely rotundate-truncate at the base, the largest leaves 2½ mm. long, the cusp ½ as long as the blade; of the ultimate branchlets similar but much smaller, with the cusp proportionally longer, the edges remotely serrulate, the outer base narrowly rounded, the inner base rotundate-cuneate. Spikes short, 1½—2 mm. diam.; sporophylla subisomorphous, ovate, acute, keeled, minutely denticulate, the ventral ones somewhat larger than the others, to 2 mm. long; macrospores white, only 2 in a macrosporangium, finely and densely rugulose, the apex flattened, without radiating ribs, encircled by a ring-shaped crest; mi-

crospores yellowish, provided with bacilliform or stipitate-capitate projections on the basal side.

*Banca.*

(18) **S. brachyblepharis**, *v. A. v. B.*, Bull. Botz., 1913, XI, 24.

Shoots more or less decumbent to subascending, ascending towards the apex, 15—30 cm. long, pinnate, or dichotomous with pinnate secondary shoots; main rachis subterete, somewhat compressed, 5 mm. broad including the lateral leaves; pinnae erecto-patent, various in length, short or to 10 cm. long; pinnulae simple, forked or sparingly pinnate; branchlets to 1½ cm. long, to 3 mm. broad. Leaves of the lower plane remote on the main rachis, close or approximate on the branchlets; of the main rachis horizontal, very unequal-sided, 4 mm. long, 1½ mm. broad, blunt or bluntish, the upper side minutely denticulate, or subentire towards the apex, imbricate over the rachis and ciliolate towards the very cordate base, the lower side entire, or ciliolate-denticulate at the narrow, slightly cordate base, subentire towards the apex; those of the branchlets ascending, elliptical-oblong, nearly equal-sided, the largest 2 mm. long, hardly more than ½ mm. broad, acute or submucronulate, rounded or rotundate-cuneate at the base, margined with more or less distinct spurious veinlets, the upper side ciliolate towards the base, subentire towards the apex, the lower side entire, with 0—4 short or tooth-like ciliae at the base; leaves of the upper plane erect; of the main rachis close, broadly oblong, 3 mm. long, nearly abruptly long-cuspidate, more or less minutely denticulate especially on the outer side at the base, obliquely cordate at the base, the outer base broad, much produced, hamato-incurvate, the cusp ½—⅔ as long as the blade; those of the branchlets similar, imbricate, smaller, acuminate-cuspidate, with the outer side pellucid-margined, less conspicuously produced and more narrowly cordate at the base, the auricle rather entire, the inner base cuneate. Spikes mostly solitary, short, to 1 cm. long, 2 mm. diam., nearly square; sporophylla erecto-patent, imbricate, ovate, acute or somewhat acuminate, minutely denticulate, pellucid-margined, keeled, of the lower plane somewhat larger, 1½ mm. long; macrospores whitish, rugulose with short or elongated, straight, flexuose, branched or reticulate rumples, the apical ribs encircled by a hardly elevated ring-shaped crest; microspores whitish or yellowish, provided with bacilliform or stipitate-capitate projections.

*Borneo.*



(19) **S. Springiana**, v. A. v. R., Bull. Btz., 1913, XI, 28; *S. intermedia*, Spring (not Hieron.), Mon., II, 128; *S. atroviridis*, Spring, Bk., Fern All., 77, p. p.; *S. Grabowskyi*, v. A. v. R. (not Warb.), Bull. Btz., 1911, I, 16, p. p.; (not *Lycopodium intermedium*, Bl.); — var. *tumida*, v. A. v. R., 1913, l. c.

Shoots procumbent, or ascending towards the apex, to 30 cm. long, sparingly pinnate, or forked and pinnate, the stem rather unequally quadrangular, concave on the face and sides, or convex on the face, convex on the back, regularly foliate, as are the branches; pinnae erecto-patent; pinnulae erecto-patent, once or twice forked with short branchlets. Leaves firm; leaves of the lower plane subhorizontal and somewhat spaced on the stem, more ascending and close on the branchlets; of the stem conspicuously unequal-sided, subfalcate-oblong, 4—5 mm. long,  $\frac{1}{2}$  as broad at the base, acutate, the upper side more or less denticulate, or entire at the centre, not rarely ciliolate to ciliate towards the broadly rotundate-subcordate base, the lower side entire, or minutely denticulate towards the apex, provided with 0—6 ciliate at the rather narrow base; of the branchlets nearly similar, smaller,  $1\frac{1}{2}$ —3 mm. long, less unequal-sided, more or less rounded on the upper side at the base; leaves of the upper plane erect; of the stem rather spaced, 3 mm. more or less long, suborbicular-oblong or broadly obovate, abruptly long-cuspidate, denticulate or ciliolate, or ciliate at the base, nearly keeled, the cusp often more than  $\frac{1}{2}$  as long as the blade, the outer base conspicuously produced with the auricle rotundate to hamato-incurvate; of the branchlets similar, smaller, imbricate. Spikes square, 5—15 mm. long; sporophylla ovate, acute or acuminate, keeled, minutely ciliolate-serrulate; macrospores whitish, 2 in a macrosporangium, more or less densely rugulose with short or elongated, flexuose, branched or connected rumples on the basal side, the apex flattened, without radiating ribs, encircled by a crown-shaped crest; microspores probably wanting.

Forma typica. — *Western Malaya*.

**Var. tumida:** Leaves of the upper plane attached by a produced or subpeltate tumefaction between the basal lobes; the outer base less produced, rather truncate-subcordate. — *Banca*.

(20) **S. Dielsii**, Hieron., Hedwi., LI, 254.

Shoots trailing, the lower part 10 mm. broad including the lateral leaves, dichotomous, the upper part pinnate; pinnae to 7 mm. broad

towards the base, 3 mm. broad near the apex. Leaves heteromorphous; those of the lower plane horizontal on the main stem, spreading on the branchlets; of the stem approximate, unequal-sided, obliquely oval, bluntish, submucronulate, rather pale beneath, the upper side more or less obsoletely denticulate towards the apex, minutely denticulate and narrowly pellucid-margined towards the broadly rounded base, the lower side entire, or obscurely denticulate towards the apex, cuneate at the base, the largest leaves to 5 mm. long and 2 mm. broad; of the branchlets smaller, to 3 mm. long; of the upper plane unequal-sided, oblong, cuspidate, minutely denticulate on both sides and slightly keeled towards the apex, auriculate-cordate-rotundate at the outer base, rotundate-cuneate at the inner base, the cusp  $\frac{1}{3}$ — $\frac{1}{2}$  as long as the blade; of the stem the largest, 3 mm. long, 1 mm. broad. Spikes solitary, nearly square, 2—5 cm. long, 3 mm. diam.; sporophylla equal-sided, deltoid-ovate, acuminate, keeled, minutely piloso-denticulate, the posterior ones somewhat larger, to 2 mm. long and  $\frac{1}{2}$  as broad; macrospores yellowish-white, obsoletely rugulose on the basal side, the apical ribs encircled by an undulated, pellucid crest; microspores pale-reddish, provided with crowded stipitate-capitate projections on the basal side.

*Borneo.*

(21) **S. lonko-batu**, *Hieron. & v. A. v. R.*, Bull. Botz., 1914, XVI, 42.

Shoots creeping, flexuose, 25—30 cm. long, pinnate, the main and secondary rachises stramineous,  $1\frac{1}{2}$ —2 mm. thick, 6—8 mm. broad including the lateral leaves; pinnae alternate, flexuose, short or elongate, probably growing out to new shoots, pinnate; pinnulae simple, forked or pinnate again; branchlets short, 4 mm. broad. Leaves heteromorphous; lateral leaves horizontal or nearly so; of the main rachis contiguous or subcontiguous, obliquely oblong, unequal-sided, to 4 mm. long, bluntish, the upper edge minutely denticulate towards the apex and the broadly rounded base, the lower edge entire, or subentire towards the apex and sparingly denticulate at the narrowly rotundate-truncate base; of the branchlets similar-but smaller, more crowded, 2— $2\frac{1}{2}$  mm. long, narrowly pellucid-margined on both sides, less unequal-sided, the upper base rotundate-cuneate, the lower base narrowly rounded; leaves of the upper plane erect; of the main rachis more or less remote,  $2\frac{1}{2}$ —3 mm. long, ovate to obovate-oblong, rather gradually cuspidate, rather keeled, more

or less copiously denticulate, the inner base cordate, the outer base much produced, hamate-incurvate; of the branchlets similar but smaller, imbricate, rounded or rotundate-subcordate at the inner base, slightly hamate at the outer base. Spikes solitary or double,  $1\frac{1}{2}$ —2 mm. diam.; sporophylla ovate, acuminate, denticulate, keeled, to  $1\frac{1}{2}$  mm. long; macrospores yellow-brown or yellowish-white, indistinctly rugulose or rather smooth, the apical ribs whether or not encircled by a slightly elevated ring; microspores . . . . .

*Celebes.*

(22) **S. atroviridis**, *Spring*, Mon., II, 124; Bk., Fern All., 77; *Lycopodium atroviride*, *Wall.*, Hk. & Grev., Ic. Fil., tab. XXXIX.

Shoots more or less decumbent to subascending, ascending towards the apex, 15—30 cm. long, branched from the base, the stem 2-sulcate down the face, flat on the back, the branching between pinnate and dichotomous. Leaves of the lower plane close on both stem and branches or somewhat spaced on the stem, spreading or rather ascending, rhomboid-oblong, straight or subfalcate,  $3\frac{1}{2}$ — $7\frac{1}{2}$  mm. long,  $1\frac{1}{2}$ — $2\frac{1}{2}$  mm. broad, those of the main stem the largest, more or less obtuse, dark-green above, pale-glittering and spuriously veined beneath, unequal-sided, broadly rounded or subcordate on the upper side at the base, very minutely denticulate or subentire on the pale-margined upper side; leaves of the upper plane  $\frac{1}{4}$ — $\frac{1}{2}$  as long, oblong, ovate or obovate, minutely denticulate, rather long-cuspidate, much imbricated, the inner base rounded or slightly cordate, the outer base prominent, cordate, the cusp  $\frac{1}{3}$ — $\frac{1}{2}$  as long as the blade. Spikes square,  $\frac{1}{2}$ — $2\frac{1}{2}$  cm. long, 2—3 mm. diam.; sporophylla ascending, or the lower subspreading, triangular-oblong, acuminate, entire or minutely serrulate, distinctly keeled; macrospores 3—4 in a macrosporangium, white, yellow or brown, irregularly verruculose, rugulose or somewhat reticulate on the basal side, with 3 radiating ribs which are encircled by by ring-shaped crest; microspores provided with bacilliform or stipitate-capitate projections on the basal side.

*Br. India and China to New Guinea.*

(23) **S. sumatrana**, *Hieron. & v. A. v. R.*, Bull. Btz., 1914, XVI, 43.

Like *S. atroviridis* *Spring* but the leaves of the lower plane relatively narrower, more unequal-sided at the base, with the spurious veinlets

interrupted, and the upper side subentire towards the less blunt apex and ciliolate-denticulate towards the base, the leaves of the upper plane with the cusp longer,  $\frac{3}{4}$  as long as the blade, the sporophylla elongate-ovate, the microspores provided with needle-like or bacilliform projections which are whether not thickened at the apex.

*Sumatra.*

(24) **S. sarawakensis**, *Hieron.*, Hedwi., L, 13.

Shoots trailing, repeatedly dichotomous, the rachis of the primary branches 10 mm. broad including the lateral leaves, the ultimate branchlets 5 mm. broad. Lateral leaves rather close; of the stem horizontal or nearly so, unequal-sided, obliquely falcate-oblong, bluntish or subacute, the upper side papilloso-denticulate, ciliolate at or towards the broadly rounded base, the lower side obsoletely denticulate towards the apex, ciliolate at the truncate-rotundate base, the midrib thickened towards the apex, the largest leaves 5—5½ mm. long and 2 mm. broad; of the branchlets similar, subspreading, more rotundate-cuneate at the minutely denticulate lower base, the largest leaves 3—3½ mm. long; leaves of the upper plane obliquely subfalcate-ovate, unequal-sided, cuspidate, minutely ciliolate-denticulate on both sides; of the stem 3 mm. long, with the inner base narrowly rotundate-cordate, the outer base more broadly so and more produced, the cusp  $\frac{1}{2}$  as long as the blade; of the branchlets similar but smaller, more rounded on the inner side at the base. Spikes solitary or double, 1 cm. more or less long, 1¼—1¾ mm. diam.; sporophylla subisomorphous, equal-sided, deltoid, shortly aristate-acuminate, keeled, minutely denticulate, the ventral ones the largest, 1½ mm. long; macrospores mostly 2 (never 4) in a macrosporangium, white, rugulose with flexuose, branched or reticulate rumples, the apex without radiating ribs, encircled by a lacerate-denticulate crown-like crest; microspores pale-yellow, sparingly provided with capitate projections on the basal side.

*Borneo.*

(25) **S. auriculata**, *Spring*, Mon., II, 108; Bk., Fern All., 48; *S. plumosa*, *Pr.*, Abh. Boehm. Ges., III, 583.

Shoots trailing, 15 cm. long, the stem 2-sulcate down the face, copiously pinnately branched; branches approximate, little compound. Leaves of the lower plane close on both stem and branches, oblong-lanceolate, 3—4 mm. long and 1—2 mm. broad, horizontal or rather ascending, dark above, pale beneath, bluntish, spuriously veined, moderately

firm in texture, ciliated on both sides at the base, a little dilated-auricled and slightly imbricated over the rachis on the upper side at the base, with a distinct midrib, the higher nearly equal-sided; leaves of the upper plane roundish-ovate, 1—2 mm. long, distinctly cuspidate, ciliate on both sides at the base which is obliquely cordate and much produced on the outer side. Spikes 1½—2½ cm. long, 1¼ mm. diam.; sporophylla crowded, ovate, acuminate, entire, keeled; macrospores verruculose- or reticulate-rugulose; microspores capitate-verruculose on the basal side. — A form reported from Celebes (Christ, Fil. Saras., II, 218) has the branches mostly simple, to 10 cm. long, with the lateral leaves 6—7 mm. long, and the leaves of the upper plane 2 mm. each way.

*Philippines, Celebes (?)*.

(26) **S. longaristata**, *Hieron.*, Hedwi., L., 16.

Shoots decumbent, often repeatedly forked in the lower part, pinnately branched in the upper part, the rachises of the primary branches 10 mm. broad including the lateral leaves, the ultimate branchlets 5—6 mm. broad. Leaves of the lower plane spreading or subhorizontal, spaced on the main stem, rather contiguous on the branchlets, unequal-sided, obliquely falcate-oblong, broadest on the upper side; of the main stem the largest, to 4—5 mm. long and 1½ mm. broad, subacute, very minutely serrulate on both sides towards the apex, ciliate on both sides at the base, the cilia of the upper base passing gradually into the serratures of the apex or the upper edge entire at the centre, those of the lower base few, sometimes wanting, the upper base broadly rounded or subcordate, the lower base narrowly truncate; of the branchlets to 3 mm. long, with the under surface striated with 2 lines resembling spurious veins, the upper base rotundate-cuneate; leaves of the upper plane unequal-sided, long-cuspidate, the largest 3 mm. long, nearly keeled, both sides denticulate towards the apex, rather ciliate at or towards the base, the outer base cordate, the inner base shortly cordate or rotundate-cuneate, the cusp ¾ as long as the blade. Spikes nearly square, 4—6 mm. long, 2 mm. diam.; sporophylla deltoid, equal-sided, acute, narrowly pellucid-margined, pilosodenticulate, the ventral ones somewhat larger than the others, to 1¾ mm. long; macrospores 1—2 in a macrosporangium, white, rugulose with flexuose or reticulate ridges, the apex without radiating ribs, encircled by a ring-shaped ridge or crest; microspores probably wanting.

*Borneo, Billiton, Banca, Malacca.*

a. **Homocostachys.** 4. **Ascendentes.**

**1.** *Intermedial leaves of the stem blunt at the apex.* (27) *S. Cumingiana.*

**1.1.** *Intermedial leaves of the stem acute to cuspidate at the apex.*

**2.** *Sporophylla entire or sparingly denticulate-serrulate.*

△ *Lateral leaves at least partly, but distinctly, denticulate-serrulate.*

○ *Spikes rather slender.* (28) *S. longipes.*

○○ *Spikes rather stout.* (29) *S. Quadrasii.*

△△ *Lateral leaves entire or nearly so.* (30) *S. integrifolia.*

**2.2.** *Sporophylla more copiously denticulate-serrulate.*

**3.** *Lateral leaves of the main rachis more or less copiously ciliate or ciliolate, at least on 1 side at the base.*

**a.** *Intermedial leaves of the principal rachises cordate or semicordate at the base, the produced auricle distinctly hamato-incurvate.*

× *Two incurved auricles.* (31) *S. banajaoensis.*

×× *Only one incurved auricle.*

+ *Primary branches simple or pinnate.*

(32) *S. infantensis.*

++ *Primary branches 2—3-pinnate.*

□ *Lateral leaves of the stipe erect or suberect; spikes 1—1½ mm. diam.*

○ *Branchlets 2—4 mm. broad.*

(33) *S. Neei.*

○○ *Branchlets 4—5 mm. or more broad.*

(34) *S. Fénixii.*

□□ *Lateral leaves of the stipe more or less spreading, or the spikes stouter.*

▽ *Intermedial leaves entire or at best minutely denticulate.* (35) *S. Bacanii.*

▽▽ *Intermedial leaves ciliate or ciliolate, at least at the base.*

♂ *Lateral leaves of the stipe ascending or erect.* (36) *S. sibuyanensis.*

♂♂ *Lateral leaves of the stipe spreading, or the lower more ascending.*

(37) *S. Toppingii.*

**a.a.** *Intermedial leaves of the principal rachises whether or*

*not cordate at the base, the produced auricle, if present, not hamate-incurvate.*

**b.** *Lateral leaves of the principal rachises cuneate or rotundate-cuneate on the upper side at the base.*

• *Lateral leaves of the branchlets entire.*

(38) *S. halconensis.*

\*\* *Lateral leaves of the branchlets more or less denticulate or ciliolate, at least on the upper side at the base.*

(39) *S. Sancti Antonii.*

**b.b.** *Lateral leaves of the principal rachises rotundate to auriculate-cordate on the upper side at the base.*

**c.** *Intermedial leaves of principal rachises not ciliate.*

(40) *S. Kerstingii.*

**c.c.** *Intermedial leaves of principal rachises ciliate, at least on 1 side at the base.*

**d.** *Lateral leaves of ultimate branchlets 1—2 mm. long.*

**e.** *Relatively small plants.*

(41) *S. fimbrillifera.*

**e.e.** *Large or middle-sized plants.*

**f.** *Sporophylla not pellucid-margined.*

(42) *S. Meyenii.*

**f.f.** *Sporophylla more or less pellucid margined.*

**g.** *Intermedial leaves of branchlets short-cuspidate.*

(43) *S. fallax.*

**g.g.** *Intermedial leaves of branchlets long-cuspidate.*

**h.** *Lateral leaves of the stipe rather erect, at best the higher more spreading.*

(44) *S. Ramosii.*

**h.h.** *Lateral leaves of the stipe horizontal or spreading.*

(45) *S. plumea.*

**d.d.** *Lateral leaves of ultimate branchlets 2—4 mm. long.*

○ *Spikes slender, 1—1½ mm. diam.*  
(46) *S. Gregoryi*.

○○ *Spikes stouter, 1½—2 mm. diam.*

⊖ *Lateral leaves entire or subentire towards the apex.*

÷ *Lateral leaves spuriously nerved.* (47) *S. similis*.

÷÷ *Lateral leaves not spuriously nerved.* (48) *S. Moszkowskii*.

⊖⊖ *Lateral leaves minutely denticulate towards the apex.*

÷ *Lateral leaves of main rachis rotundate-cuneate on the lower side at the base.*

(49) *S. Wigmanii*.

÷÷ *Lateral leaves of main rachis not rotundate-cuneate on the lower side at the base.*

(50) *S. Copelandii*.

**d.d.d.** *Lateral leaves more than 4 mm. long.*

(51) *S. grandis*.

**3.3.** *Lateral leaves of the main rachis entire or at best minutely denticulate-serrulate.*

**4.** *Ultimate branchlets 10—20 mm. or more broad.*

○ *Lateral leaves crowded on both stem and branches.*

(9) *S. alopecuroides*.

○○ *At least lower lateral leaves of main rachis spaced.*

(52) *S. magnifica*.

**4.4.** *Ultimate branchlets 1—10 mm. or less broad.*

**5.** *Intermedial leaves of principal rachises with at least the outer base produced and distinctly incurvate-(hamate-)auriculate<sup>(1)</sup>.*

*α.* *Lateral leaves of ultimate branchlets to 3 mm. long.*

*β.* *Lateral leaves of principal rachises cuneate or rounded on the upper side at the base.*

(<sup>1</sup>) See also (62) *S. sungemagneana* and (63) *S. billitonensis* v. A. v. R.





*rounded or cuneate on the upper side at the base.*

⌘ *Lateral leaves not spuriously veined.*  
 ÷ *Ultimate branchlets short, under 4 mm. broad.*

(64) *S. Vanvuureni.*

÷÷ *Ultimate branchlets long, or more than 4 mm. broad.*

(65) *S. subserpentina.*

⌘⌘ *Lateral leaves spuriously veined.*

· *Shoots simply pinnate.*

(66) *S. sambasensis.*

·· *Shoots more compoundly branched.* (54) *S. Grabowskyi.*

**7.7.** *Macrospores 4 in a macrosporangium, with 3 radiating apical ribs.*

**S.** *Lateral leaves of branchlets to 2 mm. long.* (67) *S. Elmeri.*

**S.S.** *Lateral leaves of branchlets 2 mm. or more long* <sup>(4)</sup>.

**9.** *Upper edge of lateral leaves denticulate in the lower part only.*

(68) *S. obesa.*

**9.9.** *Upper edge of lateral leaves denticulate more throughout.*

÷ *Small plants.*

(69) *S. wahauensis.*

÷÷ *Large or middle-sized plants.*

∧ *Pinnulae simple, forked or simply pinnate.*

= *Lateral leaves not spuriously veined.*

(70) *S. Posewitzii.*

=== *Lateral leaves spuriously veined.*

(71) *S. Cesatii.*

<sup>(4)</sup> See also (38) **S. halconensis** Hieron.

^^ *Pinnulae more compound-ly branched.*

|| *Spikes slender, to 2 mm. diam.*

(72) *S. simpokakensis.*

||| *Spikes stouter, more than 2 mm. diam.*

(73) *S. novae-guineae.*

(27) **S. Cumingiana**, *Spring*, *Mon.*, II, 126; *Bk.*, *Fern All.*, 77.

Shoots probably springing from a scandent main stem, 30—45 cm. long, pinnate, the stem obtusely quadrangular, sulcate down the face or sides, 12—14 mm. broad including the lateral leaves; pinnae ascending, the lower pinnate. Leaves of the lower plane contiguous on the branchlets, more spaced on the lower part of the stem, subhorizontal or spreading, rhomboid-oblong, 5—7 cm. long, those of the stem the longest,  $\frac{1}{2}$  as broad, blunt or bluntish, indistinctly spuriously veined, moderately thin in texture, nearly equal-sided, the upper side very minutely denticulate and somewhat pellucid-margined, rounded and denticulate or ciliolate at the base, the lower side entire or subentire, ciliolate at the rotundate or broadly cuneate base, the ciliae continued upon the rachis; leaves of the upper plane oblique-ovate, 2—3 times smaller, blunt, oblique and ciliated at the obliquely subcordate base, the outer base produced, cordate-auriculate. Spikes square, 2 $\frac{1}{2}$ —5 cm. long, 2 $\frac{1}{2}$  mm. diam.; sporophylla ovate, gradually long-acuminate from a broad base, very minutely serrulate, keeled; macrospores yellowish, nearly smooth, or irregularly verrucose, rugulose or somewhat reticulate, the apical ribs encircled by a somewhat undulated crest-shaped wing; microspores reddish, provided with needle-like or capitate projections.

*Philippines.*

(28) **S. longipes** (*longistipes*), *v. A. v. R.*, *Bull. Botz.*, 1914, XVI, 46.

Shoots erect from a creeping base, 35—60 cm. long when fully developed, the lower part simple, to 30 cm. long, when dry brownish and irregularly angled, the upper part deltoid or ovate, 3-pinnate, the main rachis 8—10 mm. broad including the lateral leaves; lowest pinnae

mostly spreading, lanceolate, to 15 cm. long; ultimate branchlets to 3½ cm. long, 3½—5 mm. broad. Leaves heteromorphous; lateral leaves of the lowest ½—¾ of the stipe unequal-sided, erect or suberect, remote, broadly oblong, bluntish, the inner side very minutely denticulate towards the base, the outer side entire or subentire, the outer base truncate-rotundate, the inner base auriculate-cordate, the auricle rounded or hamate-incurvate; lateral leaves of the branched portion spreading; of the main rachis the largest, approximate, similar to those of the stipe but somewhat falcate, indistinctly spuriously veined, to 5 mm. long and 3 mm. broad, the upper side entire or obsoletely denticulate, more distinctly denticulate in the lower part, broadly rotundate-cordate at the base, the lower side entire or subentire, abruptly cuneate-truncate at the base; of the branchlets smaller, to 2½ mm. long, relatively much narrower, more distinctly spuriously veined, less unequal-sided, the upper side cuneate in the lower half, rounded at the very base; intermedial leaves more or less erect; of the stipe remote, broadly oblong, acuminate, entire or obsoletely denticulate, 2-auriculate-cordate at the base, the outer auricle produced, somewhat hamate-incurvate; of the main rachis similar but more close, the largest 3—4 mm. long, mucronate-acuminate or shortly cuspidate; of the branchlets smaller, imbricate, the inner base narrowly rounded or rotundate-cuneate, the outer base rotundate-cordate. Spikes square, to 2 cm. long, 1½ mm. diam.; sporophylla isomorphous, ovate, acute, keeled, entire or sparingly denticulate; macrospores yellow-brown or dirty-brown, densely irregularly rugulose on the basal side, the apical ribs encircled by an irregular rugiform ring, the ridges not rarely glauco-pruinose; microspores dirty-orange, provided with scattered conical or bacilliform projections on the basal side.

*Borneo.*

(29) **S. Quadratif**, *Hieron.*, Fed., Rep., X, 114.

Shoots 40—50 cm. long, the lower part simple, yellowish, to 2½ mm. thick, the upper part sub-3-pinnate. Lateral leaves spreading; of the stipe unequal-sided, obliquely subfalcate-ovate, bluntly acuminate, the upper side narrowly pellucid-margined, minutely serrulate in the lower half, obsoletely denticulate in the upper half, rounded at the base, the lower side subentire or minutely and obsoletely denticulate, rotundate-cuneate at the base, the largest leaves 6½ mm. long and 3½ mm. broad; of the main rachis glaucous-green, similar to those of the stipe; of the

branchlets spreading, close, more falcate, ovate-oblong, blunt, the upper base rotundate-cuneate, the lower broadly so and provided with 0—3 ciliae, the largest leaves 4—5 mm. long and 1½—2 mm. broad; inter-medial leaves erect; of the stipe falcate-ovate, nearly equal-sided, shortly acuminate, minutely piloso-denticulate, the outer base produced, hamate-incurvate, the inner base subcuneate, the largest leaves ¼ mm. long; of the main rachis similar to those of the stipe but a little shorter; of the branchlets shorter, falcate-obovate, abruptly shortly aristate-acuminate, more or less denticulate towards the apex, cordate on the outer side at the base, cuneate on the inner side. Spikes 1—2½ cm. long, to 3 mm. diam.; sporophylla broadly deltoid-oblong, acuminate, narrowly pellucid-margined in the lower part, sparingly denticulate, keeled, the largest 1½ mm. long; macrospores blackish, brownish or yellowish, provided with flexuose, branched or reticulate rumples on the basal side; microspores yellow or yellowish, sparingly provided with capitate projections on the basal side.

*Mindanao.*

(30) **S. integrifolia**, *v. A. v. R.*, Bull. Botz., 1913, XI, 33.

Shoots erect from a more or less ascending base, 10—20 cm. long, the lower part rather short, simple or forked, terete or obtusely angular, 1—1½ mm. thick, stramineous-grey, the upper part branched; pinnae to 9 cm. long; pinnulae simple, forked or sparingly pinnate; ultimate branchlets ½—1½ cm. long, 1½—2 mm. broad including the lateral leaves. Leaves heteromorphous on both stem and branches; leaves of the lower plane erecto-patent, oblong, nearly straight, bluntish, entire, or very sparingly and minutely denticulate on the upper side at the base; of the stem somewhat remote, unequal-sided, 2 mm. long and ½ as broad, rotundate-cuneate on both sides at the base, the upper side the broadest, rounded, pellucid-margined; of the branchlets similar but narrower, the largest nearly as long, more close, less unequal-sided, cuneate at the base; leaves of the upper plane oblong or subobovate-oblong, shortly cuspidate, entire, pellucid-margined, cuneate on the inner side at the base, produced and cordate on the outer side at the base, the cusp to ⅓ as long as the blade; of the stem rather remote, 2 mm. long; of the branchlets imbricate, smaller. Spikes short, square, 1½—2 mm. diam.; sporophylla deltoid-ovate, acute or acuminate, entire, or very sparingly and minutely denticulate at the base, pellucid-margined, keeled, 1 mm. long; macrospores whitish or yellowish-white, finely reticulate or rugulose,

nearly smooth, the apical ribs encircled by a narrow, slightly elevated, ring-shaped crest; microspores yellowish or pale-orange, provided with bacilliform or stipitate-capitate projections on the basal side.

*Borneo.*

(31) **S. banajaoensis**, *Hieron.*, Fed., Rep., X, 45.

Shoots 20—25 cm. long, the lower part simple, stipitiform, compresso-quadrangular, stramineous-green, smooth, to  $2\frac{1}{2}$  mm. thick, the upper part irregularly decomposed, triangular or ovate in outline, the pinnae 2—3-pinnate. Leaves heteromorphous on both stem and branches; lateral leaves of the stipe spreading, broadly oblique-ovate, unequal-sided, mucronate-acuminate, auriculate and broadly rounded on the upper side at the base, rotundate-truncate on the lower side, with the upper edge denticulate, ciliate towards the base, the lower edge piloso-denticulate, ciliate at the base, the midrib thickened towards the apex, the largest leaves  $2\frac{1}{2}$  mm. long and  $1\frac{1}{2}$  mm. broad; leaves of the upper plane of the stem ovate, ciliated and incurvate-auriculate on both sides at the base but more prominently on the outer side, piloso-denticulate, aristate, the arista  $\frac{1}{2}$  as long as the blade; lateral leaves of the main and secondary rachises similar to those of the stipe but larger, to 5 mm. long and  $2\frac{1}{2}$  mm. broad, less acuminate, and the lower edge entire except at the minutely denticulate apex and the ciliate base; leaves of the upper plane of the main and secondary rachises similar to those of the stipe, sparingly pellucid-dotted; lateral leaves of the branchlets similar to those of the rachises but smaller,  $1\frac{1}{2}$ —2 mm. long and  $\frac{3}{4}$ —1 mm. broad, pellucid-margined on the upper side; leaves of the upper plane of the branchlets similar to those of the rachises but smaller, the edges sparingly denticulate, the base rotundate on the inner side, sparingly ciliate. Spikes solitary or double, square, 3—12 mm. long, 2 mm. diam.; sporophylla triangular-ovate, shortly aristate-acuminate, keeled, hardly pellucid-margined and copiously denticulated on both sides, ciliolate at the base, the ventral ones somewhat broader, the largest 2 mm. long; macrospores yellowish or whitish, encircled by a wing-like, undulated, hyaline, equatorial crest, the basal side provided with crowded, flexuose, branched or reticulated rumples, the apical ribs similar to the equatorial wing; microspores yellowish or orange-red, provided with minute rumples and scattered conical or short-stalked capitate projections.

*Luzon.*

(32) **S. infantensis**, *Hieron.*, Fed., Rep., X, 111.

Shoots 30—50 cm. long, the lower part simple, stramineous, much compressed, to 2 mm. thick, the upper part simply pinnate or sub-2-pinnate. Leaves heteromorphous; lateral leaves spreading; of the stipe unequal-sided, obliquely subfalcate-ovate, shortly acuminate, with the upper side minutely piloso-denticulate, ciliolate at the broadly cordate base, the lower side subentire, very minutely denticulate towards the apex, sparingly ciliolate at the truncate-cordate base, the largest leaves 3—3½ mm. long and 1¾ mm. broad; of the main rachis similar to those of the stipe but larger, to 6 mm. long and ½ as broad, falcate-ovate, subobtuse, with the upper side rotundate at the base, the lower side subentire, subtruncate-rotundate at the base; of the branchlets similar, ovate-oblong, spuriously nerved, 1¼—2½ mm. long, to ¾ mm. broad; intermedial leaves erect; of the stipe unequal-sided, falcate-ovate, shortly aristate-acuminate, piloso-denticulate, ciliate and hamate-incurvate on the outer side at the base, subtruncate-rotundate on the inner side at the base, the largest leaves 3 mm. long, with the cusp ½ as long as the blade; of the main rachis similar; of the branchlets similar but smaller, entire or rarely denticulate, and cordate on the outer side at the base, sparingly denticulate towards the apex. Spikes solitary, 5—7 mm. long, 1¼ mm. diam.; sporophylla ovate, acute, pellucid-margined, shortly piloso-denticulate, keeled, the largest 1 mm. long; microspores minium-red or reddish-brown, provided with sessile, capitate projections on the basal side; macrospores . . . . .

*Luzon.*

(33) **S. Neel**, *Hieron.*, Fed., Rep., X, 48.

Shoots 40—50 cm. long, the lower part simple, stipitiform, compressed-quadrangular, 3 mm. thick at the base, the upper part decomposed, sub-4-pinnate, ovate in outline. Leaves of the lower part of the stipe rather erect, nearly isomorphous; those of the lower plane unequal-sided, broadly obliquely ovate, subacute to subacuminate, cordate at the base but more broadly on the inner side, the inner edge ciliate in the lower half, minutely denticulate towards the apex, the outer edge minutely denticulate, ciliate at the base, the midrib thickened towards the apex, the largest leaves 4 mm. long, hardly more than 2 mm. broad; leaves of the upper plane as long and as broad, oblique-ovate, shortly aristate-acuminate, the inner side piloso-denticulate towards the apex, ciliate in

the lower part, cordate at the base, the outer side piloso-denticulate, auricled and ciliate at the base; leaves of the branched portion heteromorphous; leaves of the lower plane spreading, obliquely subfalcate-ovate, subacute, the upper base rotundate or subcordate-rotundate, the lower base rotundate or subtruncate-rotundate, the aligular side spuriously veined, the upper side pellucid-margined, piloso-denticulate, long-ciliate at the base, the lower side entire, long-ciliate at the base, the largest leaves of the main rachis 5 mm. long and 2 mm. or somewhat more broad, those of the ultimate branchlets 1½—2 mm. long and ½—¾ mm. broad; leaves of the upper plane erect, broadly and obliquely falcate-ovate, shortly aristate, sparingly denticulate on both sides, pellucid-dotted, the inner base truncate-rotundate, the outer incurvate-auriculate and sparingly long-ciliate, the largest leaves of the main rachis 2½ mm. long, those of the branchlets 1 mm. long, often entire and not ciliated, the cusp to ½ as long as the blade, the inner base rotundate-cuneate, the outer base rotundate-cordate. Spikes square, solitary, ¼—1½ cm. long, 1 mm. diam.; sporophylla deltoid-ovate, shortly aristate-acuminate, piloso-denticulate, pellucid-margined, keeled; macrospores yellowish or reddish-brown, provided with simple, flexuose, branched or connected rumples on the basal side, the apical ribs encircled by an equatorial ring; microspores yellowish or dirty-orange, provided with crowded conical projections.

*Luzon.*

(34) **S. Fénixii**, *Hieron.*, Fed., Rep., X, 98.

Shoots 50—60 cm. long, the lower part simple, stipitiform, green-stramineous, compressed-quadrangular, to 3½ mm. thick at the base, the upper part 3-pinnate, deltoid-ovate in outline, with the branchlets simple or forked, 4—5 mm. broad including the lateral leaves. Leaves of the stipe suberect, heteromorphous; those of the lower plane very unequal-sided, oblique-ovate, subacute, cordate and ciliate at the base, piloso-denticulate on the upper edge, subentire or minutely denticulate on the lower edge, the largest leaves 4 mm. long and 2 mm. broad; of the upper plane broadly ovate, shortly acuminate, nearly equal-sided, piloso-denticulate, ciliate and obliquely cordate at the base, the largest 3½ mm. long and 2 mm. broad; leaves of the main rachis heteromorphous; of the lower plane approximate, spreading, falcate-oblong, acuminate, ciliate at the base, indistinctly spuriously nerved, with the upper side piloso-denticulate, narrowly pellucid-margined in the lower part, auriculate-cordate at the



base, the lower side subentire, rotundate-cordate at the base, the largest leaves 5 mm. long and 2 mm. broad; of the upper plane subfalcate-obovate, shortly aristate-acuminate, piloso-denticulate, ciliate at the base, the outer base incurvate-cordate-auriculate, the inner rotundate, the largest leaves 3 mm. long and 2 mm. broad; leaves of the branches growing gradually smaller, of the branchlets the smallest; of the lower plane imbricate, subsimilar to those of the main rachis, falcate-lanceolate, more distinctly pellucid-margined and spuriously nerved, the upper side cuneate in the lower half, narrowly rounded at the very base, the lower side rotundate-subtruncate at the base, the largest 2—3 mm. long and  $\frac{3}{4}$ —1 mm. broad; of the upper plane less denticulate or rather entire, not or sparingly ciliate at the base, hardly  $1\frac{1}{2}$  mm. long and  $\frac{1}{2}$  mm. broad, the outer base cordate-rotundate, the inner base narrowed. Spikes 5—9 mm. long,  $1-1\frac{1}{2}$  mm. diam.; sporophylla subisomorphous, subdeltoid-ovate, shortly aristate-acuminate, indistinctly pellucid-margined, piloso-denticulate, keeled, those of the ventral side somewhat larger, to  $1\frac{1}{2}$  mm. long; macrospores yellowish or whitish, rugulose to subreticulate on the basal side; microspores yellowish or minium-red, shortly stipitate-capitate-verruculose on the basal side.

*Luzon.*

(35) **S. Bacanif**, *Hieron.*, Fed., Rep., X, 43.

Shoots 30—40 cm. long, the lower part simple, stipitiform, compressed, quadrangular, smooth, dirty-stramineous, to  $2\frac{1}{2}$  mm. thick, the upper part sub-3-pinnate, broadly deltoid-ovate or subrotund in outline. Leaves heteromorphous on both stem and branches; lateral leaves spreading; of the stipe remote, broadly falcate-ovate, dark-green above, glaucous-green beneath, shortly acuminate, rounded at the base but more broadly so on the upper side, with the upper edge minutely denticulate, ciliate at the base, the lower edge entire, sparingly denticulate at the base, the midrib slightly thickened in the upper part, the largest leaves  $3\frac{1}{2}$  mm. long and  $2\frac{1}{2}$  mm. broad; leaves of the upper plane erect; of the stipe remote, obliquely falcate-ovate, mucronate-acuminate, the mucro  $\frac{1}{3}$  as long as the blade, the edges piloso-denticulate but more shortly in the lower part, the base rotundate-cuneate on the inner side, produced and hamate-cordate on the outer side, the largest leaves 3 mm. long; leaves of the main rachis similar to those of the stipe but growing gradually narrower; lateral leaves of the branches obliquely oblong or ovate-oblong, nearly

straight, bluntish, rounded on the upper side at the base, rotundate-cuneate on the lower side, with the upper edge sparingly piloso-denticulate at the centre, ciliate at the base, the lower edge entire, the largest leaves of the ultimate branchlets  $1\frac{1}{2}$ —2 mm. long and  $\frac{1}{2}$  mm. broad; leaves of the upper plane of the branches obliquely subfalcate-oblong, acuminate, entire, rotundate-cuneate on the inner side at the base, produced on the outer side, those of the ultimate branchlets to  $\frac{3}{4}$ —1 mm. long. Spikes solitary, 5—10 mm. long,  $1\frac{1}{2}$  mm. diam.; sporophylla deltoid-oblong, acute, piloso-denticulate, slightly keeled, the largest 2 mm. long; macrospores dirty-yellowish-white, rugulose with short or long, flexuose or branched rumples on the basal side; microspores orange or yellowish, provided with copious sessile, capitate projections on the basal side.

*Luzon.*

(36) **S. sibuyanensis**, *Hieron.*, Fed., Rep., X, 97.

Shoots probably 50 cm. long, the lower part simple, stipitiform, stramineous-green, quadrangular, rather compressed, to 3 mm. thick, the upper part compound. Leaves heteromorphous; leaves of the lower plane very unequal-sided and broadly obliquely ovate on the stem, falcate-oblong on the branchlets; those of the stipe ascending, remote, acuminate, with the upper edge minutely denticulate, ciliolate in the broadly rotundate-cuneate and pellucid-margined lower half, ciliate at the subauriculate base, the lower edge very minutely denticulate at the apex, sparingly ciliate at the narrowly truncate base, the largest leaves  $4\frac{1}{2}$  mm. long and  $2\frac{1}{2}$  mm. broad; those of the main and secondary rachises similar but somewhat longer; of the main rachis spreading; of the branchlets close, ascending, subacute or subobtuse, slightly spuriously veined, with the upper edge sparingly piloso-denticulate and pellucid-margined in the lower half, sparingly ciliolate towards the cuneate base, the lower edge entire, or sparingly ciliate at the narrowly rotundate-cuneate base, the largest leaves 2— $2\frac{1}{2}$  mm. long,  $\frac{1}{2}$ — $\frac{3}{4}$  mm. broad; leaves of the upper plane erect, falcate-ovate, aristate-acuminate; of the stipe remote, with the outer edge involute, ciliate at the produced, auriculate base, the inner edge minutely denticulate, ciliate at the base, the largest leaves 5 mm. long, 2 mm. broad, the cusp  $\frac{1}{3}$  as long as the blade; of the main rachis incurvate-auriculate on the outer side at the base; cuneate on the inner side at the base; of the branchlets similar, imbricate, entire, smaller, rotundate-auriculate on the outer side at the base, the largest  $1\frac{1}{4}$  mm.

long, shortly aristate. Spikes square, 5—12 mm. long, 2 mm. diam., solitary; sporophylla rather isomorphous, deltoid-ovate, shortly aristate-acuminate, minutely denticulate, keeled, the ventral ones somewhat broader, the largest 1½ mm. long; macrospores yellowish-white, provided with short or long, straight or flexuose, branched or reticulated rumples on the basal side; microspores minium-red or yellowish, provided with stipitate-capitate projections on the basal side.

*Sibuyan (Philippines).*

(37) **S. Toppingii**, *Hieron.*, Fed., Rep., X, 112.

Shoots 40 cm. long, the lower part simple, stramineous-green, compresso-quadrangular, to 3 mm. thick, the upper part pinnately compound, deltoid-ovate in outline; pinnulae with their branches simple or forked. Leaves heteromorphous; lateral leaves of the stipe unequal-sided, the lowest suberect, the following spreading, remote, broadly oblique-ovate, subfalcate, shortly acuminate, with the upper side minutely denticulate, obsoletely denticulate towards the apex, ciliate at the subauriculate-cordate base, the lower side subentire, obsoletely denticulate towards the apex, ciliate at the subtruncate-rotundate base, the largest leaves 4 mm. long and 3 mm. broad; of the main rachis glaucous-green, falcate-ovate, acuminate, sparingly spuriously nerved, with the upper side piloso-denticulate, narrowly pellucid-margined in the lower half, sparingly ciliate at the subauriculate-cordate base, the lower side entire, or hardly denticulate towards the apex, sparingly ciliate at the truncate-rotundate base, the largest leaves 6 mm. long and 3 mm. broad; of the branchlets similar but smaller, contiguous, ovate-oblong, 1½—3 mm. long and ½—1 mm. broad, obtuse, more distinctly pellucid-margined and spuriously veined, the upper side cuneate in the lower half, very narrowly truncate-rotundate at the very base, the lower side narrowly cuneate or rotundate at the base; intermedial leaves erect; of the stipe remote, unequal-sided, obliquely subfalcate-ovate, shortly aristate-acuminate, more or less denticulate, ciliate at the base, with the outer base incurvate-cordate, the inner base subtruncate-rotundate, the largest leaves 3½ mm. long; of the branches similar to those of the stipe but growing gradually shorter; of the branchlets imbricate, very sparingly ciliate and rotundate-cordate on the produced outer side at the base. Spikes solitary, 5—15 mm. long, 2 mm. diam.; sporophylla subisomorphous, deltoid-oblong, shortly aristate-acuminate, minutely denticulate, indistinctly pellucid-margined in

the lower half, keeled, the largest 1½ mm. long; macrospores whitish or yellowish, rugulose with flexuose, branched or hardly reticulated rumples on the basal side; microspores orange or yellowish, minutely rugulose and sparingly capitato- or conico-verruculose on the basal side.

*Luzon.*

(38) **S. halconensis**, *Hieron.*, Fed., Rep., X, 108.

Shoots 70 cm. or more long, the lower part simple, stipitiform, yellowish or ochraceous, compresso-quadrangular, to 3½ mm. thick, the upper part sub-5-pinnate, ovate in outline. Leaves heteromorphous; lateral leaves of the stipe obliquely falcate-ovate, the lowest suberect, the following spreading, very unequal-sided, shortly acuminate, with the upper side piloso-denticulate, gradually ciliate towards the rotundate-cordate base, the lower side entire, or obsoletely denticulate towards the apex, sparingly ciliate at the subtruncate-auriculate base, the largest leaves 4 mm. long and 2½ mm. broad; of the main rachis glaucous-green, obliquely subfalcate-ovate, unequal-sided, subacute, indistinctly spuriously veined, with the upper side sparingly denticulate, hardly pellucid-margined, subentire or ciliate towards the rotundate-cuneate base, the lower side entire, sparingly ciliate at the truncate-rotundate base, the largest leaves 6 mm. long and 3 mm. broad; of the ultimate branchlets similar but smaller, subcontiguous, rather falcate-oblong, entire, with the upper side cuneate in the lower part, very narrowly truncate-cordate at the base, the lower side truncate-rotundate at the base, the largest leaves 2—4 mm. long and ¾—1¼ mm. broad; intermedial leaves erect; of the stipe broadly falcate-ovate, shortly aristate-acuminate, inequilateral, with the outer side subentire, or ciliate at the subtruncate-cordate produced base, the inner side piloso-denticulate towards the apex and gradually ciliate towards the truncate or subcordate base, the largest leaves 4 mm. long and ½ as broad; of the main rachis subsimilar to those of the stipe, with the outer base subincurvate-cordate; of the branchlets similar to those of the main rachis but smaller, to 1½ mm. long and relatively narrower, with the outer base rotundate-cordate, the inner base narrowed. Spikes solitary, 5—8 mm. long, 1¼ mm. diam.; sporophylla subisomorphous, deltoid-ovate, shortly aristate-acuminate, minutely piloso-denticulate, hardly pellucid-margined, keeled, the largest 1½ mm. long; macrospores dark or yellow-brown, provided with flexuose or branched, hardly connected rumples on the basal side, the apical ribs encircled by a nearly wing-shaped equatorial crest; micro-

spores yellowish, provided with capitate or tuberculiform projections on the basal side.

*Mindoro.*

(39) **S. Sancti Antonii**, *Hieron.*, Fed., Rep., X, 100.

Shoots 50 cm. or more long, the lower part simple, stipitiform, reddish- or greenish-stramineous, compresso-quadrangular, 2 mm. thick, the upper part sub-4-pinnate, broadly ovate in outline; pinnae remote, ovate or lanceolate, the largest 25 cm. long. Leaves heteromorphous on both stem and branches; lateral leaves of the stipe very unequal-sided, the lower erect, the higher spreading, oblique-ovate, the largest 3½ mm. long, 1½ mm. broad, acute, with the upper edge piloso-denticulate, gradually ciliate towards the rounded base, and the lower edge minutely denticulate, sparingly ciliate at the shortly truncate base; of the main rachis subhorizontal, remote, obliquely falcate-oblong, the largest 6 mm. long and 2½ mm. broad, acuminate, with the upper side minutely denticulate, pellucid-margined in the lower half, gradually ciliate towards the cuneate base and the lower side entire or subentire, minutely or obsoletely denticulate towards the apex, sparingly ciliate at the shortly truncate base; of the ultimate branchlets similar to those of the main rachis but smaller, spreading, subcontiguous, the largest 2—2½ mm. long and ⅔—¾ mm. broad; intermedial leaves erect; of the stipe remote, subfalcate-ovate, the largest 2½ mm. long, aristate, piloso-denticulate, with the inner base shortly truncate, the outer base cordate-auriculate (incurved?), sparingly ciliate, the arista ⅓ as long as the blade; of the main rachis similar, to 3 mm. long and ½ as broad, the auricle incurved; of the ultimate branchlets similar but smaller, entire, or sparingly denticulate towards the apex, the outer base rotundate-cordate, the inner base narrowed. Spikes solitary or sometimes double, 5—35 mm. long, 2—2½ mm. diam.; sporophylla nearly isomorphous, deltoid-ovate, shortly aristate-acuminate, piloso-denticulate, keeled, the largest 1½ mm. long; macrospores brownish, rugulose with short or elongate, straight, flexuose, branched or reticulate rumples; microspores minium-red or reddish-brown, provided with stipitate-capitate projections on the basal side.

*Luzon.*

(40) **S. Kerstingii**, *Hieron.*, Engl. Bot. Jahrb., L, 21.

Shoots erect from a creeping base, 50 cm. or more long, the lower

part simple, compressed, slightly grooved down the face, olivaceous or brownish, to 4 mm. thick, the upper part compound, deltoid-ovate, 30—40 cm. each way; pinnae 6—8 on a side, the lower 20 cm. long, with the lower pinnulae between pinnate and dichotomous; principal rachises 1—1½ cm. broad including the lateral leaves; ultimate branchlets 8 mm. broad. Leaves heteromorphous; lateral leaves suberecto-patent; of the stem obliquely falcate-ovate, bluntish or subacute, minutely denticulate, very unequal-sided, more or less ciliolate at the base, pellucid-margined on the upper side, the upper base cordate-rotundate, the lower base abruptly cuneate, the largest leaves 9 mm. long and 5 mm. broad; of the branches similar but proportionally narrower and growing gradually smaller, contiguous; of the branchlets 2½ mm. long, more narrowed on both sides at the base; intermedial leaves erect; of the stem broadly falcate-ovate, abruptly shortly aristate-acuminate, minutely denticulate, the outer base shortly cordate, the inner base narrowly cordate-rotundate, the largest leaves 5 mm. long and 3½ mm. broad; of the branches similar but proportionally narrower and growing gradually smaller, those of the branchlets more distinctly auricled on the outer side at the base. Spikes solitary, double or triple, square, ½—1½ cm. long, 2 mm. diam.; sporophylla subisomorphous, deltoid-ovate, acute, mucronulate, minutely denticulate, keeled, the largest 2 mm. long; macrospores pale-yellow, irregularly rugulose, the apical ribs encircled by a rumple-like crest; microspores pale-yellow, provided with scattered, sessile, capitate projections on the basal side.

*New Guinea.*

(41) **S. ambrillifera**, *v. A. v. R.*, Bull. Botz., 1914, XVI, 47.

Shoots erect, or ascending from a creeping base, 15—20 cm. long, the lower part simple, obtusely quadrangular, 1 mm. thick, convex on the back, when dry 3-sulcate on the face and sides, the upper part roundish, triangular or ovate in outline, 3-pinnate; main rachis 5—7 mm. broad including the lateral leaves; lower pinnae to 7 cm. long, deltoid; ultimate branchlets 5—12½ mm. long, 2—3 mm. broad. Lower leaves of the stipe somewhat remote, subisomorphous; of the lower plane broadly triangular-ovate, acute, very broadly adnate and narrowly 2-auriculate-cordate at the base, densely fimbriate-ciliate, the largest leaves 2 mm. long, about as broad; of the upper plane nearly similar, as long but much narrower, acuminate; leaves of the branched portion very heteromorphous;

leaves of the lower plane imbricate at least at the base; of the main rachis horizontal or nearly so, subfalcate-oblong, acute, broadest on the upper side, both sides minutely and copiously denticulate, the upper side gradually ciliolate in the lower half, cordate at the base (not auriculate), the lower side ciliate towards the cordate (narrowly auriculate) base, the largest leaves  $2\frac{1}{2}$ — $3\frac{1}{2}$  mm. long and  $\frac{2}{3}$  as broad; of the branchlets ascending, smaller, proportionally much narrower, acute, the upper side minutely serrulate, ciliolate-denticulate at the rotundate-subcordate base, the lower side minutely serrulate in the upper half, entire in the lower half, very sparingly ciliolate-denticulate at the rounded base, the largest leaves  $1\frac{1}{2}$ —2 mm. long, under  $\frac{1}{2}$  as broad; leaves of the upper plane erect; of the main rachis somewhat remote to imbricate, subfalcate-ovate, acuminate-cuspidate, ciliolate-denticulate on both sides, pellucid-margined on the outer side, less so on the inner side, fimbriate-ciliolate at the somewhat obliquely rotundate-subcordate base, the largest leaves 3 mm. long, the cusp  $\frac{1}{2}$  as long as the blade; of the branchlets similar but smaller, imbricate, more obliquely rotundate-cuneate and not or hardly ciliolate at the base. Spikes solitary, square, 5 mm. more or less long,  $1$ — $1\frac{1}{2}$  mm. diam.; sporophylla ovate-oblong, acute or mucronate-acuminate, slightly keeled, serrulate, more or less narrowly pellucid-margined, macrospores whitish, reticulate-rugulose or nearly smooth; microspores yellow-orange or red-orange, prickly, the projections varying from conical to bacilliform, not or hardly thickened at the apex.

*Borneo.*

(42) **S. Meyenii**, *Hieron.*, Fed., Rep., X, 50.

Shoots probably 20—40 cm. long, the lower part simple, stipitiform, reddish-stramineous, compressed-quadrangular,  $1$ — $1\frac{1}{2}$  mm. thick, the upper part sub-3-pinnate; branchlets 4 mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves of the stipe unequal-sided, the lower suberect, the others spreading, remote, obliquely falcate-ovate, shortly acuminate, the upper edge minutely denticulate in the upper part, ciliate towards the subauriculate-rotundate base, the lower edge entire or obsoletely papilloso-denticulate, ciliate at the rotundate-cuneate base, the midrib thickened towards the apex, the largest leaves 3 mm. long and  $2\frac{1}{4}$  mm. broad; lateral leaves of the main rachis similar, horizontal, to 5 mm. long; those of the branches obliquely subfalcate-ovate or -oblong, subobtuse, the upper side pellucid-margined, minutely

denticulate, cuneate and ciliolate in the lower half, ciliate and very narrowly auriculate at the base, the lower side entire, ciliate at the rotundate-cuneate base, the midrib thickened towards the apex, flanked by spurious veinlets, the largest leaves  $1\frac{1}{2}$ —2 mm. long,  $\frac{1}{2}$ — $\frac{3}{4}$  mm. broad; leaves of the upper plane erect; of the stipe and main rachis falcate-ovate, aristate-acuminate, piloso-denticulate on both sides, ciliate at the base, the inner base rounded, the outer produced, cordate-auriculate, the cusp  $\frac{1}{3}$ — $\frac{1}{2}$  as long as the blade, the largest leaves 3—4 mm. long; of the branches similar, shorter, more sparingly denticulate, much longer cuspidate, often non-ciliate at the base. Spikes 3—9 mm. long, nearly 2 mm. diam.; sporophylla deltoid, shortly aristate-acuminate, piloso-denticulate, keeled, the ventral ones somewhat larger,  $1\frac{1}{2}$  mm. long; macrospores pale-reddish, yellowish or reddish-blackish, provided with flexuose, branched or reticulate rumples on the basal side, the apical ribs encircled by an equatorial ring; microspores yellowish or orange, provided with stipitate-capitate projections on the basal side.

*Luzon.*

(43) **S. fallax**, *Hieron.*, Fed., Rep., X, 104.

Shoots 20—30 cm. long, the lower part simple, stipitiform, greenish- or reddish-stramineous or bluish-grey, compresso-quadrangular,  $2\frac{1}{2}$  mm. thick at the base, the upper part sub-3-pinnate, ovate in outline. Leaves heteromorphous; lateral leaves spreading; of the stipe remote, very unequal-sided, broadly oblique-ovate, broadest on the upper side, shortly acuminate, minutely denticulate on both sides, the upper side gradually, the lower suddenly, ciliated towards the cordate base, the largest leaves  $2\frac{1}{2}$  mm. long and nearly 2 mm. broad; of the main rachis similar to those of the stipe but larger, rather entire on the lower side, to 5 mm. long and 3 mm. broad; of the ultimate branchlets approximate, less unequal-sided, lanceolate-falcate, bluntish, hardly spuriously veined, with the upper side pellucid-margined, minutely denticulate, gradually ciliate towards the base, cuneate in the lower half, narrowly rounded at the very base, the lower side entire, ciliate at the truncate-rotundate base, the largest leaves  $1\frac{1}{2}$ —2 mm. long and  $\frac{1}{2}$ —1 mm. broad; intermedial leaves erect; of the stipe remote, unequal-sided, broadly oblique-ovate, shortly denticulate, shortly cordate and ciliolate at the base, the largest leaves  $3\frac{1}{2}$  mm. long, with the cusp  $\frac{1}{2}$  as long as the blade; of the main rachis similar to those of the stipe but somewhat smaller, pellucid-dotted,



of the ultimate branchlets similar to those of the rachis but smaller, sparingly denticulate, entire at the base, the outer base cordate-rotundate, produced, the inner base cuneate-rotundate, with the cusp  $\frac{1}{4}$  as long as the blade. Spikes 4—10 mm. long, 2 mm. diam.; sporophylla subisomorphous, deltoid-ovate, very shortly aristate-acuminate, pellucid-margined in the lower half, piloso-denticulate, ciliate at the base, the largest  $1\frac{1}{2}$  mm. long; macrospores yellowish-white, provided with short or elongate, straight, flexuose, branched or connected rumples on the basal side, the apical ribs encircled by an equatorial wing-shaped crest; microspores minium-red or yellowish, provided with shortly stipitate-capitate and very minutely punctiform or rugiform projections.

*Luzon.*

(44) **S. Ramosii**, *Hieron.*, Fed., Rep., X, 52.

Shoots 20—35 cm. long, the lower part simple, stipitiform, yellowish-grey, compressed-quadrangular, to  $1\frac{3}{4}$  mm. thick, the upper part sub-3-pinnate, ovate or subrotundate in outline; ultimate branchlets 3—4 mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves of the stipe erect, very unequal-sided, oblique-ovate, shortly acuminate, both sides minutely denticulate towards the apex, ciliate towards the subauriculate-cordate base, the largest leaves  $2\frac{1}{2}$  mm. long,  $1\frac{1}{2}$  mm. broad; those of the main rachis spreading, obliquely subfalcate-ovate-oblong, subauriculate on the upper side at the base, truncate-rotundate at the lower base, indistinctly spuriously veined, the upper side piloso-denticulate in the upper half, pellucid-margined, gradually ciliate towards the base, the lower edge denticulate at the apex, ciliate at the base, the largest leaves  $4\frac{1}{2}$  mm. long, 2 mm. broad; those of the branches similar, of the branchlets the smallest,  $1\frac{1}{2}$ —2 mm. long,  $\frac{1}{2}$  mm. broad, close, distinctly pellucid-margined on the upper side; intermedial leaves erect; of the stipe obliquely deltoid-ovate, shortly aristate-acuminate, both sides minutely denticulate in the upper part, ciliate towards the subauriculate-cordate base, the largest leaves  $2\frac{3}{4}$  mm. long; those of the main rachis similar but nearly equal-sided, the largest  $3\frac{1}{2}$  mm. long, more sparingly ciliate at the base, pellucid-dotted, the cusp somewhat longer; those of the branches similar, of the ultimate branchlets  $1\frac{3}{4}$ —2 mm. long, with the cusp  $\frac{3}{4}$  as long as the blade, the base whether or not ciliated, more produced on the outer side. Spikes solitary, 5—15 mm. long, 2 mm. diam.; sporophylla deltoid-ovate, shortly aristate-acuminate,

piloso-denticulate, pellucid-margined, the ventral ones somewhat broader, the largest 1½ mm. long; macrospores white or yellowish, provided with free, flexuose, branched or reticulated rumples on the basal side, the apical ribs encircled by an equatorial ring; microspores minium-red or yellowish, provided with crowded, sessile, capitate projections on the basal side.

*Luzon.*

(45) **S. plumea**, *Spring*, Mon. II, 136; Bk., Fern All., 76; — var. *trichobasis*; *S. trichobasis*, *Bk.*, l. c.

Shoots erect, or ascending from a decumbent base, 15—30 cm. long, the stem subterete or obtusely angular, the branching between dichotomous and pinnately decomposed; principal rachises 6—10 mm. broad including the lateral leaves; ultimate branchlets 2—5 mm. broad. Leaves heteromorphous; lateral leaves rather spaced on the main stem, more crowded on the branchlets; of the stem horizontal or spreading, 3—5 mm. long, bluntish or mucronulate, spuriously veined and pellucid-margined, the upper edge entire or obscurely denticulate towards the apex, gradually ciliolate or ciliate towards the much produced auriculate-cordate base, the lower edge entire, or minutely denticulate towards the rather narrowly rounded or rotundate-cuneate base, the upper surface provided with a few short, spine-like, scattered hairs near the lower edge; of the branchlets smaller, 1¼—2¼ mm. long, acute, less spreading, obliquely rounded or rotundate-cuneate at the base; intermedial leaves small, roundish, oblong, ovate or obovate, denticulate or ciliate, narrowly pellucid-margined, long-cuspidate, the cusp as long as the blade; of the stem abruptly cuspidate, obliquely cordate at the base, the outer base produced; of the branchlets acuminate-cuspidate, obliquely rounded or rotundate-cuneate at the base. Spikes copious, square, 6—12½ mm. long and 2 mm. diam.; sporophylla ovate, acuminate, denticulate-ciliolate, rather pellucid-margined, keeled; macrospores irregularly rugulose or reticulate, or verruculose, and the apical ribs encircled by a ring-shaped crest; microspores whitish or yellowish, provided with capitate or bacilliform projections on the basal side.

Forma typica: Ciliae short, rather oblique.

**Var. trichobasis:** Ciliae long, rather horizontal.

*Malacca.*

(46) **S. Gregoryi**, *Hieron.*, Fed., Rep., X, 102.

Shoots 40—60 cm. long, the lower part simple, stipitiform, compresso-

quadrangular, greenish- or greyish-stramineous, to 3 mm. thick at the base, the upper part pinnately decomposed, ovate or subrotundate in outline; pinnulae with the branches once or more times forked; ultimate branchlets 3—4½ mm. broad including the lateral leaves. Leaves heteromorphous on both stem and branches; lateral leaves of the stipe remote, the lower suberect, the higher spreading, unequal-sided, oblique-ovate, 2-auriculate-cordate and ciliate at the base, shortly acuminate, with the upper (inner) side minutely piloso-denticulate, ciliate towards the base, narrowly subpellucid-margined and the lower (outer) side minutely piloso-denticulate towards the apex, the largest leaves 3 mm. long and 2¼ mm. broad; of the main rachis similar but more broadly ovate, the acumen bluntish, the upper base cordate-rotundate, the lower truncate-rotundate, the aligular side more or less distinctly spuriously nerved, the largest leaves 5 mm. long and 3 mm. broad; of the ultimate branchlets similar but smaller, imbricate, distinctly spuriously nerved, the largest 2—3 mm. long and hardly more than 1 mm. broad, rather narrowed at the base; leaves of the upper plane erect; of the stipe broadly subfalcate-ovate, shortly aristate, ciliolate-denticulate, obliquely cordate and ciliate at the base, coarsely pellucid-dotted, the largest leaves 3 mm. long, with the cusp ¼ as long as the blade; of the main rachis similar but somewhat larger; of the ultimate branchlets similar but smaller, subentire or sparingly piloso-denticulate, the cusp relatively shorter and the base more shortly ciliolate. Spikes solitary, 3—7 mm. long, 1—1¼ mm. diam.; sporophylla broadly deltoid-oblong, shortly aristate-acuminate, piloso-denticulate, the largest 1 mm. long; macrospores reddish- or yellowish-white, provided with short or elongated, flexuose, branched or connected rumples on the basal side, the apical ribs encircled by an equatorial crest; microspores minium-red or reddish-brown, provided with shortly stipitate-capitate projections on the basal side.

*Luzon.*

(47) **S. similis**, *Kuhn*, *Forsch. Gaz.*, IV, Bot.; — var. *breviaristata*, Hieron., MS. in *Herb. Berol.*

Shoots ascending, decomposed, to 3—4-pinnate (subdichotomous), deltoid in outline, to 50 cm. long and 25 cm. broad, the stem stramineous, compressed, 2-sulcate down the face, convex on the back, the main rachis subflexuose, the partial rachises flexuose, to 10 mm. broad including the lateral leaves; ultimate branchlets 5—7 mm. broad. Leaves hetero-

morphous; lateral leaves of the stem subspreading or ascending, ovate, to 5 mm. long, obtuse, entire, spuriously nerved, rounded on the upper side at the base, cuneate on the lower side; those of the ultimate branchlets imbricated, sessile, elongate-lanceolate, obtuse or very slightly acuminate, falcate, pellucid-margined on the upper side, spuriously nerved, the upper base cordate, ciliolate, the lower base cuneate or rounded, entire or sparingly ciliated, the largest leaves 3—4 mm. long; intermedial leaves  $\frac{1}{2}$  as long; those of the stem rhomboidal-ovate, long-cuspidate, ciliolate to denticulate, soon entire, cordate on the outer side at the base, cuneate on the inner side; those of the branchlets abruptly long-aristate-acuminate, with the inner side entire, rounded at the base, the outer side ciliated and cordate at the base. Spikes square, 1—2 cm. long,  $1\frac{1}{2}$ —2 mm. diam.; sporophylla triangular-oblong, much acuminate, pellucid-margined and minutely denticulate, keeled, those on the upper side somewhat larger; macrospores yellowish-white, finely rugulose or reticulate; microspores dirty-yellowish or orange, provided with stipitate-capitate or conical projections on the basal side.

**Var. breviaristata:** Leaves of the upper plane acute or acuminate, at best shortly aristate, minutely denticulate to ciliolate.

*New Guinea.*

(48) **S. Moszkowskii**, *Hieron.*, in Engl. Bot. Jahrb., L, 14.

Shoots erect, to 50 cm. or more long, the lower part simple, stipitiform, compressed, sub-2-sulcate on the face, subconvex on the back, to 4 mm. thick, glossy, olivaceous, yellowish or brownish, the upper part sub-3-pinnate, ovate in outline, the main rachis 7—8 mm. broad including the lateral leaves; lower pinnae to 20 cm. long, with the lower pinnulae twice forked; ultimate branchlets 5—6 mm. broad. Leaves heteromorphous; leaves of the stipe rather erect, remote; lateral leaves obliquely ovate, very unequal-sided, the largest 5 mm. long and  $2\frac{1}{2}$  mm. broad, narrowed gradually to the bluntish point, the upper (inner) side indistinctly and narrowly pellucid-margined in the lower half, denticulate, entire towards the apex, gradually long-ciliate towards the auriculate-cordate base, the lower (outer) side entire, ciliate at the shortly subtruncate-rotundate base; intermedial leaves slightly obliquely falcate-ovate, unequal-sided, shortly aristate-acuminate, obliquely cordate at the base, the largest 4 mm. long and 2 mm. broad, the inner side narrowly pellucid-margined in the lower part, denticulate towards the apex, ciliate towards the base,

the outer side sparingly ciliate at the produced base; leaves of the branched portion similar to those of the stipe but gradually more contiguous, proportionally longer and narrower; lateral leaves of the main rachis spreading; of the ultimate branchlets 4 mm. long and 1¼ mm. broad, sub-erecto-patent, cordate-rotundate at the upper base, abruptly cuneate at the lower base; intermedial leaves erect; of the branchlets imbricate, remotely ciliate towards the outer base, sparingly so at the inner base. Spikes solitary or double, 5—7 mm. long or probably longer, 1½—2 mm. diam.; sporophylla subisomorphous, deltoid, narrowly pellucid-margined, denticulate, ciliate at the base; macrospores rather rugulose or reticulate, and provided with an equatorial ring; microspores . . . . .

*New Guinea.*

(49) **S. Wignani**, *v. A. v. R.*, Bull. Bot., 1913, XI, 32.

Shoots erect or ascending, 25—30 cm. long, pinnate, the stem obtusely angular, convex on the back, bisulcate down the face when dry, grey-brown; pinnae pinnate; lower pinnulae pinnate again; branchlets 3—5—7 mm. broad including the lateral leaves. Lateral leaves of the stem somewhat remote, spreading (the lower ascending), subequilateral, linear-oblong, nearly straight, rather bluntish, the upper side very minutely denticulate in the upper half, denticulate in the lower part, ciliolate at the auriculate-cordate base, the lower side entire, or obsoletely denticulate towards the apex, sparingly ciliate or ciliolate at the rotundate-cuneate base, the largest leaves 6 mm. long, 2 mm. broad; of the secondary rachises similar, more ascending, close, somewhat smaller, blunt; of the branchlets similar, ascending, more rotundate-cuneate at the lower base, more or less pellucid-margined on the upper side in the lower half and dorsally spuriously veined, the largest leaves 2—3 mm. long; intermedial leaves of the stem broadly oblique-oblong, somewhat remote, erect, cuspidate-acuminate, denticulate, ciliolate in the lower part, obliquely cordate, and produced on the outer side, at the base, the cusp ⅓—½ as long as the blade, the largest leaves 4 mm. long; of the branchlets similar, smaller, imbricate, rather pellucid-margined, less copiously denticulate and ciliolate, rather narrowly rotundate-truncate at the inner base, the cusp relatively longer. Spikes terminal or subterminal, single or double, square, 5—15 mm. long, 1½—2 mm. diam.; sporophylla triangular-ovate, shortly aristate-acuminate, keeled, denticulate; macrospores whitish or yellowish, more or less rugulose to reticulate, the apical ribs

encircled by a ring-shaped crest; microspores yellowish or whitish, the basal side provided with conical, verruciform, capitate or stipitate-capitate projections.

*New Guinea.*

(50) **S. Copelandii**, *Hieron.*, Fed., Rep., X, 106.

Shoots 40—50 cm. long, the lower part simple, stipitiform, compresso-quadrangular, 2½ mm. thick, ochraceous, the upper part 3-pinnate, deltoid in outline; ultimate branchlets 6—7 mm. broad including the lateral leaves. Leaves heteromorphous on both stem and branches; lateral leaves of the stipe spreading, unequal-sided, oblique-ovate, subobtuse or subacute, piloso-denticulate on both sides, the upper base rotundate-cordate, the lower base rotundate-cuneate and sometimes ciliate, the largest leaves 3 mm. long and 2½ mm. broad; lateral leaves of the main rachis obliquely falcate-oblong, glaucous-green, rather equal-sided, spuriously nerved, indistinctly pellucid-margined, subobtuse, the upper side minutely piloso-denticulate, gradually ciliolate towards the narrowly subcordate-rotundate base, the lower side entire, very minutely papilloso-denticulate at the apex, sparingly ciliate at the truncate-cuneate base, the largest leaves 6 mm. long and 2½ mm. broad; lateral leaves of the ultimate branchlets ascending, close, similar to those of the main rachis but smaller, the largest 3—3½ mm. long and ½ as broad; intermedial leaves erect; of the stipe subfalcate-ovate, aristate-acuminate, rather equal-sided, piloso-denticulate on both sides, the outer base cordate-auriculate, sparingly ciliate, the inner base cordate, subentire, the largest leaves 4 mm. long, with the cusp about ½ as long as the blade; intermedial leaves of the main rachis similar to those of the stipe, but the cusp ½ as long as the blade, the inner base rotundate-cordate; of the ultimate branchlets similar but smaller, imbricate, entire or sparingly denticulate, the outer base rounded, produced, the inner base rotundate-cuneate. Spikes solitary, 1—2½ cm. long, 1¼—2 mm. diam.; sporophylla deltoid-oblong, very shortly aristate-acuminate, piloso-denticulate, narrowly pellucid-margined in the lower part, keeled, the largest 1½ mm. long, to nearly as broad; macrospores blackish or pale-grey, rugulose or verruculose-rugulose on the lower side, the apical ribs encircled by a nearly wing-like equatorial crest; microspores . . . .

*Mindanao.*

(51) **S. grandis**, *Moore*, in Gard. Chron., 1882, II, 40, tab. VIII; Bk., Fern All., 98; *S. platyphylla*, *Veitch.*, Hort.

Shoots erect from a creeping base, the lower part simple, stipitiform,

subcompressed or obtusely angular, 3—5 mm. thick, the upper part decomposed, branched, suborbicular, broadly oblong or ovate in outline, 30—40 cm. long, pinnate downward, copiously dichotomous upward, the main rachis flexuose at least in the upper half; pinnae cuneate-obovate or lanceolate-oblong, pinnate at the base, more or less copiously dichotomous in the upper part, as are the pinnulae, with the rachises flexuose; ultimate branchlets numerous, crowded, 6—16 mm. broad including the lateral leaves. Leaves heteromorphous; of the stipe erect, adpressed; of the lower plane rather triangular, acute, ciliate at the base, the inner base whether or not subproduced; of the upper plane oblong-ovate, acuminate, the base ciliate, semicordate or cordate, the outer base produced; leaves of the branched portion crowded; of the lower plane spreading; of the main rachis the largest, linear-falcate, to 10 mm. long, 3 mm. broad near the base, acute, the upper side entire, pellucid-margined, ciliolate towards the rounded base, the lower side entire, provided with 0—2 ciliae at the rotundate-truncate base; of the ultimate branchlets similar but rather equal-sided, 4½—9 mm. long, 1—2 mm. broad, nearly equally rounded at the base; leaves of the upper plane erect, adpressed, imbricated, oblong or obovate; of the main rachis to 5 mm. long, long-cuspidate-acuminate, entire or obsoletely denticulate on both sides, ciliolate or ciliate, and obliquely cordate at the base, the outer base slightly hamato-incurvate; of the branches growing gradually shorter, with the cusp ⅓—½ as long as the blade, the edge entire or obsoletely denticulate, the base more or less ciliolate or ciliate, rounded on the inner side, produced and cordate on the outer side. Spikes 1—4 cm. long, 1—3 mm. diam., solitary or 2—4-nate, straight, curved or flexuose; sporophylla isomorphous, ascending, at length spreading, imbricate, triangular-ovate, keeled, acute, very minutely denticulate, the largest 2 mm. long; macrospores yellowish-white, rugulose, the rumples short or elongate, straight or flexuose, simple or branched, free or reticulate-connate, the apical ribs encircled by a ring-shaped crest; microspores yellow or pale-orange, provided with bacilliform or stipitate-capitate projections.

*Forma angustior*: Ultimate branchlets short, to 4 cm. long, 6—10 mm. broad; spikes terminal.

*Forma latior (typica)*: Ultimate branchlets elongated, 4—8 cm. long, 10—16 mm. broad; spikes partly terminal, partly in the axils of the higher branches, and then often once or twice forked at the base.

*Borneo.*

(52) **S. magnifica**, *Warb.*, Mons., I, 114, tab. III A.

Shoots ascending, to 50 cm. or more long, the lower part simple, stipitiform, when dry angular, compressed, 4 mm. thick, the upper part irregularly pinnate or 2—3 times forked, the branchlets 5—8 cm. long, 1½ cm. broad including the lateral leaves. Leaves subrigid, dark-green; of the lower part of the stem subisomorphous, ovate; of the lower plane erecto-patent, broadly long-acuminate, of the upper plane narrowly short-acuminate; leaves of the branched portion very heteromorphous; lateral leaves spreading, spaced in the lower part of the main rachis, close on the branchlets; of the main rachis elongate-oblong, subfalcate, 6—8 mm. long, obtuse, the upper side very minutely denticulate, rounded at the base, the lower side very minutely denticulate towards the apex, for the rest entire, or sparingly ciliolate at the subtruncate-rotundate-cuneate base; of the ultimate branchlets similar, imbricate over the rachis, 8—10 mm. long, spreading; intermedial leaves erect, roundish-ovate; of the main rachis very unequal-sided (conf. Warburg's plate), 3—4 mm. long, hardly oblique, shortly mucronulate-acuminate, subcordate at the base; of the branchlets imbricate, broadly subfalcate-ovate, nearly 3 mm. long, a little longer than broad, shortly acuminate, minutely denticulate, sparingly ciliolate at the obliquely rounded base. Spikes 2—3-nate, square, to 7—9 cm. long, 3 mm. diam.; sporophylla elongate-ovate, 1½—2½ mm. long, very acute, very minutely denticulate, often glittering; macrospores yellowish-white, finely rugulose or reticulate; microspores provided with conical or stipitate-capitate projections.

*Mindanao.*

(53) **S. bluensis**, *v. A. v. B.*, Bull. Botz., 1913, XI, 29.

Shoots erect, or ascending from a creeping base, to 20 cm. long, the lower part simple or forked, the upper part branched, the stem 1½—2 mm. thick near the base, terete, smooth or somewhat grooved, to 8—10 mm. broad including the lateral leaves; pinnae pinnate; pinnulae simple or forked, or the largest sparingly pinnate; ultimate branchlets ¾—2 cm. long, 4—6 mm. broad. Leaves heteromorphous on both stem and branches; leaves of the lower plane somewhat spaced on the stem, crowded on the branchlets; of the stem horizontal, linear-oblong, bluntish, not or indistinctly spuriously veined and pellucid-margined, the upper side minutely serrulate but indistinctly so towards the apex, rotundate-cuneate at the base, the lower side entire or obsoletely denticulate, narrowly



rounded at the base, the largest leaves 5 mm. long and 1½ mm. broad, with the midrib thickened towards the apex; of the branchlets similar but smaller, spreading, less unequal-sided, not rarely cuneate on the lower side at the base; leaves of the upper plane erect; of the stem remote, oblong, cuspidate-acuminate, minutely serrulate on both sides but less copiously on the outer side, obliquely cordate at the base, the outer base much produced, hamate-incurvate, the largest leaves 3 mm. long, the cusp ¼—⅓ as long as the blade; of the branchlets smaller, imbricated, the cusp relatively longer, the inner base rounded or cuneate, the outer base rather narrowly cordate. Spikes solitary, square, 1½ mm. diam.; sporophylla ovate, 1 mm. long, hardly acuminate, minutely denticulate, keeled; macrospores whitish or yellowish, often 2 in a macrosporangium, more or less compressed and lentiform, finely rugulose with flexuose, branched or connected rumples, the apex more or less flattened, without radiating ribs, encircled by a wing-shaped crest; microspores probably wanting.

*Borneo.*

(54) **S. Grabowskyi**, *Warb.*, Mons., I, 122; *S. intermedia*, *Hieron.* (not *Spring*), *Hedwi.*, LI, 269; *Lycopodium intermedium*, *Bl.*, *Enum.*, 269.

Shoots creeping, or ascending from a creeping base, 30—40 cm. long, often forked near the base, the stem yellowish when dry, 1¼—2 mm. thick; pinnae pinnate, to 7 cm. or more long; pinnulae once or twice pinnate; ultimate branchlets to 12½ mm. long, 3—4 mm. broad including the lateral leaves. Leaves of the lower plane horizontal or spreading on the stem, more ascending on the branchlets; of the stem remote, subfalcate-oblong, 3—4 mm. long, nearly ½ as broad, blunt, minutely denticulate on the upper side, broadly rounded on the upper side at the base, less so on the lower side; of the branches similar to those of the stem, hardly smaller, dark-green above, paler beneath, spuriously 2-nerved; of the branchlets similar, hardly contiguous, rounded and slightly dilated or rotundate-cuneate on the upper side at the base, the largest 2 mm. long, bluntish; leaves of the upper plane adpressed, erected; of the stem broadly ovate, 1½ mm. long, acute <sup>(1)</sup>, keeled, denticulate, produced and incurvate-cordate on the outer side at the base; of the branchlets similar

(1) I believe rather long-cuspidate.

to those of the stem, smaller, cuspidate-acuminate, rotundate-cuneate on the inner side at the base, with the cusp  $\frac{1}{2}$ — $\frac{2}{3}$  as long as the blade. Spikes square, to  $1\frac{1}{4}$  cm. long,  $1\frac{1}{2}$  mm. diam.; sporophylla ascending, ovate-oblong, acute or acuminate, minutely denticulate, keeled; macrospores white or pale-yellow, 1—2 in a macrosporangium, irregularly rugulose with short or elongated, flexuose, branched or reticulated ridges, the apex flattened, without radiating ribs, encircled by a crown-shaped ring; microspores probably wanting. — In order to avoid confusion the name *S. Grabowskyi* Warb. is maintained, though I acknowledge that the name *S. intermedia* Hieron. has a legitimate claim on priority.

*Malaya.*

(55) ***S. sibogana***, v. A. v. R., Bull. Btz., 1913, XI, 30; 1914, XVI, 44; — var. *subbinervia*, v. A. v. R., 1914, XVI, 44.

Near *S. Grabowskyi* Warb. — Shoots to 30 cm. long; stem or main rachis 6—9 mm. broad including the lateral leaves; pinnulae simple, forked or pinnate; ultimate branchlets 4—6 mm. broad; lateral leaves proportionally longer, more distinctly pellucid-margined on the upper side, less conspicuously spuriously veined, the upper edge denticulate throughout or less so in the upper part, the lower edge entire, or obsoletely denticulate towards the apex; intermedial leaves longer cuspidate, more or less denticulate on both sides, the cusp  $\frac{2}{3}$ — $\frac{4}{5}$  as long as the blade or longer.

Forma typica: Relatively small plants; lateral leaves of the main stem less falcate than those of the branchlets, often bluntish. — *Sumatra.*

**Var. *subbinervia*:** Middle-sized plants; lateral leaves of the main stem more falcate and acute, similar to those of the branchlets. — *Java.*

(56) ***S. paraguana***, Hieron., Fed., Rep., X, 109.

Shoots 50 cm. or more long, the lower part simple, brownish, compressed, to 3 mm. thick, the upper part 2-pinnate, ovate in outline; main rachis 12 mm. broad including the lateral leaves; branchlets 3—4 mm. broad. Leaves heteromorphous; lateral leaves of the stipe suberect, oblique-ovate, unequal-sided, shortly acuminate, with the upper side minutely denticulate, broadly rounded at the base, the lower side sparingly denticulate but more copiously so at the rotundate-cordate base, the largest leaves 4 mm. long and  $2\frac{1}{2}$  mm. broad; of the main rachis spreading, falcate-ovate or -oblong, glaucous-green, shortly acuminate,

minutely denticulate at the upper edge, slightly spuriously nerved, broadly rotundate on the upper side at the base, subentire on the lower side except at the hardly denticulate apex and the rotundate-truncate base, the largest leaves 6½ mm. long and 3½ mm. broad; of the branchlets similar to those of the main rachis but smaller, more ascending, narrowed at the base, the largest 2—3 mm. long and ¾—1 mm. broad; intermedial leaves erect; of the stipe obliquely subfalcate-ovate, unequal-sided, shortly aristate-acuminate, more or less copiously minutely denticulate, produced and incurvate-cordate on the outer side at the base, rotundate-subcordate on the inner side at the base, the largest leaves 4 mm. long; of the main rachis similar to those of the stipe; of the branchlets similar but smaller, subentire towards the base, sparingly denticulate towards the apex, the outer base auriculate-cordate, the inner base narrowed. Spikes solitary, 3—6 mm. long, 1—1¼ mm. diam.; sporophylla subisomorphous, deltoid-oblong, gradually aristate-acuminate, piloso-denticulate, keeled, hardly pellucid-margined, the posterior ones the largest, to 2 mm. long; microspores yellow or yellowish, provided with conical or clavate-capitate projections on the basal side; macrospores . . . . .

*Paragua (Philippines).*

(57) **S. parvifolia**, *v. A. v. R.*, Bull. Bot., 1913, XI, 30.

Shoots erect, or erect from an ascending base, 15—25 cm. long, 3—4-pinnate, the stem subterete, brownish-stramineous, 1½ mm. thick at the base; pinnae to 10 cm. long; ultimate branchlets to 1 cm. long, 2—2½ mm. broad including the lateral leaves. Leaves heteromorphous; leaves of the lower plane erecto-patent; of the stem remote or approximate, oblong, unequal-sided, 2½—3 mm. long, to 1½ mm. broad at the base, blunt or bluntish, the upper side minutely serrulate and pellucid-margined in the lower half, rounded at the base, the lower side entire, very narrowly rotundate-truncate at the base; of the ultimate branchlets similar, more or less close, often entire, subfalcate, less unequal-sided, to 2 mm. long and ½ as broad, rotundate-cuneate on the upper side at the base; leaves of the upper plane erect; of the stem remote or approximate, oblong, 3 mm. long, abruptly long-cuspidate, sparingly and very minutely serrulate, obliquely cordate at the base, or the inner base rounded or rotundate-cuneate and the outer base produced, incurvate-auriculate, the cusp to nearly as long as the blade; of the branchlets similar, smaller, imbricate, more gradually cuspidate, entire, the inner base rotundate-

cuneate, the outer base cordate. Spikes short, square, 1—1¼ mm. diam.; sporophylla ovate-oblong, keeled, 1—1¼ mm. long, acuminate, minutely serrulate in the lower part; macrospores whitish, verruculose to irregularly rugulose, the apical ribs encircled by a ring-shaped crest; microspores yellowish, provided with stipitate-capitate projections on the basal side.

*Borneo.*

(58) **S. Paxii**, *Hieron.*, in Engl. Bot. Jahrb., XLIV, 512; — var. *subpedalis*, v. A. v. R., Bull. Botz., 1913, XI, 30.

Shoots erect, 25—50 cm. long, the lower part simple, stipitiform, 2—3 mm. thick, the upper part decomposed, the main rachis 9 mm. broad including the lateral leaves; pinnae pinnate, the lower ovate or lanceolate; pinnulae crowded, ovate-lanceolate or ovate-oblong, cuneate at the base, the lower and central pinnate; ultimate branchlets 5—25 mm. long, 2—4 mm. broad. Leaves heteromorphous; leaves of the lower plane suberect on the stipe, spreading on the main rachis, more ascending on the branchlets; of the stipe very unequal-sided, obliquely subfalcate-ovate, acute or shortly acuminate, hardly spuriously veined, the upper side minutely denticulate, inconspicuously pellucid-margined, cordate-auriculate at the base, the lower side entire, very minutely denticulate at the rotundate-truncate base, the largest leaves 3 mm. long and 1 mm. broad; of the main rachis close, to 5 mm. long, relatively narrower; of the branches narrower, somewhat unequal-sided, obliquely subfalcate-ovate or ovate-oblong, subacute, spuriously nerved near the midrib, the upper side minutely piloso-denticulate, pellucid-margined at least in the lower half, the lower side entire or indistinctly denticulate; of the branchlets sub-equilateral, 1½—2½ mm. long, often cuneate on the upper side at the base; leaves of the upper plane erect; of the stem ovate or obovate, subaristate-acuminate, pellucid-margined, very minutely denticulate or rather entire, indistinctly keeled, rounded on the inner side at the base, auriculate-cordate on the outer side at the base, the auricle hamate-incurvate, the largest leaves 3—4 mm. long; of the branches smaller, broadly ovate, mostly entire, cuspidate, the base obliquely cordate or semicordate, produced on the outer side, the cusp ½—½ as long as the blade; of the ultimate branchlets 1 mm. long. Spikes single or double, 5—20 mm. long, 1½—2 mm. diam.; sporophylla ovate, shortly acuminate, keeled, piloso-denticulate, pellucid-margined, the largest 1½ mm. long; macrospores yellowish or whitish, provided with flexuose or reticulate

rumpled on the basal side, not rarely intermixed with verruciform projections, the apical ribs encircled by a ring-shaped crest; microspores yellowish or pale-orange, provided with bacilliform or stipitate-capitate projections on the basal side.

**Var. subpedalis:** Shoots shorter, 20—25 cm. long, erect from a wide-creeping base, the stipe slender, 1½ mm. thick; lateral leaves of the branchlets more acute; intermedial leaves longer cuspidate, those of the main rachis copiously denticulate.

*Borneo.*

(59) **S. ascendens, v. A. v. B.**, Bull. Bot., 1913, XI, 33.

Shoots erect from a creeping base, 20—30 cm. or more long, short-stalked or branched down quite to the base, the stem terete, sulcate, 1½—2 mm. thick, the main rachis flexuose, the branching between pinnate and dichotomous; pinnae ascending, alternate, dichotomous or subpinnate with a few simple or forked pinnulae, or the lower pinnae simple or forked, the secondary rachises 9—12 mm. broad including the lateral leaves; ultimate branchlets 1—3½ cm. long, 6—10 mm. broad, or shorter and narrower, the longest the broadest. Leaves heteromorphous; leaves of the lower plane linear-oblong, rather falcate, nearly equal-sided, acute or subacute, the upper side pellucid-margined and minutely serrulate, rounded or broadly rotundate-cuneate at the base, the lower side pellucid-margined and entire, rotundate-cordate or rotundate-truncate at the base, the midrib fine; of the stem subapproximate, horizontal; of the branchlets spreading or more ascending, to 5 mm. long and 2 mm. broad; leaves of the upper plane erect, incurvate-oblong, cuspidate, minutely serrulate but the inner side entire in the lower half, the inner base rotundate-cuneate, the outer base cordate-auriculate, the auricle hamate-incurvate; of the stem close or remote; of the ultimate branchlets imbricate, to 3 mm. long, with the cusp ⅓—½ as long as the blade. Spikes square, 1—3½ cm. long, to 2½ mm. diam., solitary or 2—4-nate; sporophylla ovate, acuminate, at length subspreading, to 1½ mm. long, keeled, minutely serrulate; macrospores whitish, mostly 2 in a macrosporangium, finely rugulose, the apex without radiating ribs, encircled by a crown-like crest; microspores probably wanting.

*Borneo.*

(60) **S. Hoscl, Hieron.**, Hedwi., LI, 245.

Shoots erect, the lower part simple, olivaceous, subterete or obscurely

4-angular, the upper part pinnately branched, ovate in outline; highest pinnae simple or forked; following pinnate, with the pinnulae simple or forked; lower pinnate; lower pinnulae pinnate, central one or more times forked, higher simple; terminal branchlets flagellate and rooting at the apex. Lateral leaves very unequal-sided; those of the stipe probably suberect, obliquely ovate, acuminate, truncate-rotundate on the lower side and broadly rounded on the upper side at the base, very minutely and sparingly denticulate on the lower edge at the base, distinctly so on the upper edge throughout, the largest 4 mm. long and 2 mm. broad, with the midrib gradually clavate at the apex; those of the branches growing gradually smaller, spreading, close, pellucid-margined on the upper side; of the ultimate branchlets hardly 1½ mm. long, ⅝ mm. broad, unequally cuneate at the base; leaves of the upper plane erect, hardly unequal-sided; those of the stipe acuminate, pellucid-margined and piloso-denticulate on both sides, subcordate-rotundate at the base and hardly produced on the outer side, the largest 3¼ mm. long and 1¾ mm. broad; of the branches growing gradually smaller, cuspidate, sparingly pellucid-dotted, keeled in the upper part, otherwise similar to the others; those of the ultimate branchlets narrowed at the base, at best 1 mm. long and ½ mm. broad. Spikes solitary, 5—7 mm. long, 1½ mm. diam.; sporophylla ovate, shortly aristate-acuminate, minutely piloso-denticulate and pellucid-margined on both sides, keeled, those of the posterior side somewhat larger, to 1¾ mm. long and ¾ mm. broad; macrospores yellowish-white, deciduously verruculose, 1—4 in a macrosporangium, the solitary ones the largest, nearly without apical ribs; microspores reddish, provided with short, bacilliform or capitate projections on the basal side.

*Borneo.*

(61) **S. cavernicola**, *Hieron.*, Hedwi., LI, 247.

Shoots ascending from a rooting base, the lower part simple, 1 mm. diam., stramineous-olivaceous, obtusely quadrangular (subterete), angular and grooved when dry, the upper part repeatedly dichotomous, flabellate-rotundate in outline, the branches often flagellate. Lateral leaves of the stipe suberect, very unequal-sided, obliquely subfalcate-ovate, shortly rotundate-cuneate on the lower side, produced, broadly rotundate-subcordate and imbricated over the rachis on the upper side at the base, with the lower edge entire towards the base, very minutely denticulate towards the apex, the upper side piloso-denticulate and narrowly pellucid-margined,

the largest leaves 3 mm. long and  $1\frac{1}{2}$  mm. broad, acutely acuminate; those of the branches spreading, rather remote, growing gradually smaller; of the ultimate branchlets more ascending, hardly 2 mm. long, 1 mm. broad, less unequal-sided, less acute, more or less indistinctly spuriously veined, subentire on both sides towards the apex; leaves of the upper plane erect, cuspidate; those of the stipe broadly ovate, narrowly pellucid-margined and piloso-denticulate on both sides, keeled towards the apex, cordate-rotundate on both sides at the base, the largest 3 mm. long and  $1\frac{1}{2}$  mm. broad, with the cusp  $\frac{1}{2}$  as long as the blade; those of the branches growing gradually smaller, of the primary branches narrower, with the cusp  $\frac{2}{3}$  as long as the blade; of the ultimate branchlets to 1 mm. long and  $\frac{1}{2}$  mm. broad, with the cusp  $\frac{1}{3}$  as long as the blade, rotundate-cuneate at the base.

*Borneo.*

(62) **S. sungemagneana, v. A. v. R.**, Bull. Bot., 1913, XI, 31.

Shoots erect or ascending, 10—17 $\frac{1}{2}$  cm. long, simple or forked in the lower part, 3—4-pinnate in the upper part, the stem terete or grooved, stramineous, 1—2 mm. thick at the base, 5—6 mm. broad including the lateral leaves; pinnae to 7 cm. long, with moderately crowded branches; ultimate branchlets 5—10 mm. long, 2—3 mm. broad. Leaves heteromorphous on both stem and branches; leaves of the lower plane spreading, horizontal or subdeflexed on the stem, ascending on the branchlets; of the stem somewhat remote, oblong, to 3 mm. long, 1 mm. broad, bluntish, the upper side minutely denticulate in the lower part, broadly cordate and much produced at the base, the lower side entire, more narrowly rotundate-truncate at the base; of the branchlets crowded, subfalcate, the largest  $1\frac{1}{2}$ —2 mm. long, to  $\frac{3}{4}$  mm. broad, rotundate or rotundate-cuneate on the upper side at the base, more narrowed on the lower side at the base, for the rest similar to those of the stem; leaves of the upper plane erect and adpressed; of the stem remote, oblong, 2 mm. long, rather suddenly very long-cuspidate, sparingly serrulate, the inner base rotundate-cordate, the outer base produced, auriculate-cordate, the auricle slightly hamate-incurvate; of the branchlets imbricate, obovate-oblong, cuspidate-acuminate, 1 mm. long, sparingly denticulate, the inner base rather cuneate, the outer base produced, cordate, the cusp  $\frac{3}{4}$  to as long as the blade. Spikes solitary, partly terminal, partly axillary in the higher forks, short, square, 1—1 $\frac{1}{2}$  mm. diam.; sporophylla iso-

morphous, ovate-oblong, 1 mm. long, acute or shortly mucronulate, keeled, minutely serrulate, the lower more spreading than the higher; macrospores 2 in a macrosporangium, whitish, verruculose-rugulose, the apex flattened, without radiating ribs, encircled by a ring-shaped crest; microspores probably wanting.

*Borneo.*

(63) **S. billitonensis**, *v. A. v. R.*, Bull. Botz., 1914, XVI, 43; S. Grabowskyi, *Warb.*, v. A. v. R., Bull. Botz., 1911, I, 16, p. p.

Resembles in aspect *S. sungemagneana v. A. v. R.*, but: Pinnulae simple or forked; ultimate branchlets a little broader; lateral leaves a little larger, indistinctly spuriously veined and pellucid-margined, shortly ciliolate towards the base on the upper side, those of the stem rounded on the upper side at the base; macrospores pale-yellow-brown.

*Billiton.*

(64) **S. Vanvuureni**, *v. A. v. R.*, Bull. Botz., 1914, XVI, 44.

Shoots erect from a decumbent base, 10—20 cm. long, branched down nearly to the base, the branching between dichotomous and pinnate, the stem obtusely quadrangular on the upper side, rounded on the lower side, 2 mm. thick, the main rachis 8—10 mm. broad including the lateral leaves; pinnae much ascending, suberect, irregularly compound; branchlets very short, 2—3 mm. broad. Leaves heteromorphous; lateral leaves horizontal and remote on the stem, ascending and imbricate on the branchlets; of the stem rather straight, oblong, blunt, unequal-sided at the base, indistinctly spuriously veined, the upper side copiously minutely denticulate, subpellucid-margined, broadly rounded at the base, the lower side entire, mostly provided with a few (1—4) minute teeth at the narrowly rotundate-truncate base, the largest leaves 5 mm. long, nearly 2 mm. broad; of the branchlets similar, the largest 3 mm. long, with the upper side more distinctly pellucid-margined, the upper base rotundate-cuneate, the lower base abruptly or gradually cuneate and entire; inter-medial leaves erect, adpressed; of the stem moderately remote, subfalcate-oblong, cuspidate-acuminate, nearly keeled, the cusp  $\frac{1}{4}$  as long as the blade, the sides more or less minutely denticulate, the inner base rotundate-cuneate, the outer base much produced with a rounded, very slightly hamate-incurvate auricle, the largest leaves 2 mm. long; of the branchlets much smaller, imbricate, the outer base slightly rotundate-auriculate,



rather cordate. Spikes square, often double, under 1 cm. long, 1½—2 mm. diam.; sporophylla deltoid-ovate, acute, pellucid-margined, minutely denticulate, keeled, to 1 mm. long; macrospores 2 in a macrosporangium, white, irregularly rugulose with simple, branched or connected rumples, the apex flattened, without radiating ribs, encircled by a ring-shaped crest; microspores probably wanting.

*Celebes.*

(65) **S. subserpentina**, *v. A. v. R.*, Bull. Btz., 1911, I, 17.

Shoots ascending from a short-creeping base, 15—35 cm. long, often one or more times forked above the base, the secondary shoots branched with the branching between pinnate and dichotomous, erect or erectopatent, very regularly foliate, as are the stem and main rachises, straight, curved or serpentino-flexuose, simple or little compound, the ultimate branchlets 2—10 cm. long, 5—8 mm. broad including the lateral leaves. Leaves heteromorphous; those of the lower plane crowded on both stem and branches, rather imbricate, subascending or rather spreading, subfalcate-oblong, 3—4 mm. long, to 2 mm. broad, rounded or rotundate-cuneate on the upper side at the base, more or less abruptly truncate-rotundate to cuneate on the lower side at the base, with the upper edge distinctly piloso-denticulate but more obsoletely so towards the apex, the lower edge entire, obsoletely denticulate towards the apex, sparingly piloso-denticulate at the very base, the under surface not spuriously nerved, the midrib narrowed towards the apex; leaves of the upper plane erect, adpressed, imbricated, obliquely obovate, distinctly aristate, piloso-denticulate, the inner base truncate- or rotundate-cuneate, the outer base produced, cordate or subcordate, the largest leaves 2 mm. long. Spikes solitary or 2—3-nate, square or nearly so, 5—50 mm. long, 1¾ mm. diam.; macrospores 2 in a macrosporangium, provided with short or elongated, straight or flexuose, branched or reticulated rumples on the basal side, the apical side rather flattened, without radiating ribs, encircled by a ring-shaped ridge; microspores probably wanting.

*Sumbawa (?)*.

(66) **S. sambasensis**, *Hieron.*, Hedwi., L, 9.

Shoots ascending from a short-creeping base, often one or more times forked at the base, pinnately branched in the upper part, the primary rachises to 9 mm. broad including the lateral leaves. Leaves of the lower plane horizontal or nearly so, obliquely falcate-oblong, unequal-sided,

shortly acuminate, rounded on both sides at the base but more truncate on the lower side, spuriously nerved, obsolete serrulate on both sides towards the apex, shortly denticulate on the upper edge, with the costa clavate towards the apex; of the main rachis the largest, subremote, 4½ mm. long, 1½ mm. broad; leaves of the upper plane erect, unequal-sided, subrhomboidal-oblong, aristate-acuminate, nearly keeled towards the apex, cordate-auriculate and slightly incurvate on the outer side at the base, rotundate-cuneate on the inner side, more or less sparingly and shortly piloso-denticulate on both edges; of the main rachis the largest, 2¾ mm. long and 1 mm. broad, with the cusp ⅓—½ as long as the blade. Spikes solitary or often 2—3-nate, subtetragonal, 5—10 mm. long, 1½ mm. diam.; sporophylla subisomorphous, deltoid, equal-sided, acute, mucronate, keeled, densely piloso-denticulate and pellucid-margined on both sides, the ventral ones somewhat larger, to 1¼ mm. long and ¾ mm. broad; macrospores 1—2 in a macrosporangium, whitish or pale-orange, provided with branched or reticulated crests on the basal side, the apex without radiating ribs, encircled by a crown-like ring; microspores probably wanting.

*Borneo.*

(67) **S. Elmeri**, *Hieron.*, Fed., Rep., X, 46.

Shoots 30 cm. long, the lower part simple, stipitiform, compresso-quadrangular, whitish-stramineous, to 2 mm. thick, the upper part decomposed; ultimate branchlets 3 mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves horizontal or spreading; of the stipe often deflexed, remote, unequal-sided, obliquely falcate-ovate, shortly acuminate, the upper side the broadest, pellucid-margined, minutely denticulate, rounded at the base, the lower side narrowly and inconspicuously pellucid-margined, entire, rotundate-cuneate and sometimes sparingly and shortly denticulate at the base, the midrib thickened towards the apex, the largest leaves 4 mm. long and 2—2¼ mm. broad; those of the main rachis approximate, similar but more elongated, 5 mm. long; of the ultimate branchlets similar, suberecto-patent, 1½—2 mm. long and ½—¾ mm. broad, rotundate-cuneate at the base; leaves of the upper plane suberect or erect; of the stem somewhat unequal-sided, falcate-ovate, aristate-acuminate, subentire or minutely denticulate, with the inner base cuneate, the outer base truncate-cordate and somewhat produced, the cusp nearly ½ as long as the blade, the largest leaves 3 mm. long and 1¼

mm. broad; those of the main rachis similar, to 4 mm. long, rather longer aristate, often subentire; of the ultimate branchlets similar, smaller, to 2 mm. long, with the cusp as long as the blade or longer, the outer base auriculate-cordate. Spikes solitary, 5—7 mm. long,  $1\frac{1}{2}$ —2 mm. diam.; sporophylla deltoid-ovate, long-aristate, pellucid-margined, sparingly piloso-denticulate, keeled, the largest 2 mm. long; macrospores pale-yellow-brown, verruculose to rugulose; microspores orange or yellowish, the basal side provided with scattered, sessile, capitate projections.

*Leyte (Philippines).*

(68) **S. obesa**, *Bk.*, Fern All., 97.

Shoots erect, up to 30 cm. long, the lower part simple, stipitiform, stramineous, the upper part decomposed, deltoid; branches close, lanceolate, copiously pinnate with short, sparingly compound, ascending pinnulae; ultimate branchlets 6—12 mm. long, 3 mm. broad including the lateral leaves. Leaves of the lower plane contiguous and patent on the branches, ascending on the branchlets, oblique-ovate,  $2-3\frac{1}{4}$  mm. long, very broad at the base which is much dilated on the upper side, broadly rounded, obscurely ciliated and much imbricated over the rachis, the margins revolute above the base; leaves of the upper plane  $\frac{1}{2}$  as long, ovate-lanceolate, with a distinct cusp. Spikes short, square,  $1\frac{1}{4}$  mm. diam.; sporophylla ovate-lanceolate, strongly keeled.

Plants occurring in the Buitenzorg Herbarium agree very well with Baker's diagnosis. They have the stem subterete, more or less irregularly grooved when dry,  $1\frac{1}{2}$ —3 mm. thick at the base, the pinnae lanceolate to linear, 10—20 cm. long and 2—3 cm. broad when fully developed, the pinnulae close, ascending, the lower and central pinnulae pinnate with 1—2 branchlets on each side or the central forked, the higher simple or forked, the ultimate branchlets to 5 mm. broad, the leaves dimorphous, the leaves of the lower plane blunt, remote on the stem, subcontiguous to imbricate on the branchlets, those of the stem and lower part of the main rachis obliquely deltoid-cordate, minutely sub-appresso-pilose on the upper surface, with the upper edge minutely denticulate in the lower half, the lower edge entire except at the very base, both sides pellucid-margined, the largest leaves 5 mm. long and to 3 mm. broad at the base, those of the branchlets subhorizontal or ascending, obliquely subfalcate-oblong,  $2-2\frac{1}{2}$  mm. long, 1 mm. broad, naked, with the upper base broadly rotundate-cuneate, rotundate or sub-

cordate, the lower base rotundate-cuneate or narrowly rounded, both sides pellucid-margined, the upper edge minutely denticulate towards the base, the leaves of the upper plane erect, nearly equilateral, those of the stem and lower part of the rachis remote, broadly subcordate- or triangular-ovate, 3—4 mm. long, cuspidate-acuminate, naked, pellucid-margined, very minutely denticulate, those of the branchlets adpressed, imbricated, ovate, long-cuspidate-acuminate, to 2½ mm. long, pellucid-dotted, the base obliquely rounded or the inner base rotundate-cuneate and the outer base subcordate, more or less produced, the inner side pellucid-margined and minutely denticulate, the outer side more broadly pellucid-margined, minutely denticulate towards the apex, the cusp rather more than ½ as long as the blade, the spikes solitary, to 1 cm. long, the sporophylla acutely subulate at the apex, distinctly pellucid-margined and minutely denticulate on both sides, at length squarrose, the macrospores whitish or yellowish, finely and irregularly rugulose, with the apical ribs encircled by a ring-shaped crest, the microspores yellowish, provided with bacilliform projections which are often capitate at the apex.

*Borneo.*

(69) **S. wahuensis**, *Hieron.*, Hedwi., LI, 250.

Shoots ascending from a creeping base, 10—15 cm. long, the lower part simple, short-stipitiform (1—4 cm. long), the upper part branched, ovate-lanceolate in outline; lower pinnae pinnate, 3—3½ cm. long, higher simple or forked; pinnulae few, 2—4 on a side, hardly more than 1 cm. long, simple or rarely forked. Leaves heteromorphous on both stem and branches; those of the lower plane spreading, obliquely falcate-ovate, unequal-sided; those of the stipe and main rachis the largest, to 3½ mm. long, to 1½ mm. broad, acuminate, cuneate on the lower side at the base, broadly rotundate-cuneate on the upper side at the base, entire on the lower edge except towards the apex, minutely denticulate and pellucid-margined on the upper side; those of the branches growing gradually smaller; of the ultimate branchlets 2¼ mm. long, hardly ½ mm. broad; leaves of the upper plane unequal-sided, oblique-ovate, cuspidate, slightly keeled towards the apex, narrowly pellucid-margined on both sides and minutely denticulate except at the base, sparingly pellucid-dotted, rotundate-cuneate on the inner side, shortly and narrowly rotundate-truncate and hardly produced on the outer side at the base, the largest 2 mm. long and ⅔ mm. broad, the cusp ½ as long as the blade. Spikes 5—8 mm.

long, 1 mm. diam.; sporophylla ovate, aristate-acuminate, keeled, piloso-denticulate and narrowly pellucid-margined on both sides, with the cusp  $\frac{1}{3}$  as long as the blade, the posterior ones somewhat larger, to  $1\frac{1}{2}$  mm. long and  $\frac{1}{2}$  as broad; macrospores yellowish-white, finely rugulose to reticulate, with the apical ribs encircled by a subentire or undulate, hyaline, wing-like equatorial crest; microspores orange-coloured, provided with scattered, long-stalked, capitate projections.

*Borneo.*

(70) **S. Posewitzii**, *Hieron.*, Hedwi., LI, 241.

Shoots erect, 20—25 cm. long, the lower part simple, subterete, somewhat compressed, the upper part branched, cordate-rotundate in outline; upper part of the main rachis to 10 mm. broad including the lateral leaves; lower pinnae 2-pinnate, the rachis 8 mm. broad; lower pinnulae pinnate, central one or more times forked, higher simple; ultimate branchlets 3—4 mm. broad. Lateral leaves of the stem subspreading, very unequal-sided, acuminate, broadly rounded at the upper base, straight or shortly subtruncate at the lower base, subentire or obsoletely denticulate on the lower edge, copiously denticulate and rather pellucid-margined on the upper side, the largest hardly more than 3 mm. long and  $1\frac{1}{4}$  mm. broad; those of the branches similar but subfalcate, shortly acuminate, entire on the lower edge, the largest 4 mm. long and  $2\frac{1}{2}$  mm. broad; of the branchlets 2— $2\frac{1}{2}$  mm. long, rotundate-cuneate on the upper side at the base; leaves of the upper plane of the stem unequal-sided, oblique-ovate, aristate-acuminate, minutely piloso-denticulate and rather pellucid-margined on both sides, somewhat keeled and pellucid-dotted in the upper part, obliquely rotundate at the base and rather subcordate on the outer side and subcuneate on the inner side, the largest  $3\frac{1}{2}$  mm. long and  $1\frac{1}{2}$  mm. broad; those of the branches similar but relatively narrower and growing gradually smaller; those of the ultimate branchlets  $\frac{3}{4}$  mm. long and  $\frac{1}{2}$  mm. broad. Spikes solitary, 5—20 mm. long,  $1\frac{1}{2}$  mm. diam.; sporophylla nearly isomorphous, the posterior ones somewhat larger, ovate, shortly aristate-acuminate, minutely piloso-denticulate and rather pellucid-marhined on both sides, keeled, the largest hardly  $1\frac{1}{2}$  mm. long and  $\frac{3}{4}$  mm. broad; microspores red or yellow, provided with a few scattered, shortly conical projections; macrospores . . . . .

*Borneo.*

(71) **S. Cesatii**, *Heron.*, Hedwi., L, 6.

Shoots 25—50 cm. long, sometimes forked at the base, the lower part simple, stipitiform, the upper part branched, ovate or deltoid-ovate in outline; lower pinnae pinnate, higher forked, highest simple; lower pinnulae of the lower pinnae forked, higher simple. Lateral leaves of the stem very unequal-sided, falcate-ovate, subacute, very minutely denticulate on the upper edge except towards the apex, rotundate-cuneate on the upper side at the base, rotundate-truncate and entire on minutely denticulate on the lower side at the base, the largest leaves 4½ mm. long, 2½ mm. broad; those of the branches much narrower, somewhat unequal-sided, broadly sessile, lanceolate-oblong, distinctly spuriously veined, pellucid-margined on the upper side in the lower half, cuneate at the upper base, otherwise similar to those of the stem, the largest of the branchlets hardly more than 3 mm. long, 1 mm. broad; leaves of the upper plane of the stem obovate, acuminate, subaristate-mucronate, broadly auriculate-rotundate on the outer side at the base, subcordate on the inner side, pellucid-dotted, the largest 3 mm. long, 2 mm. broad; those of the branches smaller, entire, narrowly pellucid-margined towards the apex, relatively long-aristate, the largest of the branchlets hardly 2 mm. long, ¾ mm. broad, rotundate-subcordate at the outer base, narrowed at the inner base. Spikes nearly square, ½—1½ cm. long, 1¼ mm. diam.; sporophylla nearly isomorphous, ovate, shortly aristate-acuminate, pilosodenticulate, pellucid-dotted and -margined in the upper part, keeled, the largest 1¼ mm. long; macrospores orange or yellowish, densely flexuose-rugose on the basal side, if solitary then without apical ribs; microspores orange, sparingly provided with short-stalked capitate projections.

*Borneo.*

(72) **S. simpokakensis**, *Heron.*, Engl. Bot. Jahrb., XLIV, 511.

Shoots 25—50 cm. long, the lower part simple, stipitiform, hardly more than 2½ mm. thick, the upper part decomposed; pinnae 3—4-pinnate; ultimate branchlets 3—4 mm. broad including the lateral leaves. Lateral leaves of the stipe and main rachis very unequal-sided; of the stipe rather erect, obliquely subfalcate-ovate, acute, broadly rounded on the upper (inner) side at the base, rotundate-cuneate on the lower (outer) side, indistinctly spuriously veined, pellucid-margined and minutely denticulate on the upper side; those of the main rachis the largest, to 5 mm. long and 2 mm. broad; those of the branches nearly equilateral, oblong

or ovate-oblong, subobtuse; of the ultimate branchlets relatively narrower, to  $2\frac{1}{2}$  mm. long and  $\frac{3}{4}$  mm. broad; intermedial leaves of the stipe and main rachis obliquely ovate, unequal-sided, aristate, shortly subcordate-auriculate on the outer side at the base, rounded on the inner side, piloso-denticulate and pellucid-margined on both sides, sparingly pellucid-dotted; those of the stem to 4 mm., of the rachis to 3 mm. long, the cusp  $\frac{1}{3}$  as long as the blade; those of the ultimate branchlets ovate, the largest  $1\frac{1}{2}$  mm. long. Spikes flexuose, square, 1—3 cm. long,  $1\frac{1}{4}$  mm. diam.; sporophylla ovate, shortly aristate-acuminate, keeled, piloso-denticulate and pellucid-margined on both sides; macrospores yellowish-white, rugulose with flexuose or reticulated rumples; microspores dirty-orange, provided with scattered, sessile, capitate projections on the basal side.

*Borneo.*

(73) **S. novae-guineae**, *Hieron.*, Hedwi., XLI, 183.

Shoots ascending from a creeping base, 35 cm. more or less long, the lower  $\frac{1}{4}$  simple, brown-green, subquadrangular, compressed, to 3 mm. thick, with the leaves subisomorphous, subequilateral, cordate-ovate, more or less denticulate, 4 mm. long,  $2\frac{1}{2}$  mm. broad, bluntish or subacute, the lower suberect, the higher lateral spreading; upper part pinnate, broadly ovate in outline; pinnae often 2-pinnate; penultimate branches often forked or dichotomous; main rachis 8—10 mm. broad in the upper part; ultimate branchlets 3—5 mm. broad including the lateral leaves. Leaves of the branched portion heteromorphous; of the lower plane elongate-oblong, bluntish, rather spuriously veined near the costa and margin; of the branches subremote, to 5 mm. long, 3 mm. broad, unequally rotundate-subcordate at the base, the upper side sparingly denticulate towards the apex and the base, the lower side denticulate towards the apex; of the branchlets shorter, to 3 mm. long,  $\frac{3}{4}$  mm. broad, approximate, unequally rounded or cordate at the base; leaves of the upper plane ovate-oblong or subobovate-oblong, subcuspidate-acuminate; of the branches obliquely cordate at the base, with the outer auricle produced, both sides minutely denticulate, pellucid-margined, the largest leaves 4 mm. long, 2— $2\frac{1}{2}$  mm. broad; of the branchlets smaller, unequally rotundate-cuneate at the base. Spikes  $\frac{1}{2}$ —2 cm. long,  $2\frac{1}{2}$ —4 mm. diam.; sporophylla ovate, acuminate, dark-green, copiously denticulate on both sides, 2 mm. long, hardly 1 mm. broad; macrospores yellowish-white,

finely and irregularly rugulose; microspores reddish-yellow, sparingly capitate-verruculose on the basal half.

*New Guinea.*

a. **Homocostachys.** 5. **Cauliscentes.**

1. *Lateral leaves of principal rachises provided with a minute spur-shaped auricle on the upper side at the base.* (74) *S. Presliana.*
- 1.1. *Lateral leaves without a spur-shaped auricle at the base.*
2. *Intermedial leaves distinctly cuspidate, the cusp often very long.*
  - a. *Intermedial leaves hardly oblique, not much produced on the outer side, at the base.*
    - △ *Lateral leaves ciliate or ciliolate, at least at the base.* (75) *S. argentea.*
    - △△ *Lateral leaves entire, at best minutely denticulate.* (76) *S. Griffithii.*
  - a.a. *Intermedial leaves distinctly oblique, produced on the outer side, at the base.*
    - b. *Lateral leaves of principal rachises cordate or semicordate at the base, at least one of the basal auricles hamate-incurvate.* (77) *S. nutans.*
    - b.b. *Lateral leaves not cordate or semicordate at the base, and if so, then the basal auricles not hamate.*
      - c. *Ultimate branchlets to 2 mm. broad.*
        - *Spikes slender, to 1 $\frac{3}{4}$  mm. diam.* (78) *S. pteriphyllus.*
        - *Spikes stouter, 2 mm. or more diam.*
          - ▽ *Lateral leaves of principal rachises produced at least on one side at the base.* (79) *S. Jagori.*
          - ▽▽ *Lateral leaves not produced at the base.* (80) *S. luzonensis.*
      - c.c. *Ultimate branchlets 2 mm. or more broad.*
        - d. *Shoots rather small, 15—30 cm. long.* (81) *S. parvifrons.*
        - d.d. *Shoots larger, 35—75 cm. or more long.*



- e. Lateral leaves of the branchlets to 2½ mm. long. (82) *S. frondosa*.
- e.e. Lateral leaves of the branchlets 3 mm. or more long. (83) *S. latifrons*.
- 2.2.** Intermedial leaves blunt to acuminate, at best shortly cuspidate.
  - 3.** Leaves conspicuously ciliated. (84) *S. pungentifolia*.
  - 3.3.** Leaves not conspicuously ciliated.
    - 4.** Stipes terete or nearly so, not grooved.
      - 5.** Pinnulae simple or forked, at best the largest pinnate.
        - Lateral leaves nearly as broad as long. (85) *S. polyura*.
        - Lateral leaves distinctly longer than broad.
          - ▽ Spikes slender, to 1 mm. diam. (89) *S. caulescens*.
          - ▽▽ Spikes stouter, more than 1 mm. diam. (86) *S. caudispica*.
- 5.5.** Pinnulae, at least the largest, pinnate.
  - 6.** Spikes short, to 5 mm. long. (87) *S. Warburgii*.
  - 6.6.** Spikes elongated, 5 mm. or more long.
    - Lateral leaves without spurious veins.
      - Lateral leaves to 2 mm. long. (88) *S. Boschai*.
      - Lateral leaves at least 2 mm. long. (82) *S. frondosa*.
    - Lateral leaves with spurious veins.
      - × Spikes slender, to 1¾ mm. diam. (89) *S. caulescens*.
      - ×× Spikes stouter, 2 mm. or more diam. (90) *S. striolata*.
- 4.4.** Stipes more or less angular or grooved.
  - 5.** Intermedial leaves shortly cuspidate.
    - 6.** Branchlets to 1¾ mm. broad. (91) *S. aenea*.
    - 6.6.** Branchlets at least 2 mm. broad.
      - 7.** Intermedial leaves of main rachis with the basal auricle acute or rounded. (92) *S. albomarginata*.
      - 7.7.** Intermedial leaves of main rachis with the basal auricle hamato-incurvate.

- S.** *Lateral leaves of main rachis auricled on the upper side at the base.*  
 (77) *S. nutans.*
- S'S.** *Lateral leaves of main rachis not auricled on the upper side at the base.*  
 (82) *S. frondosa.*
- S'.S'. Intermedial leaves blunt or acute, at best acuminate.**
- *Branchlets to 2 mm. broad.*
- ▽ *Lateral leaves of secondary rachises truncate, rounded or cuneate at the base.*  
 (93) *S. Brausei.*
- ▽▽ *Lateral leaves of secondary rachises, at least the lower, cordate or semicordate at the base.*
- *Intermedial leaves entire or subentire.*  
 (94) *S. cupressina.*
- *Intermedial leaves distinctly denticulate to ciliate.*  
 (95) *S. leytensis.*
- *Branchlets at least 2 mm. broad.*
- △ *Lateral leaves distinctly spuriously veined.*  
 (96) *S. flabelloides.*
- △△ *Lateral leaves not or hardly spuriously veined.*
- × *Branchlets 2—3 mm. broad.*  
 (82) *S. frondosa.*
- ×× *Branchlets 3—5 mm. or more broad.*
- + *Intermedial leaves entire or denticulate at the base.*  
 (97) *S. pentagona.*
- ++ *Intermedial leaves more or less ciliate or ciliolate at the base.*  
 (98) *S. suffruticosa.*

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(74) **S. Presliana**, *Spring*, Mon., II, 161; *S. pennula*, *Spring*, Bk., Fern All., 95, p. p.

Shoots erect, 30—60 cm. long, the lower part simple, square or soon terete, firm, sparingly foliate, the upper part deltoid and decompose;

branches spreading; branchlets numerous, erecto-patent, often simple, 1¼—2 mm. broad including the lateral leaves. Leaves rigid, deep-green above, pale and glittering beneath, those of the stem isomorphous, not copious; those of the branched portion heteromorphous. Leaves of the branches contiguous, those of the lower plane ovate-lanceolate, 2—2½ mm. long, 1—1¼ mm. broad, falcate, acuminate, nearly equal-sided, subentire, auricled on the upper side at the base, somewhat imbricated over the rachis, the auricle revolute, spur-shaped; those of the upper plane ½ as long, ascending, ovate-oblong, cuspidate, falcate, subentire, oblique, and produced on the outer side at the base, imbricate. Spikes short, square, 4—5 mm. long; sporophylla adpressed, keeled, cuspidate; macrospores finely ruguloso-reticulate; microspores . . . . .

*Philippines.*

(75) **S. argentea**, *Spring*, Mon., II, 154; *S. trinervia*, *Spring*, l. c., 125 (t. Hier.); *S. caulescens*, *Spring*, var. *argentea*, Bk., Fern All., 95; *Lycopodium argenteum*, *Wall.*, Cat., No. 127.

Shoots ascending or erect from a trailing base, 15—30 cm. long, the lower part simple, stramineous, obtusely quadrangular, the upper part decomposed, deltoid in outline; branches subspreading; pinnulae simple or somewhat compound; branchlets 2—3 mm. broad including the lateral leaves. Leaves of the stipe minute, erect, lanceolate, scale-like, entire except at the produced base; leaves of the branches heteromorphous; of the lower plane contiguous, subspreading, subfalcate-lanceolate, acute or subacute, indistinctly spuriously nerved, the upper side obsoletely denticulate towards the apex, denticulate towards the base, ciliolate at the rounded base, pellucid-margined in the lower half, the lower side entire or subentire, ciliolate at the subcordate-truncate base, the largest leaves 2½ mm. long and 1½ mm. broad; of the ultimate branchlets similar but smaller, more ascending, to 1¾ mm. long, relatively narrower, less copiously ciliolate at the lower base; leaves of the upper plane erect, imbricate, acute-ovate, cuspidate or aristate, serrulate, pellucid-margined, rounded or cordate at the base, the outer base a little produced. Spikes short, square, 1 mm. diam.; sporophylla ovate, acute, pellucid-margined, serrulate, keeled.

*Malacca, Celebes* (t. Christ.).

(76) **S. Griffithii**, *Spring*, Mon., II, 151; Bk., Fern All., 96; *S. brevipes*, *A. Br.*, Hieron. in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 680.

Shoots erect, 15—30 cm. long, the lower part simple, unequally quadrangular, the upper part decomposed, flabellate-deltoid; lower pinnae elongate, triangular, pinnately compound; ultimate branchlets contiguous, ascending, 6—12 mm. long. Leaves of the lower plane rather contiguous on the branchlets, spaced on the main rachis, more or less ascending, green, pale-glittering beneath, ovate-oblong, 2—4 mm. long, 1—2 mm. broad, subacute, spuriously veined, pellucid-margined and minutely denticulate on the upper side, rounded, dilated and imbricated over the rachis on the upper side at the base; leaves of the upper plane  $\frac{1}{2}$  as long, roundish or obovate, distinctly cuspidate, pellucid-margined and minutely denticulate, somewhat obliquely cordate at the base. Spikes square, 5—12 mm. long,  $1\frac{1}{4}$  mm. diam.; sporophylla ovate, finely acuminate, pellucid- or pale-margined, minutely denticulate, keeled; macrospores white, finely rugulose-reticulate (? the apical ribs surrounded by a ring-shaped crest); microspores provided with needle-like, bacilliform or stipitate-capitate projections.

Forma typica: Lateral leaves distinctly piloso-serrulate on the upper side throughout, distinctly spuriously veined.

Forma brevipes: Lateral leaves piloso-serrulate on the upper side towards the base, entire or very obsolete denticulate towards the apex, less distinctly spuriously veined.

*Southern Asia.*

(77) **S. nutans**, *Warb.*, Mons., I, 117; — var. *capitata*, v. A. v. R., Bull. Bot., 1911, I, 18; — var. *grandiscapia*, v. A. v. R., l. c., 1913, XI, 35.

Shoots erect from a decumbent base, to 30 cm. more or less long, the lower part simple, more or less angular, yellowish-grey,  $1\frac{1}{2}$ —2 mm. thick, the upper part pinnately compound; pinnae 6—10 on a side, the lowest the longest, 10—15 cm. long, copiously 2—3-pinnate; ultimate branchlets crowded, 6—12 mm. long, 3—4 mm. broad including the lateral leaves. Leaves of the stipe erected, adpressed, triangular or triangular-oblong, remote, to 4 mm. long, entire, acute, the base cordate, the basal lobes hamato-incurvate, ciliolate; leaves of the branched portion heteromorphic; leaves of the lower plane broadly lanceolate-oblong, subfalcate, bronze-green above, pale beneath; of the main rachis 4—5 mm. long, approximate, subspreading, subacute, the base unequally cordate, with the basal lobes hamato-incurvate, the upper one the largest, or the lower more rotundate, the upper edge minutely denticulate towards the base,

the upper base ciliolate, the lower provided with 0—6 short ciliae; of the ultimate branchlets similar, crowded, 2 mm. long, hardly acute, subtruncate-rotundate at the base, the upper base very minutely serrulate, the lower entire or hardly ciliolate; leaves of the upper plane erect, oblong; of the main rachis acuminate to shortly cuspidate, more or less minutely denticulate, or entire towards the base, somewhat keeled, the base cordate or semicordate like in the leaves of the lower plane and more or less ciliolate; of the ultimate branchlets smaller, shortly cuspidate or acuminate, entire, rotundate-cuneate on the inner side at the base, produced and rotundate to cordate on the outer side. Spikes square, to 20 mm. long, 1 mm. diam.; sporophylla broadly ovate, acute, keeled, minutely denticulate; macrospores yellowish-white, more or less rugulose or reticulate, the apical ribs encircled by a crest-shaped ring; microspores yellowish or whitish, provided with conical projections on the basal side.

Forma typica. — *Java, Sumatra.*

**Var. capitata:** Microspores provided with sessile or short-stalked capitate projections. — *Java (?)*.

**Var. grandiscapla:** Large plants; shoots 40—60 cm. long, the branches proportionally larger; stipes 3—4 mm. thick; ultimate branchlets narrower, 2—2½ mm. broad including the lateral leaves which are 1½ mm. long and more distinctly ciliolate-denticulate on the upper edge in the lower half; microspores as in var. capitata. — *Sumatra.*

(78) **S. pteriphyllus, Spring,** Mon., II, 162; Bk., Fern All., 95; *S. myosuroides, Pr.,* Abh. Boehm. Ges., III, 581.

Shoots erect, to 30 cm. long, simple in the lower part, deltoid and decomposed in the upper part; lower pinnae deltoid, 3-pinnate; ultimate branchlets to 8½ mm. long, 1¼ mm. broad including the lateral leaves. Leaves of the stipe decussate, remote, ovate-lanceolate, cuspidate, semi-cordate and ciliate at the base, the auricle incurvate-hamate; leaves of the branches heteromorphous; leaves of the lower plane erecto-patent, lanceolate-oblong, acute, contiguous only on the ultimate branchlets, dark-green above, pale-glittering beneath, moderately firm, nearly equal-sided, narrowed from the middle to the base, the upper edge serrulate towards the apex, gradually ciliate towards the rotundate-cuneate base, the lower edge entire, or sparingly ciliate at the base; of the main rachis remote, 2 mm. long by 1 mm. broad; of the branchlets bluntish, 1¼—1½ mm. long; leaves of the upper plane to ½ as long, erect, obovate, short-cuspidate,

minutely denticulate; of the main rachis remote, the base obliquely cordate, produced, incurved and ciliated on the outer side; of the branchlets close, subentire, the inner base rotundate-cuneate, the outer base produced, rotundate-cordate, the auricle not incurved.

*Philippines.*

(79) **S. Jagori**, *Warb.*, Mons., I, 116.

Shoots erect, 40—50 cm. long, the lower part simple, yellow, 2—3 mm. thick, the upper part branched, broadly ovate or suborbicular; branches few, 6—7 on each side, the lower pinnately decomposed; branchlets 1—2½ cm. long, often forked, 2 mm. broad including the lateral leaves. Leaves of the stipe adpressed, broadly ovate, 2—3 mm. long, acuminate, truncate or semicordate at the base; leaves of the branches heteromorphous; leaves of the lower plane spreading, remote; of the main rachis subfalcate-ovate, 4 mm. long, acute, narrowed at the base, the upper side ciliolate-denticulate, gradually long-ciliate at the broadly rotundate-cuneate base; of the branchlets erecto-patent, sublanceolate, 2 mm. long, bluntish, the upper side subentire towards the apex, gradually ciliate towards the cuneate base, the upper base slightly produced; leaves of the upper plane suberect, ovate; of the main rachis broadly adnate at the base, hardly obliquely cordate, hardly falcate, 2½ mm. long, cuspidate; of the ultimate branchlets similar, shorter, imbricate, long-cuspidate, the cusp ½—¾ as long as the blade. Spikes 7—12 mm. long, square, 2—2½ mm. diam.; sporophylla ovate, acuminate, distinctly keeled, glittering, ciliolate at the edge; macrospores irregularly rugulose on the basal half; microspores capitato-verruculose on the basal half.

*Luzon.*

(80) **S. luzonensis**, *Hieron.*, Hedwi., XLI, 181.

Shoots erect from a creeping base, hardly 25 cm. long, the lower ⅔ part simple, dirty-grey-green, hardly 1½ mm. thick, the upper part subflabellately pinnate, ovate or orbicular in outline; pinnae sessile, pinnately compound, with the lower and central pinnulae pinnate or dichotomous, the higher simple or forked; branches with the rachises 4—5 mm. broad including the lateral leaves; ultimate branchlets 1½—2 mm. broad. Leaves of the stipe isomorphous, ovate-oblong, long-acuminate, minutely denticulate; leaves of the branched portion heteromorphous; lateral leaves rather spuriously veined on the aligular side, inequilateral;

those of the main rachis 3 mm. long, 2 mm. broad, denticulate on the upper side; those of the secondary rachises broadly oblong, bluntish, minutely denticulate on the upper side, entire on the lower side except at the apex; of the branchlets ovate-oblong, subacute, straight, rather subfalcate, minutely denticulate on the upper side in the lower half, 1½ mm. long, ¾ mm. broad; leaves of the upper plane ovate, long-aristate-cuspidate, cordate-auriculate on the outer side at the base, rotundate-cuneate on the inner side at the base, the cusp ½—⅔ as long as the blade; those of the main rachis piloso-denticulate towards at the apex, the largest 3 mm. long, 1 mm. broad; those of the branchlets smaller, more or less pellucid-margined towards the apex. Spikes square, to 5 mm. long, 2—2½ mm. diam.; sporophylla nearly isomorphous, equal-sided, ovate, aristate-cuspidate, hardly auricled at the base, densely piloso-denticulate, the ventral ones somewhat larger, the largest to 1¾ mm. long, 1 mm. broad; macrospores yellowish-white, finely and irregularly reticulate-rugulose on the basal half; microspores provided with baculiform or capitate projections on the basal side.

*Luzon.*

(81) **S. parvifrons, v. A. v. H.**, Bull. Botz., 1913, XI, 34.

Shoots erect from a decumbent base, 20 cm. or more high, the lower (shorter) part simple, 1 mm. thick, irregularly angular and grooved when dry, the upper (longer) part branched, lanceolate-ovate in outline, 15 cm. or more long; pinnae suberect, the higher simple or forked, the lower pinnate, to 10 cm. long; pinnulae suberect, simple or forked; ultimate branchlets 1¼—2½ cm. long, 3½—4½ mm. broad including the lateral leaves. Leaves of the stipe subisomorphous, rather remote, erect, oblong, 3 mm. long, shortly cuspidate-acuminate, entire, obliquely rotundate-subcordate at the base; leaves of the branched portion heteromorphous; leaves of the lower plane more or less ascending; of the main rachis approximate, falcate-oblong, 4½—5 mm. long, ½ as broad, bluntish or subacute, unequal-sided, the upper side rounded, minutely denticulate in the lower half, cuneate at the base, the lower side nearly straight, entire, narrowly rotundate-truncate at the base; of the branchlets similar but less unequal-sided, to 4 mm. long, to 2 mm. broad, close or imbricate, spuriously 2-nerved, indistinctly pellucid-margined on the upper side in the lower half; leaves of the upper plane erect; of the main rachis similar to those of the stipe, close, hardly longer, distinctly broader, subentire or

very minutely denticulate, more cordate and hamato-incurvate on the outer side at the base; of the branchlets similar, the largest  $1\frac{3}{4}$ —2 mm. long, entire, not incurved at the base, the cusp  $\frac{1}{3}$  as long as the blade. Spikes solitary, square, to 2 cm. long,  $1\frac{3}{4}$ —2 mm. diam.; sporophylla ovate, acute, keeled, minutely denticulate, the largest  $1\frac{1}{2}$ — $1\frac{3}{4}$  mm. long; macrospores whitish, irregularly reticulate-rugulose, the apical ribs encircled by a ring-shaped crest; microspores whitish to yellow, provided with bacilliform or stipitate-capitate projections on the basal side.

*Borneo.*

(82) **S. frondosa**, *Warb.*, Mons., I, 117; *S. flabellata*, *Bk.* (not *Spring*), Journ. of Bot., XVIII, 217; — var. *borneensis*, Hieron., Engl. Bot. Jahrb., XLIV, 511; — var. *ciliata*, v. A. v. R., Bull. Botz., 1914, XVI, 48; — var. *splendida*, v. A. v. R., Bull. Botz., 1912, VII, 31.

Shoots erect, 35—50 cm. long, the lower part simple,  $1\frac{1}{2}$ —4 mm. thick, yellowish-grey when dry, subterete or rather obtusely quadrangular, grooved when dry, the upper part compound, oblong, roundish or transversely oblong, to 35 cm. broad; pinnae 8—16 on a side, contiguous, the lowest the largest, 3-pinnate, to 25 cm. long, to 20 cm. broad, the higher simply pinnate, the highest simple or forked; ultimate branchlets crowded, to 1 cm. or more long,  $2\frac{1}{2}$ —3 mm. broad including the lateral leaves. Leaves of the stipe isomorphous, erected, adpressed, triangular or oblong,  $2\frac{1}{2}$ —4 mm. long, acute, the base rotundate-truncate or semicordate, entire to ciliolate; leaves of the branched part heteromorphous; leaves of the lower plane dark-bright-green above, green or glaucescent beneath, approximate, more or less ascending; of the main rachis oblong, subfalcate, slightly inequilateral, subobtuse, obliquely truncate-rotundate to cordate and more or less ciliolate on both sides at the base, entire, but minutely denticulate on the upper side towards the base, the largest leaves 5—6 mm. long and half as broad; of the branchlets subsimilar, 2—4 mm. long, relatively narrower, contiguous or somewhat imbricated, rotundate-subcordate to subcuneate at the base, with the lower base provided with 0—4 short ciliae; leaves of the upper plane erected, adpressed; of the main rachis to 4 mm. long, oblong, much acuminate or shortly cuspidate, more or less keeled, entire or obsoletely denticulate, with the base more or less cordate, often sparingly ciliolate, produced and mostly distinctly hamato-incurvate on the outer side; of the ultimate branchlets smaller, shortly cuspidate, entire or ciliolate at the base, the inner base rotundate or



rotundate-cuneate, the outer base produced, cordate. Spikes square, 1—2 cm. long, 1—1½ mm. diam.; sporophylla isomorphous, erecto-patent, ovate, acute, keeled, entire or very minutely denticulate, the largest 1½ mm. long; macrospores pale-orange, yellowish or whitish, irregularly rugulose or reticulate on the basal side, the apical ribs encircled by a ring-shaped crest; microspores yellowish or whitish, provided with conical, tuberculiform, capitate, stipitate-capitate or bacilliform projections on the basal side.

Forma typica. — *Sumatra to the Andamans.*

**Var. borneensis:** Leaves of the lower plane more falcate, more acute; of the upper plane acuminate. — *Borneo.*

**Var. ciliata:** Leaves of the lower plane strongly ciliated at the base; of the upper plane acuminate. — *Borneo.*

**Var. splendida:** Leaves of the lower plane (of the branchlets) rather sparingly, minutely denticulate (not ciliolate) on the upper side at the base. — *Sumatra.*

(83) **S. latifrons**, *Warb.*, *Mons.*, I, 120.

Shoots erect, 50—70 cm. long, the lower part simple, terete, 2½—3½ mm. thick, yellowish when dry, the upper (larger) part branched, broadly ovate; branches copious, the lower to 20 cm. long, decomposed, the higher pinnate, 2—4 cm. long; branchlets 1—2 cm. long, 3—6 mm. broad including the lateral leaves. Leaves of the stem adpressed, ovate, 4 mm. long, acute, truncate at the base; leaves of the branches heteromorphous; leaves of the lower plane spreading, contiguous, very oblique, subfalcate-ovate; of the secondary rachises to 6 mm. long and 3 mm. broad, dark-green above, pale and glittering beneath, not ciliate, subacute, the upper side very minutely denticulate, broadly rounded and subbullate at the base; of the branchlets lanceolate-falcate, entire, rotundate-cuneate at the base, rather spuriously veined, 3—4 mm. long; leaves of the upper plane erect; of the secondary rachises ovate, 3 mm. long, cuspidate-acuminate, the inner side very minutely denticulate, cuneate at the base, the outer side entire, auriculate-cordate at the base, keeled; of the branchlets similar, shorter, the outer base slightly produced, rounded. Spikes 8—12 mm. long, 2 mm. diam.; sporophylla ovate, 1½ mm. long, acuminate, minutely denticulate, keeled, glittering; macrospores yellow-white, rugulose; microspores with conical projections on the basal half.

*Luzon.*

(84) **S. pungentifolia**, *v. A. v. R.*, in Bull. Btz., 1911, I, 20.

Shoots erect, 30 cm. more or less long, simple, angular and grooved in the lower  $\frac{1}{2}$ — $\frac{2}{3}$ , branched upwards, with the branches and leaves liable to curl up in drought; pinnae not copious, 2-pinnate, with the branchlets simple or forked; ultimate branchlets to 2 cm. long, 2—3 mm. broad including the lateral leaves. Leaves of the stipe and lower part of the main rachis isomorphous, erect, triangular-subulate, the margin spinuloso-ciliate, the base cordate; leaves of the branches heteromorphous; lateral leaves somewhat remote and subspreading on the rachises, more or less contiguous and erecto-patent or slightly remote and subspreading on the branchlets, those of the ultimate branchlets falcate, to  $1\frac{1}{2}$  mm. long, to nearly 1 mm. broad, firm, the apex very acute or sharply acuminate, both edges conspicuously and more or less remotely setulose or spinuloso-ciliate towards the base, gradually more or less sharply dentate or denticulate towards the apex, the base broadly adnate, with the free corners narrowly rounded or the lower one narrowly truncate; intermedial leaves lanceolate, those of the branchlets  $1\frac{1}{4}$ — $1\frac{1}{2}$  mm. long,  $\frac{1}{2}$ — $\frac{3}{4}$  mm. broad, sharply acuminate, the margin remotely setulose or spinuloso-ciliate towards the base, more or less sharply dentate or denticulate towards the apex, the base very oblique, cuneate on the inner side, produced and cuneate to cordate on the outer side. Spikes to 2 cm. long, square or nearly so, 2 mm. diam.; sporophylla isomorphous, ovate,  $1\frac{1}{4}$  mm. long, acuminate, keeled, remotely setulose or spinuloso-ciliate towards the base, more or less denticulate or dentate towards the apex; macrospores yellowish-white, densely and finely verruculose to rugulose; microspores . . . . . — Very distinct by its conspicuously acute and spinuloso-ciliate leaves, which give the whole plant, when seen under the lens, a thorny appearance.

*Java.*

(85) **S. polyura**, *Warb.*, Mons., I, 116, tab. IV A (not quite correct); *S. Merrillii*, *v. A. v. R.*, Bull. Btz., 1911, I, 21.

Shoots erect from a creeping base, 15—50 cm. long, the lower part simple, rather terete, the upper part pinnate, lanceolate-ovate in outline, to 35 cm. long, to 15 cm. broad at the base; pinnae ascending, 5—10 on a side, the higher short, simple or forked, the lower linear-lanceolate, pinnate, 3—15 cm. long, to 4 cm. broad at the base; pinnulae ascending, simple or forked, or the larger ones laxly pinnate with 1—3 branchlets on a side. Leaves of the stipe erect, adpressed, ovate, acute, semicordate

at the base; leaves of the branched portion heteromorphous, firm; lateral leaves somewhat ascending; of the main rachis moderately remote, broadly cordate-ovate, acuminate, pellucid-margined and minutely denticulate on the upper side, 2½—3 mm. long, 2—2½ mm. broad; of the branchlets similar, imbricate, rather triangular, hardly falcate, rather equal-sided, rounded to truncate on the upper side at the base, rounded to cordate on the lower side, 1—1½ mm. long, ¾—1 mm. broad; intermedial leaves erect, adpressed; of the main rachis similar to those of the stipe, parallel, nearly straight, keeled towards the apex, acuminate, distinctly and obliquely cordate at the base which is somewhat produced on the outer side, the largest 2—2½ mm. long; of the branchlets close, broadly rhomboidal-oblong, acuminate, more or less denticulate-ciliolate, keeled towards the apex, rotundate-cuneate on the inner side at the base, cordate and somewhat produced on the outer side, the largest to ¾ mm. long and ½ mm. broad. Spikes ¾—6 cm. long, 1½—2 mm. diam.; sporophylla ascending, broadly ovate, acute or acuminate, keeled, minutely denticulate, to 2 mm. long; macro- and microspores as in *S. caulescens* Spring.

*Luzon, Mindanao.*

(86) ***S. caudispica*, v. A. v. B.**, Bull. Botz., 1913, XI, 35.

Shoots erect from a creeping base, 30—40 cm. long, the lower part simple, stramineous, terete or subterete, the upper part pinnate, ovate in outline; pinnae ascending, the higher simple or forked, the lower pinnate, oblong, 4—10 cm. long and 2—5 cm. broad; pinnulae close, ascending, simple or forked, or the lower subpinnate (3-furcate); branchlets ½—4 cm. long, 2½—4 mm. broad including the lateral leaves. Leaves of the stem isomorphous, remote, erect, small, adpressed, ovate, acute, cordate or semicordate at the base; leaves of the branches heteromorphous; lateral leaves imbricate, subspreading, thick, subfalcate-oblong, acute, spuriously nerved, with the upper side minutely denticulate in the lower part, somewhat dilated and rotundate-cordate at the base, the lower side entire, rotundate-cuneate at the base; of the branchlets to 2 mm. long and nearly 1 mm. broad; of the secondary rachises relatively broader; intermedial leaves imbricate, erect, subparallel, acuminate, rather keeled, subentire or minutely denticulate, with the inner base rotundate-cuneate, the outer base rather produced, more or less auriculate-cordate, sparingly ciliolate-denticulate. Spikes square, very long, 6—15 cm. long, 1½—2

mm. diam., irregularly flexuose; sporophylla ascending, at length spreading, triangular-ovate, 1½—2 mm. long, acute, minutely denticulate, keeled; microspores whitish to yellowish-orange, provided with subcylindrical, conical or stipitate-capitate projections on the basal side; macrospores . . .

*Borneo.*

(87) **S. Warburgii**, *Hieron.*, Leaflet, VI, 1988; *S. microstachya*, *Warb.*, *Mons.*, I, 116; *S. caulescens*, *Spring*, *Mon.*, II, 158, p. p.; (not *Lycopodium microstachyum*, *Desv.*)

Shoots erect from a creeping base, 40—50 cm. long, the lower part unbranched, terete, yellowish when dry, 1¼—2 mm. thick, the upper part branched; pinnae ascending, 8—10 on each side, the lower 2-pinnate, 12—18 cm. long, the higher simply pinnate, the highest hardly 1 cm. long; branchlets ascending, 1—2 cm. long, 2—3 mm. broad including the lateral leaves. Leaves of the stem erect, adpressed, broadly ovate, 2—3 mm. long, subacute, produced on the outer side at the base, hardly ciliate at the edge; leaves of the branches heteromorphous; those of the lower plane spreading, suboblique, subcordate-ovate, 2 mm. long, subacute, ciliolate at the base, denticulate on the upper edge in the lower half; those of the upper plane erect, ovate, 1½ mm. long, acuminate, somewhat keeled, denticulate; leaves of the branchlets similar but smaller; those of the lower plane imbricate, rather rotundate on the upper side at the base, cuneate-truncate on the lower side at the base. Spikes short, 3—5 mm. long, square, hardly 1 mm. diam.; sporophylla imbricate, nearly orbicular, hardly ⅔ mm. long, subcuspidate, minutely denticulate, strongly keeled.

*Luzon.*

(88) **S. Boschali**, *Hieron.*, *Hedwi.*, LI, 243.

Shoots erect, 25—30 cm. long, the lower part simple, subterete, somewhat compressed, to 1½ mm. thick at the base, the upper part subpinnately compound, ovate or ovate-oblong in outline; lower pinnae branched, ovate or oblong, with the pinnulae on the lower side whether or not elongated; higher pinnae simple or forked; lower pinnulae pinnate or repeatedly forked. Leaves of the stem subdecussate, deltoid-ovate, equal-sided, piloso-denticulate, cordate and ciliolate on both sides at the base, the largest 1 mm. long and ⅔—¾ mm. broad; leaves of the branches heteromorphous; leaves of the lower plane subovate-oblong, falcate,

subequilateral, rounded on the upper side, truncate on the lower side at the base, copiously ciliated on the upper edge in the lower half, otherwise entire, the largest 2 mm. long and  $\frac{3}{4}$  mm. broad, provided with scattered sclerotic cells; leaves of the upper plane falcate-ovate, equal-sided, shortly acuminate, entire or sparingly piloso-denticulate, sparingly pellucid-dotted, rounded on the inner side, subcordate-ovate, hardly produced and provided with 1—2 ciliae on the outer side at the base, the largest 1 mm. long and  $\frac{1}{2}$  mm. broad.

*Borneo.*

(89) **S. caulescens**, *Spring*, Mon., II, 158; Bk., Fern All., 94, p. p.; *S. circinalis*, *Pr.*, Abh. Boehm. Ges., III, 583; *S. involvens*, *Hieron.* (not *Spring*), Hedwi., L, 2; *Lycopodium involvens*, *Sw.*, Syn. Fil., 182; *L. circinale*, *Thb.*, Flor. Jap., 341; *L. caulescens*, *Wall.*, Cat., No. 137; — var. *brachypoda*, Bk., l. c., 95; — var. *bellula*, *Hieron.*, l. c., 4; *S. bellula*, *Ces.*, Fel. di Bor., 36.

Shoots erect from a creeping or scandent base, generally 15—45 cm. long or longer, the lower part unbranched, the upper part compound, the stem varying from relatively short to long, terete or nearly so, not angular, with isomorphous, erected, adpressed, spaced, ovate-lanceolate leaves; pinnae close or approximate, deltoid, ovate-lanceolate or linear; pinnulae more or less copiously pinnate with ascending, often contiguous, simple, forked or pinnate tertiary branches; final branchlets 5—35 mm. long,  $2\frac{1}{2}$ —4 mm. broad including the lateral leaves, those of the most compound forms often the narrowest, and vice-versa, liable to curl up in drought. Leaves of the branches heteromorphous; leaves of the lower plane subcontiguous to imbricated, oblong,  $1\frac{1}{2}$ — $2\frac{1}{2}$  mm. long, rather ascending, bluntish to acuminate, bright-green, firm in texture, rather unequal-sided, spuriously nerved, rounded or cordate at the base, the upper side ciliolate or minutely denticulate at least towards the base, the upper base more or less imbricated over the rachis, the lower side entire, or denticulate to ciliolate or plicated and lacerato-denticulate at the base; leaves of the upper plane  $\frac{1}{4}$ — $\frac{1}{3}$  as long, erected, adpressed, entire or denticulate, acuminate or subcuspidate, straight or curved, imbricated, the base more or less truncate or semicordate, produced on the outer side. Spikes square, 5—40 mm. long,  $1\frac{1}{4}$  mm. diam.; sporophylla ovate-acuminate, entire or serrulate, keeled; macrospores white, yellow or brown, compressed, lentiform, encircled by an equatorial wing; microspores

verruculose with cylindrical, semiglobose or conical projections on the basal half. — Very variable. — In order to avoid confusion the name *S. caulescens* Spring is maintained though I acknowledge that the name *S. involvens* Hieron. has a legitimate claim on priority.

Forma typica: Shoots 15—45 cm. long, the stipes proportionally very long; largest pinnae deltoid to ovate-lanceolate. — *Br. India to New Guinea.*

**Var. brachypoda:** Like the type, but the stipes proportionally very short. — *Java.*

**Var. bellula:** Shoots 50—75 cm. long; largest pinnae linear or linear-lanceolate, relatively narrow, narrowed gradually from base to apex; otherwise like the type but the pinnulae not rarely simple or forked only, and the spikes up to even 15 cm. long, 1—1¼ mm. diam. — Specimens occurring in the Buitenzorg Herbarium or cultivated in the Buitenzorg Gardens have the young plants with the shoots linear-lanceolate, similar in shape to the pinnae of adult plants. — *Western Malaya, Philippines, New Guinea.*

(90) **S. striolata**, *Warb.*, *Mons.*, I, 116.

Shoots erect from a creeping base, 40 cm. long, the lower part simple, terete, 1¼ mm. thick, yellowish when dry, the upper part branched; pinnae oblique, 8 on each side, often 2-pinnate, the lower 15 cm. long, the higher 2—3 cm. long; branchlets ascending, 6—15 mm. long, 2—2½ mm. broad including the lateral leaves. Leaves of the stipe adpressed, ovate 1½—2 mm. long, acute, peltate or semicordate at the base, hardly ciliolate; leaves of the branches heteromorphous; of the lower plane erecto-patent, subremote, broadly ovate, 1½—2½ mm. long, subobliquely acuminate, the base truncate-cordate, apparently spuriously veined, the upper side pellucid-margined, minutely denticulate, the lower side sparingly denticulate at the very base; of the upper plane erect, ovate, 1 mm. long, acute, somewhat keeled, minutely denticulate, ciliolate at the obliquely cordate base; leaves of the branchlets similar but smaller; of the lower plane subimbricate, truncate-rotundate at the base, the upper side sparingly denticulate, entire towards the apex; of the upper plane obliquely rounded at the base, not ciliolate. Spikes 8—15 mm. long, square, 2 mm. diam.; sporophylla subsquarrose, ovate-lanceolate, 1¼ mm. long, acute, gradually acuminate, strongly keeled, minutely denticulate; macrospores brown, compressed, encircled by an equatorial plicate-undulate wing; microspores . . . . .

*Luzon.*

(91) **S. aenea**, *Warb.*, Mons., I, 115.

Shoots erect, 50 cm. long, the lower part simple, 2 mm. thick, yellowish when dry, the upper part branched, broadly ovate in outline; branches 8 on each side, decomposed, the lower 3-pinnate, to 20 cm. long, the upper simply pinnate, 2 cm. long; branchlets  $\frac{1}{2}$ —1 cm. long,  $1\frac{1}{2}$  mm. broad including the lateral leaves. Leaves of the stem adpressed, ovate, 2—3 mm. long, acute, not produced at the base; leaves of the branches heteromorphous, dark-green above, paler beneath, glossy and bronze-glittering on both sides; of the lower plane oblique-patent, broadly lanceolate, subfalcate, 3—5 mm. long, truncate at the base, subacute, the upper side minutely or absolutely denticulate towards the apex, gradually ciliate towards the narrowly rotundate-truncate base, the lower side entire, sparingly ciliate at the truncate-subcordate base; of the upper plane erect, ovate,  $1\frac{1}{2}$ —2 mm. long, shortly cuspidate-acuminate, keeled, the inner side minutely denticulate, narrowed at the base, the outer side subentire, or sparingly ciliolate at the subauriculate-cordate base; leaves of the branchlets similar but shorter and narrower; of the lower plane lanceolate,  $1\frac{1}{2}$  mm. long,  $\frac{1}{2}$  mm. broad, ciliated in the lower half, hardly contiguous, rather somewhat remote, not produced at the base; of the upper plane ovate, rather entire, keeled, acuminate. Spikes square, 5—7 mm. long,  $1\frac{1}{4}$  mm. diam.; sporophylla subsquarose, broadly ovate,  $\frac{3}{4}$  mm. long, acute, keeled, glittering, ciliolate; macrospores irregularly rugulose; microspores capitato-verruculose.

*Mindanao.*

(92) **S. albomarginata**, *Warb.*, Mons., I, 119, tab. IV B.

Shoots erect, 30—40 cm. long, the lower part simple, deeply grooved, 2 mm. thick, the upper part branched, more broad than long; branches 5 on a side, the lowest to 15 cm. long, 2-pinnate, the highest 1—2 cm. long, forked or hardly pinnate; branchlets 1—2 cm. long, 4—5 mm. broad including the lateral leaves. Leaves of the stem adpressed, broadly lanceolate, 4 mm. long; leaves of the branches heteromorphous; of the lower plane spreading, remote, subfalcate-lanceolate, to 6 mm. long, dark-green above, more or less distinctly spuriously veined, paler and glittering beneath, subacute, rounded on the upper side and cuneate on the lower side at the base, the upper side dilated, pellucid-margined, denticulate; of the upper plane lanceolate, 4 mm. long, hardly oblique, cuspidate-acuminate, keeled, minutely denticulate, pellucid-margined, the inner base

cuneate, the outer base narrowly auriculate, the auricle acute, straight or incurved, spur-like; leaves of the branchlets similar; of the lower plane 3 mm. long, narrowly rotundate-curved at the upper base; of the upper plane 2 mm. long, narrowly rounded at the outer base. Spikes 6—8 mm. long, square, 2 mm. diam.; sporophylla lanceolate, acuminate, denticulate, albo-marginate, 1½ mm. long; macrospores white, finely rugulose-reticulate; microspores reddish, capitato-verruculose on the basal half.

*New Guinea.*

(93) **S. Brausei**, *Hieron.*, Fed., Rep., X, 41.

Shoots 30—40 cm. long, the lower part simple, tetragonal, 1½—2 mm. thick at the base, the upper part decomposed, ovate in outline, sometimes 2-partite at the base with the fork-branches similarly decomposed; pinnae lanceolate, ovate or obovate in outline; lower pinnulae pinnate, with the lower branches simple or forked and the central one or more times forked. Leaves of the stipe and lower part of the main rachis isomorphous, equilateral, triangular, cordate at the base, acute or acuminate, keeled, denticulate on both sides, ciliate at the base; leaves of the branches and the upper part of the main rachis heteromorphous; lateral leaves ascending, obliquely falcate-ovate, subacute, spuriously nerved, denticulate on the upper side which is ciliolated at the rotundate-cuneate base, entire on the lower edge which is provided with 0—2 ciliae at the rotundate-truncate or cordate-truncate base; of the main rachis the largest, rather remote, to 2¼ mm. long, to 1 mm. broad; of the ultimate branchlets close, to 1 mm. long and ½ mm. broad; intermedial leaves erect, ovate, shortly acuminate, pellucid-dotted; of the principal rachises minutely denticulate on both sides, sparingly ciliate at the obliquely cordate base, the largest leaves 1½ mm. long and ¾ mm. broad; of the branchlets smaller, obliquely rotundate-cuneate at the base, rather entire. Spikes solitary, ½—1 cm. long, 1 mm. diam.; sporophylla nearly isomorphous, subdeltoid-ovate, shortly acuminate, nearly keeled, copiously denticulate on both sides, the ventral ones somewhat larger, the largest hardly 1 mm. long; macrospores yellowish or yellowish-white, rugulose, the rumples often flexuose, ramose or reticulate; microspores orange or yellowish, sparingly provided with short-stalked, capitate projections on the basal side.

*Mindanao.*

(94) **S. cupressina**, *Spring*, Mon., II, 113, p. p.; *S. pennula*,



*Spring*, l. c., 160; Bk., Fern All., 95, p. p.; *S. flabellata*, *Spring*, Bk., l. c., 98, p. p.; ? *S. debilis*, *Ces.*, Fel. Becc. Polin., 6; *Lycopodium cupressinum*, *Willd.*, Spec., V, 42; — var. *anceps*; *S. anceps*, *Pr.*, Abh. Boehm. Ges., III, 581.

Shoots 30—60 cm. or more long, erect or ascending from a trailing base, the lower part simple, stipitiform, obtusely quadrangular, the upper part decomposed, ovate or deltoid in outline: lower pinnae erecto-patent or spreading, ovate or deltoid, 2—4-pinnate, to 15 cm. or more long, the contiguous final branchlets to 10 mm. long, 1¼—2 mm. broad including the lateral leaves. Leaves of the stipe isomorphous, decussate, remote, ovate-lanceolate or triangular-oblong, erect, adpressed, acute, ciliate or denticulate, cordate at the base; leaves of the branches heteromorphous, crowded; leaves of the lower plane ascending; of the secondary rachises lanceolate-oblong, to 2½ mm. long, bluntish or acute, nearly equal-sided, the lower ones cordate at the base, entire, but the upper side ciliate or ciliate-denticulate in the lower half, the lower side provided with 0—6 ciliae at the base; of the branchlets to 1¾ mm. long, more narrowly rotundate on the upper side and rather truncate-cuneate on the lower side at the base, less copiously denticulate-ciliate; leaves of the upper plane erect, ⅓—½ as long, oblique-oblong, acute, entire or somewhat denticulate, the base produced on the outer side; of the secondary rachises remote or subcontiguous, auriculate-cordate and provided with 0—4 ciliae on the outer side at the base; of the branchlets similar but the outer base more rotundate. Spikes square, 5—40 mm. long, 1¼ mm. diam.; sporophylla ovate, acuminate, keeled, entire or serrulate.

Forma typica: Macrospores whitish, irregularly verruculose-rugulose; microspores yellow, provided with sessile or stipitate-capitate projections on the basal side.

**Var. *anceps*:** Macrospores yellowish, reticulate-rugulose; microspores minium-red, prickly.

*Borneo and the Philippines to New Guinea, Sumbawa* (? Colfs No. VII).

(95) ***S. leytensis*, Hieron.**, Fed., Rep., X, 43.

Shoots erect, 30—40 cm. long, or longer, the lower part simple, obtusely quadrangular, subterete, smooth, dirty-stramineous, hardly more than 1¾ mm. thick, the upper part decomposed, ovate in outline; largest pinnae lanceolate or ovate; lower pinnulae pinnate or dichotomous, central ones one or more times forked; ultimate branchlets 1½ mm. broad

including the lateral leaves. Leaves of the stem isomorphous, equal-sided, cordate-subulate, minutely denticulate, ciliated at the base; leaves of the branches heteromorphous; leaves of the lower plane lanceolate-oblong, subfalcate, acuminate, nearly equal-sided, cordate or subtruncate-cordate at the base, spuriously striolate-venulose, with the upper edge piloso-denticulate in the lower half, ciliated at the base, the lower edge entire, with 0—4 ciliae at the base, the midrib thickened towards the apex; of the principal rachises the largest, 2½ mm. long, hardly more than 1 mm. broad; of the ultimate branchlets smaller, ascending; leaves of the upper plane ovate, oblique at the base, rather produced, cordate and more or less ciliated on the outer side at the base, acuminate, piloso-denticulate, sparingly pellucid-dotted, the largest leaves 1½ mm. long, those of the ultimate branchlets often quite entire. Spikes solitary, 3—7 mm. long, 1—1½ mm. diam.; sporophylla deltoid-ovate, shortly aristate-acuminate, keeled, piloso-denticulate, the ventral ones a little larger, to 1 mm. long; macrospores whitish, irregularly rugulose with short or elongated, flexuose, branched or reticulated ridges on the basal side; microspores orange or yellowish, sparingly provided with stipitate-capitate projections. — A duplicate of Elmer's No. 7058, occurring in the Buitenzorg Herbarium, has the lateral leaves bluntish, the sporophylla acute, the projections of the microspores partly bacilliform.

*Leyte.*

(96) **S. flabelloides**, *Warb.*, Mons., I, 118; *S. flabellata*, *Spring*, Bk., Fern All., 98, p. p.

Shoots erect, 35—60 cm. long, the lower part simple, 1½—2½ mm. thick, angular, distinctly grooved, the upper (smaller) part branched, broadly ovate in outline; lowest branches 3-pinnate; branchlets 6—10 mm. long, 2—4 mm. broad including the lateral leaves. Leaves of the stem adpressed, lanceolate-triangular, 3 mm. long, acute, the base truncate to cordate, ciliolate; leaves of the branched portion heteromorphous; those of the lower plane distant, subspreading, broadly lanceolate, 2½—3½ mm. long, subfalcate, subacute, not oblique, black-green above, paler, glittering and distinctly spuriously veined beneath, the base truncate, ciliate, rounded on the upper side, partly hiding the rachis, with 0—4 ciliae on the lower side; those of the upper plane ascending, ovate, oblique, 2—2½ mm. long, acute, hardly acuminate, keeled; leaves of the branchlets similar but smaller; those of the lower plane close but not imbricate, 1½—2 mm.

long; those of the upper plane  $1\frac{1}{4}$  mm. long. Spikes 10—15 mm. long, square,  $1\frac{1}{2}$  mm. diam., glittering; sporophylla ovate,  $1\frac{1}{4}$  mm. long, acute, keeled; macrospores white, ruguloso-reticulate on the basal half, with the apical ribs surrounded by a ring-like crest; microspores capitato-verruculose on the basal half.

*Luzon.*

(97) **S. pentagona**, *Spring*, Mon., II, 150; Bk., Fern All., 96.

Shoots ascending, 30—45 cm. long, sometimes lengthened, nutant and taking root at the apex, the lower part simple, firm, woody,  $1\frac{1}{2}$ —2 mm. thick, unequally 4—5-angular, the upper part pinnately compound; pinnae suberect, the lower 2—3-pinnate; ultimate branchlets crowded, erect, 6—25 mm. long, 3— $4\frac{1}{4}$  mm. broad including the lateral leaves. Leaves of the stem isomorphous, erected, distant, lanceolate-oblong, sub-2-auriculate, entire; leaves of the main rachis and branches heteromorphous; leaves of the lower plane contiguous, ascending, lanceolate-ovate, falcate, 2—4 mm. long,  $\frac{2}{3}$  as broad, acute, entire or very minutely denticulate, rounded on the upper side at the base, the lower base very slightly auricled; of the principal rachises the largest; leaves of the upper plane  $\frac{1}{4}$ — $\frac{1}{3}$  as long, lanceolate-oblong, acute, rather keeled, pellucid-margined, mostly entire, somewhat produced on the outer side at the base; of the main rachis rotundate-cordate; of the branchlets rotundate-cuneate at the base. Spikes short, square,  $1\frac{1}{4}$ —2 mm. diam.; sporophylla ovate-lanceolate, acute, keeled, minutely denticulate, pale-margined; macrospores white or yellowish, tuberculate or verruculose; microspores dirty-yellow or minium-red, minutely tuberculato-verruculose.

*Celebes* (? t. Christ); *Br. India.*

(98) **S. suffruticosa**, *v. A. v. R.*, Bull. Btz., 1911, I, 22.

Shoots erect from a short-creeping base, 35—40 cm. long, the lower part simple, firm, woody, 2—3 mm. thick, obtusely 4—5-angular, the upper part pinnately compound; pinnae suberect, the lower 2—3-pinnate; ultimate branchlets crowded, conspicuously ascending, 5—30 mm. long,  $3\frac{1}{2}$ — $4\frac{1}{2}$  mm. broad including the lateral leaves. Leaves of the stipe isomorphous, erected, adpressed, triangular-oblong, acute or acuminate, entire, keeled, broadly adnate at the base, the free corners varying from narrowly rounded to truncate or cordate, entire, denticulate or shortly ciliate; leaves of the main rachis and branches heteromorphous; leaves of

the lower plane contiguous, ascending, lanceolate-oblong, dark above, pale beneath, slightly falcate, firm; those of the branchlets much imbricated over the rachis, somewhat imbricate, bluntish, obsoletely denticulate at the apex, the upper edge entire, or minutely denticulate towards the base, the lower edge entire, the upper base rounded, the lower base narrowly truncate, rounded or rotundate-cuneate, sparingly ciliolate, the largest leaves 3 mm. long, 1 mm. broad, slightly dilated on the upper side near the base; leaves of the upper plane imbricated, erected, ovate-oblong, the largest 2 mm. long, shortly acuminate, nearly acute, entire or obsoletely denticulate, keeled, the inner base rotundate-cuneate, the outer base cordate, sparingly ciliolate, hardly produced. Spikes square, to 2 cm. long, 2—2½ mm. diam.; sporophylla triangular-ovate, imbricate, spreading, or erecto-patent when young, acute, entire or obsoletely denticulate; macrospores yellowish-white, smooth or irregularly reticulate, naked or pulverulent, the apical ribs encircled by a ring-shaped crest; microspores yellow or pale-orange, provided with subcylindrical or shortly stipitate-capitate projections.

*Java, New Guinea.*

a. **Homocostachys.** 6. **Pubescentes.**

**1.** *Lateral leaves decurrent upon the rachis.*

△ *Rhizome 1-stelical.* (99) *S. Vogelii.*

△△ *Rhizome 2-stelical.* (100) *S. Braunii.*

**1.1.** *Lateral leaves not decurrent, though sometimes more or less broadly adnate at the base.*

**2.** *Ultimate branchlets 1—3 mm. broad.*

**3.** *Intermedial leaves cuspidate.* (101) *S. biformis.*

**3.3.** *Intermedial leaves blunt, acute or at best acuminate.*

**4.** *Lateral leaves narrowed at the base.*

\* *Lateral leaves of branchlets oblong, very blunt.*

(102) *S. Dahlii.*

\*\* *Lateral leaves of branchlets lanceolate, or not very blunt.*

(103) *S. Sonneratii.*

**4.4.** *Lateral leaves broad or cordate at the base.*

**5.** *Ultimate branchlets 1—1½ mm. broad.*

+ *Leaves of the stipe isomorphous.*

(104) *S. angustiramea.*

++ *Leaves of the stipe heteromorphous.*

(105) *S. Hellwigii.*

**5.5.** *Ultimate branchlets 1½—3 mm. broad.*

**6.** *Lateral leaves not distinctly spuriously veined.*

(106) *S. melanesica.*

**6.6.** *Lateral leaves distinctly spuriously veined.*

**7.** *Lateral leaves proportionally short and broad.* (107) *S. Hieronymiana.*

**7.7.** *Lateral leaves proportionally long and narrow.* (108) *S. d'Albertisii.*

**2.2.** *Ultimate branchlets 3—5 mm. broad.*

○ *Branchlets crowded, relatively narrow.* (109) *S. marosensis.*

○○ *Branchlets loose, or relatively broad.* (110) *S. wariensis.*

**2.2.2.** *Ultimate branchlets more than 5 mm. broad.* (111) *S. Burkei.*

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(99) **S. Vogellii**, *Spring*, Mon., II, 170.

Rhizome wide-creeping, subterraneous, pink-tinted, 1-stelical, scaly, the scales remote, deciduously flocculent, those of the extremity ovate-oblong, acuminate, lacerate-denticulate, pink-tinted, crowded. Shoots erect, 45—65 cm. high, the lower part simple, terete or subterete, deciduously pubescent, pink-tinted at least towards the slightly compressed and somewhat grooved base, the base 2—4 mm. thick, the upper part copiously branched, broadly ovate, triangular or pentagonal in outline, 20—30 cm. long, 20—30 cm. broad at or near the base; rachises pubescent beneath; pinnae many, contiguous, ascending, the higher simple or forked, very short, the lower the largest, stalked, 3—4-pinnate; pinnulae ascending, contiguous, the higher simple or forked, the lower pinnately compound, the lowest posterior not rarely produced; ultimate branchlets contiguous, 5—15 mm. long, 3—5 mm. broad including the lateral leaves. Leaves of the stipe and lower part of the main and secondary rachises erect, very distant, isomorphous, triangular, acute, minutely denticulate, peltate and truncate at the base; leaves of the branches heteromorphous, flaccid, herbaceous, bright-green or bluish above, pale-green beneath; lateral leaves sub-rhomboidal-oblong; those of the principal rachises distant, horizontal or

nearly so, bluntish or subacute, entire, more or less cuneate, rounded or truncate at the base, somewhat dilated on the upper side near the base, laterally affixed, the largest 4 mm. long, 2—2½ mm. broad; those of the ultimate branchlets nearly similar, crowded, more ascending, subequilateral, with the upper base cuneate, the lower base adnate, rather decurrent, with a small, rounded corner above the base, the largest leaves 2½ mm. long, 1—1½ mm. broad; leaves of the upper plane erect, rather parallel; those of the principal rachises distant, triangular-falcate, incurved, long-acuminate or cuspidate, entire, the largest 2 mm. long, with the inner base rounded or truncate, the outer base cuneate, long-decurrent; those of the ultimate branchlets smaller, imbricated, obliquely ovate-lanceolate, long-cuspidate, the cusp as long as the blade, the inner edge slightly rounded, the outer conspicuously so, the inner base rotundate-cuneate, the outer cuneate, long-decurrent. Spikes often solitary, sometimes double, square, 5 mm. more or less long, 1 mm. diam.; sporophylla isomorphous, ovate, acuminate, keeled, entire, erecto-patent, at length somewhat spreading; macrospores whitish or yellowish, irregularly tuberculato- or conico-verrucose to subrugulose, the projections of the basal side scattered, those of the apical side crowded; microspores yellowish or whitish, tuberculato- or capitato-verruculose to subrugulose. — The description is taken from a cultivated specimen determined by Hieronymus.

*In cultivation.* — *Orig. loc.:* West Africa (Cameroon to Gaboon, Fernando Po).

(100) **S. Braunii, Bl.**, Fern All., 96; *S. Hieronymi, v. A. v. R.*, Bull. Botz., 1911, I, 18.

Shoots erect or ascending from a creeping, subterraneous, lacerato-squamulose, 2-stelical rhizome, simple in the lower part, decomposed in the upper part, the branched portion deltoid or ovate in outline, with the branches liable to curl up in drought, the stem obtusely quadrangular at the base, stramineous, 1- or sub-2-stelical, more or less deciduously pubescent like the main rachis beneath; pinnae more or less ascending or subspreading, the higher simple or forked, the largest triangular, ovate or lanceolate-oblong, 2—3-pinnate, the rachises pubescent beneath; ultimate branchlets 2—4 mm. broad including the lateral leaves. Leaves of the stipe and lower part of the main rachis isomorphous, erect, remote, oblong, 2½ mm. long and 1 mm. broad, the apex shortly but sharply acuminate, the edges parallel, entire, the base irregularly truncate, peltate; leaves

of the branches and upper part of the main rachis heteromorphous; lateral leaves somewhat distant on the main rachis, approximate or contiguous on the branchlets, subspreading or somewhat ascending, recurved and rugulose when dry; those of the branchlets rhomboid-oblong, the largest 2—2½ mm. long, 1—1¼ mm. broad, blunt, entire, recurved at the edge, the upper base abruptly rotundate-cuneate, the lower decurrent; leaves of the upper plane erect, adpressed, lanceolate-oblong; those of the ultimate branchlets close or approximate, the largest 1½ mm. long, acuminate, entire, subparallel, straight or subfalcate, the higher obliquely adnate, cuneate and decurrent on the outer side at the base, the lower peltate and rounded at the base. Spikes short, square, 1¼—2 mm. diam.; sporophylla broadly ovate, to 2 mm. long, acuminate, keeled, entire; macrospores pale-yellow, purplish or brownish, rugulose or verruculose; microspores yellowish or pale-orange, provided with conical or cylindrical projections which may be thickened at the apex.

Forma typica: Shoots rather large, 25—50 cm. long.

Forma Hieronymi: Shoots small, 7½—20 cm. long, the branched portion 5—15 cm. long, 4—12½ cm. broad.

*In cultivation.* — *Orig. loc.:* China.

(101) **S. biformis**, **A. Br.**, Hieron., Leafl., VI, 2001; *S. hirticaulis*, Warb., Mons., I, 114; *S. cupressina*, Spring, Mon., II, 113, p. p.

Shoots creeping, or ascending from a trailing base, 15—40 cm. long, the stem yellowish, pubescent below with pale, deciduous hairs, as are the rachises; pinnae ascending, to 25 on a side, 1—2-pinnate or once to twice forked, rarely simple; ultimate branchlets 2—3 mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves spreading; of the stem remote, ovate, hardly oblique, 1½—2½ mm. long, acute, subentire towards the apex, the upper side denticulate, ciliolate towards the subcordate or rounded base, the lower side entire, or sparingly ciliolate at the rounded or truncate-cuneate base; of the branchlets similar to those of the stem but smaller, close or more or less imbricate; intermedial leaves erect; of the stem broadly ovate, very oblique, ¾—1½ mm. long, cuspidate-acuminate, minutely denticulate, the inner base rotundate-cuneate, the outer base produced, rounded; of the branchlets cuspidate, hardly denticulate, keeled. Spikes square, 6—12 mm. long, 1¼—2 mm. diam.; sporophylla ovate, ¾—1 mm. long, acute, ciliolate-denticulate; macrospores pale-grey or yellowish-white, irregularly rugulose-verruculose; microspores

dirty-yellow or orange, provided with shortly conical or bacilliform projections on the basal half.

*Philippines across Celebes, Java, Sumatra to Assam, Burmah and South China.*

(102) **S. Dahlii**, *Hieron.*, in Engl. Bot. Jahrb., L, 10.

Shoots ascending from a creeping base, 30 cm. long, the lower part simple, compressed, when dry sometimes slightly angled and grooved, grey-stramineous or dirty-coloured, densely puberulous, as are rachises, to 2 mm. thick, the upper part 4-pinnate, ovate in outline, the main rachis 7 mm. broad including the lateral leaves; pinnae ovate, to 15 cm. long; ultimate branchlets 2—3 mm. broad. Leaves of the stipe subisomorphic, erect, remote; of the lower plane elongate-deltoid, broadly adnate, acute, the upper (inner) side remotely and minutely denticulate, very shortly rotundate-cuneate at the base, the lower (outer) side entire, or obscurely denticulate towards the apex, straight at the base, the largest leaves 4 mm. long by hardly 1 mm. broad; of the upper plane deltoid-oblong, acuminate, keeled, hardly and sparingly denticulate, the base broadly adnate, narrowly auriculate and somewhat produced on the outer side, rotundate-cuneate on the inner side; leaves of the branches distinctly heteromorphic; those of the lower plane spreading; of the secondary rachises remote, elongate-oblong, subacute, the upper side rather sparingly denticulate, rotundate-cuneate at the base, the lower side straight, the largest leaves 3½ mm. long by 1¼ mm. broad; those of the upper plane erect; of the secondary rachises approximate, obliquely ovate, acuminate, the inner side rather minutely denticulate, rounded at the base, the outer side subentire, denticulate at the produced cordate base, the largest leaves 2¾ mm. long by 1 mm. broad; leaves of the branchlets smaller; of the lower plane subfalcate-oblong, to 1½ mm. long and hardly more than ½ mm. broad, obtuse, distinctly spuriously veined, the upper base only sparingly denticulate and pellucid-margined; of the upper plane imbricate, the inner side pellucid-margined in the upper part and minutely denticulate, the outer side denticulate in the upper part and pellucid-margined.

*New Guinea.*

(103) **S. Sonneratii**, *Hieron.*, in Engl. Bot. Jahrb., L, 7.

Shoots ascending from a creeping base, 40—50 cm. long, the lower



part simple, subterete, slightly compressed, to 2 mm. thick, when dry subangular and irregularly grooved, castaneous or dirty-coloured, the upper part 4-pinnate, ovate in outline, the main rachis 7 mm. broad including the lateral leaves; pinnae ovate or lanceolate, to 20 cm. long, the rachises puberulous; ultimate branchlets hardly more than 2 mm. broad. Leaves heteromorphous; leaves of the stipe scattered; of the lower plane acute, minutely denticulate on both sides, broadest at the rounded upper base, straight at the lower base, the largest 2½ mm. long and 1 mm. broad; of the upper plane obliquely ovate, aristate-acuminate, slightly keeled, the inner side minutely denticulate, rounded at the base, the outer side subentire, slightly decurrent at the base, the largest leaves 2½ mm. long and 1½ mm. broad, with the cusp ¼ as long as the blade; leaves of the branched portion gradually approximate; leaves of the main rachis the largest; of the lower plane very remote, spreading, to 3½ mm. long and 1½ mm. broad, obliquely lanceolate, acute, the upper side minutely denticulate, pale-margined in the lower ¾, rotundate-cuneate at the base, the lower side entire, rotundate-cuneate at the base; of the upper plane obliquely ovate, to 2½ mm. long and 1½ mm. broad, subcuspidate-long-acuminate, the cusp ⅓ as long as the blade, the sides partly narrowly pellucid-margined, the inner side remotely denticulate, rotundate-cuneate at the base, the outer side hardly denticulate, cordate-auriculate at the base, the auricle rounded; leaves of the branchlets similar but smaller; of the lower plane approximate, to 1½ mm. long and ½ mm. broad, bluntish, narrowed at the base. Spikes solitary, 1½ mm. diam.; sporophylla subisomorphous, ovate, mucronate, keeled, denticulate, the ventral ones the largest, to 1½ mm. long; macrospores more or less yellow, provided with simple or branched, free or connected rumples; microspores orange or yellowish, provided with short-stalked, capitate projections on the basal side.

*New Guinea.*

(104) **S. angustiframen**, *Muell. & Bk.*, Journ. of Bot., XXVI, 26.

Shoots stiffly erect, to 30 cm. long, the stem slender, the lower part simple, the upper part 3-pinnate; pinnae much ascending, deltoid-oblong, 5—7½ cm. long, the rachises deciduously and finely hairy; branchlets sometimes 2½—4 cm. long, 1—1½ mm. broad including the lateral leaves. Leaves of the branches heteromorphous; lateral leaves crowded or nearly close, suberect, liable to curl up in drought, nearly as broad as long,

blunt to mucronulate, the upper edge minutely denticulate, the lower edge entire; of the rachises 1 mm. long, obliquely 2-auriculate-cordate at the base and moderately copiously ciliolate, produced at the lower (outer) base; of the branchlets smaller, more spreading, cordate and rather sparingly ciliolate at the lower base; intermedial leaves erect; of the rachises ovate, 1 mm. long, subacute, the inner edge denticulate, the outer edge entire, the base obliquely cordate and sparingly ciliolate, much produced on the outer side; of the branchlets smaller, hardly ciliolate at the base, the inner base rotundate-cuneate, the outer base cordate, less produced. Spikes short, terminal, 1 mm. diam.; sporophylla ovate, acute, keeled. — Plants recently gathered, and very probably identical with this, agree with the following description: Shoots erect from an ascending base, 30—60 cm. long, the lower part simple, terete, stramineous, 1½—2 mm. thick, the upper part copiously 4—5-pinnate, lanceolate-ovate in outline, to 40 cm. long and 20 cm. broad, the rachises very sparingly hairy; pinnae erecto-patent, lanceolate, to 20 cm. long; ultimate branchlets 1—1½ mm. broad. Leaves of the stipe erect, adpressed, the lower remote, ovate, bluntish or acute, entire or partly very minutely denticulate, broadly adnate, subpeltate, not produced at the base, the higher similar to those of the main rachis; leaves of the main rachis isomorphous, erect, remote, obliquely ovate, acute, the inner side minutely serrulate, ciliolate-serrulate at the rounded base, the outer side minutely serrulate, auriculate-cordate at the base, the auricle produced, slightly incurved, minutely and irregularly eroso-ciliolate, the largest leaves 2½ mm. long, 1½ mm. broad; leaves of the branches growing gradually smaller, heteromorphous; lateral leaves involute when dry; of the secondary rachises suberect, nearly as broad as long, bluntish or mucronulate, obliquely 2-auriculate-cordate and irregularly eroso-ciliolate at the base, the upper side minutely denticulate, the lower side entire; of the ultimate branchlets subspreading, close or imbricate, ovate-oblong, blunt, spuriously veined, the upper side sparingly minutely denticulate, rounded at the base, the lower side entire, or sparingly ciliolate-denticulate at the truncate-rotundate or subcordate base, the largest leaves ¾ mm. long and ½ mm. broad; intermedial leaves erect; of the secondary rachises subfalcate-ovate, acute or shortly acuminate, the inner side minutely serrulate, rounded and sparingly ciliolate at the base, the outer side subentire or obsoletely denticulate, much produced and eroso-ciliolate at the auriculate-cordate base; of the ultimate branchlets close, subfalcate-ovate, acute or shortly acuminate, the inner side provided

with 1—2 very minute teeth, rounded or rotundate-cuneate at the base, the outer side entire, or provided with a single minute tooth at the produced cordate base. Spikes square, 1 mm. diam.; sporophylla isomorphous, ovate, acuminate, keeled, minutely serrulate, to 1 mm. long, at length spreading; microspores yellowish or dirty-pale-orange, verruculose; macrospores . . . . .

*New Guinea.*

(105) **S. Hellwigii**, *Hieron.*, in Engl. Bot. Jahrb., L, 12.

Shoots erect from an ascending base, 15—30 cm. long, the lower part simple, compressed, dirty-stramineous-brown, like the rachises minutely pubescent on the back, when dry 3-sulcate, to 2 mm. thick, sparingly leafy, the upper part 4-pinnate, ovate or rotundate-ovate, to 20 cm. each way, the main rachis 3—4 mm. broad including the lateral leaves; pinnae rather close, ovate, to 12 cm. long, with closely placed pinnulae; ultimate branchlets 1 mm. broad. Leaves heteromorphous; lateral leaves of the stipe erect, remote, triangular-ovate, unequal-sided, broadest on the inner side, acute, narrowly 2-auriculate-cordate at the base, obsoletely denticulate on both sides, the largest leaves to 4 mm. long and 1 $\frac{2}{3}$  mm. broad; intermedial leaves of the stipe ovate-oblong, long-acuminate, slightly keeled, obsoletely or very minutely denticulate, unequal-sided at the base, the inner base shortly cordate, the outer base produced, auriculate-cordate, the auricles hamato-incurvate, the largest leaves 3 mm. long and 1 mm. broad; lateral leaves of the main rachis suboblique-ovate, acute, nearly equal-sided, the upper side minutely denticulate but obsoletely so towards the apex, partly pellucid-margined, subcordate-rotundate at the base, the lower side obsoletely denticulate towards the apex, minutely denticulate at the truncate-auriculate base, the largest leaves 3 $\frac{1}{2}$  mm. long and 1 $\frac{2}{3}$  mm. broad; intermedial leaves of the main rachis ovate-oblong, shortly aristulate-acuminate, somewhat denticulate in the upper part, the inner base rounded, the outer base produced, the auricle slightly incurved, rounded or subtruncate, the largest leaves 2 mm. long and 1 mm. broad; leaves of the branchlets subsimilar but smaller, bluntish, the lateral ones to  $\frac{3}{4}$  mm. long, obliquely rotundate-truncate at the base, the intermedial ones often quite entire, acute, the inner base narrowly rotundate-cuneate, the outer base rotundate-subcordate. Spikes solitary, short, nearly 2 mm. diam.; sporophylla ovate, to 1 $\frac{1}{4}$  mm. long, the longest the narrowest, aristulate-acuminate, keeled, minutely denticulate; macrospores yellow-

white, more or less reticulate-rugulose, the apical ribs encircled by a slightly elevated equatorial ring; microspores minium-red or brown-red, provided with scattered stipitate-capitate projections on the basal side.

*New Guinea.*

(106) **S. melanesica**, *Kuhn*, *Forsch. Gaz.*, IV, Bot., 17.

Shoots ascending or erect, the lower part simple, to 25 cm. long, indistinctly quadrangular, thinly pubescent, stramineous, the upper part pinnately compound, deltoid in outline, 30—50 cm. long, the main rachis somewhat hairy; pinnae ascending, 3-pinnate; ultimate branchlets hardly 2 mm. broad including the lateral leaves. Leaves of the stipe isomorphous, remote, erected, adpressed, broadly ovate, acuminate, finely serrulate at the apex; leaves of the branched portion heteromorphous, deep-green, glossy, imbricated; of the lower plane erecto-patent, small, unequal-sided, elongate-lanceolate, subfalcate, acuminate, the upper side finely serrulate, ciliolate at the pellucid-margined, rounded or rotundate-cuneate base, the lower side finely serrulate at the apex, entire, or sparingly ciliolate at the subauriculate-truncate base, the largest leaves of the branchlets nearly 2 mm. long,  $\frac{3}{4}$  mm. broad; leaves of the upper plane  $\frac{1}{2}$  as long, ovate, unequal-sided, acuminate, finely serrulate, the inner base rounded, the outer base auriculate-cordate. Spikes square, 1—1½ cm. long; sporophylla elongate-lanceolate, acuminate, finely serrulate, keeled; microspores yellow or dirty-orange, provided with scattered conical or short-cylindrical projections on the basal side; macrospores . . . . .

*Papua.*

(107) **S. Hieronymiana**, *c. A. v. B.*, *Bull. Btz.*, 1912, VII, 31; *S. minutifolia*, *Ces.* (not *Spring*), *Fel. Becc. Polin.*, 9.

Shoots erect from a trailing base, 50—75 cm. long when fully developed, the lower part simple, terete or subterete, stramineous, deciduously pilose, 2½—3 mm. thick near the base, the upper part pinnately compound, more or less ovate in outline, the rachises pilose; pinnae ovate to lanceolate, the largest to 35 cm. long, 2—4-pinnate; quaternary branches simple or forked; ultimate branchlets 2—15 mm. long, 1½—2 mm. broad including the lateral leaves, the terminal ones not rarely much elongated and caudiform. Leaves of the stipe and lower part of the main rachis isomorphous, erected, adpressed, ovate, acute, subentire, the base truncate-rotundate or obliquely cordate, peltate; leaves

of the branches and upper part of the main rachis heteromorphous; leaves of the lower plane erecto-patent, imbricate on the branchlets, somewhat remote on the principal rachises; of the branchlets ovate-oblong, to 1½ mm. long and ½ as broad, bluntish, straight or slightly falcate, nearly equal-sided, spuriously veined beneath, more or less slightly and obliquely cordate at the base or the upper base rounded, the upper edge minutely denticulate, the lower edge entire, or denticulate at the very base; of the penultimate rachises similar but somewhat larger, acute or sub-acute, with the lower base slightly produced and lacerato-denticulate; leaves of the upper plane erected, adpressed; of the branchlets subfalcate-ovate, crowded, to 1 mm. long, acute, minutely denticulate, oblique at the base, the inner base rounded or rotundate-cuneate, the outer base cordate, much produced, subciliolate; of the penultimate rachises similar but somewhat larger, denticulate. Spikes very numerous, square, 2—30 mm. long, 1—1½ mm. diam.; sporophylla ascending, finally subspreading, ovate, acute, keeled, minutely denticulate; macrospores probably lentiform and provided with an equatorial wing; microspores yellowish or pale-orange, provided with scattered, conical, tuberculiform or subcylindrical projections on the basal side. — The description is taken from a specimen from Amboyna, cultivated in the Buitenzorg Gardens.

*New Guinea, Amboyna.*

(108) **S. d'Albertisii**, Hieron., Engl. Bot. Jahrb., L, 2; *S. involvens*, Hieron., var. *d'Albertisii*, Hieron., Hedwi., L, 4.

Shoots probably erect, the lower part simple, very slender, terete, stramineous, the upper part pinnately decomposed, the rachises deciduously pubescent; ultimate branchlets 2—3 mm. broad including the lateral leaves. Leaves of the stipe erect, isomorphous, distant, thin, lanceolate, 2 mm. long, acute or shortly acuminate, produced and auriculate-cordate on one side at the base; leaves of the branches heteromorphous; lateral leaves subfalcate-oblong; of the branchlets subspreading, to 1½ mm. long, ½ as broad, blunt or bluntish, spuriously veined, the upper edge minutely denticulate except at the apex, the lower edge sometimes sparingly denticulate, the base rounded or rotundate-truncate; intermedial leaves erect; of the branchlets imbricate, small, acute or shortly acuminate, minutely denticulate, the base obliquely rounded or rotundate-truncate, produced on the outer side. — A specimen occurring in the Buitenzorg Herbarium, considered by Hieronymus as a variety of this species, has the spikes

slender,  $\frac{3}{4}$ —1 mm. diam., the sporophylla ovate, acuminate, minutely denticulate, keeled, the microspores verruculose.

*New Guinea.*

(109) **S. marosensis**, *v. A. v. R.*, Bull. Botz., 1911, I, 19.

Shoots erect from a decumbent base, 30—45 cm. long, the lower part simple, stramineous, 2—3-sulcate down the face, deciduously hairy, the upper part pinnate, oblong in outline, 20—30 cm. long, 6—10 cm. broad, acuminate; pinnae ascending, oblong, to 10 cm. long; pinnulae simple or forked, or the largest pinnate, ascending; branchlets 1—3 cm. long, 3—5 mm. broad including the lateral leaves; rachises distinctly but not densely hairy beneath. Leaves of the stipe and lower part of the main rachis distant, erect, adpressed, isomorphous, ovate,  $2\frac{1}{2}$  mm. long, acuminate, entire, cordate on the outer side at the base; leaves of the branched portion heteromorphous, thin, flaccid; leaves of the lower plane approximate on the branchlets, rather spaced on the main rachis; those of the main rachis rather ascending, lanceolate-oblong, falcate, the largest 5 mm. long and 2 mm. broad, bluntish, minutely denticulate on the upper edge towards the base, slightly dilated on the upper side, moderately distinctly spuriously veined, with the upper base cuneate, the lower base obliquely truncate; those of the branchlets similar, 2—3 mm. long,  $\frac{1}{2}$  as broad, blunter, the lower base provided with 0—4 short ciliae; leaves of the upper plane erect, ovate, acuminate, cuspidate, entire, keeled, cordate and produced on the outer side at the base; those of the main rachis distant, to 3 mm. long, somewhat incurvate-falcate; those of the branchlets more close, rather straight, to 2 mm. long. Spikes nearly square,  $1\frac{1}{2}$ —2 mm. diam.; sporophylla ascending, ovate-subulate, acute, minutely denticulate, keeled, those on the ventral side the longest, to 2 mm. long; macrospores rugulose, with the apical ribs surrounded by a ring-like crown; microspores provided with capitate or subcylindrical projections.

*Celebes.*

(110) **S. wariensis**, *Hieron.*, in Engl. Bot. Jahrb., L, 19.

Shoots erect, probably 50 cm. or more long, the lower part simple, compressed, convex on the face and back, nearly honey-yellow, between opaque and glossy, more or less pubescent, to 4 mm. thick, the upper part laxly 3—4-pinnate, rotundate-ovate in outline, the rachises more or less pubescent, the stem 10— $12\frac{1}{2}$  mm. broad including the lateral leaves;

lower pinnae to 25 cm. long, the rachis 8—10 mm. broad; lower pinnulae pinnately divided, the following once or twice forked, the higher simple; ultimate branchlets long, 3—6 mm. broad. Leaves heteromorphous; lateral leaves of the stem ascending, subapproximate, somewhat obliquely falcate-ovate, acute, the upper side pellucid-margined, minutely denticulate, rounded at the base, the lower side minutely denticulate at the rotundate-cordate base only, the largest leaves 7 mm. long by 4 mm. broad; intermedial leaves of the stem obliquely falcate-ovate, aristate-acuminate, the outer edge minutely denticulate near the apex, ciliate at the produced incurvate-auriculate base, the inner edge rotundate-cordate at the base, minutely denticulate, the largest leaves 7 mm. long; leaves of the branches growing gradually smaller; lateral leaves of the branchlets close, subacute, rather rotundate-cordate at the base, slightly spuriously veined, the upper side minutely denticulate in the lower half, indistinctly pellucid-margined, ciliolate at the base, the lower side entire between the minutely denticulate apex and ciliate base, the largest leaves 2½—3 mm. long, less than half as broad; intermedial leaves of the branchlets smaller, long-acuminate, subcuspidate, rotundate-cuneate at the inner base, cordate at the outer base, the auricle rounded. Spikes square, terminal, ½—1½ cm. long, 2—2½ mm. diam., solitary on abbreviated lateral branchlets or 2—4-nate on elongated terminal branchlets; sporophylla isomorphous, triangular-ovate, aristulate-acuminate, minutely denticulate, keeled, to 2 mm. long; microspores yellow or orange, provided with stipitate-capitate projections on the basal side; macrospores . . . . .

*New Guinea.*

(111) **S. Burkel**, *Hieron.*, Engl. Bot. Jahrb., L, 16; — var. *luisiadiensis*, Hieron., l. c., 18.

Shoots probably 50 cm. or more long, the lower part simple, stipiform, compressed, fulvous or fulvo-olivaceous, to 5 mm. thick, when dry slightly 2-sulcate on the face, convex on the back, pubescent on the angles, as are the rachises, the upper part branched, the main rachis 10—12½ mm. broad including the lateral leaves, the ultimate branchlets 6—10 mm. broad; lower pinnae to 20 cm. long, subpinnate, the central 2—3 times forked, the higher simple. Leaves heteromorphous; lateral leaves of the stipe remote, ascending, 5 mm. long by 2½ mm. broad; of the branched portion more contiguous, obliquely subfalcate-ovate, the apex very minutely denticulate, acuminate, the point bluntish, both sides

entire at the centre, the upper base cordate-rotundate, ciliolate, the higher ciliae dentiform, the lower base cuneate-truncate, provided with 1—5 moderately long ciliae, the costa flanked by 2 narrow spurious veinlets near the apex; of the main rachis 7 mm. long and 3 mm. broad; of the branches growing gradually smaller; of the ultimate branchlets 5—5½ mm. long and nearly ½ as broad; intermedial leaves, erect; of the stipe subfalcate-ovate, narrowly pellucid-margined, rather entire, the apex shortly aristate-acuminate and hardly denticulate, the outer base produced, the auricle slightly incurved, ciliate, the inner base rounded, ciliolate or denticulate, the largest leaves 6 mm. long and 2½ mm. broad; of the branched portion growing gradually smaller; of the branchlets cuneate at the base, or the outer base rounded. Spikes terminal, solitary or double, quadrangular, 5—10 mm. long and 2—2½ mm. diam.; sporophylla isomorphous, deltoid-ovate, shortly aristate-acuminate, keeled, denticulate, to 1½ mm. long; microspores yellowish or orange, provided on the basal side with conical or capitate projections; macrospores . . . . .

Forma typica. — *New Guinea*.

**Var. luisiadiensis:** Intermedial leaves hardly pellucid-margined towards the apex only, the apex subabruptly aristate, the cusp a little longer. — *Rossell Island*.

b. **Heterostachys.** 1. **Intertextae.**

**1.** *Lateral leaves hardly longer than broad.*

△ Spikes to 1¾ mm. broad. (112) *S. calcicola*.

△△ Spikes more than 1¾ mm. broad. (113) *S. alutacea*.

**1.1.** *Lateral leaves distinctly longer than broad.*

**2.** Spikes not resupinate. (114) *S. Rothertii*.

**2.2.** Spikes resupinate.

**3.** *Largest lateral leaves to 1 mm. long.*

+ *Lateral leaves cordate at the base.* (115) *S. oligophylla*.

++ *Lateral leaves not or hardly cordate at the base.*

(116) *S. eurycephala*.

**3.3.** *Largest lateral leaves more than 1 mm. long.*

**4.** *Leaves crowded everywhere.*

⊙ *Lateral leaves ciliate at least on 1 side at the base.*

(117) *S. ujensis*.



⊙⊙ *Lateral leaves entire or at best denticulate.*

(118) *S. Winkleri.*

**4.4.** *Leaves more or less spaced on the main stem.*

**5.** *Spikes to 2½ mm. broad.*

**6.** *Intermedial leaves rather long-cuspidate-acuminate.*

**7.** *Spikes to 1¾ mm. broad.*

× *Branchlets to 2 mm. broad.*

(119) *S. Künstleri.*

×× *Branchlets more than 2 mm. broad.*

(120) *S. longiciliata.*

**7.7.** *Spikes more than 1¾ mm. broad.*

**8.** *Lateral leaves entire or at best denticulate.*

**9.** *Main rachis to 4 mm. broad including lateral leaves.*

(121) *S. exasperata.*

**9.9.** *Main rachis more than 4 mm. broad including lateral leaves.*

(122) *S. humifusa.*

**8.8.** *Lateral leaves ciliate or ciliolate, at least on 1 side at the base.*

= *Ultimate branchlets to 3 mm. broad.*

† *Pinnae rather close, the lower 2-pinnate.*

(123) *S. phanotricha.*

†·† *Pinnae remote, or the lower at best sparingly pinnate.*

(124) *S. brevipinna.*

== *Ultimate branchlets more than 3 mm. broad.*

(125) *S. membranifolia.*

**6.6.** *Intermedial leaves not long-cuspidate-acuminate.*

♂ *Lateral leaves entire or at best denticulate.*

♀ *Lateral leaves of ultimate branchlets close or approximate.* (126) *S. bancana.*

♀♀ *Lateral leaves of ultimate branchlets remote.*

- *Lateral leaves very unequal-sided.*  
(127) *S. karimatae*.
- *Lateral leaves not very unequal-sided.* (128) *S. Loriai*.
- ♂♂ *Lateral leaves ciliate or ciliolate at least on 1 side at the base* <sup>(1)</sup>.
- ♀ *Ultimate branchlets to 1½ mm. broad.*
  - *Sporophylla of the lower plane blunt or acute.*  
(129) *S. subspinulosa*.
  - *Sporophylla of the lower plane acuminate to cuspidate.*  
(130) *S. Weinlandii*.
- ♀♀ *Ultimate branchlets more than 1½ mm. broad.*
  - = *Sporophylla of the lower plane long-cuspidate.* (131) *S. Burbidgei*.
  - == *Sporophylla of the lower plane not long-cuspidate.*
    - |· *Lateral leaves blunt or bluntish.* (132) *S. Lauterbachii*.
    - |·|· *Lateral leaves acute or acuminate.* (133) *S. intertexta*.

**5.5. Spikes 3 mm. or more broad.**

- △ *Ultimate branchlets to 2 mm. broad.*  
(134) *S. Hallieri*.
- △△ *Ultimate branchlets more than 2 mm. broad.*
  - *Sporophylla of the lower plane ciliate.*  
(135) *S. Belangeri*.
  - *Sporophylla of the lower plane not ciliate.*  
(136) *S. lanceolata*.

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(112) **S. calcicola**, *Hieron.*, Hedwi., LI, 258.

Shoots trailing, more or less elongated, often forked at the base,

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(1) See also (126) **S. bancana** *Warb.*

sparingly pinnate in the upper part, the stem  $\frac{1}{2}$  mm. thick, compresso-terete, 2—3 mm. broad including the lateral leaves; pinnae 1—3 $\frac{1}{2}$  cm. long, the higher simple, the lower more or less dichotomous or subpinnate with 1—3 pinnulae on a side; ultimate branchlets 1—2 mm. broad. Leaves heteromorphous, glaucous-green above; lateral leaves subequilateral, broadly ovate, blunt, very minutely apiculate, somewhat spuriously veined, the upper side subentire or minutely denticulate towards the apex, ciliolate in the lower part, the lower side entire or minutely denticulate; of the stem remote, ascending, 1 $\frac{1}{4}$ —1 $\frac{1}{2}$  mm. long, nearly as broad; of the ultimate branchlets smaller, close; intermedial leaves, ovate, subaristate-acuminate, narrowly pellucid-margined, the inner side ciliolate, the outer side sparingly so at the base, the base obliquely rounded, or subcordate-truncate on the outer side. Spikes solitary,  $\frac{1}{2}$ —2 cm. long, 1—1 $\frac{1}{4}$  mm. broad in the lower part; sporophylla of the upper plane very inequilateral, oblique-ovate, hardly 1 $\frac{1}{4}$  mm. long, minutely apiculate-acuminate, sparingly ciliolate, keeled, more or less pellucid-margined on the upper side; of the lower plane equal-sided, ovate,  $\frac{3}{4}$  mm. long, shortly acuminate, ciliate; macrospores yellow, coarsely verrucose to subrugose on the basal side; microspores orange or carmine-red, verrucose on the basal side.

*Borneo.*

(113) **S. alutacea**, *Spring*, Mon., II, 237; Bk., Fern All., 110; - var. *sphaerophylla*, Bk., l. c., 111.

Shoots trailing, caespitose, under 10 cm. long, forked low down, copiously pinnate; pinnae erecto-patent, the lower repeatedly dichotomous. Leaves of the lower plane spaced on the stem, spreading, broadly ovate, 2 $\frac{1}{2}$  mm. long, rather acute, moderately firm, very unequal-sided, ciliate on the upper side towards the base, denticulate on the lower side; leaves of the upper plane much smaller, cordate-ovate, aristate-acuminate, ciliolate. Spikes copious, 1 $\frac{1}{4}$ —2 $\frac{1}{2}$  cm. long, 2 $\frac{1}{2}$  mm. broad, sometimes forked; sporophylla of the upper plane erecto-patent, ovate-lanceolate, acute, ciliate; of the lower plane imbricate, ovate, long-acuminate, ciliate, keeled.

**Var. sphaerophylla:** Leaves of the lower plane smaller, crowded, suborbicular, firmer, concave on the face; spikes narrower, the sporophylla less dimorphous.

*Penang.*

(114) **S. Rotherli**, *v. A. v. R.*, Bull. Botz., 1912, VII, 30.

Shoots trailing, caespitose, dichotomous, the secondary shoots 8—20 cm. long, pinnate, the stem grooved,  $\frac{1}{2}$  mm. thick, 5 mm. broad including the lateral leaves; pinnae alternate, the highest the shortest, simple, the lower to 5 cm. long, simple or sparingly simply pinnate; ultimate branchlets  $3\frac{1}{2}$  mm. broad. Leaves weak, thin, pale-green, partly red, heteromorphous on both stem and branches; leaves of the lower plane remote or approximate, spreading or horizontal; of the main stem broadly ovate, unequal-sided,  $2\frac{1}{2}$ —3 mm. long, to 2 mm. broad, acutely acuminate, rounded at the base but more broadly on the upper side, minutely denticulate on both edges, the midrib hardly distinct; of the branches similar but smaller, rotundate-cuneate at the base; leaves of the upper plane erect or erecto-patent,  $\frac{1}{3}$  smaller; of the main stem ovate, nearly equal-sided, acuminate, slightly obliquely rounded at the base, somewhat produced at the outer base, minutely denticulate on both edges; of the branchlets similar, smaller, rotundate-cuneate at the base. Spikes hardly distinct, platystichous, not resupinate, simple or branched, 2—5 cm. long; sporophylla of both planes similar to the leaves in shape and arrangement; macrospores whitish or yellowish, densely finely verruculose; microspores . . . . .

*Java.*

(115) **S. oligophylla**, *Warb.*, Mons., I, 124.

Small plants, with the stem slender,  $\frac{1}{6}$  mm. thick, grooved, yellowish, the branches 3 cm. long, sparingly branched, the branchlets hardly 1 cm. long. Leaves of the lower plane spreading; of the stem very remote, broadly ovate, 1 mm. long, obtuse, denticulate, cordate at the base, produced on the upper side and slightly imbricate over the rachis; leaves of the upper plane ascending; of the main rachis broadly ovate, acute, ciliolate; leaves of the branchlets similar to those of the stem but somewhat smaller. Spikes 4 mm. long and 3 mm. broad; sporophylla very dimorphous; of the upper plane about 6 on a side, spreading, imbricate, ovate-oblong, 1 mm. or more long, minutely ciliolate, obtuse or very shortly cuspidate; of the lower plane ascending, orbicular-lanceolate, under  $\frac{3}{4}$  mm. long, cuspidate, hardly ciliate; macrospores bright-yellow, nearly smooth, slightly finely foveolate; microspores verruculose.

*Celebes.*

(116) **S. eurycephala**, *Warb.*, *Mons.*, I, 124.

Shoots very short, 4—5 cm. long, the main rachis slender,  $\frac{1}{4}$  mm. thick, yellowish, the branches spreading, 1—2 cm. long, sparingly branched, the branchlets short. Leaves of the lower plane spreading; of the main rachis remote, ovate,  $\frac{1}{2}$ — $\frac{3}{4}$  mm. long, pale, nearly obtuse, rounded at the base, hardly oblique, the margin minutely piloso-denticulate; leaves of the upper plane erect; of the main rachis broadly lanceolate, acute or shortly cuspidate, minutely ciliolate-denticulate; leaves of the branchlets similar to those of the main rachis, hardly shorter, moderately distant. Spikes 4 mm. long,  $2\frac{1}{2}$  mm. broad; sporophylla of the upper plane 7—8 on a side, subhorizontal, hardly imbricate, narrowly lanceolate, more than 1 mm. long,  $\frac{1}{3}$  mm. broad, keeled beneath, the upper side and the keel hardly denticulate; those of the lower plane shorter, suberect, ovate, very acute, pale, ciliate at the edge; macrospores bright-yellow, with very minute conical or papilliform projections; microspores reddish, verruculose, the projections free or confluent.

*Celebes.*

(117) **S. ujensis**, *Hieron.*, *Engl. Bot. Jahrb.*, XLIV, 514.

Shoots caespitose, repeatedly dichotomous, the stems subterete, rather compressed, decumbent, the rachises 3 mm., the branchlets  $2\frac{1}{2}$  mm. broad including the lateral leaves. Leaves crowded; leaves of the lower plane very unequal-sided, much produced on the upper side, oblique-ovate, subacuminate, pale-green, minutely piloso-denticulate towards the apex, the upper side ciliate in the lower half, rounded at the base, the lower side very minutely denticulate, rotundate-truncate at the base, both sides pellucid-margined, the largest leaves  $1\frac{1}{2}$  mm. long,  $\frac{3}{4}$  mm. broad; leaves of the upper plane rather unequal-sided, ovate, subaristate-acuminate, pellucid-margined on both sides, very minutely denticulate, the outer base subcordate, the inner base rounded, the largest leaves  $1\frac{1}{2}$  mm. long,  $\frac{3}{4}$  mm. broad. Spikes  $\frac{1}{2}$ —1 cm. long, 2 mm. broad; sporophylla of the upper plane unequal-sided, narrowly pale-margined, keeled, piloso-denticulate to ciliate, the largest 2 mm. long, 1 mm. broad; sporophylla of the lower plane equal-sided, pale-margined, ciliolate, keeled, 2 mm. long,  $1\frac{1}{4}$  mm. broad; macrospores yellow or whitish, nearly smooth, indistinctly and minutely rugulose; microspores dirty-orange-coloured, minutely punctulate-verruculose on the basal side.

*Borneo.*

(118) **S. Winkleri**, *Hieron.*, Engl. Bot. Jahrb., XLIV, 516.

Shoots decumbent, caespitose, repeatedly dichotomous, the primary and secondary rachises 3 mm., the ultimate branchlets 2½ mm. broad including the lateral leaves. Leaves crowded everywhere; leaves of the lower plane unequal-sided, broadest on the upper side, ovate-oblong, pale-green, shortly acuminate, sparingly minutely denticulate on the upper side, sparingly and indistinctly so on the lower side towards the apex, pale-margined on both sides, rounded on both sides at the base, the largest leaves 2 mm. long, 1 mm. broad; leaves of the upper plane unequal-sided, obliquely broadly rounded at the base, shortly mucronate-acuminate, both sides sparingly and very minutely denticulate and narrowly pale-margined, the largest leaves 1½ mm. long, ¾ mm. broad. Spikes suberect, flexuose, 2—2½ cm. long, 2—2½ mm. broad; sporophylla of the upper plane spreading, very unequal-sided, lanceolate-ovate, acute, sparingly and shortly denticulate, keeled; of the lower plane more ascending, equal-sided, ovate, acuminate, ciliolate-denticulate on both sides, keeled, nearly as large as the dorsal ones, to 2 mm. long, 1¼ mm. broad; macrospores white or yellowish, finely rugulose on the basal side; microspores orange-coloured, very minutely verruculose-rugulose, apparently smooth.

*Borneo.*

(119) **S. Künstleri**, *Bk.*, Kew Bull., 1893, 14.

Shoots wide-trailing, remotely branched, the branches erecto-patent; branchlets few, short, 1 mm. broad including the lateral leaves. Lateral leaves firm, clasping, ovate; of the principal rachises laxly disposed, spreading or horizontal, very unequal-sided, to 2 mm. long, bluntish or subacute, the upper surface copiously deciduously short-hairy, the upper side very minutely denticulate towards the apex, gradually ciliate towards the broadly rounded base, the lower side subentire or very minutely denticulate; of the ultimate branchlets imbricating, ascending, nearly 1 mm. long, nearly equal-sided and broadly rotundate-cuneate at the base; intermedial leaves smaller, erect, unequal-sided, ovate, cuspidate, obliquely broadly rotundate-cuneate at the base; of the principal rachises sparingly ciliate on both sides, or minutely denticulate on the outer side; of the branchlets minutely denticulate. Spikes numerous, 5—7½ mm. long, 1¾ mm. broad, often forked; sporophylla of the upper plane linear-lanceolate, ciliolate-denticulate; of the lower plane subulate-ovate, long-acuminate, sparingly ciliate, keeled.

*Malacca.*

(120) **S. longiellata**, *Hieron.*, in Engl. Bot. Jahrb., L, 33.

Shoots wide-creeping, decumbent or subascending towards the apex, the lower part simple, 2—3 mm. broad including the lateral leaves, the upper part decomposed, the main rachis  $\frac{1}{2}$  mm. thick, yellowish-green, nearly 2-sulcate down the face, 4—6 mm. broad; pinnae to  $2\frac{1}{2}$  cm. long, the lower sparingly pinnate, the higher simple or forked; ultimate branchlets 3 mm. broad. Lateral leaves horizontal or nearly so; of the main rachis remote, obliquely ovate, unequal-sided, shortly acuminate, rather acute, the upper side sparingly minutely denticulate towards the apex, finely long-ciliate in the  $\frac{1}{2}$ — $\frac{3}{4}$  lower part, broadly rounded at the base, the lower side very minutely denticulate towards the apex, sparingly long-ciliate at the narrowly rounded base, the largest leaves 3 mm. long and  $1\frac{1}{2}$  mm. broad; of the branchlets smaller, to 2 mm. long, proportionally narrower, less unequal-sided, often destitute of ciliae on the lower base, close or approximate; intermedial leaves erect; of the main rachis remote, broadly ovate, long-cuspidate-acuminate, loosely long-ciliate, the outer base shortly auricled, the auricle blunt or acute, the inner base more or less rounded, the cusp  $\frac{1}{2}$  as long as the blade, the largest leaves  $1\frac{1}{2}$  mm. long; of the branchlets smaller, more crowded, longer cuspidate. Spikes solitary, 2—3 mm. long,  $1\frac{1}{2}$  mm. broad; sporophylla of the upper plane spreading, narrowly deltoid-ovate, acute, to  $1\frac{3}{4}$  mm. long, loosely long-ciliate, keeled; of the lower plane suberect, ovate, long-cuspidate-acuminate, loosely long-ciliate, keeled, to  $1\frac{1}{3}$  mm. long; macrospores yellow, finely indistinctly verruculose-rugulose; microspores yellow or yellowish, smooth.

*New Guinea.*

(121) **S. exasperata**, *A. Br.*, MS. in Herb. Berol.; Warb., Mons., I, 126; — var. *rectisulca*, Warb., l. c.

Shoots trailing, 10—15 cm. long, the stem  $\frac{1}{2}$  mm. thick, yellowish when dry; branches distant, 2—3 cm. long; branchlets few, 1— $1\frac{1}{2}$  cm. long. Leaves of the lower plane firm, spreading; of the stem remote, broadly ovate,  $1\frac{1}{2}$  mm. long, subacuminate, entire, very oblique, dilated on the upper side, the base obliquely rounded, imbricate over the stem, piloso-denticulate; leaves of the upper plane pale, erect, elliptical, very long-cuspidate, keeled, minutely denticulate; leaves of the branchlets similar to those of the stem but growing gradually shorter and less distant. Spikes commonly double, 3—8 mm. long.  $2$ — $2\frac{1}{2}$  mm. broad;

sporophylla of the upper plane spreading, lanceolate, 1 mm. long, acute, rather close, subimbricate, the upper base obliquely cordate, keeled, ciliolate, the keel long-ciliated; those of the lower plane shorter, ascending, broadly lanceolate, long-cuspidate, spinulose at the edge; macrospores yellow-white, finely glandular on the basal side; microspores yellowish, smooth.

Forma typica. — *Borneo*.

**Var. rectisulca:** Spikes longer, to 15 mm. long; rows of dorsal sporophylla separated by a straight, longitudinal groove. — *Java*.

(122) **S. humifusa**, *Hieron.*, Hedwi., LI, 257.

Shoots wide-trailing, sparingly pinnate, the stem hardly  $\frac{1}{2}$  mm. thick, 5—6 mm. broad including the lateral leaves; pinnae 1 cm. apart, 1—1 $\frac{1}{2}$  cm. long, 3—4 mm. broad, simple or forked. Leaves heteromorphous; leaves of the lower plane somewhat remote on the main rachis, less so on the branchlets; of the main rachis subhorizontal, very unequal-sided, obliquely oblong-ovate, subacute, glaucous-green, with the upper side very minutely denticulate especially towards the apex and the broadly rounded base, the lower side indistinctly denticulate towards the apex, subentire towards the rotundate-truncate narrow base, the largest leaves 3 mm. long and 1 $\frac{1}{2}$  mm. broad; of the branchlets ascending, smaller, narrower at the base; leaves of the upper plane erect, obliquely ovate-oblong, long-cuspidate, rather keeled towards the apex, with the edges very minutely denticulate, the outer base rounded, the inner base rotundate-cuneate, the largest leaves hardly more than 1 $\frac{1}{2}$  mm. long and  $\frac{3}{4}$  mm. broad. Spikes solitary, hardly more than 3 mm. long, 2—2 $\frac{1}{2}$  mm. broad; sporophylla of the upper plane spreading, very unequal-sided, obliquely ovate, acute, minutely denticulate, keeled, rotundate-cuneate on the upper side at the base; of the lower plane equal-sided, deltoid-ovate, long-acuminate, somewhat keeled, minutely denticulate on both edges; microspores red or carmine, very minutely verruculose on the basal side; macrospores . . . . .

*Borneo*.

(123) **S. phanotricha**, *Hk.*, Fern All., 109; *S. ciliaris*, *Ces.*, Fel. di Bor., 36.

Shoots decumbent, or ascending towards the apex, dichotomous in the lower part, the secondary shoots to 12 $\frac{1}{2}$  cm. long, pinnate, the stem  $\frac{1}{2}$  mm. thick; pinnae rather close, the lower 2-pinnate at the base;



ultimate branchlets to 5 mm. long,  $1\frac{1}{2}$ —2 mm. broad including the lateral leaves. Leaves heteromorphous; leaves of the lower plane rather remote on the stem, more or less contiguous on the branchlets; of the stem horizontal or spreading, very unequal-sided, triangular-ovate, the largest  $2\frac{1}{2}$  mm. long,  $1\frac{1}{4}$  mm. broad, acute, entire or obsoletely denticulate on both sides, the upper side ciliolate towards the very broadly rounded or subcordate base, the lower side rather cuneate at the base, the upper surface minutely papilloso-pilose; of the branchlets ascending, smaller,  $1\frac{1}{4}$  mm. long, less unequal-sided, relatively narrow, subacute, obliquely rotundate-cuneate at the base; leaves of the upper plane erect; of the stem subcontiguous, ovate, equal-sided, 2 mm. long, keeled, cuspidate-acuminate, the cusp relatively long, the outer side entire or obsoletely denticulate, the inner side piloso-denticulate, the base rounded, not or hardly produced on the outer side; of the branchlets similar but smaller. Spikes solitary or double,  $\frac{1}{2}$ — $1\frac{1}{2}$  cm. long,  $2\frac{1}{2}$  mm. broad; sporophylla of the upper plane close, subspreading, lanceolate-oblong,  $1\frac{1}{2}$  mm. long, acute, keeled, with the upper edge sparingly denticulate to ciliolate in the lower part, as is the keel; those of the lower plane erecto-patent or suberect, ovate, long-acuminate, remotely ciliate except at the apex; macrospores yellowish-white, deciduously verruculose, at length smooth; microspores . . . . .

*Borneo.*

(124) **S. brevipinna**, *v. A. v. B.*, Bull. Bot., 1911, I, 23.

Shoots decumbent, very wide-trailing, to more than 40 cm. long, repeatedly forked, caespitose, the secondary shoots pinnate, the stem slender, stramineous,  $\frac{3}{4}$  mm. thick, compresso-terete, smooth or somewhat grooved,  $3\frac{1}{2}$  mm. broad including the lateral leaves; pinnae distant, erecto-patent, short,  $\frac{3}{4}$ — $1\frac{1}{2}$  cm. long, simple, forked, or pinnate with a single pinnula on each side; pinnulae very short, the largest at best  $\frac{3}{4}$  cm. long,  $2\frac{1}{2}$  mm. broad including the lateral leaves. Leaves heteromorphous; leaves of the lower plane spreading and spaced on the stem, ascending and imbricated on the branchlets; of the stem broadly ovate, 2— $2\frac{1}{2}$  mm. long,  $1\frac{1}{2}$  mm. broad, very unequal-sided, rather acute, naked or sparingly papilloso-pilose above, the upper edge obsoletely denticulate towards the apex, denticulate at the centre, gradually ciliate or ciliolate at the base, the lower edge obsoletely denticulate towards the apex, entire at the centre, denticulate at the base, the upper base much dilated, truncate-

rotundate to subcordate and imbricated over the stem, the lower base rotundate to rotundate-cuneate; leaves of the upper plane spaced on the stem, imbricated on the branchlets, erect, adpressed; of the stem ovate, long-acuminate to long-cuspidate, keeled, 1½ mm. long, shortly ciliolate on both sides, rather equal-sided, rotundate-cuneate on both sides at the base, the outer base not or hardly produced; of the ultimate branchlets similar to those of the stem but growing gradually somewhat smaller. Spikes generally solitary, to 5 mm. long, 2¼ mm. broad; sporophylla of the upper plane rather imbricate, somewhat ascending, lanceolate, to 2 mm. long, acute, keeled, spinulose on the upper edge, obsoletely denticulate on the lower edge, the keel spinulose; sporophylla of the lower plane erected, imbricated, lanceolate-ovate, acuminate to cuspidate, spinulose on both edges, keeled; macrospores yellowish-white, the largest finely verruculose on the lower side, finely foveolate between the apical ribs, the smallest similar but nearly smooth; microspores yellowish or whitish, nearly smooth.

*Lingga Islands.*

(125) **S. membranifolia**, *v. A. v. B.*, Bull. Botz., 1912, VII, 31.

Shoots elongated, decumbent, repeatedly dichotomous, caespitose; secondary shoots pinnately branched, the rachis stramineous, irregularly grooved when dry, under 1 mm. thick, 4—6 mm. broad including the lateral leaves; pinnae remote, short and simple or elongated and more or less pinnately or dichotomously decomposed; branchlets short, 3—5 mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves very thin, diaphanous, horizontally spreading or nearly so; those of the main rachises approximate or remote, oblong, rather straight, unequal-sided, much the broadest on the anterior side, the largest 3 mm. long, 2 mm. broad near the base, acute or subobtuse, entire or obsoletely denticulate, the upper side ciliolate towards the base, the base truncate or subcordate-truncate on the upper side, rotundate or subcordate-rotundate and sparingly denticulate on the lower side; those of the branchlets similar but smaller, rather approximate and more ascending, relatively narrower, acute, more rotundate-cuneate at the base, less unequal-sided (except in the simple pinnae); leaves of the upper plane remote, erect; those of the main rachises not adpressed, ovate, 2 mm. long, long-aristate-acuminate, the edges more or less obscurely denticulate but the inner edge ciliolate towards the base, the base slightly obliquely rounded,

hardly produced on the outer side; those of the branchlets similar but smaller, approximate or contiguous, keeled. Spikes solitary on the branchlets, straight, curved or flexuose,  $\frac{3}{4}$ — $2\frac{1}{2}$  cm. long,  $2\frac{1}{2}$  mm. broad; sporophylla of the upper plane ascending, close or approximate, the higher somewhat imbricated, narrowly lanceolate, subfalcate, obscurely acuminate, more or less distinctly denticulate, conspicuously keeled, the keel ciliated towards the base; those of the lower plane erected, imbricated, lanceolate-ovate, subcuspidate (long-acuminate), ciliated, keeled; macrospores whitish, smooth or nearly so (obsoletely rugulose); microspores . . . . .

*Batu Island.*

(126) **S. bancana**, *Warb.*, *Mons.*, I, 126.

Shoots trailing, repeatedly forked, rather caespitose; secondary shoots 4—7 cm. long, with the main rachis  $\frac{1}{3}$  mm. thick, yellowish when dry; pinnae remote,  $1\frac{1}{2}$ —2 cm. long, sparingly branched; branchlets 1 cm. long,  $1\frac{3}{4}$  mm. broad. Leaves of the main rachis remote, firm; of the lower plane spreading, broadly ovate, very unequal-sided, 1—2 mm. long, obtuse, dilated, rounded, denticulate to ciliate and imbricated over the rachis on the upper side at the base; of the upper plane erect, ovate, shortly cuspidate, denticulate, nearly keeled; leaves of the branchlets similar to those of the main rachis but smaller, more close, often imbricate. Spikes single or double, 4—6 mm. long,  $1\frac{1}{2}$ —2 mm. broad; sporophylla of the upper plane erecto-patent, ovate-lanceolate, imbricate, acute, ciliate, keeled; of the lower plane hardly smaller, ascending, lanceolate, cuspidate-acuminate, spinuloso-ciliate; macrospores pale-yellow, smooth or nearly so; microspores bright-yellow, smooth.

*Banca.*

(127) **S. karimatae**, *v. A. v. R.*, *Bull. Botz.*, 1914, XVI, 48; *S. Burbidgei*, *Bk.*, *Fern All.*, 106, p. p.

Shoots trailing, to 10 cm. long, pinnate, or forked at the base with pinnate secondary shoots, the main rachis stramineous,  $\frac{3}{4}$  mm. thick, 2—3 mm. broad including the lateral leaves; pinnae remote, alternate, erecto-patent, to 2 cm. long, the largest forked, the smallest simple; ultimate branchlets to  $1\frac{1}{2}$  cm. long, to 2 mm. broad. Leaves heteromorphous; lateral leaves remote even on the branchlets, erecto-patent, very unequal-sided, nearly semiovate; of the main rachis  $1\frac{1}{2}$ — $1\frac{3}{4}$  mm. long,  $1$ — $1\frac{1}{4}$  mm. broad, acute or subacute, entire, or very minutely

denticulate towards the apex, the upper side broadly rounded, denticulate towards the rotundate-cuneate base, the lower side slightly rounded, adnate at the base; of the ultimate branchlets similar, smaller, 1—1½ mm. long; intermedial leaves erect, ovate, acuminate, obliquely cuneate or rotundate-cuneate at the base, with the outer base slightly produced; of the main rachis remote, 1—1¼ mm. long, more or less denticulate on the inner side; of the branchlets similar but smaller. Spikes solitary, lanceolate, to 7½ mm. long, 1½—2 mm. broad near the base, narrowed towards the apex; sporophylla of the upper plane lanceolate, acute or acuminate, keeled, denticulate on the upper side, the lower suberectopotent, to 1½ mm. long, the higher suberect, smaller, imbricate; of the lower plane suberect, imbricate, ovate, acuminate, keeled, piloso-denticulate; macrospores whitish with yellow contents, pulverate, soon smooth; microspores . . . . .

*Karimata Islands.*

(128) **S. Loriai**, *Hieron.*, in Engl. Bot. Jahrb., L, 27.

Small plants. Shoots creeping, the loose branching between dichotomous and pinnate, the upper branches simple or forked, to 1 cm. long; main rachis 2½ mm. broad including the lateral leaves; ultimate branchlets 1½—2 mm. broad. Leaves heteromorphous; lateral leaves horizontal or nearly so, narrowly pellucid-margined, remote; of the main rachis the largest, oblique-ovate, blunt or bluntnish, the upper side subentire or indistinctly denticulate in the upper part, sparingly and very minutely denticulate in the lower part, rounded or rotundate-truncate at the base, the lower side subentire or indistinctly denticulate, narrowly rotundate-truncate at the base, the largest leaves 1½ mm. long by ¾ mm. broad; of the branches growing gradually smaller; intermedial leaves erect; of the main rachis the largest, obliquely subfalcate-ovate, slightly acuminate, the sides very narrowly pellucid-margined, indistinctly or sparingly and very minutely denticulate, the base obliquely rounded, or rotundate-cuneate on the inner side, the largest leaves 1¼ mm. long. Spikes solitary, 2—3 mm. long by 2 mm. broad; sporophylla of the upper plane unequal-sided, obliquely oblong-ovate, keeled, the upper side the broadest, sparingly minutely denticulate and narrowly pellucid-margined, the lower side narrower, much shorter, the largest sporophylla 1¼ mm. long, under ¾ mm. broad; sporophylla of the lower plane deltoid-ovate, subcucullate, acute, indistinctly keeled, sparingly minutely denticulate,

the largest 1 mm. long; microspores orange or minium-red, smooth; macrospores . . . . .

*New Guinea.*

(129) **S. subspinulosa**, *Spring*, in Pl. Jungh., 277; *S. spinulosa*, *Bk.* (not *Spring*), Fern All., 64, et passim.

Shoots trailing, 2½—5 cm. long, little branched, the stem very slender; branches simple or slightly branched again; ultimate branchlets very short, 1—1½ mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves spaced even on the ultimate branchlets, subspreading, oblong-ovate; of the main rachis to 1½ mm. long, ⅓ as broad, straight, blunt or bluntish, nearly keeled, the upper side sparingly ciliate, rounded at the base, the lower side entire or denticulate; inter-medial leaves erect, ¼ as large, subequilateral, ovate-oblong, acute or shortly acuminate, spinuloso-denticulate. Spikes to 4 mm. long, nearly square; sporophylla ovate, ciliate, keeled; of the upper plane unequal-sided, much the broadest on the upper (inner) side, bluntish; of the lower plane equal-sided, acute; macrospores yellow, nearly smooth; microspores reddish, smooth.

*Java.*

(130) **S. Weinlandii**, *Hieron.*, in Engl. Bot. Jahrb., L, 29.

Shoots creeping, the lower part dichotomous, the upper part pinnate, the stem compresso-terete, yellow-green, to ⅓ mm. thick, the main rachis 2½ mm. broad including the lateral leaves; higher pinnae simple or forked, to 2 cm. long, lower pinnate; ultimate branchlets 1—10 mm. long, 1—1½ mm. broad. Lateral leaves remote on both stem and branches; of the stem nearly horizontal or spreading, ovate, blunt or bluntish, nearly equal-sided, hardly pellucid-margined, rounded at the base, the upper side sparingly ciliated in the lower half, very minutely denticulate in the upper part, the lower side very minutely denticulate except in the lower ¼, the largest leaves 1¼ mm. long and ¾ mm. broad; of the branchlets smaller, to 1 mm. long, more ascending; inter-medial leaves erect, ovate, nearly straight; of the stem shortly aristate-acuminate, sparingly ciliate, very sparingly denticulate at the apex, obliquely rounded at the base, the outer base somewhat produced, the largest leaves 1 mm. long; of the branchlets smaller, subacute. Spikes solitary and terminal on the branchlets, 2—2½ mm. long by 1½—2 mm.

broad; sporophylla of the upper plane spreading, lanceolate-ovate, somewhat recurved, to 1½ mm. long, acute, keeled, the upper side very narrowly pellucid-margined, sparingly minutely denticulate towards the apex, sparingly ciliolate towards the base; of the lower plane suberect, ovate, acutely acuminate, hardly keeled, sparingly ciliate, the apex very sparingly denticulate; macrospores yellow or yellow-white, very minutely verruculose, apparently smooth or nearly so; microspores minium-red or orange, smooth.

*New Guinea.*

(131) **S. Burbidgel**, *Bk.*, Fern All., 106, p. p.

Shoots trailing, the stem slender, stramineous, intermatted, angled on the face, copiously branched, the distant, erecto-patent branches sparingly compound. Leaves of the lower plane spaced even on the branches, spreading on the stem, erecto-patent on the branchlets, broadly cordate-ovate, 2—2½ mm. long, subacute, bright-green, rather firm, strongly ciliated and much imbricated over the rachis on the upper side at the base; leaves of the upper plane ½ as long, cordate-ovate, shortly cuspidate. Spikes 1¼—2½ cm. long, 2½ mm. broad; sporophylla of the upper plane nearly spreading, oblique-lanceolate, acute; those of the lower plane ascending, very different, ovate-lanceolate, long-cuspidate, strongly keeled and ciliated.

*Borneo.*

(132) **S. Lauterbachii**, *Hieron.*, in Engl. Bot. Jahrb., L, 31.

Shoots creeping, dichotomous in the lower part, pinnate in the upper part, the main and secondary rachises hardly more than 2½ mm. broad including the lateral leaves; pinnae ½—1½ cm. long, simple or forked, or the lower rarely pinnate; ultimate branchlets 1½—2 mm. broad. Lateral leaves of principal rachises remote, spreading, unequal-sided, ovate-oblong, blunt or bluntish, pellucid-margined, the upper side sparingly obsolete denticulate in the upper part, gradually loosely ciliate towards to the rotundate base, the lower side sparingly obsolete denticulate, subcordate at the base, the largest leaves 2 mm. long by 1 mm. broad; lateral leaves of the branchlets smaller, more ascending, less remote, to 1 mm. long and ½ mm. broad; intermedial leaves erect; of the principal rachises distant, nearly equal-sided, ovate, subacuminate, very narrowly pellucid-margined, loosely minutely denticulate, the outer base shortly cordate-auriculate, the inner base rotundate-cuneate, the largest leaves

1¼ mm. long; of the branchlets much smaller, somewhat keeled. Spikes 3—6 mm. long, 1 mm. broad, nearly square; sporophylla deltoid-ovate, acute, very narrowly pellucid-margined, loosely minutely denticulate; of the upper plane strongly keeled, to 1 mm. long, proportionally longer and narrower than those of the lower plane, which are slightly keeled; macrospores yellowish or ochraceous, finely and densely verruculose on the basal side; microspores red or pale-orange-brown, smooth.

*New Guinea.*

(133) **S. intertexta**, *Spring*, *Mon.*, II, 237; *Bk.*, *Fern All.*, 107.

Shoots decumbent, repeatedly dichotomous, caespitose, the secondary shoots 2—5 cm. long, sparingly pinnate, the apex not rarely flagellate-elongate and very minutely foliate in the longest forms, the main stem ½ mm. thick, pale-stramineous, 2½ mm. broad including the lateral leaves; pinnae short, to 1 cm. long, simple, or the lower more elongate and sparingly pinnate; ultimate branchlets 1¾—2¼ mm. broad. Leaves heteromorphous, membranaceous; leaves of the lower plane ascending, rather equal-sided; of the stem distinctly, though not very, remote, ovate, 1¾—2 mm. long, 1 mm. broad, straight or slightly falcate, very minutely apiculate-acuminate, rounded at the base, very minutely (nearly obsoletely) denticulate on both sides, the upper side ciliate in the lower half; of the branchlets similar, less remote, or subcontiguous, more rotundate-cuneate at the base, 1—1½ mm. long and ½ as broad; leaves of the upper plane erect, broadly subfalcate-ovate, acuminate, subentire, or sparingly piloso-denticulate on the outer side towards the base, the inner base rotundate-cuneate, the outer base cordate or rotundate-subcordate; of the stem 1½ mm. long, somewhat remote; of the branchlets shorter, somewhat imbricate. Spikes solitary, short, 1½—2 mm. broad; sporophylla of the upper plane subfalcate-lanceolate, acute or somewhat acuminate, sparingly or obsoletely denticulate, to 1½ mm. long, the lower subspreading; of the lower plane erecto-patent, ovate, acuminate, sparingly piloso-denticulate, the lower ciliate and slightly keeled; macrospores whitish, broadly areolate with a few reticulate, slender rumples, the apical ribs encircled by a ring-shaped ruffle; microspores yellow or pale-orange, the smaller smooth, the larger moderately densely verruculose. — Cuming's No. 2015 is unknown to me, the description is taken from specimens gathered by Loher and Curran.

, *Luzon.*

(134) **S. Halleri**, *v. A. v. R.*, Bull. Botz., 1913, XI, 36.

Main stem slender, caespitose, trailing, repeatedly dichotomously branched, 3 mm. broad including the lateral leaves, the ultimate branchlets narrower, 2—6 mm. long, 1—2 mm. broad. Leaves heteromorphous, firm; leaves of the lower plane much spaced even on the branchlets, rather spreading, broadly ovate, nearly equal-sided, blunt, the upper side rounded at the base, minutely piloso-denticulate in the lower half, the lower side entire, subcordate at the base, those of the main stem the largest, 1<sup>3</sup>/<sub>4</sub>—2 mm. long, 1<sup>1</sup>/<sub>4</sub>—1<sup>1</sup>/<sub>2</sub> mm. broad, those of the branchlets smaller, to 1 mm. long; leaves of the upper plane <sup>1</sup>/<sub>2</sub> as large, erect, ovate, long-acuminate, subcuspidate, the outer edge entire or slightly denticulate at the apex, the inner edge minutely piloso-denticulate. Spikes 5—15 mm. long, 3 mm. broad; sporophylla very heteromorphous; those of the upper plane imbricate, subspreading, unequal-sided, ovate, bluntish, keeled, the base rounded on the upper side, cuneate on the lower side, the upper edge minutely piloso-denticulate in the lower half; those of the lower plane ascending, lanceolate, acuminate, ciliated on both sides; macrospores yellowish, sparingly finely verruculose; microspores yellowish, smooth. — Near *S. Belangeri Spring*, but the lateral leaves relatively shorter and broader, and the branches looser.

*Borneo.*

(135) **S. Belangeri**, *Spring*, Mon., II, 242; *S. proniflora*, *Bk.*, Fern All., 108; *Lycopodium Belangeri*, *Bory*, Voy. Bot., II, tab. I, fig. 2.

Shoots trailing, or ascending towards the apex, 2<sup>1</sup>/<sub>2</sub>—10 cm. long, caespitose, often repeatedly forked, the stem slender, the branches spreading to suberect, simple or little compound. Leaves heteromorphous; those of the lower plane spaced even on the branches, horizontal or spreading, ovate, 1<sup>1</sup>/<sub>2</sub>—2<sup>1</sup>/<sub>2</sub> mm. long, to <sup>1</sup>/<sub>2</sub> as broad, pale to bright-green, membranaceous or herbaceous, acute or bluntish, unequal-sided, dilated on the upper side and subcordate at the base, with the upper edge sparingly or remotely denticulate towards the apex, denticulate to ciliate towards the base; of the upper plane <sup>1</sup>/<sub>2</sub> as long, ovate, acute to acuminate, rather equally cordate to rotundate-subcordate at the base, with the edges subentire, or sparingly denticulate to ciliate at the base. Spikes commonly solitary, 7<sup>1</sup>/<sub>2</sub>—20 mm. long, 3—5 mm. broad; sporophylla of the upper plane somewhat ascending, whether or not imbricated, similar to the leaves of the lower plane but not rarely more falcate and acuminate, often relatively



narrower, with the upper edge subentire, or denticulate to ciliate towards the base; of the lower plane paler, ascending, shorter, ovate, acute to acuminate or cuspidate, keeled, ciliated; macrospores white or yellow, finely verruculose to irregularly rugulose, the projections free or connected; microspores minium-red or brownish, provided with conical, subcylindrical, bacilliform or capitate projections on the basal side. — Very variable.

Forma olivacea: Leaves and dorsal sporophylla olivaceous.

*Br. India across Malaya and Papua to North Australia.*

(136) **S. lanceolata**, *Warb.*, *Mons.*, I, 123, tab. IV *E.*

Shoots trailing, the stem yellowish, grooved, 1—1½ mm. thick, the branches 2—8 cm. long, twice branched; branchlets distant, often forked. Leaves of the stem distant; of the lower plane spreading, deltoid-oblong, 3 mm. long, obtuse, very unequal-sided, the upper side dilated, rounded at the base, much imbricated over the rachis, the edge minutely denticulate at the base, the lower side narrowly cuneate at the base; of the upper plane erect, ovate-lanceolate, cuspidate, minutely denticulate, somewhat oblique and rotundate or subcordate-rotundate at the base; leaves of the branchlets similar, but ½ as long and less distant, imbricate when young. Spikes 4—8 mm. long, 3 mm. broad; sporophylla of the upper plane broadly lanceolate, 1½ mm. long, oblique, blunt, subspreading, imbricate at the base, minutely denticulate; of the lower plane ascending, lanceolate, hardly 1 mm. long, cuspidate-acuminate, keeled, minutely denticulate; macrospores yellow, with conical projections on the basal side; microspores orange-coloured, verruculose on the basal side, the projections tuberculiform.

*Celebes.*

b. **Heterostachys.** 2. **Bisulcatae.**

1. *Lower sporophylla of the lower plane produced, much larger than the following.* (137) *S. opaca.*

1.1. *Lower sporophylla of the lower plane not produced, hardly larger than the following.*

2. *Leaves of the lower plane entire or at best denticulate.*

(138) *S. Beccariana.*

**2.2.** *Leaves of the lower plane ciliate or ciliolate, at least on 1 side at the base.*

(139) *S. singalanensis*.

(137) ***S. opaca*, Warb.**, Mons., I, 122.

Shoots wide-trailing, more or less flexuose, irregularly branched, the stem semiterete or angular, often grooved, stramineous to grey-brown, 1½—2½ mm. thick; pinnae irregularly 2—3-pinnate with rather few branchlets varying from ½ to 2 cm. long. Leaves heteromorphous; leaves of the lower plane oblong; those of the main stem very remote, horizontal or somewhat deflexed, 4—6 mm. long and 1½—3 mm. broad, subacute or shortly apiculate, rounded at the base but more broadly so on the upper side, more or less piloso-denticulate on the upper edge, not or hardly imbricated over the rachis; those of the branchlets smaller, more approximate, rotundate-cuneate, and the higher subbullate, at the base, somewhat imbricated over the rachis, slightly ascending; leaves of the upper plane erected, adpressed; those of the main stem remote, broadly oblong, 2—3½ mm. long, suddenly long-cuspidate, somewhat keeled, denticulate or ciliolate, rounded at the base; those of the branchlets smaller, imbricate, more obovate, rather rotundate-cuneate at the base. Spikes single, rarely double, 3—12 mm. long, 3—4 mm. broad; sporophylla of the upper plane ascending, lanceolate-oblong, more or less acute, ciliolate, imbricate at the base, the lower ones somewhat larger than the higher; of the lower plane suberect, ovate, cuspidate-acuminate, ciliolate, hardly smaller than those of the upper plane except the 2—4 lower, which are much larger than the others and very unequal-sided, broadest on the inner side; macrospores pale-reddish, ochraceous or whitish, nearly smooth; microspores whitish, reddish or brown, irregularly verruculose.

*Java.*

(138) ***S. Beccariana*, Bk.**, Fern All., 106; *S. radicata*, Bk. (not *Spring*), Journ. of Bot., XVIII, 217, p. p.

Shoots trailing, 15—20 cm. long, forked and pinnately compound, the stem 1—1½ mm. thick, angular or sulcate on the face when dry, convex on the back, 4—6 mm. broad including the lateral leaves; pinnae 2—3-pinnate; ultimate branchlets 2 mm. broad. Leaves heteromorphous; eaves of the lower plane much spaced on the stem, less so on the

branchlets, rather ascending; of the stem unequal-sided, oblique-ovate, 3—4 mm. long, dark-green, moderately firm, bluntish, with the upper side subentire or very minutely denticulate, more distinctly denticulate in the lower half or towards the broadly rotundate-subcordate base, the lower side entire, adnate at the base, with a narrow subtruncate-rotundate free corner; of the branchlets similar but smaller, to 2 mm. long; leaves of the upper plane very small; of the stem remote, triangular-ovate, mucronate-acuminate, more or less minutely denticulate, rather rounded at the base; of the branchlets imbricate, rather cuneate at the base. Spikes 6¼—12½ mm. long, 2—2½ mm. broad; sporophylla of the upper plane crowded, suberecto-patent, oblique-ovate, bluntish, minutely denticulate on the upper side; of the lower plane erect, smaller, broadly ovate, cuspidate-acuminate, keeled, denticulate; macrospores pale-flesh-coloured, white-punctulate or pulverulent, at length smooth; microspores yellowish to orange-coloured, provided with crowded, verruciform or short-stalked capitate projections.

*Sumatra.*

(139) **S. singalanensis**, Hieron., Hedwi., L, 18; *S. radicata*, Bk. (not *Spring*), Journ. of Bot., XVIII, 217, p. p.

Shoots trailing, pinnately divided, forked at the base, the main stem 7 mm. broad including the lateral leaves. Lateral leaves remote on the stem, close on the ultimate branchlets; of the stem horizontal, very unequal-sided, much produced on the upper side, broadly subcordate-ovate or ovate, bluntish or subacute, mucronulate, the upper side minutely denticulate towards the apex, ciliolate towards the broadly rotundate-cordate base, the lower side minutely denticulate, narrowly rounded at the base, the largest leaves 3½ mm. long, 2 mm. broad; of the ultimate branchlets smaller, ascending; intermedial leaves unequal-sided, obliquely broadly ovate, aristate-cuspidate, minutely denticulate towards the apex, ciliate at the base; of the stem the largest, 2½ mm. long, 1½ mm. broad, cordate at the base; of the branchlets smaller, broadly rotundate-cuneate at the base. Spikes 4 mm. long, 2½ mm. broad; sporophylla of the upper plane spreading, very unequal-sided, ovate, acute, denticulate, strongly keeled, the largest 2 mm. long; of the lower plane erect or suberect, equal-sided, broadly ovate, acuminate, denticulate, keeled, the largest 1½ mm. long; macrospores pale or dirty-yellowish, opaque, verruculose with crowded deciduous projections on the basal side; microspores

orange-coloured or yellow, provided with crowded conical projections on the basal side.

*Sumatra.*

b. **Heterostachys.** 3. **Suberosae.**

**1.** *Shoots to about 8 cm. long* (1).

△ *Lateral leaves entire or at best denticulate.*

× *Intermedial leaves distinctly cuspidate.* (140) *S. Junghuhniana.*

×× *Intermedial leaves not or slightly cuspidate.*

(141) *S. Zollingeriana.*

△△ *Lateral leaves ciliate or ciliolate, at least on 1 side at the base.*

+ *Lateral leaves decurrent on the lower side at the base.*

(142) *S. Kärnbachii.*

++ *Lateral leaves at best broadly adnate, but not decurrent, at the base.*

○ *Both sides of lateral leaves ciliate or ciliolate.*

(143) *S. macroblepharis.*

○○ *Only one side of lateral leaves ciliate or ciliolate.*

▽ *Spikes to 2 mm. broad.*

○ *Lateral leaves obtuse.* (144) *S. polyblepharis.*

○○ *Lateral leaves acute.* (145) *S. philippina.*

▽▽ *Spikes more than 2 mm. broad.* (146) *S. Zahnii.*

**1.1.** *Shoots more than 8 cm. long when fully developed.*

**2.** *Sporophylla hardly heteromorphous.*

× *Lateral leaves more or less ciliate or ciliolate.*

(147) *S. birarensis.*

×× *Lateral leaves entire or at best denticulate.* (148) *S. decipiens.*

**2.2.** *Sporophylla distinctly heteromorphous.*

**3.** *Intermedial leaves not or slightly cuspidate.*

**4.** *Sporophylla of the lower plane ciliate or ciliolate.*

▽ *Spikes to 2 mm. broad.* (149) *S. Hollrungii.*

▽▽ *Spikes more than 2 mm. broad.*

(150) *S. Teysmanni.*

**4.4.** *Sporophylla of the lower plane entire, at best denticulate.*

(1) See also (160) *S. tenuifolia* Spring and (161) *S. aristata* Spring.

- 5.** *Lateral leaves minutely denticulate throughout.*  
(151) *S. elegantissima.*
- 5.5.** *Lateral leaves at least partly entire, and whether or not ciliate or ciliolate.*
- 6.** *Lateral leaves at best 1 mm. long.*  
(152) *S. ketra-ayam.*
- 6.6.** *Lateral leaves at least 1 mm. long.*
- 7.** *Lateral leaves more or less ciliate or ciliolate.* (153) *S. Schefferi.*
- 7.7.** *Lateral leaves not ciliate or ciliolate.*  
(154) *S. lepida.*
- 3.3.** *Intermedial leaves distinctly cuspidate.*
- 4.** *Spikes 3 mm. or more broad.*
- ▽ *Sporophylla of the lower plane heteromorphous, the lower quite different from the following.*  
(155) *S. cerebriformis.*
- ▽▽ *Sporophylla of the lower plane isomorphous.*
- *Lateral leaves denticulate on both sides throughout.* (162) *S. strobiformis.*
- *Lateral leaves at least partly entire and whether or not ciliate or ciliolate.*  
(156) *S. suberosa.*
- 4.4.** *Spikes to 3 mm. broad.*
- 5.** *Lateral leaves of the stem ciliate or ciliolate, at least on 1 side at the base.*
- *Intermedial leaves of the stem 2-auriculate-cordate at the base.* (157) *S. myosuroides.*
- *Intermedial leaves of the stem at best semi-cordate-auriculate at the base.*  
(158) *S. subcalcarata.*
- 5.5.** *Lateral leaves of the stem entire, at best denticulate.*
- 6.** *Fully developed plants more than 15 cm. long, the intermedial leaves of the main rachis cordate or semicordate at the base.*  
(159) *S. chrysocaulos.*
- 6.6.** *Fully developed plants to 15 cm. long, or the intermedial leaves of the main rachis cuneate or rounded at the base.*

✓. *Shoots tufted.* (160) *S. tenuifolia.*

✓.✓. *Shoots not tufted.* (161) *S. aristata.*

(162) *S. strobiformis.*

(140) **S. Junghuhniana**, *Spring*, Pl. Jungh., 276.

Shoots very small, caespitose, ascending, 2½—4 cm. long, branched from the base, triangular in outline, the stem very slender, yellow when dry, the lower branches spreading, with 1—2 short branchlets, the higher ascending. Leaves pale, whitish beneath, thin, diaphanous, flaccid; those of the lower plane spreading, spaced on both stem and branches, lanceolate-oblong, 2—3 mm. long, 1—2 mm. broad, subentire, or very minutely denticulate on the upper edge, broadly rounded at the upper base, the higher ones acute, the lower bluntish; those of the upper plane very minute, lanceolate, long-cuspidate, subentire. Spikes 5 mm. long; sporophylla of the upper plane oblong, acute, minutely denticulate, rather keeled, contiguous, the higher growing gradually shorter; of the lower plane ½ as long, ovate-lanceolate, adpressed, long-acuminate, paler, minutely serrulate-denticulate, erected. — A plant gathered in Java (Junghuhn No. 255), which is probably the original specimen, has the lateral leaves minutely serrulate on both sides, the leaves of the upper plane with the cusp nearly twice as long as the blade, the macrospores pale-yellow-brown, rather smooth, the microspores orange-coloured, sparingly punctulate-verruculose.

*Java, Sumatra.*

(141) **S. Zollingeriana**, *Spring*, Pl. Jungh., 278; Bk., Fern All., 114.

Shoots erect or ascending, caespitose, 2½—8 cm. long, lanceolate or triangular in outline, branched from the base, the stem slender, moderately firm, yellowish when dry, the branches erecto-patent with 3—4 short branchlets, or more compound in the larger specimens. Leaves heteromorphous, pellucid; lateral leaves erecto-patent, spaced on both stem and branches, ovate-oblong; of the stem 1—2 mm. long, ½—1 mm. broad, bluntish or subacute, nearly equal-sided, minutely denticulate, obliquely rounded at the base; of the branchlets smaller, to 1 mm. long; intermedial leaves to ⅔ as long, ovate-oblong, subequilateral, subacuminate, keeled,

subentire or minutely denticulate, obliquely rounded at the base. Spikes 5—15 mm. long; sporophylla of the upper plane erecto-patent, ovate-lanceolate, inequilateral, very minutely denticulate, keeled, shortly acuminate; of the lower plane  $\frac{2}{3}$  as long, suberect, ovate-lanceolate, acuminate, keeled, minutely denticulate; macrospores yellowish-white, smooth; microspores minium-red, smooth.

*Java.*

(142) **S. Kärnbachii**, *Hieron.*, Hedwi., XLIII, 64.

Shoots erect or ascending from a slightly creeping base, to 7 cm. long, pinnately branched, the stem hardly  $\frac{1}{2}$  mm. thick, subterete, rather compressed, stramineous-green, often forked at the base; secondary shoots sublanceolate or ovate in outline; lower branches hardly  $2\frac{1}{2}$  cm. long, sparingly pinnate, higher forked or simple. Leaves heteromorphous, subglaucous-green; lateral leaves somewhat unequal-sided, ovate, decurrent and auricled on the lower side, subcordate and rounded on the upper side at the base, subobtusate, the upper side narrowly pellucid- or pale-margined, with the edge provided with moderately long, straight or recurved ciliae towards the base, both edges more or less distinctly serrulate towards the apex, the largest leaves 1— $1\frac{1}{2}$  mm. long,  $\frac{3}{4}$  mm. broad; intermedial leaves ovate, the largest 1 mm. long,  $\frac{1}{2}$  mm. broad, shortly acuminate, with the inner base cordate, the outer base shortly auriculate, both sides narrowly pellucid-margined, and shortly and sparingly ciliate at the edge. Spikes conspicuously platystichous, to 12 mm. long,  $2\frac{1}{2}$  mm. broad; sporophylla of the upper plane, unequal-sided, oblique-ovate, acute, pellucid-margined, ciliated, slightly piloso-denticulate towards the apex, keeled, the largest  $1\frac{1}{2}$  mm. long, hardly  $\frac{1}{2}$  mm. broad; those of the lower plane pale-green, more or less equal-sided, ovate, acute, subaristate, long-ciliate on both sides at the edge, the largest 1 mm. long,  $\frac{1}{2}$  mm. broad; macrospores opaque-yellow or white, smooth; microspores minium-red, smooth.

*New Guinea.*

(143) **S. macroblepharis**, *Warb.*, Mons., I, 124, tab. III C.

Shoots subcreeping or rather ascending, 7—8 cm. long, the stem slender,  $\frac{1}{2}$  mm. thick, yellowish; pinnae 2—3 cm. long; pinnulae  $\frac{1}{2}$ —1 cm. long, remote, simple or the lower forked. Leaves heteromorphous; leaves of the lower plane spaced on both stem and branches, spreading

or horizontal, oblong, subacute, rounded on both sides at the base, white-margined, remotely ciliated on both sides; of the stem  $\frac{3}{4}$ —1 mm. long; of the branchlets smaller; leaves of the upper plane ovate-lanceolate, acuminate, rather equally rotundate-cuneate on both sides at the base, ciliated on both sides. Spikes relatively short and broad, 3 mm. long and 2 mm. broad; sporophylla of the upper plane 3—4 on a side, spreading, oblong, 1 mm. long, hardly acute, ciliated, keeled, imbricated at the base; those of the lower plane erect, ovate, acuminate, ciliate, keeled; macrospores yellowish-white, rather smooth; microspores orange, smooth.

*New Guinea (?)*; *Bismarck Islands*.

(144) **S. polyblepharis**, *Warb.*, *Mons.*, I, 127.

Shoots erect, 4—6 cm. long, the stem slender, when dry yellowish and  $\frac{1}{2}$  mm. thick; branches 1—4 cm. long, pinnate, or the lower 2-pinnate. Leaves of the lower plane erecto-patent; of the stem elliptical, under 1 mm. long, hardly oblique, obtuse, rounded at the base, not imbricate over the stem, copiously ciliate on the upper side towards the base; leaves of the upper plane ascending, somewhat smaller; of the stem ovate, nearly keeled, acute, ciliolate; leaves of the branchlets similar to those of the stem, hardly smaller, more close. Spikes slender, relatively long, to 1 cm. long, 1 mm. broad; sporophylla of the upper plane many, obliquely ascending, lanceolate,  $\frac{2}{3}$  mm. long, subacute, ciliolate, rounded at the base, not close; of the lower plane pale, hardly more ascending, ovate, keeled, subcuspidate, long-ciliate; macrospores smooth or slightly foveolate, or subverruculose to slightly rugulose; microspores smooth.

*Luzon*.

(145) **S. philippina**, *Spring*, *Mon.*, II, 105; *Bk.*, *Fern All.*, 83; *S. Cumingiana*, *Pr.*, *Abh. Böhm. Ges.*, III, 582.

Shoots erect, copiously pinnate, the stem slender, unequally quadrangular, flat on the face, convex on the back; lower pinnae elongated, with 3—5 alternate pinnulae; pinnulae simple or forked; branchlets  $1\frac{1}{4}$  mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves spaced even on the branchlets, erecto-patent, oblong; of the stem nearly equal-sided,  $1\frac{1}{4}$ —2 mm. long, acute, minutely serrulate on both sides but sparingly so on the lower side, hardly semicordate-rotundate on the upper side at the base; of the ultimate branchlets smaller, rather



rotundate-cuneate at the base; intermedial leaves  $\frac{1}{2}$  as long, oval, acute, shortly apiculate, hardly falcate, pale-margined, minutely denticulate, somewhat keeled, adnate and more or less rotundate-cuneate at the base. — The description is compared with a sterile specimen of Cuming's No. 1999 occurring in the Buitenzorg Herbarium; it agrees exactly with a fertile specimen of Elmer's No. 9273. The said specimens have the shoots small, under 7 cm. long, the lateral leaves pellucid-margined on both sides, with the upper side ciliate or ciliolate in the lower half, rounded at the base, the spikes platystichous, resupinate, to  $1\frac{1}{2}$  cm. long,  $1\frac{1}{2}$ —2 mm. broad at the base, the sporophylla of the upper plane spreading, elongate-oblong, bluntish, keeled, the keel ciliolate, the upper side remotely denticulate, remotely ciliolate towards the base, the sporophylla of the lower plane erect, triangular-ovate, acuminate, remotely ciliate, the macrospores yellow or pale-ochraceous, smooth, opaque, the microspores yellow or minium-red, smooth.

*Philippines.*

(146) **S. Zahnli**, *Heteron.*, in Engl. Bot. Jahrb., L, 37.

Shoots suberect from a creeping or subascending base, branched from the base, the stem stramineous, distinctly 2-sulcate down the face, the main rachis 4 mm. broad including the lateral leaves; lower and central pinnae to  $2\frac{1}{2}$  cm. long; pinnulae simple, to 1 cm. long, the lower rarely forked; ultimate branchlets 2 mm. broad. Lateral leaves somewhat remote on the main rachis, approximate or close on the branchlets; of the main rachis subhorizontal, obliquely triangular-ovate, bluntish or subacute, the upper side rounded, sparingly and very minutely denticulate in the upper part, sparingly and gradually ciliolate towards the broadly rounded base, narrowly pellucid-margined in the lower part, the lower side nearly straight, sparingly and very minutely denticulate towards the apex, subentire towards the narrowly rotundate-subtruncate base, the largest leaves 3 mm. long by  $1\frac{3}{4}$  mm. broad; of the branchlets smaller, spreading, unequally rotundate-cuneate at the base, the largest  $1\frac{1}{2}$  mm. long; intermedial leaves erect; of the main rachis ovate-lanceolate, nearly straight, narrowly long-acuminate, subaristate, obliquely rounded at the base, narrowly pellucid-margined, sparingly and very minutely denticulate, the outer base somewhat produced, the inner base sparingly ciliolate, the largest leaves 2 mm. long; of the branchlets smaller, proportionally narrower, more lanceolate. Spikes terminal and solitary, 4—7 mm. long,

2½ mm. broad; sporophylla of the upper plane obliquely lanceolate-deltoid, acute, spreading, somewhat recurved, keeled, sparingly and minutely denticulate, the upper side sparingly ciliate towards the base, the largest sporophylla 1¾ mm. long; of the lower plane suberect, deltoid-ovate, narrowly long-acuminate, subaristate, sparingly ciliate, keeled, to 1¼ mm. long; macrospores stramineous-white, provided with minute conical or verruciform projections; microspores orange or yellowish, smooth.

*New Guinea.*

(147) **S. birarensis**, *Kuhn*, Forsch. Gaz., IV, Bot.

Shoots 14—20 cm. long, to 3-pinnate, erect from an ascending base, the stem 2-sulcate down the face, convex on the back; branches spreading, elongated, acuminate, narrowed at the base; ultimate branchlets 2—3½ mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves of the stem ovate, obtuse, entire, nearly equally cordate on both sides at the base, the upper (inner) side ciliated in the lower half, the lower (outer) side only so at the base; intermedial leaves of the stem rhomboidal-ovate, acuminate, ciliated on both sides, auriculate-cordate on the outer side and rounded on the inner side at the base; leaves of the branches deep-green above, paler beneath; lateral leaves of the branchlets rather approximate, with the interstices less broad than the leaves, spreading, ovate, subfalcate, subobtuse, subentire, auriculate-cordate and ciliated on the upper side at the base, rounded or rotundate-cuneate on the lower side at the base; intermedial leaves of the branchlets ½ as long, broadly ovate, subfalcate, acuminate, obliquely rounded at the base, with both edges ciliated. Spikes to 5 mm. long; sporophylla not very heteromorphous; of the upper plane ovate-elongate, acuminate, ciliate, keeled; of the lower plane somewhat smaller, broadly ovate, acuminate, ciliate, slightly keeled; microspores smooth; macrospores . . . .

*Papuan Islands.*

(148) **S. declivens**, *Warb.*, Mons., I, 127.

Shoots ascending from a creeping base, 80 cm. long, the lower part simple, pale-brown or yellowish, irregularly angled when dry, 2—3 mm. thick, sparingly foliate, the upper part branched, lanceolate in outline; lower pinnae 10—15 cm. long, 2-pinnate; ultimate branchlets 6—8 mm. long, 3 mm. broad including the lateral leaves. Leaves of the stem

suberect, ovate, subentire, hardly acute, the lateral ones somewhat larger than the intermedial; leaves of the branches heteromorphous; lateral leaves approximate, ovate; of the secondary rachises subhorizontal, very unequal-sided, to 4 mm. long, blunt, the upper side minutely denticulate and very broadly abruptly rotundate-cuneate at the base, the lower side entire, narrowly rounded at the base; of the ultimate branchlets to 2 mm. long, subfalcate, subacute, subentire, nearly equally rounded on both sides at the base; intermedial leaves ovate, shortly cuspidate, minutely denticulate, rounded or rotundate-subcordate at the base. Spikes 3—4 mm. long, 1—1½ mm. broad; sporophylla not very heteromorphous; of the upper plane ascending, broadly lanceolate, hardly 1 mm. long, bluntish, minutely denticulate; of the lower plane suberect, somewhat broader and shorter, acuminate, keeled, minutely denticulate; macrospores yellow, verrucose with deciduous, tuberculiform projections; microspores orange, minutely verruculose.

*Malacca; Br. India.*

(149) **S. Hollrungii**, *Hieron.*, in Engl. Bot. Jahrb., L, 35.

Shoots erect or suberect from a creeping base, to 12 cm. long, loosely branched from the base, the main stem compresso-terete, sub-2-sulcate down the face, convex below, yellowish-green, to ½ mm. thick, 2½ mm. broad including the lateral leaves; lower pinnae to 5 cm. long; pinnulae simple or forked, rarely sparingly pinnate; ultimate branchlets 1½ mm. broad. Lateral leaves ascending or spreading; of the main stem remote, broadly oblique-ovate, blunt, pale-margined, the upper side minutely denticulate towards the apex, rather sparingly long-ciliated in the lower ½—⅔ part, rounded at the base, the lower side entire or very minutely denticulate, somewhat adnate and shortly auriculate-cordate at the base, the largest leaves 1¾ mm. long by 1¼ mm. broad; of the branchlets smaller, to 1 mm. long, less remote; intermedial leaves erect; of the main stem obliquely subfalcate-ovate, subacuminate, pellucid-margined, entire or sparingly minutely denticulate, rotundate-cuneate or rotundate and adnate at the base, the adnate portion concave-rotundate, the largest leaves 1 mm. long and ¾ mm. broad. Spikes solitary and terminal on the branchlets, 5—8 mm. long, 1—1½ mm. broad; sporophylla of the upper plane spreading, deltoid-lanceolate, subrecurved, unequal-sided, acute, narrowly pellucid-margined, keeled, minutely denticulate, to 1 mm. long; of the lower plane suberect, deltoid-ovate, nearly equal-sided, ciliate,

narrowly pellucid-margined, slightly keeled; macrospores yellow, minutely punctulate; microspores minium-red or orange, smooth.

*New Guinea.*

(150) **S. Teysmanni**, *Hieron.*, Hedwi., XLIII, 60.

Shoots erect or ascending from a more or less trailing base, densely caespitose, to 10 cm. long, the stem compressed, sulcate above, convex beneath, at best  $\frac{1}{3}$  mm. thick, stramineous, the lower part simple or dichotomous, the higher part pinnate; pinnae simple or forked, or the lower dichotomous. Leaves heteromorphous, very remote on both stem and branches, pale-green, very thin; lateral leaves more or less horizontal, equal-sided, suboblong-ovate, subobtuse, upper base rounded, lower base rather rotundate-truncate, upper edge sparingly piloso-denticulate towards the apex, shortly and slightly ciliate towards the base, lower edge piloso-serrulate towards the apex, often entire towards the base, largest leaves under 2 mm. long, under 1 mm. broad; intermedial leaves equilateral, lanceolate-ovate, acutely acuminate but not cuspidate, outer base cuneate, somewhat decurrent, inner base rounded, edges piloso-denticulate, largest leaves hardly 1 mm. long, under  $\frac{1}{2}$  mm. broad. Spikes hardly more than  $3\frac{1}{2}$  mm. long, to  $2\frac{1}{2}$  mm. broad; sporophylla very heteromorphous; of the upper plane more or less contiguous, subspreading, very unequal-sided, keeled, obtuse, lower side sparingly, shortly serrulate, upper side sparingly piloso-denticulate, ciliolate towards the base, the largest 2 mm. long, under  $\frac{1}{2}$  mm. broad; of the lower plane deltoid-ovate, acuminate, ciliate on both sides, the largest under 1 mm. long,  $\frac{1}{2}$  mm. broad; macrospores bright-yellow or orange-coloured, smooth, or irregularly rugulose to ruguloso-reticulate on the basal side; microspores reddish-brown, densely verruculose.

*Celebes.*

(151) **S. elegantissima**, *Warb.*, Mons., I, 128; *Hieron.*, in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, fig. 406.

Shoots erect, 12—18 cm. long, ovate in outline, 4—7 cm. broad, the stem stramineous,  $\frac{1}{2}$  mm. thick; pinnae spreading or subascending, 2—5 cm. long, laxly pinnate, or 2-pinnate at the base, the branchlets 2—16 mm. long. Leaves heteromorphous, very distant on the stem, less so on the branchlets; leaves of the lower plane spreading; of the stem oblong, 1 mm. long, acute, minutely denticulate on both sides, oblique and nearly

rounded at the base, rather dilated on the upper side at the base, slightly imbricate over the stem or rachis; leaves of the upper plane erect, adpressed, broadly lanceolate, to  $\frac{3}{4}$  mm. long, acuminate, denticulate; leaves of the branchlets similar, but smaller. Spikes copious, oblong, 5—8 mm. long, 2 mm. broad; sporophylla of the upper plane spreading, not imbricate, hardly contiguous, oblong,  $\frac{2}{3}$  mm. long, more or less acute, slightly keeled, minutely denticulate on the upper side; of the lower plane  $\frac{1}{2}$  as long, erect, ovate-lanceolate, acute, denticulate; macrospores white to yellow, minutely papilloso-verruculose (Hieron., l. c., 699), smooth to reticulate (in Zollinger's No. 3313 and conf. Hieron.'s drawing); microspores minium-red, densely verrucose on the basal side.

*Celebes.*

(152) **S. ketra-ayam, v. A. v. B.**, Bull. Botz., 1911, I, 24.

Shoots probably erect from a creeping base, caespitose, lanceolate in outline, when adult 10—15 cm. long,  $1\frac{1}{2}$ —4 cm. broad at the middle, the stem stramineous, compresso-terete, slightly grooved,  $\frac{1}{3}$  mm. thick, 2 mm. broad including the lateral leaves; pinnae erecto-patent, the central ones the largest,  $1\frac{1}{2}$ —4 cm. long, pinnate; pinnulae simple or forked; branchlets to  $1\frac{3}{4}$  cm. long, 1 mm. broad or hardly broader including the lateral leaves. Leaves heteromorphous; leaves of the lower plane very distant on the stem, less so or even contiguous on the branchlets, nearly erecto-patent; of the stem broadly ovate-oblong, very unequal-sided, nearly 1 mm. long, nearly  $\frac{3}{4}$  mm. broad near the base, acute or subacute, with the upper edge minutely denticulate, the lower edge obsoletely so, the upper base dilated, rounded or rotundate-cuneate, imbricated over the stem, the lower base rather narrowly rounded; of the branchlets similar but somewhat smaller; leaves of the upper plane erected, distant on the stem, contiguous on the branchlets; of the stem ovate, 1 mm. long, nearly straight, acuminate, minutely denticulate on the inner edge, obsoletely so on the outer edge, the base obliquely rounded, somewhat produced and apparently slightly peltate; of the branchlets similar but smaller, hardly produced at the base. Spikes short, oblong, 2—4 mm. long,  $1\frac{1}{2}$ —2 mm. broad; sporophylla of the upper plane 2—4 on a side, subascending, lanceolate, very shortly mucronate-acuminate, keeled, minutely denticulate on the upper edge; those of the lower plane suberect, ovate, acuminate, keeled, denticulate on both edges; macrospores yellowish-white, finely

and sparingly powdered, nearly smooth; microspores yellowish or pale-orange, smooth.

*Banca.*

(153) **S. Schefferi**, *Hieron.*, Engl. Bot. Jahrb., L, 24.

Shoots ascending or suberect from a short-creeping base, 20—30 cm. long, the lower part simple, stipitiform, obtusely quadrangular in the lower half, smooth, naked, stramineous or pale-ochraceous, 1—1½ mm. thick, the upper part ovate or lanceolate in outline, 2-pinnate or sub-3-pinnate, the rachis 5—6 mm. broad including the lateral leaves; lower pinnae 4—8 cm. long, pinnate or sub-2-pinnate; ultimate branchlets 2—3 mm. broad. Leaves heteromorphous; lateral leaves of the stipe unequal-sided, obliquely ovate, to 2 mm. long by 1½ mm. broad, bluntish, the upper side denticulate in the upper part, gradually copiously ciliated in the lower part, broadly rounded at the base, the lower side sparingly denticulate in the upper part, rotundate-cuneate in the lower part, auricled at the base; of the main rachis similar but 3 mm. long by 1¾ mm. broad; of the branchlets less unequal-sided, ovate-oblong, 1½ mm. long, subfalcate, subacute, the upper side indistinctly pellucid-margined, rounded at the base, the lower side rotundate-truncate at the base; intermedial leaves of the stipe similar to the lateral leaves but shortly acuminate, minutely denticulate on both sides; of the main rachis similar but shortly aristate, 2½ mm. long and 1½ mm. broad, the cusp ¼ as long as the blade; of the branchlets similar but smaller, and the cusp proportionally a little longer. Spikes solitary, 4—8 mm. long by 2 mm. broad; sporophylla of the upper plane unequal-sided, obliquely deltoid, sparingly denticulate on both sides in the upper part, keeled, 1½ mm. long; of the lower plane equal-sided, deltoid-ovate, shortly aristate-acuminate, denticulate, indistinctly keeled; macrospores yellow or black, finely reticulate; microspores red or orange, smooth.

*New Guinea.*

(154) **S. lepida**, *Hieron.*, Hedwi., LI, 260.

Shoots ascending from a trailing base, dichotomous in the lower part, pinnate in the upper part, 10 cm. long, the stem hardly more than ¼ mm. thick, compresso-terete, 2—2½ mm. broad including the lateral leaves; pinnae ½—1 cm. apart, 1—2½ cm. long, the higher simple, the lower one or more times forked or subpinnate with 1—4 branchlets on

a side; ultimate branchlets 1—1½ mm. broad. Leaves heteromorphous, glaucous-green, remote on both stem and branches; lateral leaves ascending; of the stem unequal-sided, oblique-ovate, blunt or subacute, rounded on the upper side and rather narrowly subcordate on the lower side at the base, with the upper edge entire or sparingly denticulate towards the base, the lower side entire, or sparingly and minutely denticulate towards the apex, the largest leaves 1¼—1½ mm. long and 1 mm. broad; of the ultimate branchlets smaller, rather rotundate-cuneate on the lower side at the base; intermedial leaves nearly equal-sided, ovate, long-acuminate, hardly aristate, somewhat obliquely rounded at the base, with the inner edge sparingly and minutely denticulate and the outer edge entire, or minutely denticulate towards the apex, the largest leaves 1¼ mm. long and hardly more than ½ mm. broad. Spikes solitary, ½—1½ cm. long, 1½—2 mm. broad, not rarely flagellate-proliferous; sporophylla of the upper plane very unequal-sided, oblique-ovate, acute, keeled, minutely serrulate on both sides; of the lower plane equal-sided, deltoid, aristate-acuminate, somewhat keeled, sparingly minutely serrulate; macrospores whitish to yellow, smooth or minutely papilloso-tuberculate on the basal side; microspores red or yellow, smooth.

*Borneo.*

(155) **S. cerebriformis**, *v. A. v. R.*, Bull. Bot., 1912, VII, 32.

Shoots probably erect, more than 8 cm. long, pinnate, the stem 1½ mm. thick, stramineous and unequally grooved down the face and sides when dry; pinnae remote, 3½ cm. long, between 2-pinnate and 2—3 times forked; ultimate branchlets 7½—15 mm. long, 4—5 mm. broad including the lateral leaves. Leaves heteromorphous; leaves of the lower plane spreading or horizontal; those of the ultimate branchlets rather remote, rhomboidal-oblong, the largest 2½ mm. long, 1 mm. broad, somewhat falcate, acute, obliquely cuneate or rotundate-cuneate at the base, the lower edge entire, the upper edge sparingly ciliolate-denticulate, or entire towards the apex; those of the main rachis similar but more distant, larger, to 5 mm. long, more broadly rounded on the upper side at the base; leaves of the upper plane erect, adpressed; those of the ultimate branchlets imbricated, parallel, nearly straight, obovate-oblong, the largest 2 mm. long, nearly equally cuneate on both sides at the base, the apex rounded and abruptly cuspidate, the cusp more than ½ as long as the blade, the edges ciliolate-denticulate; those of the main rachis similar, but distant, larger, more

rotundate-cuneate at the base. Spikes rather short, 4—5 mm. broad; sporophylla trimorphous; of the upper plane ascending, lanceolate, shortly mucronulate-acuminate, more or less keeled and ciliolate-denticulate, 3 mm. long; of the lower plane erect, the higher regularly ovate-acuminate, keeled, long-cuspidate, ciliolate,  $2\frac{1}{4}$  mm. long, the lower (of the macrosporangia) ovate, very unequal-sided,  $3\frac{1}{2}$  mm. long, keeled, the apex shortly cuspidate, the outer side very narrow, gradually narrowed towards the apex, the inner side very broad, with the apex blunt, rounded, emarginate at the base of the cusp, both edges ciliolate-denticulate but the outer edge entire towards the apex; macrospores whitish or yellowish, smooth; microspores yellowish or pale-orange, densely and irregularly rugulose with connected tuberculiform projections giving them a brain-shaped aspect. — The classification of this species is not quite positive, the description being taken from an incomplete specimen.

*Sumatra.*

(156) **S. suberosa**, *Spring*, Mon., II, 252; Bk., Fern All., 119.

Shoots densely tufted, suberect, copiously pinnate, often above 30 cm. long, the stem pale, shining-brown or stramineous, spongy, to  $3\frac{1}{4}$  mm. thick at the base, the branches erecto-patent and decompound. Leaves of the lower plane spaced and erecto-patent on the branches, very distant and spreading on the stem, oblique-ovate or ovate-lanceolate, 3— $3\frac{1}{4}$  mm. long,  $\frac{1}{2}$  as broad, acute, bright-green, membranous, unequal-sided, much produced, broadly rotundate-subcordate, rotundate or rotundate-cuneate, entire, or sparingly ciliated and a little imbricated over the stem on the upper side at the base, more or less narrowly rounded on the lower side; leaves of the upper plane  $\frac{1}{2}$ — $\frac{2}{3}$  as long, obovate-oblong, long-aristate, slightly narrowed and obliquely decurrent at the base, entire or sparingly denticulate or ciliate. Spikes copious, 6—20 mm. long, 3— $4\frac{1}{4}$  mm. broad; sporophylla of the upper plane lanceolate, erecto-patent, somewhat ciliate at the base, keeled; of the lower plane ascending, ovate-subulate, long-acuminate, ciliate, keeled; macrospores yellowish or greyish, with deciduous tuberculiform verrucae; microspores reddish, with tuberculiform projections.

*Malacca to Northern India.*

(157) **S. myosuroides**, *Spring*, Mon., II, 236; Bk., Fern All., 118; *Lycopodium myosuroides*, *Klf.*, Enum. Fil., 19.

Shoots erect or ascending, 10—20 cm. long, pinnate, the stem



stramineous, nearly 1 mm. thick; pinnae more or less copious, ascending or suberect, the lower simply pinnate or rarely 2-pinnate; branchlets erecto-patent or suberect, the lower to 2 cm. long, 2—3 mm. broad including the lateral leaves. Leaves thin, heteromorphous; leaves of the lower plane spreading or ascending; of the stem remote, unequal-sided, oblique-oblong, the largest 2—2½ mm. long and ½ as broad, very minutely denticulate on both sides or subentire on the lower side, ciliate on the upper side in the lower half or towards the base, the upper base broadly rounded, the lower base more narrowly so; of the branchlets similar, smaller, 1½ mm. long, relatively narrower, less unequal-sided, more acute, less remote, less rounded at the base; leaves of the upper plane erect, contiguous or imbricate; of the stem obovate, to 2 mm. long, cuspidate, keeled in the upper part, minutely denticulate on both sides or rather entire on the outer side, more or less ciliate at the base, the base obliquely cordate, produced on the outer side, the cusp ½ as long as the blade; of the branchlets similar but smaller, more distinctly denticulate, less ciliate, the inner base rotundate-cuneate, the cusp often relatively longer. Spikes ½—1½ cm. long, 2½—3 mm. broad; sporophylla of the upper plane lanceolate, acute, the lower the largest, spreading, to 2 mm. long, the upper side denticulate, ciliate at the base, the keel ciliate; of the lower plane erecto-patent or suberect, ovate, acuminate, ciliate, keeled; macrospores yellowish-white, smooth; microspores minium-red or yellowish, smooth.

*Luzon.*

(158) **S. subcalcarata**, *v. A. v. R.*, Bull. Botz., 1914, XVI, 49.

Near *S. myosuroides* *Spring*, but the pinnae sometimes much elongated and always pinnate, the intermedial leaves of the stem rounded or rotundate-cuneate at the inner base, subcalcarate-cordate at the outer base, the spikes narrower, 1½—2 mm. broad, the sporophylla of the upper plane shorter, not ciliate at the upper base, the macrospores probably greyish-white and smooth or nearly smooth, the microspores smooth or sparingly punctulate.

*Borneo.*

(159) **S. chrysocaulos**, *Spring*, Mon., II, 250; Hieron., Hedwi., XLIII, 15; Bk., Fern All., 117, p. p.; *Lycopodium chrysocaulon*, *Hk. & Grev.*, Enum. Fil., No. 182.

Shoots erect from a creeping base, 15—35 cm. long, the base simple, compressed, subquadrangular, bright-yellow, glossy, to 1 mm. or more thick, the upper part pinnately compound, ovate-lanceolate in outline; lower pinnae 3-pinnate at the base, central 2-pinnate at the base, higher simply pinnate; branchlets simple or forked. Leaves of the lower part of the stipe isomorphous, more or less decussate, bracteiform, those of the main rachis and branches heteromorphous, bright-green, rigid; leaves of the lower plane spaced even on the branchlets; of the main rachis very unequal-sided, oblique, ovate, acute, rounded on the upper side, shortly truncate or auricled on the lower side at the base, pellucid-margined on the upper side, piloso-denticulate on both sides, the largest 3 mm. long, 1½—1¾ mm. broad; of the branches less unequal-sided, subfalcate, acute, the largest of the ultimate branchlets 1½ mm. long, ½ mm. broad; leaves of the upper plane of the main rachis cordate at the base, subauricled on the outer side, subcuspidate-acuminate, pellucid-margined, piloso-denticulate, the largest 2¼ mm. long, 1 mm. broad; of the branches more distinctly cuspidate, the largest of the ultimate branchlets hardly 1½ mm. long, under ½ mm. broad. Spikes hardly more than 5 mm. long, 2 mm. broad; sporophylla of the upper plane oblique-oblong, very unequal-sided, keeled, more or less distinctly pellucid-margined and slightly piloso-denticulate; of the lower plane equal-sided, ovate, acuminate, setiform at the point, pale-green, keeled, the base auricled, the margin slightly piloso-denticulate; macrospores yellowish, minutely granulate on the basal side; microspores densely and coarsely verrucose.

*Malacca to Br. India.*

(160) **S. tenuifolia**, *Spring*, *Mon.*, II, 253; *Bk.*, *Fern All.*, 118.

Shoots tufted, suberect, 7½—17½ cm. long, copiously pinnate, the stem naked, thick-spongy below, stramineous or brownish, 2-sulcate down the face; pinnae copiously compound. Leaves heteromorphous; lateral leaves spaced and spreading on the main stem, approximate and erecto-patent on the branchlets, ovate-rhomboid or oblong-rhomboid, 2—3¼ mm. long (after *Spring* 4 mm. long, 2½ mm. broad; probably those of the main rachis), subacute or blunt, pale-green, membranaceous, the upper side minutely serrulate, broadly rounded or cordate at the base, the lower side subentire (after *Hieronymus* minutely serrulate), narrowed at the base; intermedial leaves ½ as long, ovate, long-cuspidate, minutely serrulate, keeled. Spikes copious, short, 2½ mm. broad; sporophylla very

heteromorphous; of the upper plane erecto-patent, lanceolate-rhomboid, serrulate, white-margined, keeled; of the lower plane suberect, broadly ovate, long-cuspidate, ciliolate-serrulate, acutely keeled; macrospores yellowish or greyish, deciduously verrucose; microspores verrucose.

*Malacca; Hindostan.*

(161) **S. aristata**, *Spring*, Mon., II, 245; *S. debilis*, *Spring*, l. c., 122; *S. tenera*, *Spring*, Bk., Fern All., 118, p. p.

Shoots erect from the base or creeping in the lower part, 6—12 cm. long, the flaccid, erecto-patent branches pinnate; ultimate branchlets short, 2½—3½ mm. broad including the lateral leaves. Leaves thin; lateral leaves much spaced and spreading or squarrose on the stem, ascending and less remote on the branchlets; of the stem rhomboid-oblong, 2½—3 mm. long, 1½ mm. broad, subacute or bluntish, membranous, unequal-sided, much dilated and broadly rounded or subcordate on the upper side at the base, narrowly rounded on the lower side, very minutely serrulate, or entire at the base; of the branchlets smaller, 2 mm. long; intermedial leaves rather equal-sided, small, ovate, long-acuminate-cuspidate, narrowly pale-margined. Spikes to 9 mm. long, 2½—3½ mm. broad; sporophylla of the upper plane spreading, lanceolate-oblong, acute, minutely serrulate on both sides, keeled; of the lower plane suberect, ovate, long-acuminate-cuspidate, serrulate, keeled; macrospores pale-reddish or yellowish-white, finely punctulate-verruculose; microspores minium-red or orange, irregularly verruculose or rugulose-verruculose.

*Philippines, Java (?)*.

(162) **S. strobiformis**, *Warb.*, Mons., I, 124, tab. III B.

Shoots ascending from a short-decumbent base, ovate in outline, branched down nearly to the base, 8—15 cm. long, the stem stramineous, ½—1 mm. or more thick in the lower part; pinnae erecto-patent or subspreading, the lower pinnate, little compound, the higher simple, the largest to 6 cm. long; ultimate branchlets at best 1 cm. long, 3—3½ mm. broad including the lateral leaves. Leaves heteromorphous, thin-membranaceous; lateral leaves very remote on the main stem, less so on the branches, with the interstices at least as broad as the leaves, the lower horizontal, the higher more ascending, ovate-oblong, blunt or bluntish, minutely denticulate on both sides, broadly subcordate or rounded on the upper side at the base; of the stem 2—2½ mm. long, of the branches

1—2 mm. long; intermedial leaves erect, ovate-oblong, narrowly pellucid-margined, with a cusp  $\frac{1}{2}$ — $\frac{3}{4}$  as long as the blade or longer, minutely denticulate, rather rounded at the base, the largest to 1 $\frac{1}{4}$  mm. long. Spikes 4—10 mm. long, 3 mm. broad, narrowed towards the apex; sporophylla of the upper plane subspreading, lanceolate-oblong, acute, minutely serrulate on both sides, keeled; of the lower plane suberect, triangular-ovate, subulate-acuminate and somewhat cuspidate, minutely denticulate; macrospores white or yellowish, smooth, finely verruculose, foveolate or rugulose; microspores verruculose. — I cannot distinguish this from the preceding, and plants gathered in Java agree in my opinion with the diagnoses of both.

*New Guinea, Java (?)*.

b. **Heterostachys.** 4. **Brachystachyae.**

- 1.** *Sporophylla not very heteromorphous.* (163) *S. megaphylla.*
- 1.1.** *Sporophylla conspicuously heteromorphous.*
- 2.** *Intermedial leaves hardly produced on the outer side at the base.*
- 3.** *Ultimate branchlets to 3 mm. broad including the lateral leaves.* (164) *S. d'Armandvillei.*
- 3.3.** *Ultimate branchlets 4 mm. or more broad including the lateral leaves.* (165) *S. brachystachya.*
- 2.2.** *Intermedial leaves distinctly produced on the outer side at the base.*
- 3.** *Intermedial leaves long-cuspidate.* (166) *S. fimbriata.*
- 3.3.** *Intermedial leaves not long-cuspidate.* (167) *S. subfimbriata.*

(163) **S. megaphylla**, *Bl.*, Fern All., 113.

Shoots 15—30 cm. long, assurgent from a decumbent base, more or less dichotomous in the lower part, more pinnately divided upwards, the stem sulcate down the face, the branches copiously compound. Leaves of the lower plane contiguous except low down the stem, spreading from an oblique base, linear-oblong, 4—6 mm. long, 3—4 times as long as broad, obtuse, serrulate, rounded and a little imbricated over the rachis on the upper side at the base; leaves of the upper plane ovate-lanceolate,

cuspidate. Spikes short,  $3\frac{1}{4}$  mm. broad; sporophylla of the upper plane lanceolate, acuminate, rigidly erecto-patent; of the lower plane paler, rather shorter, more ascending; macrospores reddish-white to brown, with conical or torulose projections on the basal side; microspores minium-red, with crowded conical projections on the lower side.

*Sumatra; North India.*

(164) **S. d'Armandvillei**, *v. A. v. R.*, Bull. Btz., 1911, I, 23; 1914, XVI, 50; — var. *busuensis*, *v. A. v. R.*, 1914, l. c.

Shoots ascending, 15—40 cm. long, linear or linear-lanceolate in outline, pinnate, the stem stramineous when dry, subterete, to  $1\frac{1}{2}$  mm. thick; pinnae suberect,  $1\frac{1}{2}$ —3 cm. broad, distant, the higher simple or forked, the lower  $1\frac{1}{2}$ —3 cm. long, pinnate; pinnulae with a few simple or once or twice forked branchlets; ultimate branchlets 2—6 mm. long, 2—3 mm. broad including the lateral leaves. Leaves heteromorphous, very distant on the stem, less so on the branchlets; leaves of the lower plane horizontal or nearly so; of the stem oblong, 2 mm. long,  $1-1\frac{1}{2}$  mm. broad at the base, very blunt at the apex, the upper edge minutely denticulate, rather entire towards the apex, the lower edge entire or nearly so, the upper base much dilated and broadly rounded, the lower base cuneate; leaves of the upper plane ovate-acuminate,  $1\frac{1}{2}$  mm. long, unequal-sided, broadest on the inner side, minutely denticulate, rounded at the base; leaves of the branchlets similar but smaller; those of the lower plane rather blunter, less dilated at the upper base, with the upper edge entire towards the apex; those of the upper plane incurvate-falcate, rather keeled. Spikes oblong, 3—15 mm. long, 2—3 mm. broad; sporophylla of the upper plane similar to the leaves of the lower plane but less blunt, subacute, broadly keeled, the lower spreading, to 2 mm. long, not imbricated, the higher more ascending; those of the lower plane ascending, ovate-acuminate, equal-sided, to  $1\frac{1}{2}$  mm. long, minutely denticulate, keeled; macrospores whitish, densely deciduously and minutely papilloso-verruculose; microspores orange-coloured to whitish, apparently reticulated by the densely crowded, sharply bounded, tuberculiform projections.

**Var. busuensis:** Pinnae to 8 cm. long; ultimate branchlets narrower, at best 2 mm. broad; leaves of the upper plane smaller, rather straight; of the stem to 1 mm. long, broadly adnate and both sided rotundate-cuneate at the base; spikes narrower, at best 2 mm. broad.

*Celebes.*

(165) **S. brachystachya**, *Spring*, Mon., II, 255; Bk., Fern All., 113; *Lycopodium brachystachyum*, *Hk. & Grev.*, Bot. Misc., Add. & Covr., 107; — var. *ornata*, Bk., Fern All., 113, p. p.; *S. ornata*, *Spring*, l. c., 259; *L. ornatum*, *Hk. & Grev.*, l. c., 108.

Shoots reaching 30—45 cm. in length, copiously compound, generally assurgent from a decumbent base, the stem unequally quadrangular, sulcate down the face and sides, the branching midway between pinnate and flabellate, the branchlets 4—5 mm. broad including the lateral leaves. Leaves of the lower plane contiguous on the branchlets, spaced on the stem, black-green, spreading, rhomboid-oblong, 4—5¼ mm. long, rather straight, hardly falcate, obtuse, subentire, much dilated, broadly rounded and much imbricated over the stem on the upper side at the base, narrowed and adnate on the lower side; leaves of the upper plane much smaller, ovate, subentire, keeled, rounded and nearly equal-sided at the base, aristate-cuspidate, incurvate-falcate. Spikes 6—12½ mm. long, 3¼ mm. broad; sporophylla of the upper plane ovate-oblong, blunt, keeled, entire; those of the lower plane ½ as long, ascending, deltoid, long-acuminate, spinuloso-denticulate, keeled; macrospores pale-yellow, finely verruculose to rugulose on the basal side; microspores reddish, tuberculato-verruculose.

Forma typica: — *South India, Ceylon.*

**Var. ornata:** Leaves smaller; of the lower plane slightly falcate, denticulate, less broadly rounded, not much imbricated over the rachis on the upper side at the base; of the upper plane mucronate, denticulate; spikes longer, narrower, subquadrangular; sporophylla less dimorphous, those of the upper plane more acute. — *Java, Sumatra.*

(166) **S. fimbriata**, *Spring*, Mon., II, 258; *S. brachystachya*, *Spring*, var. *ornata*, Bk., Fern All., 113, p. p.

Shoots erect, or ascending from a decumbent base, reaching 30 cm. or more in length, the stem stramineous, obtusely quadrangular, convex on the face and back, slightly grooved down the sides; pinnae erecto-patent, pinnate; pinnulae simple or forked; ultimate branchlets 3—5 mm. broad including the lateral leaves. Leaves heteromorphous; leaves of the lower plane rather spaced on the stem, more approximate to contiguous on the branchlets, rather spreading, firm, dark above, paler beneath; of the main rachis the largest, elongate-oblong, 3—5 mm. long, to 2 mm. broad, hardly falcate, bluntish or subacute, cordate-emarginate at the

base, dilated, auriculated, piloso-denticulate and somewhat imbricated over the rachis on the upper side at the base; of the branchlets  $\frac{1}{2}$  as long; leaves of the upper plane much smaller, erected, parallel, straight, ovate, long-cuspidate, minutely denticulate at the edge, keeled, cordate at the base, distant on the main rachis, imbricated on the branchlets, rounded to cordate at the base, the outer base distinctly produced. Spikes  $12\frac{1}{2}$ —25 mm. long, 2—3 mm. broad; sporophylla of the upper plane similar to the lateral leaves but smaller, subacute, keeled, serrulate, somewhat ascending; of the lower plane more ascending, subparallel, ovate, acuminate to cuspidate, serrulate, keeled; macrospores whitish or pale-yellow, densely and minutely verruculose; microspores pale, dirty-yellow or orange, verruculose with capitate or tuberculiform projections. — A plant gathered by Dr. Koorders, which is probably a form of this species, differs in having the lateral leaves rounded or rotundate-cuneate (not auriculate) on the upper side and somewhat dilated on the lower side at the base, the spikes single or double, the macrospores more or less deciduously verruculose.

*Java.*

(167) **S. subfimbriata**, *v. A. v. R.*, Bull. Botz., 1911, I, 26; ? *S. javanica*, Klotz., *var. gracilior*, A. Br., MS.; — *var. polyura*; *var. Backeri*, v. A. v. R., l. c.; *S. fimbriata*, Spring, *var. polyura*, Warb., Mons., I, 127; *S. brachystachya*, Spring, *var. polyura*, Warb., MS.; — *var. Koordersii*, v. A. v. R., l. c.; ? *S. fimbriata*, Spring, *var. brevifolia*, A. Br., MS. in Herb. Berol.

Shoots erect, or ascending from a decumbent or ascending base. Lateral leaves dilated, rotundate-cuneate, broadly rounded or subcordate on the upper side at the base, cordate-truncate and not rarely subauriculate on the lower side, those of the ultimate branchlets contiguous or rather remote, more or less ascending; leaves of the upper plane acute to acuminate. Spikes single or double, 1—4 cm. long,  $1\frac{1}{2}$ —2 mm. broad, distinctly platystichous in the broadest, nearly square in the narrowest forms. — Otherwise like *S. fimbriata* Spring.

**Var. polyura:** Differs from the type in having the branches narrower, the ultimate branchlets at best 3 mm. broad, the lateral leaves smaller, more or less approximate on the main rachis, not rarely subimbricate on the branchlets, the spikes narrower,  $1-1\frac{1}{2}$  mm. broad, sometimes forked at the apex.

**Var. Koordersii:** Differs from the type in having the shoots smaller, to 15 cm. long, with the stem slender, hardly 1 mm. thick, the ultimate branchlets at best 3 mm. broad, the leaves smaller, the spikes short, to 6 mm. long, 1—1½ mm. broad.

*Java.*

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A<sup>2</sup>. PLEIOSTELICAE.

1. *Stems 3-stelical.*
2. *Leaves spinuloso-lacerate at the base.* (168) *S. lacerata.*
- 2.2. *Leaves not spinuloso-lacerate at the base.*
3. *At least the lower axillary leaves of the main rachis roundish, i. e. proportionally very short and broad, if elongated, then relatively very large when compared with the lateral leaves.*
4. *Stems rough.* (169) *S. tylophora.*
- 4.4. *Stems not rough.*
5. *Lateral leaves of the branchlets decurrent at the base.* (170) *S. finium.*
- 5.5. *Lateral leaves of the branchlets not decurrent, though not rarely more or less broadly adnate, at the base.*
6. *Shoots wide-trailing.* (171) *S. Mayeri.*
- 6.6. *Shoots at best trailing at the base.*
7. *Pinnulae simple, under 9 mm. broad including the lateral leaves.*
  - △ *Lateral leaves quite entire.* (172) *S. axillifolia.*
  - △△ *Lateral leaves not quite entire.* (173) *S. stipulata.*
- 7.7. *Pinnulae more compound, or more than 9 mm. broad including the lateral leaves.*
8. *Pinnae linear or linear-lanceolate, articulate at the base.* (174) *S. gastrophylla.*
- 8.8. *Pinnae roundish to ovate, or not articulate at the base.*
9. *Leaves not pellucid-margined.*



+ *Lower axillary leaves roundish, small.*

(188) *S. Willdenowii.*

++ *Lower axillary leaves elongate, large.* (175) *S. Hewittii.*

**9.9.** *Leaves pellucid-margined by rows of sclerotic cells.*

□ *Lower axillary leaves cordate-rotundate or deltoid-ovate, broadest at or near the base.*

(176) *S. furcillifolia.*

□□ *Lower axillary leaves roundish-oblong, broadest at the middle.*

○ *Ultimate branchlets under 7½ mm. broad including the lateral leaves.*

(177) *S. latupana.*

○○ *Ultimate branchlets more than 7½ mm. broad including the lateral leaves.*

(203) *S. maxima.*

□□□ *Lower axillary leaves obovate, broadest near the apex.*

(190) *S. plana.*

**3.3.** *Axillary leaves elongated, not relatively very large when compared with the lateral leaves.*

**a.** *Pinnulae simple or forked, at best the largest subpinnate.*

**b.** *Lateral leaves with the lower base adnate.*

(178) *S. viridangula.*

**b.b.** *Lateral leaves with the lower base not adnate.*

**c.** *Stems rough, or velutinous and finally roughish.*

**d.** *Lateral leaves of principal rachises calcarate-auriculate on the upper side at the base.*

**e.** *Lateral leaves of ultimate branchlets also calcarate.* (179) *S. gracilis.*

**e.e.** *Lateral leaves of ultimate branchlets not calcarate.* (180) *S. Nymani.*

**d.d.** *Lateral leaves not calcarate-auriculate.*

(181) *S. velutina.*

**c.c.** *Stems smooth.*

♀ *Pinnulae invariably simple.*

△ *Spikes 1—2-nate.*

⊙ *Proportionally small plants.*

(183) *S. elliptica.*

⊙⊙ *Proportionally large or middle-sized plants.* (182) *S. Wallichii.*

△△ *Spikes 3—6-nate.*

(184) *S. polystachya.*

♀♀ *Pinnulae not invariably simple.*

△ *Lateral leaves of the stem not auriculate-cordate at the base, or if so, the auricles not hamate-incurvate.*

⊙ *Spikes to 2 mm. diam.*

(192) *S. Pouzoliana.*

⊙⊙ *Spikes 2 mm. or more diam.*

(185) *S. Schildei.*

△△ *Lateral leaves of the stem 2-auriculate-cordate or semiauriculate-cordate at the base, the auricles hamate-incurvate.*

⊙ *Leaves of the stem distinctly dimorphous, the intermedial acute, the lateral blunt or rounded at the apex.*

(186) *S. permutata.*

⊙⊙ *Leaves of the stem isomorphous, though the intermedial mostly smaller than the lateral.*

(187) *S. Kittyae.*

**a.a.** *Largest pinnulae pinnately branched, or the central dichotomous.*

**b.** *Sporophylla proportionally short and broad, hardly exceeding the sporangia.*

(188) *S. Willdenowii.*

**b.b.** *Sporophylla proportionally long and narrow, distinctly exceeding the sporangia.*

**c.** *Intermedial leaves bounded by a pale or pellucid margin consisting of sclerotic cells.*

△ *Lateral leaves auricled on the upper side at the base, the auricle spur-like, spreading or inflexed.* (190) *S. plana*.

△△ *Lateral leaves not or hardly auricled on the upper side at the base, and if so, the auricle not spur-like, plicate.*

○ *Largest lateral leaves rounded or rotundate-cuneate on the lower side at the base.* (191) *S. fulvicaulis*.

○○ *Largest lateral leaves rotundate-truncate to distinctly cordate on the lower side at the base.*

× *Upper base of lateral leaves not auriculate.* (192) *S. Pouzolziana*.

×× *Upper base of lateral leaves more or less plicate-auriculate.*

+ *Slightly plicate.*

(204) *S. d'Urvillei*.

++ *Conspicuously plicate.*

(193) *S. plicata*.

**c.c.** *Intermedial leaves not pale or pellucid-margined.*

**d.** *Intermedial leaves of ultimate branchlets rotundate-cuneate to cordate on the outer side at the base. Shoots springing from a scandent, 5—8-stelical main stem.*

(194) *S. muricata*.

**d.d.** *Intermedial leaves of ultimate branchlets cuneate and decurrent on the outer side at the base, or the main stem 3-stelical.*

**e.** *Macrospores rugose, rugulose or reticulate.* (195) *S. Schlechteri*.

**e.e.** *Macrospores smooth, prickly or verrucose-tuberculate.*

**f.** *Largest lateral leaves more or less plicate or auriculate on the upper side at the base.*

- g.** *Lateral leaves of the branchlets broadly adnate on the lower side at the base.*

(196) *S. Hindsii*.

- g.g.** *Lateral leaves of the branchlets not broadly adnate on the lower side at the base.*

(189) *S. Engleri*.

- f.f.** *Largest lateral leaves neither plicate nor auriculate on the upper side at the base.* (197) *S. inaequifolia*.

**1.1.** *Stems 4—9-stelical.*

- 2.** *Lateral leaves of the branchlets nearly entirely adnate on the lower side at the base.* (198) *S. Lobbii*.

- 2.2.** *Lateral leaves of the branchlets at best partly adnate on the lower side at the base.*

- 3.** *Pinnulae simple or forked, ultimate branchlets under 9 mm. broad including the lateral leaves.*

◇ *Branchlets to 3½ mm. broad.*

(199) *S. Gaudichaudiana*.

◇◇ *Branchlets 4 mm. or more broad.* (200) *S. bidiensis*.

- 3.3.** *Lower pinnulae pinnately branched, or the ultimate branchlets more than 9 mm. broad including the lateral leaves.*

- 4.** *Intermedial leaves not pellucid-margined.*

▽ *Lateral leaves of branchlets cuneate-truncate on the lower side at the base.* (194) *S. muricata*.

▽▽ *Lateral leaves of branchlets not cuneate-truncate on the lower side at the base.*

(201) *S. denuana*.

- 4.4.** *Intermedial leaves pellucid-margined by rows of sclerotic cells.*

- 5.** *Lateral leaves revolutto-auriculate on the upper side at the base.* (202) *S. padangensis*.

- 5.5.** *Lateral leaves not revolutto-auriculate on the upper side at the base.*

**6.** *Ultimate branchlets more than 7½ mm. broad.* (203) *S. maxima*.

**6.6.** *Ultimate branchlets under 7½ mm. broad.*

- 7'. Lower axillary leaves roundish, not much longer than broad.

(176) *S. furcillifolia*.

- 7.7'. Axillary leaves oblong, conspicuously longer than broad.

(204) *S. d'Urvillei*.

(168) ***S. lacerata*, Warb.**, Mons., I, 120.

Shoots erect, 40 cm. long, the lower part simple, 2 mm. thick, 3-stelical, sulcate, yellowish when dry, the upper (larger) part branched, ovate in outline; pinnae 7 on a side, lanceolate, copiously simply pinnate, caudiculate; ultimate branchlets 1½—2 cm. long, 4 mm. broad including the lateral leaves. Leaves of the stipe adpressed, broadly lanceolate, 3 mm. long, subtruncate or auricled on 1 side at the base; leaves of the branched portion heteromorphous; lateral leaves spreading, remote on the main rachis, close on the branches; of the secondary rachises broadly lanceolate, 4 mm. long, very oblique, acute, the base subcordate, appendiculate-lacerate, the appendages subulate, intricate; intermedial leaves ½ as long, erect, adpressed, falcate, acuminate, somewhat keeled; of the secondary rachises peltate, sometimes lacerate at the base; leaves of the ultimate branchlets similar to those of the principal rachises but smaller, not or hardly lacerate at the base, the lateral subfalcate-oblong, 3 mm. long, suboblique, hardly acute, subauriculate at the narrowed upper base, truncate at the lower base, the intermedial very oblique, lanceolate, shortly cuspidate, not keeled. Spikes yellow, 4—5 mm. long, 1½ mm. diam.; sporophylla broadly lanceolate, hardly 1 mm. long, acutely acuminate, entire; macrospores white, pale-yellow or pale-brown, densely verruculose; microspores white, provided with free or connected, crowded, short-cylindrical or shortly stipitate-capitate projections on the basal side.

*Philippines.*

(169) ***S. tylophora*, v. A. v. R.**, Bull. Bot., 1914, XVI, 50.

Shoots erect from a creeping or ascending base, 15—20 cm. long, branched down to the base, or the lower part simple or provided with a few reduced pinnae, the stem brownish-grey or ochraceous when dry, 3-stelical, asperous with crowded minute warts, the upper part pinnate,

the main rachis asperulous, with the axillary leaves proportionally large, linear-oblong, subacute, rather 2-auriculate-cordate at the base; pinnae ascending, lanceolate, 5—6 cm. long, 1½—2½ cm. broad; pinnulae crowded, simple or forked, or the largest pinnate; ultimate branchlets to 1½ cm. long, 2—3 mm. broad including the lateral leaves. Leaves of the stem remote, erect, partly ovate-lanceolate, partly deltoid-oblong, acute, entire, the base cordate or semicordate, the auricles whether or not produced, not rarely hamato-incurvate; leaves of the branches very heteromorphous, firm; lateral leaves crowded, ascending or hardly spreading, often imbricate; of the secondary rachises lanceolate-oblong, subacute, or blunt at the very point, entire, pellucid-margined on the upper side, the upper base rotundate-cordate, the lower base more or less auriculate-cordate or inciso-cordate, the largest leaves 2½ mm. long, 1 mm. broad; of the ultimate branchlets shorter, sparingly and minutely denticulate on the upper side, the lower base more abruptly truncate-cordate, the largest leaves 1½ mm. long and 1 mm. broad; intermedial leaves erect or suberect; of the secondary rachises remote, triangular-oblong, subfalcate, bluntish or bluntly short-acuminate, entire or nearly so, the base obliquely rotundate-cordate or truncate-cordate to auriculate-cordate, pellucid-margined, the largest leaves 2 mm. long; of the branchlets smaller, imbricate, rather obovate-oblancoleate, subfalcate-incurvate, the base broadly obliquely adnate, cuneate on the inner side, produced and narrowly rotundate-cordate on the outer side. Spikes 1 mm. diam.; sporophylla deltoid-ovate, subacute or bluntish, entire or very sparingly minutely denticulate, pellucid-margined; spores . . . .

*Sumatra.*

(170) **S. finium, v. A. v. R.**, Bull. Btz., 1914, XVI, 52.

Shoots sarmentose, 50 cm. more or less long, branched down nearly or quite to the base, the stem stramineous, 1½—2 mm. thick, 3-stelical, obtusely angular; pinnae ascending, elongate-ovate, to 20 cm. long; pinnulae simple, forked or pinnate; ultimate branchlets 2—8 cm. long, 6—8 mm. broad including the lateral leaves. Leaves heteromorphous; axillary leaves of the main stem broadly truncate-subcordate, rather broader than long; lateral leaves more or less remote; of the stem deflexed, subpetiolulate, oblong, the largest 5 mm. long, 2 mm. broad, blunt, entire, broadly rotundate-cordate at the upper base, narrowly truncate-cuneate at the lower base; of the secondary rachises similar but horizontal and proportionally narrower; of the ultimate branchlets spreading,

subfalcate, the largest 4 mm. long, 1 mm. broad, bluntish or subacute, entire, the upper base rotundate-cuneate, the lower base broadly adnate, decurrent; intermedial leaves erect; of the stem remote, narrowly lanceolate, the largest 5 mm. long, long-cuspidate-acuminate, entire, the base truncate-rotundate, not produced on the outer side; of the branchlets nearly similar but smaller, imbricate, the base obliquely cuneate, produced and decurrent on the outer side. Spikes 2—3 mm. diam.; sporophylla ovate, acuminate, entire, keeled, at length spreading, the largest to 2 mm. long; macrospores whitish or pale-yellow-brown, densely verrucose; microspores yellowish-white, provided with reticulated, broad, wing-like crests.

*Borneo.*

(171) **S. Mayeri**, *Hieron.*, in Engl & Prantl., Nat. Pfl.Fam., I<sup>4</sup>, 700.

Shoots wide-trailing, pinnately decomposed from the base, the stem 3-stelical, subterete or somewhat flattened on the dorsal and ventral sides, laterally grooved, the main rachis 8 mm. broad including the lateral leaves, with the lower axillary leaves nearly orbicular, broadest at the middle; branchlets few (1—4 on a side), mostly simple, 5 mm. broad. Leaves heteromorphous, entire; lateral leaves spreading; of the main rachis remote, obliquely short-oblong, blunt, pellucid-margined, the upper base rounded or rotundate-cuneate, the lower base cordate-truncate, the largest leaves 4 mm. long, 3 mm. broad; of the ultimate branchlets subapproximate, elongate-oblong, bluntly short-acuminate, the lower base truncate-cuneate, the largest leaves 2½ mm. long, 1 mm. broad; intermedial leaves erect; of the main rachis subfalcate-oblong, remote, nearly bluntly short-acuminate, pellucid-margined, the inner base narrowly rotundate-cordate, the outer base much produced with a broad, rounded, hamate-incurvate auricle; of the branchlets imbricate, subfalcate-obovate, the acumen proportionally longer, the base very obliquely adnate, narrowly cuneate on the inner side, rotundate-cordate and much produced on the outer side. Spikes 2 mm. diam; sporophylla triangular-ovate, acute, entire, pellucid-margined; macrospores yellowish-white, foveolate-reticulate on the basal side; microspores provided with reticulated wing-like crests.

*Singapore.*

(172) **S. axillifolia**, *v. A. v. R.*, Bull. Botz., 1913, XI, 37; — var. *retroflexa*, *v. A. v. R.*, l. c., 38.

Shoots ascending or erect, pinnate down to the base or simple in

the lower part, 20—30 cm. long, the stem 3-stelical, irregularly angular and grooved when dry, provided with large, subcordate-oblong axillary leaves; pinnae elongate-lanceolate, to 15 cm. long, to 3 cm. broad, acuminate, spreading, the higher often ascending, the lower sometimes deflexed; pinnulae simple, erecto-patent, contiguous or approximate, the largest 2—3 cm. long, 5—7 mm. broad including the lateral leaves. Leaves heteromorphous; leaves of the lower plane spaced on the stem, crowded on the branchlets; of the stem horizontal, subpetiolate, oblong, unequal-sided, 4—5 mm. long, 2 mm. broad, acute, entire, broadest on the upper side, rotundate-cuneate on the upper base, rotundate-truncate on the lower base; of the branchlets spreading, less unequal-sided, to 3—4 mm. long and 1½—2 mm. broad, minutely apiculate-acuminate, more suddenly cuneate on the lower base, narrowly pellucid-margined on the upper side; leaves of the upper plane erect; of the stem remote, falcate-ovate, acute or acuminate, to 3 mm. long, entire, cuneate or rotundate-cuneate on the inner base, cuneate or rounded to cordate on the outer base; of the branchlets smaller, imbricate, cuspidate-acuminate, the cusp ½ as long as the blade, both sides more or less narrowly pellucid-margined. Spikes solitary, square, to 4 cm. long, 1½—3 mm. diam.; sporophylla isomorphous, lax, suberect, at length often spreading, triangular-oblong, acute or acuminate, entire, keeled, narrowly pellucid-margined, to 2 mm. long; macrospores yellow-brown, partly verrucose, partly rugose, the projections free or connected; microspores whitish or yellowish, provided with thick, crowded, tuberculate or shortly stipitate-capitate projections on the basal side.

**Var. retroflexa:** Leaves of the lower part of the stem retroflexed; leaves of the rachis more crowded, spreading or retroflexed; inter-medial leaves of the pinnulae with the cusp longer, not rarely as long as the blade; macrospores yellowish, finely verruculose.

*Borneo.*

(173) **S. stipulata**, *Spring*, *Mon.*, II, 144; *S. Wallichii*, *Spring*, *Bk.*, *Fern All.*, 90, p. p.; *Lycopodium stipulatum*, *Bl.*, *Enum.*, 268.

Shoots erect from a creeping base, 30 cm. or more long, the stem quadrangular, 3-stelical, stramineous when dry, with the axillary leaves proportionally large, obovate-oblong, acute, cuneate at the base; pinnae erecto-patent; pinnulae simple, parallel, 3—5 mm. broad including the lateral leaves, narrowed gradually towards the apex. Leaves hetero-



morphous; lateral leaves horizontal or deflexed on the stem, ascending on the branchlets; of the stem oblong, subacute, obliquely rotundate-truncate at the base, the upper edge minutely denticulate towards the apex and the base; of the branches slightly unequal-sided, subfalcate-oblong, to 3 mm. long and  $\frac{1}{2}$  as broad, broadest on the upper side, obscurely denticulate towards the mucronulate-acuminate apex, the upper side minutely denticulate at least at the rotundate-cuneate base, the lower side entire, narrowly cuneate or truncate-cuneate at the base; intermedial leaves  $\frac{1}{6}$ — $\frac{1}{5}$  as long; of the stem obovate-oblong, acuminate, entire, obliquely 2-auriculate-cordate at the base; of the branchlets cuneate at the inner base, rotundate-adnate or decurrent at the outer base, aristate-acuminate, with the arista  $\frac{1}{2}$  as long as the blade. Spikes 8—15 mm. long; sporophylla ovate-lanceolate, denticulate.

*Java.*

(174) **S. gastrophylla**, *Warb.*, Mons., I, 121, tab. IV D.

Shoots erect from a creeping base, 30—45 cm. long, the lower part simple, 3—4 mm. thick, 3-stelical, stramineous, irregularly grooved when dry, the upper part branched; lowest branches to 30 cm. long, elongate-lanceolate, 3-pinnate, articulated at the base, provided with short and broad, nearly rounded or broadly cordate axillary leaves hardly longer than broad; ultimate branchlets 8—12 mm. long, 3 mm. broad including the lateral leaves. Leaves of the stem and secondary rachises spreading or erecto-patent, subfalcate, 4—5 mm. long, 2 mm. broad, hardly acute, hardly cordate at the base; leaves of the branches smaller; leaves of the lower plane subspreading; of the secondary rachises oblong, to 3 mm. long,  $1\frac{1}{2}$  mm. broad, subfalcate, hardly acute, entire, lax, bright-green, the lower side truncate at the base, the upper side truncate, auriculate at the base, the auricle plicate; of the branchlets close, to 2 mm. long, less truncate and plicate at the base; leaves of the upper plane erect; of the secondary rachises broadly lanceolate, hardly 2 mm. long, falcate, slightly acuminate, pellucid-margined, with a distinct midrib, obliquely narrowly truncate at the base; of the branchlets obliquely adnate at the base, the outer base subdecurrent. Spikes square, 15—20 mm. long, acuminate; sporophylla acuminate, entire, keeled, the higher growing gradually shorter; macrospores yellowish-white, finely verruculose on the basal side; microspores provided with conical projections.

- *Mindanao, Sanggir Islands.*

(175) **S. Hewittii**, Hieron., Hedwi., LI, 262.

Shoots branched in the upper part, the main rachis 4 mm. thick, smooth, stramineous, subquadrangular, sulcate when dry, 3-stelical, sparingly foliate; axillary leaves elongate-oblong, broadly cordate at the base; pinnae 3-pinnate in the lower part, not articulate at the base, ovate, 5 cm. long, 3½ cm. broad, the rachis hardly more than 4 mm. broad including the lateral leaves; ultimate branchlets 1—3 on a side, 2—3 mm. broad. Leaves glaucous-green, entire; lateral leaves bluntish; those of the main rachis spreading, remote, oblique-oval, broadly rounded on the upper side and subtruncate-rotundate on the lower side at the base, with the midrib thickened towards the apex, the largest leaves 4½ mm. long and 2½ mm. broad; those of the ultimate branchlets close, subfalcate-lanceolate-ovate, cuneate on the upper side and truncate-rotundate on the lower side at the base, the largest 2½ mm. long and ¾ mm. broad; intermedial leaves bluntish on the main rachis, acuminate on the ultimate branchlets; of the main rachis unequal-sided, oblique-oblong, obliquely truncate-rotundate at the base, with the midrib gradually thickened towards the apex, the largest leaves 5 mm. long, 1½—1¾ mm. broad; of the ultimate branchlets nearly equal-sided, falcate-ovate, pellucid-dotted, cuneate at the inner base, decurrent and rotundate-cuneate on the outer base, the largest 1 mm. long and ½ mm. broad. Spikes 3—6 mm. long, 1—1½ mm. diam., solitary; sporophylla ovate, shortly acuminate, entire, slightly keeled, the largest hardly more than 1 mm. long and ¾ mm. broad; macrospores whitish or yellowish, densely and coarsely verrucose on the basal side; microspores yellowish, verrucose on the basal side. — Plants to 120 cm. high, probably divaricating-scandent.

*Borneo.*

(176) **S. furellifolia**, Hieron., Hedwi., L, 31; — var. *tumidifolia*, Hieron. & v. A. v. R., Bull. Btz., 1913, XI, 37.

Shoots ascending or erect, the upper part pinnate, ovate or obovate in outline, the stem to 5 mm. thick, 3-stelical, moderately sparingly foliate, fulvo-ochraceous or subferruginous, subolivaceous when young, provided with large, roundish or broadly subcordate axillary leaves; pinnae pinnate, ovate or lanceolate-ovate, to 20 cm. long, to 10 cm. broad, not articulate at the base; pinnulae pinnate, the higher once or repeatedly forked, the highest simple; tertiary branches simple or sometimes forked; ultimate branchlets 5 mm. broad including the lateral

leaves. Leaves of the lower plane oblique, subfalcate-oblong, subacute, entire, unequal-sided; of the branchlets rather close, ascending, the upper base cuneate, auriculate, the auricle revolute, the lower base produced, with a rounded corner, the margin entire, pellucid, the largest leaves  $3\frac{1}{4}$  mm. long,  $1\frac{1}{2}$  mm. broad; of the stem distant, horizontal, to 7 mm. long, cordate and auricled on both sides at the base, with the upper auricle the largest; leaves of the upper plane entire, erect; of the branchlets imbricate, falcate-ovate, subinequilateral, acuminate, pellucid-margined, pellucid-dotted, decurrent at the outer base, cuneate at the inner base; of the stem distant, oblong,  $5\frac{1}{2}$  mm. long,  $2\frac{1}{4}$  mm. broad, acute, truncate-cordate at the base. Spikes 5—35 mm. long, rather square,  $1\frac{1}{2}$ —2 mm. diam.; sporophylla subisomorphous, equal-sided, ovate, shortly acuminate, entire, pellucid-margined, keeled, the ventral ones somewhat larger than the dorsal, and paler, the largest  $1\frac{1}{2}$  mm. long, 1 mm. broad; macrospores fulvous, whitish when dry, verruculose on the basal side; microspores yellow, provided with stipitate-capitate projections on the basal side. — Specimens occurring in the Buitenzorg Herbarium and probably belonging to this species differ from Hieronymus' diagnosis in having the shoots partly independent (young forms?), partly springing from a divaricating-scandent main stem (adult forms?), with the stems 3—5-stelical, if 3-stelical, then commonly with a tendency to become 4-stelical, with the lateral leaves spreading and very remote on the main stem, remote on the principal rachises, subascending and approximate or contiguous on the branchlets, not positively auricled but conspicuously plicate on the upper side at the base and therefore apparently revolute-auriculate, the macrospores densely rotundate-verruculose, the microspores white, yellowish or pale-orange, provided with densely crowded projections which are either narrowly subcylindrical or coarsely verruciform, whether or not thickened (clavate or capitate) at the tip.

Forma typica. — *Borneo, Sumbawa* (?).

**Var. tumidifolia:** Axillary leaves attached by a basal tumefaction, the lowest relatively small, obliquely broadly deltoid-ovate, unequal-sided at the base, the following growing gradually larger and more lanceolate-ovate, the higher growing gradually smaller. — *Ambocina*.

(177) **S. latupana, v. A. v. R.**, Bull. Botz., 1914, XVI, 54.

Shoots probably large, pinnately compound, the stem 3-stelical, stramineous, smooth, the main rachis subterete, when dry slightly 2-

sulcate, with the lower axillary leaves rather small, roundish, broadest at the middle, subpetiolulate, bluntly short-acuminate, entire; pinnae suberect, lanceolate, to 18 cm. long and 5 cm. broad; pinnulae suberect, close, the largest to 6 cm. long, forked or sparingly pinnate, the terminal ones often caudate-elongate; ultimate branchlets 1—3 on a side, 1½—2 cm. long or the terminal ones caudate-elongate, 3—5 mm. broad including the lateral leaves. Leaves heteromorphous, entire; lateral leaves various in size; of the main rachis small, remote, erecto-patent, obliquely subovate-lanceolate, bluntly short-acuminate; of the secondary rachises subapproximate, the lower subhorizontal, ovate-oblong, subfalcate, acuminate, obliquely cordate-truncate at the base, the upper side plicate at the base, often broadly rotundate-cuneate in the lower half, the largest leaves 4 mm. long, ½ as broad; of the ultimate branchlets close or somewhat imbricate, the upper side narrowly pellucid-margined, rotundate-cuneate in the lower half, the largest leaves 3 mm. long, ½ as broad; intermedial leaves erect; of the main rachis remote, triangular-ovate, acute; of the secondary rachises obliquely oblong, shortly mucronulate-acuminate, the base obliquely adnate, the inner side slightly rounded, the outer side rounded, rather cuneate at the base, the largest leaves 2 mm. long; of the branchlets very small, distinctly pellucid-margined. Spikes solitary, to 2 cm. long, 1½ mm. diam.; sporophylla broadly triangular-ovate, slightly acuminate, entire, pellucid-margined, keeled, at length subhorizontal, the largest 1½ mm. long; macrospores yellowish-white, densely finely verruculose; microspores yellowish-white, densely irregularly verruculose, the projections free, or connected and crest-like.

*Celebes.*

(178) **S. viridangula**, *Spring*, Bk., Fern All., 92.

Shoots suberect, sarmentose, 90—120 cm. long, the stem 3-stelical; pinnae deltoid, reaching 30 cm. in length, erecto-patent; pinnulae to 10 on a side, the lower dichotomous or pinnately compound, the others forked; ultimate branchlets usually 1¼—2½ cm. long, 5—8 mm. broad including the lateral leaves. Lateral leaves lanceolate-falcate, acute, entire, moderately firm in texture, the upper base rounded or rotundate-cuneate, the lower base broadly adnate, with a short, rounded, free angle; of the secondary rachises much spaced, 6 mm. long; of the ultimate branchlets contiguous or nearly so, 3—5¼ mm. long; intermedial leaves very small, oblong, with a distinct cusp, obliquely adnate at the base. Spikes 1—4—8 cm.

long,  $2\frac{1}{2}$ —4 mm. diam.; sporophylla ovate-lanceolate, acuminate, entire, keeled; macrospores brownish, often white-glaucous, with verruciform or rugulose-elongated projections on the basal side; microspores brownish, provided with reticulated wing-like crests.

*New Guinea; Samoa, Fiji.*

(179) **S. gracilis**, *Moore*, Gard. Chron., I, 752; Bk., Fern All., 90; *S. aspericaulis*, *Warb.*, Mons., I, 121; (not *A. Br.*), Hieron., in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 702; *S. d'Urvillei*, *A. Br.*, var. *aspericaulis*, Kuhn, Forsch. Gaz., IV, Farne, 18; *S. hypacantha*, *A. Br.*, MS. in Herb. Berol.

Shoots erect, or ascending from a creeping base, 30—60 cm. more or less long, the lower part simple,  $2\frac{1}{2}$ —4 mm. thick at the base, 3-stelical, the upper part pinnate, the stem pale-grey-brown, rough with more or less deciduous, minute, papilliform warts; pinnae moderately close, ascending, lanceolate, to 20 cm. long, 3—4 cm. broad near the base; pinnulae erecto-patent, close, simple or forked, 3—5 mm. broad including the lateral leaves. Leaves of the stipe erect, remote, subulate- or lanceolate-triangular, entire, equally or obliquely cordate at the base, the auricles incurved; leaves of the branches heteromorphous; axillary leaves conspicuously hastate at the base; leaves of the lower plane subspreading or more ascending; of the secondary rachises close or remote, triangular- or subrhomboidal-oblong, subfalcate, rather acute, entire, the upper side somewhat pellucid-margined, rotundate-cuneate in the lower part, the very base provided with a small, spreading or ascending, not rarely adpressed, spur-like auricle, the lower side somewhat produced and truncate-subauriculate at the base, the largest leaves 3—4 mm. long, and  $1\frac{1}{2}$ —2 mm. broad at the base; of the branchlets contiguous or subimbricate, similar but somewhat smaller, more falcate, with the basal auricle still smaller, or wanting in the higher leaves; leaves of the upper plane erect; of the secondary rachises remote, lanceolate, pellucid-margined, acute or bluntish, entire, very obliquely attached, more or less cordate and hamato-incurvate on the outer side at the base, the largest leaves 2—3 mm. long; of the branchlets similar but smaller, close or imbricate, more lanceolate-oblong. Spikes square,  $1\frac{1}{2}$  mm. diam.; sporophylla deltoid-ovate,  $1\frac{1}{2}$  mm. long, acute, entire; macrospores whitish, nearly smooth or more or less minutely verruculose; microspores whitish or yellowish, minutely verruculose on the basal side.

*New Guinea; Bismarck Islands, Polynesia.*

(180) **S. Nymanii**, *Hieron.*, in Engl. Bot. Jahrb., L, 39.

Shoots erect from a creeping base, 50—100 cm. long, the stem finely asperulo-verruculose, the lower part simple, subcompresso-terete, when dry irregularly grooved, yellowish or stramineous, 3-stelical, sparingly foliate, the upper part branched, ovate, to 40 cm. long and 30 cm. broad; pinnae 5—7 on a side, elongate, to 25 cm. or more long, copiously pinnate; pinnulae ascending, contiguous or nearly so, simple or the lower rarely forked; ultimate branchlets 3—5 mm. broad including the lateral leaves. Leaves entire; leaves of the stipe remote, isomorphous, sublanceolate-deltoid, acute, straight or subfalcate, to 4½ mm. long by 1½ mm. broad, the base adnate, narrowly 2-auriculate-cordate, the auricles hamate-incurvate, or the inner base deflexo-calcarate and the outer base more bluntly rotundate-auriculate; leaves of the branches heteromorphous; axillary leaves 2-auriculate (hardly hastate) at the base; lateral leaves horizontal or sub-horizontal on the secondary rachises, ascending on the branchlets; of the principal rachises subremote, obliquely deltoid-lanceolate, subfalcate, unequal-sided, acuminate or acute, the upper side pellucid-margined, rotundate-cuneate in the lower part, provided with a exceedingly minute, erected, acute spur-shaped auricle at the very base, the lower side truncate and dilated at the base, the largest leaves 4 mm. long by 2 mm. broad; of the branchlets smaller, ascending, contiguous, without a spur-like auricle, more falcate, the largest leaves 3½ mm. long; intermedial leaves erect; of the principal rachises sublanceolate-deltoid, falcate or straight, acuminate, subpellucid-margined, the base very obliquely attached, cuneate on the inner side, much produced and rotundate-adnate on the outer side, the largest leaves 2½ mm. long by ¾ mm. broad; of the branchlets smaller. Spikes square, 1½—6½ cm. long, to 2 mm. diam.; sporophylla isomorphous, deltoid-ovate, acuminate, entire, somewhat keeled, to 2½ mm. long; microspores whitish or stramineous-white, densely verruculose on the basal side; macrospores . . . . .

*New Guinea.* .

(181) **S. velutina**, *Ces.*, Fel. Becc. Polin., 9; *S. motiensis*, *Hieron.*, in Engl. & Prantl, Nat. Pfl. Fam., I<sup>4</sup>, 702; *S. aspericaulis*, *A. Br.*, MS. in Herb. Berol.

Shoots erect, 60—90 cm. long, the stem 3-stelical, thinly velutinous, the hairs deciduous, leaving the stem rough by their persistent bases; secondary rachises to 6 mm. broad including the lateral leaves, branched; branchlets

6—7 mm. broad. Leaves of the stem erect, adpressed, lanceolate-oblong, bluntish; leaves of the branches dark-green; of the lower plane lanceolate-oblong, subfalcate, pale-margined on the upper side, entire, oblique at the base, upper base rounded, lower nearly auricled; of the upper plane adpressed, lanceolate, subacute, pellucid-dotted, pale-margined, auricled on the outer side at the base. Spikes  $1\frac{1}{4}$ — $2\frac{1}{2}$  cm. long, acute, square; sporophylla spreading, triangular-ovate, entire, albo-marginate, bluntly acuminate.

*New Guinea, Moti Island.*

(182) **S. Wallichii**, *Spring*, Mon., II, 143; Bk., Fern All., 90; *S. Wallichii*, *Spring*, var. *elegans* & var. *sericea*, Warb., Mons., I, 106; *Lycopodium Wallichii*, *Hk. & Grev.*, Enum. Fil., No. 106; — var. *megalura*; *S. Wallichii*, *Spring*, var. *typica* & var. *macroura*, Warb., l. c.; *S. megalura*, *Hieron.*, in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 702; — var. *Walkeri*, v. A. v. R., Bull. Btz., 1914, XVI, 51.

Shoots suberect, 45—90 cm. long, the lower part simple, the stem 3-stelical, the upper part pinnate; pinnae lanceolate, 10—30 cm. long, the invariably simple pinnulae crowded, erecto-patent, 1—6 cm. long, 3—6 mm. broad including the lateral leaves, the terminal ones sometimes much elongated. Leaves of the stem very remote, more or less isomorphous; leaves of the branches heteromorphous; leaves of the lower plane spreading; of the main rachis remote; of the branchlets crowded, lanceolate-oblong,  $1\frac{3}{4}$ — $3\frac{1}{4}$  mm. long, to 2 mm. broad, subfalcate, spreading, obscurely petiolulate, dark above, pale-glittering beneath, entire, the lower side truncate or slightly cordate at the base, the upper side rotundate-cuneate to slightly cordate; leaves of the upper plane  $\frac{1}{2}$ — $1\frac{1}{4}$  as long, falcate-oblong, mucronate-acuminate, obliquely cordate to rotundate-cuneate at the base, imbricate. Spikes square, terminal, 1 or rarely 2 on a pinnulae, to 6 cm. long, 2— $2\frac{1}{2}$  mm. diam.; sporophylla ovate, mucronate-acuminate, entire, keeled.

Forma typica: Pinnulae 1—3 cm. long; spikes to 1 cm. long; macrospores yellowish-white, verruculose; microspores finely foveolate on the basal side, provided with an equatorial ring consisting of tuberculiform projections. — *Malacca; Br. India, Assam.*

**Var. megalura:** Pinnulae 1—3 cm. long; spikes 1—2 cm. long; macrospores brown, slightly white-glaucous, rugulose to reticulate; microspores finely verruculose, nearly smooth. — *Borneo; Assam.*

**Var. Walkeri:** Pinnulae 3—6 cm. long; spikes 3—6 cm. long; macrospores whitish, densely verruculose; microspores orange, provided with crowded, sessile or short-stalked capitate projections on the basal side. — *Singapore*.

(183) **S. elliptica, v. A. v. R.**, Bull. Bot., 1914, XVI, 51.

Near *S. Wallichii* Spring but: Shoots to 20 cm. long; pinnae 5—7½ cm. long, 1½ cm. broad; pinnulae 1—1½ cm. long, 3—4 mm. broad including the lateral leaves. Lateral leaves more or less unequal-sided, elliptical-oblong, nearly straight, acute or shortly mucronulate-acuminate; of the main rachis remote, horizontal, rounded at the upper base, slightly cordate at the lower base, 2 mm. long, to 1¼ mm. broad; of the pinnulae ascending, contiguous or somewhat remote, acuminate, rather cuneate at the base, to 2 mm. long, to nearly 1 mm. broad, very narrowly pellucid-margined; intermedial leaves erect; of the main rachis remote, oblong, acuminate, cordate at the base, 2 mm. long; of the pinnulae smaller, imbricate, falcate-oblong, long-cuspidate-acuminate, obliquely cuneate at the base, very narrowly pellucid-margined. Spikes 1½ mm. diam.; sporophylla subulate-ovate; macrospores whitish or yellowish, densely verruculose; microspores whitish or pale-orange, provided with crowded, short, subconical, clavate or stipitate-capitate projections.

*Sumatra*.

(184) **S. polystachya, Hieron.**, in Engl. & Prantl, Nat. Pfl.Fam., I, 702; *S. Wallichii*, Spring, var. *polystachya*, Warb., Mons., I, 106.

Near *S. Wallichii* Spring, but the pinnulae broader, to nearly 10 mm. broad; spikes terminal, 3—5 or rarely 2 on a pinnula; macrospores yellowish-white, provided with conical projections of which those placed in the equatorial line are the largest; microspores capitate-verruculose.

*Sumatra*.

(185) **S. Schildei, Hieron.**, in litt.

The description of this species has not yet been received by me.

*Sumatra* (?).

(186) **S. permutata, Hieron.**, Hedwi., L, 24; *S. Lobbii*, Bk., (not Moore), Journ. of Bot., XVIII, 217.

Shoots erect from a short-creeping base, 25—35 cm. long, branched



down quite to the base or the lower part simple or provided with reduced branches, the stem 3-stelical, stramineous, grooved down the face or sides when dry, 2—3 mm. thick, the upper part pinnate or forked and pinnate; pinnae lanceolate in outline, 10—17½ cm. long, to 4 cm. broad; pinnulae approximate or crowded, erecto-patent, simple or once to twice forked; branchlets 4—6 mm. broad including the lateral leaves. Leaves heteromorphous, thin; leaves of the stem erect or erecto-patent; of the lower plane often straight, equal-sided, linear-oblong, blunt or rounded at the apex, entire, more or less narrowly pellucid-margined, unequally 2-auriculate-cordate at the base with the auricles hamate-incurvate, the largest leaves 5—6 mm. long and 2 mm. broad; of the upper plane subparallel, elongate-triangular or lanceolate-oblong, straight or subfalcate, acute or subacuminate, entire, pellucid-margined, 2-auriculate-cordate at the base with the auricles hamate-incurvate, the largest leaves 4—5 mm. long and 1¾—2 mm. broad; leaves of the branches very heteromorphous; leaves of the lower plane somewhat remote and subhorizontal on the secondary rachises, crowded and suberecto-patent on the branchlets; of the secondary rachises subfalcate-oblong, unequal-sided, blunt, entire, distinctly pellucid-margined on the upper side, narrowly so on the lower side, the upper base broadly rounded and auriculate-cordate, the lower base narrowly auriculate-cordate, the largest leaves 4½ mm. long and 2½ mm. broad; of the branchlets similar but smaller, nearly equal-sided, not auriculate at the base, the upper base rounded or rotundate-cuneate, the lower base truncate-subcordate, the largest leaves 3½ mm. long and 1½ mm. broad; leaves of the upper plane erect; of the secondary rachises lanceolate-oblong, subfalcate, the lowest nearly similar to those of the main rachis but smaller, 3 mm. long, pellucid-margined, with the basal auricles hardly hamate-incurvate, the higher still smaller, more acuminate, rotundate-cuneate and whether or not minutely cordate at the base; of the branchlets similar to the higher ones of the secondary rachises, rather long-acuminate. Spikes solitary, square, 1—1½ mm. diam.; sporophylla elongate-ovate, acuminate, entire, narrowly pellucid-margined, slightly keeled, the largest 1¼ mm. long; macrospores white, or black and white-pruinose, densely and more or less deciduously verruculose; microspores whitish or pale-orange, provided with crowded, more or less irregular, free or connected, verruciform or shortly clavate projections on the basal side.

*Sumatra.*

(187) **S. Kittyae**, *v. A. v. R.*, Bull. Bot., 1912, VII, 35; *S. permutata*, Hieron., *forma viridifolia*, v. A. v. R., l. c., 1911, I, 27; — var. *aeneifolia*, v. A. v. R., l. c., 36.

Differs from *S. permutata* Hieron. by the following characters: Shoots 35—55 cm. long, the stem dirty-red, when dry pale-brownish-red; leaves of the stem hardly dimorphous, similar to those of the upper plane of the stem in *S. permutata*; of the lower plane 4—5 mm. long; of the upper plane 3 mm. long; leaves of the upper plane of the branchlets shortly acuminate; sporophylla relatively shorter and broader, more sharply acuminate,  $\frac{3}{4}$ —1 mm. long; macrospores whitish to black-brown, rather densely verruculose to rugulose-verruculose.

Forma typica: Leaves bright-green above, pale-green beneath; spikes green.

**Var. aeneifolia:** Leaves bronze-green above, olivaceous beneath; spikes bronze-green.

*Sumatra.*

(188) **S. Willdenowii**, *Bk.*, Fern All., 93; *S. laevigata*, Spring, Mon., II, 137; *Lycopodium Willdenowii*, Desv., Hk. & Grev., Ic. Fil., tab. LVIII.

Shoots spreading-ascending, deltoid, springing from a branched, divaricate-scandent or intricate-decumbent, 3-stelical, smooth, glossy main stem reaching a length of 3—7 m.; stems smooth, with the lower axillary leaves obovate-orbicular, bluntly rounded, narrowed and narrowly 2-auriculate-cordate at the base; pinnae deltoid, 6—8 on a side, the lowest pinnately compound; lowest pinnulae pinnate, central pinnulae pinnate or dichotomous. Lateral leaves remote on the stem, contiguous on the branchlets, flaccid, dark-green or with a tint of blue, subsending or subspreading, subfalcate, ovate or oblong, 2— $3\frac{1}{4}$  mm. long, bluntish, entire, more or less cordate on both sides, or rounded on the upper side and truncate-cuneate on the lower side, at the base, generally distinctly plicate or auricled on the upper base, not imbricate over the rachis; leaves of the upper plane  $\frac{1}{2}$  as long, oblique-oblong, entire, acute or bluntly acuminate, not cuspidate, those of the principal rachises obliquely cordate, of the ultimate branchlets obliquely adnate, cuneate on the inner side, decurrent on the outer side, at the base. Spikes square,  $\frac{1}{2}$ — $2\frac{1}{2}$  cm. long, 2 mm. diam.; sporophylla broadly cordate or ovate, shortly acuminate, scarcely longer than the sporangia, those of the macrosporangia much the

largest; macrosporangia conspicuously protruded; macrospores yellowish- or brownish-white, coarsely rugose to tuberculate or reticulate; microspores yellowish or pale-brownish, provided with reticulated, membranous wing-like crests.

*Malaya; Cochinchina.*

(189) **S. Engleri**, *Hieron.*, in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 704.

Differs from *S. Willdenowii* Bk. in having the stems and main stem opaque, the axillary leaves elongate, acute, distinctly 2-auriculate-plicate at the base, the leaves of the lower plane acute, those of the upper plane more acutely acuminate, the sporophylla longer, the macrospores verrucose, the microspores densely verruculose on the basal side with the projections capitate, tuberculiform or irregularly angular. — A plant, gathered in Sumatra by Teysmann, probably a form of this species, has the stems and main stem densely punctulato-asperulous.

*Luzon, Sumatra (?)*.

(190) **S. plana**, *Hieron.*, in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 703; *S. canaliculata*, Bk., Fern All., 91, p. p.; *S. caudata*, Spring, Mon., II, 139, p. p.; *S. canaliculata*, Bk., var. *caudata*, Warb., Mons., I, 107; *S. Guichenotii*, *Hieron.*, l. c., 701; *S. caudata*, Spring, var. *Guichenotii*, Spring, l. c., 140; *Lycopodium planum*, Desv., Enc. Bot., III, 158.

Shoots procumbent, ascending from a more or less trailing base, or erect, up to 60—120 cm. long, sometimes springing from a divaricating-scandent main stem, the lower part simple, short or long, to 45 cm. long in the largest forms, the stem 3-stelical, angular, stramineous, woody, the upper part pinnately compound; pinnae ovate, pinnate, with the largest pinnulae once or twice pinnate again; ultimate branchlets to 1—2 cm. long. Leaves firm, bright-green above, paler beneath, heteromorphous; leaves of the stem remote, obliquely cordate-oblong, acuminate; leaves of the branches more close to subimbricate; leaves of the lower plane more or less spreading; of the secondary rachises ovate-oblong, falcate, 2—3¼ mm. long, to ½ as broad, acute or acuminate, entire, the upper side rather pellucid-margined, rotundate-cuneate in the lower part, provided with a spreading or revolute, hyaline, spur- or tooth-like auricle at the very base, the lower base produced, rotundate-truncate to cordate; of the branchlets similar, but the basal auricle not rarely wanting or rudimentary; leaves of the upper plane ½ as long, ovate or obovate, acuminate, entire, pellucid-margined, broadly attached at the base,

the outer base decurrent and varying from cuneate to rotundate-cordate. Spikes square,  $\frac{1}{2}$ —7 cm. long, 1—2 mm. diam.; sporophylla rather crowded, erecto-patent, ovate-acuminate, keeled, pellucid-margined, finely serrulate; macrospores white to brown, more or less distinctly rugulose or reticulate; microspores whitish or yellowish, provided with reticulated, membranous crests. — Very variable. The type has the axillary leaves of the stem large, elongate-obovate, 2-calcarate-auriculate at the base, the leaves of the stem similar to those of the branches but larger and (or) broader, and the leaves of the upper plane conspicuously 2-auriculate-cordate at the base, the outer auricle much produced and hamate-incurvate, the inner auricle often hardly so. — *S. Guichenotii* Hieron. is a sarmentose form only.

*Malaya to Br. India.*

(191) **S. fulvicaulis**, Hieron., Hedwi., L, 29; *S. monospora*, Bk. (not *Spring*), Journ. of Bot., XVIII, 217.

Shoots probably ascending or erect from a short-creeping base and perhaps reaching a length of 50—60 cm., pinnate or forked and pinnate in the upper part, the stem 3-stelical, compressed and fulvous when dry; pinnae pinnate, lanceolate or linear-lanceolate in outline, 10—20 cm. long and 3—6 cm. broad; lower and central pinnae pinnate again, higher simple or forked, the largest to 5 cm. long; ultimate branchlets 3—5 mm. broad including the lateral leaves. Lateral leaves ascending; of the main and secondary rachises more or less conspicuously remote, unequal-sided, oblong, bluntish, acute or shortly acuminate, entire, pellucid-margined, unequally rotundate-cuneate at the base or the lower base rounded, the largest leaves 5 mm. long; of the branchlets similar but less unequal-sided, crowded,  $2\frac{1}{2}$ — $3\frac{1}{2}$  mm. long, to  $1\frac{1}{4}$  mm. broad; inter-medial leaves more or less falcate-oblong, mucronate-acuminate, entire, pellucid-margined, rotundate-cuneate at the base; of the main rachis  $3\frac{1}{2}$  mm. long; of the branchlets to 2 mm. long. Spikes square, 5—8 mm. long,  $1\frac{1}{2}$ — $2\frac{1}{2}$  (after Hieronymus  $3\frac{1}{2}$ —4) mm. diam.; sporophylla sub-isomorphous, ovate, mucronate-acuminate, pellucid-margined, entire, keeled, the largest  $2\frac{1}{2}$  mm. long; macrospores dirty-white or dirty-yellow, irregularly verruculose to rugulose; microspores yellowish-white, provided with sessile, capitate projections on the basal side.

*Sumatra.*

(192) **S. Pouzoliana**, Spring, Mon., II, 142; *S. punctata*, A. Br.,

MS.; *S. canaliculata*, Bk., Fern All., 91, p. p.; *Lycopodium Pouzolzianum*, Gaud., Freyc., Voy. Ur. Phys., Bot., I, 287; — var. *philippinensis*, Hieron., in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 701; — ? var. *brevifolia*, Hieron., Hedwi., LI, 262.

Shoots decumbent, or ascending from a wide-trailing base, reaching a length of 30—120 cm., the stem 3-stelical, when dry angular and sulcate; pinnae often 10—15 cm. long; pinnulae varying from simple to copiously pinnate; ultimate branchlets erecto-patent, to 3½ cm. long, 4—6 mm. broad including the lateral leaves. Leaves entire, heteromorphous; lateral leaves remote on the stem, close on the branchlets; of the stem oblong, acuminate, the upper side rounded, narrowed gradually at the base, the lower side nearly straight, subcordate-rotundate at the base; of the branchlets horizontal or spreading, lanceolate-oblong, 2—3 mm. long, 1½—2 mm. broad, rather abruptly mucronulate-acuminate, narrowly pellucid-margined, the upper side rotundate-cuneate at the base, the lower side more or less truncate-rotundate and somewhat dilated at the base; intermedial leaves erect; of the stem remote, oblong, nearly straight, acuminate, obliquely rotundate-cordate at the base, the auricles more or less rotundate-incurvate; of the branchlets imbricate, subfalcate-ovate, acuminate to cuspidate, pellucid-margined, very obliquely adnate and narrowly cuneate at the base, the produced outer base decurrent or somewhat rounded. Spikes 1—2 mm. diam.; sporophylla ovate, acuminate, entire, pellucid-margined.

Forma typica: Pinnae broadly ovate or triangular-ovate; macrospores brownish, albo-verruculose; microspores more or less prickly. — *Nicobares to the Moluccas, Formosa and South China.*

Forma punctata: Pinnae elongate-oblong or lanceolate. — Cuming's No. 1995 has the macrospores pale-brown, finely verruculose, the microspores yellowish, with densely crowded clavate or stipitate-capitate projections. — Jagor's No. 905 (var. *angustiramosa*, Hieron., MS.), which would be better treated as forma *angustiramosa*, has the macrospores pale-yellow, finely verruculose, the projections punctiform or shortly rugiform, the microspores yellowish-white, with the projections tuberculiform or clavate. — *Mindoro.*

**Var. philippinensis:** Macrospores black, somewhat glaucous, black-verruculose. — *Philippines.*

**Var. brevifolia:** Lateral leaves smaller, oblong, to 2½ mm. long, to 1¼ mm. broad, less abruptly acuminate, rather minutely

papilloso-denticulate on both sides towards the apex. Spikes unknown. — *Borneo*.

(193) ***S. plicata***, *v. A. v. R.*, Bull. Btz., 1914, XVI, 53.

Shoots erect, the upper part pinnate, the stem 3-stelical with a tendency to become 4—5-stelical, grooved when dry; pinnae linear-lanceolate, 15—20 cm. long, 2—4 cm. broad; pinnulae ascending, to 4 cm. long, the largest pinnate with 1—3 branchlets on a side; branchlets to 2 cm. long, 4—5 mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves remote and horizontal on the stem, close to imbricate and ascending on the branchlets; of the stem triangular-oblong, nearly straight, 3—4 mm. long, acute, entire, unequally truncate-cordate at the base, broadest on the upper side, the upper auricle incurved; of the ultimate branchlets falcate-oblong, the largest 3 mm. long,  $\frac{1}{2}$  as broad, subacute, entire, the upper side rather pellucid-margined, subcuneate in the lower part, conspicuously plicate-auriculate at the base, the lower side truncate at the base; intermedial leaves erect, much smaller; of the stem acute, obliquely truncate-cordate at the base; of the branchlets acute or acuminate, nearly longitudinally adnate at the base, the inner side straight, the outer side rounded, pellucid-margined, decurrent-cuneate at the base. Spikes  $1\frac{1}{2}$  mm. diam.; sporophylla triangular-ovate, to  $1\frac{1}{2}$  mm. long, acuminate, entire, pellucid-margined; microspores densely verruculose; macrospores . . . . .

*Borneo*.

(194) ***S. muricata***, *Ces.*, Fel. Becc. Polin., 9; — var. *inermis*, *v. A. v. R.*, Bull. Btz., 1914, XVI, 52; *S. Willdenowii*, *A. Br.*, MS.

Shoots springing from a scandent, 5—8-stelical main stem, pinnately compound, the lower part simple, ochraceous, the stem 3-stelical; pinnae 3—4-pinnate, with ovate or flabellate pinnulae. Leaves of the stem erect, oblong, subobtuse, with the base varying from rotundate-cuneate to narrowly incurvate-2-auriculate; leaves of the branches heteromorphous; of the lower plane rather spreading, oblong, subfalcate, bluntish or subacute, entire, nearly equal-sided, rounded and more or less plicate on the upper side at the base, truncate-cuneate on the lower side at the base; of the upper plane adpressed, lanceolate, oblique, acuminate, the point bluntish, entire, the base more or less rounded on the outer side. Spikes numerous,  $2\frac{1}{2}$ —4 cm. long when fully developed; sporophylla triangular, shortly acuminate. —

Resembles *S. d'Urvillei* A. Br., but the leaves of the upper plane and the sporophylla not pellucid- or pale-margined. The specimens occurring in the Buitenzorg Herbarium have the pinnae dark-brown to blackish at the base.

Forma typica: Stems muricate; macrospores white, yellowish or pale-brown, densely tuberculate-verruculose with roundish or oblong projections; microspores densely tuberculate- or capitate-verruculose. — *New Guinea, Saparua, Ceram.*

**Var. inermis:** Differs from the type only in having the stems smooth. — *New Guinea, Amboyna.*

(195) **S. Schlechteri**, Hieron., in Engl. Bot. Jahrb., L, 41.

Shoots erect, 1—1½ m. long, the lower part simple, the stem subterete, 3-stelical, when dry slightly grooved, pale-stramineous-brown, to 5 mm. or more thick; the upper part branched, ovate, 1 m. long by ¾ m. broad; pinnae ovate, 2-pinnate, the rachis 2 cm. broad including the lateral leaves; branchlets 1—1½ cm. broad, narrowed towards the apex. Leaves heteromorphous, entire; lateral leaves remote on the stem, more approximate on the branchlets; of the stipe unequal-sided, deltoid-ovate, the inner base auricled, the outer base shortly truncate, the largest leaves 8—9 mm. long by 3½—4 mm. broad; of the secondary rachises remote, spreading, lanceolate-oblong, subfalcate, acuminate, the point bluntish, the upper base rounded, subauriculate-plicate, the lower base broadly adnate, with a small free rounded corner, the costa prominent towards the apex in dried material, the largest leaves 1 cm. long by ⅓ cm. broad; of the branchlets smaller, to 9 mm. long; intermedial leaves remote on the stem, imbricate on the branchlets; of the stipe lanceolate-deltoid, 2-auriculate at the base, shortly aristate-acuminate, the arista ⅕ as long as the blade, the largest leaves 1 cm. long by ⅓ cm. broad; of the secondary rachises contiguous, falcate-ovate, narrowed on both sides at the base, the outer base produced, adnate, the costa prominent, the apex cuspidate, the cusp ¼—½ as long as the blade, the largest leaves 9 mm. long by 3 mm. broad; of the branchlets smaller, falcate-lanceolate, the cusp proportionally much longer. Spikes solitary and terminal, 1½—2½ cm. long, 4—5 mm. diam.; sporophylla ovate, acuminate, entire, keeled, the largest 4½ mm. long; macrospores yellow or yellowish, coarsely rugose, the rumples undulate-dentate, free, simple, branched or reticulate; microspores yellow or stramineous, provided with reticulated wing-like crests.

*New Guinea.*

(196) **S. Hindsii**, *Mitron.*, in Engl. Bot. Jahrb., L, 43.

Shoots probably more than 1 mm. long, the upper part decomposed, the main rachis 3-stelical, obtusely quadrangular, slightly laterally compressed, when dry angular and irregularly grooved, ochraceous or yellowish, to 8 mm. thick; pinnae to 50 cm. long, oblong, 3—4-pinnate, the rachis 12 mm. broad including the lateral leaves; ultimate branchlets narrowed towards the apex, 5—7 mm. broad at the base. Leaves of the branched portion heteromorphous, entire; lateral leaves remote on the main and secondary rachises, subapproximate on the branchlets; of the main rachis obliquely deltoid-ovate, unequal-sided, shortly acuminate, obliquely cordate at the base, the lower base produced, the largest leaves 8 mm. long by 3½—4 mm. broad; of the secondary rachises subhorizontal, subobliquely falcate-ovate, the upper base rounded, slightly plicate, the lower base broadly adnate, decurrent, with a small free rotundate-truncate corner, the largest leaves 6 mm. long by 2½ mm. broad; of the branchlets spreading, to 2½ mm. long; intermedial leaves erect; of the main rachis remote, elongate-deltoid, cuspidate-acuminate, obliquely cordate at the base, the outer base produced, the largest leaves 6—8 mm. long by 2½ mm. broad; of the secondary rachises obliquely lanceolate-ovate, subfalcate, long-acuminate, obliquely rounded at the base, the outer base produced; of the branchlets imbricate, subabruptly long-acuminate, unequally rotundate-cuneate at the base, the outer base decurrent, the largest leaves 2 mm. long. Spikes solitary and terminal on the branchlets, ½—1 cm. long, 3—4 mm. diam.; sporophylla ovate, acuminate, entire, slightly keeled, at length spreading; macrospores subcompressed, ochraceous, the basal side provided with tuberculiform or shortly rugiform projections; microspores pale-yellow or pale-ochraceous, provided with reticulate, often interrupted or eroso-denticulate, wing-like crests.

*New Guinea.*

(197) **S. inaequifolia**, *Spring*, Mon., II, 148; Bk., Fern All., 91; *Lycopodium inaequifolium*, *Hk. & Grev.*, Enum. Fil., No. 139.

Shoots much elongated, rooting everywhere, reaching a length of 90—120 cm., branched, the main rachis conspicuously grooved when dry, 3-stelical; pinnae lanceolate-oblong, 15 cm. long, the erecto-patent pinnulae 2½—4 cm. long, pinnate with ascending contiguous branchlets narrowed gradually towards the apex. Leaves heteromorphous; lateral leaves horizontal or spreading, entire; of the main rachis remote, nearly equal-sided,



oblong, 4—5 mm. long, obliquely rotundate-cuneate to rotundate-truncate at the base; of the secondary rachises more approximate, somewhat falcate; of the ultimate branchlets nearly close, somewhat more obliquely cuneate at the base, the largest leaves 2—4 mm. long, subacuminate; intermedial leaves to  $\frac{1}{2}$  as long, entire, erect; of the main rachis remote, triangular-oblong, acute, truncate-subcordate at the base; of the secondary rachises lanceolate-falcate-oblong, acuminate, obliquely rotundate-subcordate at the base; of the branchlets more close, cuspidate, still more oblique at the base. Spikes 6—12 mm. long,  $1\frac{1}{2}$ —2 mm. diam.; sporophylla ovate, acuminate, entire, keeled; macrospores brown or yellowish, with shortly conical projections; microspores yellowish-white or pale-orange, minutely verruculose or provided with crowded, elevated or stipitate-capitate projections.

*Java; Br. India.*

(198) **S. Lobbii**, *Moore*, Bk., Fern All., 90.

Shoots erect or ascending, reaching a length of 90—120 cm., the lower part simple, 5-stelical, stramineous, pubescent with short, thick, spreading, more or less deciduous, fibril-like hairs and provided with scattered, adpressed, uniform leaves, the upper part branched, oblong in outline, the main rachis hairy like the stipe, with approximate or remote, dimorphous leaves; pinnae ascending, regular, linear-lanceolate, to 25 cm. long; pinnulae crowded, numerous, regular, linear, erecto-patent, the largest 4—6 cm. long, simple, or the lower forked. Leaves of the lower plane contiguous, lanceolate-falcate, 3—6 mm. long, the largest  $1\frac{1}{2}$  mm. broad, bluntish, entire, the upper base rounded, not imbricated over the rachis, the lower base broadly adnate, subauriculate; leaves of the upper plane  $\frac{1}{3}$  as long, ovate, acuminate to cuspidate, entire, rotundate-cuneate at the base. Spikes square, 6—25 mm. long, 3 mm. diam.; sporophylla ovate, acuminate, keeled, entire, ascending, 2 mm. long; macrospores brownish or white-glaucous, coarsely verrucose to rugose, the projections often elongated, curved, flexuose or reticulate; microspores whitish, with a high, membranous, ring-like equatorial crest, and free or connected, membranous crests on the basal side. — Specimens occurring in the Buitenzorg Herbarium have the shoots 40—50 cm. long, springing from a sarmentose and probably divaricating-scandent, 5-stelical main stem, articulated at the base.

*Borneo, Sumbawa* (? Colfs No. VIII).

(199) **S. Gaudichaudiana**, *Spring*, Mon., II, 149; *Lycopodium canaliculatum*, *Gaud.*, Freyc., Voy. Ur. Phys., Bot., I, 287.

Shoots ascending from a more or less creeping base, to 60 cm. long, the lower part simple, unequally quadrangular, deeply grooved, 5-stelical, asperous, the upper part branched; pinnae unequal, irregularly spreading, simply pinnate; pinnulae irregularly parallel, 3—3½ mm. broad including the lateral leaves, narrowed towards the apex. Leaves rigid; of the stem regularly arranged, approximate, ovate-acuminate, straight, soon heteromorphous, falcate, erected; of the branches heteromorphous; leaves of the lower plane spreading; of the branchlets close, falcate, ovate-oblong, 2—2½ mm. long, 1—1¼ mm. broad, acuminate, entire, with the upper base rounded, the lower base truncate-rotundate to truncate-cordate; leaves of the upper plane erect; of the branchlets, oblong, ¼—⅓ as long, parallel or incurvate-falcate, acuminate, entire, obliquely rounded at the base, or the outer base rotundate-cordate, the inner base rotundate-cuneate. Spikes . . . . .

*Rawak.*

(200) **S. bidiensis**, *Hieron.*, Hedwi., LI, 265.

Shoots erect from a creeping or ascending base, the lower part simple, obtusely 3-angular, rather subterete, irregularly sulcate when dry, smooth, glossy, dirty-stramineous, to 3 mm. thick, 5—7-stelical, sparingly foliate, the upper part branched, densely foliate; pinnae articulated at the base, copiously pinnate, linear-lanceolate, to 20 cm. long; pinnulae approximate, hardly more than 2½ cm. long, the lower often forked; ultimate branchlets 5 mm. broad including the lateral leaves. Leaves of the branches conspicuously heteromorphous, those of the branchlets rather the largest; of the lower plane falcate-oblong, narrowed at the apex but blunt at the point, somewhat unequal-sided, entire, obsolete pellucid-margined on the upper side by a single row of sclerotic cells, cuneate and revolute-auriculate at the upper base, truncate and rotundate-subauriculate at the lower base, with the midrib thickened gradually towards the upper ⅓, the largest leaves 3½ mm. long and 1½ mm. broad; of the upper plane falcate-ovate, nearly equal-sided, shortly acuminate into an obtuse mucro, entire, finely pellucid-dotted, narrowly pellucid-margined by a single row of sclerotic cells, decurrent with an adnate auricle on the outer side at the base, subtruncate-rotundate at the inner base, the largest leaves 1½ mm. long and ¾ mm. broad.

Plants occurring in the Buitenzorg Herbarium and perhaps belonging

to this species differ from Hieronymus' original diagnosis by the following characters: Stems rather 2-sulcate down the face, 5—8-stelical, the main rachis copiously but not densely foliate; pinnae ascending, to 22 cm. long and 3 cm. broad; pinnulae crowded, to 3½ cm. long, the terminal ones not rarely caudate-elongate; branchlets 4—6 mm. broad, narrowed gradually towards the apex; leaves dark above, pale beneath; leaves of the lower plane more or less plicate or revoluta-auriculate on the upper side at the very base, the midrib thickened above the middle, narrowed gradually to both ends; leaves of the upper plane of the ultimate branchlets falcate-obovate; spikes numerous, single or double, to 20 mm. long, 1½ mm. diam.; sporophylla crowded, broadly ovate, to 1½ mm. long, subacute, entire, hardly keeled; microspores white or yellow, provided with short, straight, flexuose or branched, moderately crowded, membranous crests intermixed with bacilliform or tuberculiform projections. Two of the specimens are destitute of their stipitiform basal portion; they have the pinnae not articulated at the base. A third specimen has single or double shoots springing from an 8-stelical (scandent?) main stem; the double shoots are springing nearly from the same point, with the posterior ones adherent and the anterior or accessory (axillary) ones articulated to the main one, both smaller in all dimensions, the pinnae not articulated at the base, the main rachis provided with a few still smaller accessory shoots articulated at the base and springing from the axils of the pinnae. — Hieronymus thinks these specimens to be different from his species.

*Borneo.*

(201) **S. denuanu**, *v. A. v. R.*, Bull. Botz., 1914, XVI, 55.

Shoots decomposed, the stem 5-stelical, 2 mm. thick, smooth, stramineous, subquadrangular, above sulcate when dry, sparingly foliate, with the axillary leaves roundish-ovate, the lower nearly as broad as long; pinnae lanceolate, the largest 15 cm. long and 5 cm. broad, with the rachis ¾—1 cm. broad including the lateral leaves; pinnulae crowded, the largest lanceolate-oblong, to 5 cm. long and 2½ cm. broad, pinnate with 1—3 suberect, falcate, simple or forked branchlets on a side; ultimate branchlets to 2 cm. long, 4—6 mm. broad, narrowed gradually in the upper part. Leaves heteromorphous, entire; lateral leaves much spaced on the stem, close on the branchlets; of the stem oblique, subfalcate-oblong, 3 mm. long, blunt; of the ultimate branchlets spreading, falcate, bluntish, the upper base rotundate-cuneate, plicate, the lower base

cordate-truncate, the largest leaves 4 mm. long, 1½ mm. broad; inter-medial leaves erect; of the stem remote, ovate-oblong, 2 mm. long, blunt; of the branchlets close, falcate-oblong, bluntly and shortly acuminate, the inner side straight, the outer side rounded, the base obliquely adnate, rather decurrent on the outer side. Spikes terminal, 1½—2 mm. diam.; sporophylla broadly triangular-ovate, subacute or bluntish, entire, hardly keeled; macrospores white, grey or brown, verrucose, the projections roundish or shortly linear, rather low, the apical ribs encircled by 2 rows of much higher projections; microspores whitish or yellowish, densely verrucose, the projections roundish, free or connected. — Accessory shoots articulated at the base and springing from the axils of the pinnae.

*Java.*

(202) **S. padangensis**, *Hieron.*, Hedwi., L, 34.

Shoots ascending from a creeping base, the lower part simple, sparingly foliate, the upper part compound, ovate or obovate, the stem grooved, 5—7-stelical, to 6 mm. thick, puberulous, at length glabrescent and smooth or minutely tuberculato-asperous, stramineous; pinnae often distinctly articulated to the main rachis, branched from the base, the rachis 9 mm. broad including the lateral leaves; lower pinnulae sub-2-pinnate, higher repeatedly dichotomous or simply forked; branches of the lower pinnulae pinnately or dichotomously branched; ultimate branchlets to 6 mm. broad. Lateral leaves of the stem unequal-sided, subfalcate-ovate, subacute, more or less narrowly pellucid-margined on both sides, entire, obliquely cordate at the base, the largest leaves 2½ mm. long, 1½ mm. broad; of the branches obliquely falcate-oblong, subacute or subobtuse, the upper base auricled, rounded, the auricle revolute, diaphanous, the lower base cordate to truncate, the margin bounded by a narrow, decoloured line on both sides, the largest leaves 5 mm. long, 1½ mm. broad near the base, those of the branchlets ⅓—½ as long; intermedial leaves of the stem subfalcate-ovate, subobtuse, entire, narrowly pellucid-margined, the inner base rounded, the outer base subauriculate-cordate, the largest leaves 3 mm. long; of the branches falcate-ovate, equal-sided, the outer base decurrent or adnate-auriculate, the inner base subtruncate-rotundate, the apex short-bluntish, the margin bounded by a narrow, decoloured line, the largest leaves 2½ mm. long, hardly 1 mm. broad at the middle. Spikes square, 5—16 mm. long, 1½ mm. diam., solitary on the branchlets; sporophylla subdeltoid, shortly acutely mucronate, pale-green, keeled, the

largest 1½ mm. long, 1 mm. broad; macrospores verruculose on the basal side; microspores yellowish, verruculose on the basal side, the verrucae subconical.

*Sumatra, Borneo.*

(203) **S. maxima, v. A. v. B.**, Bull. Botz., 1914, XVI, 53.

Shoots of young plants erect from a decumbent base, of adult plants springing from a subterete, probably scandent, main stem 5—6 mm. diam.; main stem sparingly foliate with subisomorphous, ovate, acute, entire leaves; secondary stems articulated at the base, relatively short, 2—2½ mm. thick, 3—5-stelical, with the axillary leaves broadly oblong or suborbicular-rhomboidal; pinnae few, lanceolate, 20—30 cm. long, 6—8 cm. broad; pinnulae simple, close, ascending, the central ones 5—6 cm. long, 10—12 mm. broad including the lateral leaves. Leaves of the pinnae heteromorphous; lateral leaves rather close, lanceolate-falcate, bluntish, entire, narrowly pellucid-margined; of the ultimate branchlets 6—6½ mm. long, 2½—3 mm. broad, rotundate or rotundate-cuneate and slightly plicate at the upper base, rather rotundate-truncate at the lower base; intermedial leaves erect, unequal-sided, ovate, subabruptly long-acuminate-cuspidate, entire, pellucid-margined, obliquely rotundate-cuneate at the base; of the branchlets close or imbricate, 3 mm. long. Spikes solitary, 1½—2½ mm. diam.; sporophylla ovate, acuminate, entire, pellucid-margined, at length spreading, the largest nearly 2 mm. long; macrospores whitish or yellowish, densely verrucose; microspores copiously provided with short or elongated, flexuose, free or irregularly reticulated wing-like crests.

*Borneo.*

(204) **S. d'Urvillei, A. Br.**, in Verh. Zool. Bot. Ges., 1869, 585; Hieron. in Engl. & Prantl, Nat. Pfl.Fam., I<sup>4</sup>, 703; *S. caudata*, Spring, var. *Durvillaei*, Spring, Mon., II, 139; *S. canaliculata*, Bk., var. *d'Urvillei*, Warb., Mons., I, 107; *Lycopodium Durvillaei*, Bory, Voy., I, 245, p. p.

Shoots erect or ascending from a decumbent base, 30 cm. or more long, pinnately compound, the stem 4—5-stelical; pinnulae rather numerous, at least the lower pinnate; ultimate branchlets 4—5 mm. broad including the lateral leaves. Leaves heteromorphous; leaves of the stem remote, rather erect; intermedial leaves lanceolate-oblong, acuminate, 2-auriculate-cordate at the base, the auricles shortly hamate-incurvate; leaves of the branches gradually more close; leaves of the branchlets close or imbricate;

lateral leaves spreading, falcate, acute, entire, to 2 mm. long, the upper base cuneate, not auricled, or if so, the auricle rudimentary, plicate-revolute, the lower base rather truncate; intermedial leaves shorter, erect, obliquely lanceolate-oblong, acuminate, pellucid-margined, the base oblique, cuneate-decurrent or somewhat rounded on the outer side. Spikes 1—2 mm. diam.; sporophylla deltoid-oblong, acuminate, entire, narrowly pellucid-margined; macrospores pale-yellow, pale-yellow-brown or reddish, finely verruculose to shortly rugose-verrucose; microspores yellowish or whitish, densely verruculose to coarsely verrucose. — According to the plants occurring in the Buitenzorg Herbarium, and determined as *S. d'Urvillei*, this species seems to be variable, or the incomplete description available to me fits several different, though related, forms. Horne's No. 549 from Fiji has the lateral leaves blunt or bluntish, those of the stem and branches with a cuneate upper base with a minute, narrowly incurvate-hamate basal auricle, the axillary leaves of the stem and pinnae lanceolate-elongate, broadest in the lower half, the base 2-auriculate-cordate, the inner auricle hamate-incurvate, the outer auricle straight, spur-like; and a form gathered in Amboina has the intermedial leaves of the stem obliquely rounded or subcordate at the base, the auricles hardly produced, not incurved. Some of our specimens have the stems incompletely 4—5-stelical, rather 3-stelical with a tendency to become 4—5-stelical, and the axillary leaves hardly 2-auriculate-cordate at the base.

*Amboina to Polynesia.*

## INDEFINITAE.

Species of an indefinite systematical place, probably belonging to the groups in which they are placed here.

### A<sup>1</sup>. MONOSTELICAE.

#### a<sup>2</sup>. *Radicantes.*

**S. Ridleyi**, *Bl.*, Ann. of Bot., VIII, 131.

Shoots decumbent, intricate, the higher branches distant, short, simple,

decumbent. Leaves of the lower plane close, rhomboid-oblong, spreading, obtuse, copiously ciliated, with the upper base produced, cordate; leaves of the upper plane  $\frac{1}{2}$  as long, ascending, ovate, conspicuously mucronate. Spikes slender, square; sporophylla uniform, ovate, small.

*Malacca.*

**S. pinangensis**, *Spring*, Mon., II, 205; Bk., Fern All., 67.

Shoots trailing, to 45 cm. long, closely pinnate, the main rachis very slender, sulcate on the face; central pinnae pinnate with 3—4 short, contiguous branchlets. Leaves of the lower plane close on both stem and branches, spreading, subdiaphanous, dark-green above, yellow-glittering beneath, ovate-oblong or subrhomboidal, 2—3 $\frac{1}{2}$  mm. long, subobtuse, nearly equal-sided, rounded or subcordate on both sides at the base, dilated and a little imbricated over the rachis on the upper side, with a distinct midrib, ciliated through the lower half on the upper side; leaves of the upper plane oblique-ovate, suborbicular,  $\frac{1}{3}$ — $\frac{1}{2}$  as long, with a cusp nearly as long as the blade, ciliated, white-margined. Spikes square, 2 $\frac{1}{2}$ —7 $\frac{1}{2}$  mm. long, 1 $\frac{1}{4}$  mm. diam.; sporophylla ovate, acute, pale-margined, keeled.

*Penang; Assam.*

a<sup>4</sup>. **Ascendentes.**

**S. barbata**, *Spring*, Mon., II, 240, p. p.; Bk., Fern All., 74; *Lycopodium barbatum*, *Klf.*, Enum., 18.

Shoots suberect, 15 cm. long, copiously pinnate, the stem angled on the face, the close, erecto-patent pinnae copiously compound. Leaves soon heteromorphous; of the lower plane close on the branches, spaced on the stem, ascending, bright-green, moderately firm, ovate, 2 $\frac{1}{2}$  mm. long, acute, nearly equal-sided, subfalcate, serrulate, pale-margined, broadly rounded and ciliated on both sides at the base, imbricated over the rachis; of the upper plane  $\frac{1}{2}$  as long, oblique-ovate, acute or acuminate, pale-margined, serrulate-denticulate, obliquely cordate at the base, the outer base produced, long-ciliated. Spikes square, to 7 $\frac{1}{2}$  mm. long, 2 $\frac{1}{2}$  mm. diam.; sporophylla deltoid, crowded, long-acuminate, serrulate, soon spreading or spuarrose.

*Philippines.*

**S. suberecta**, *Bk.*, Fern All., 74; *S. barbata*, *Spring*, Mon., II, 204, p. p.; *S. caulescens*, *Spring*, p. p. (t. Warb.).

Shoots suberect, 15—25 cm. long, little branched in the lower  $\frac{1}{2}$ , copiously branched upwards with crowded, ascending, very compound branches, the stem rounded on the back, acutely angled on the face. Leaves of the lower plane crowded and much imbricated on the branchlets, nearly contiguous on the stem, ascending, oblique-ovate, 2—3 $\frac{1}{4}$  mm long, acute, bright-green, moderately firm, more produced and ciliate on the upper side, very cordate and much imbricated over the rachis on the upper side at the base; leaves of the upper plane as long, oblique-ovate, cuspidate, much imbricated on the branchlets. Spikes . . . . .

*Malacca; China.*

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a<sup>5</sup>. **Caulescentes.**

**S. Muelleri**, *Bk.*, Fern All., 94.

Shoots erect, 15—20 cm. long, simple in the lower part, decomposed upwards; pinnae crowded, deltoid; final branchlets close, erecto-patent; 1 $\frac{1}{4}$ —2 mm. broad including the lateral leaves. Leaves of the lower plane ascending, rather imbricated on the branchlets, ovate-lanceolate, 1 $\frac{1}{4}$ —2 mm. long, bright-green, moderately firm in texture, rounded on both sides at the base, the midrib central, the margin white, denticulate, not anywhere distinctly ciliated; leaves of the upper plane much imbricated,  $\frac{1}{2}$  as long, oblique-ovate, cuspidate. Spikes short; sporophylla ovate, as long as the leaves of the lower plane, cuspidate. — A fragment of Armit's original plant, occurring in the Buitenzorg Herbarium, has the ultimate branchlets under 1 mm. broad, with the lateral leaves at best  $\frac{3}{4}$  mm. long, minutely denticulate on the upper edge, slightly cordate on the lower side at the base, the leaves of the upper plane acuminate, entire, obliquely adnate at the base, with the outer base narrowly subcordate, the sporophylla denticulate.

*New Guinea.*

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b<sup>1</sup>. *Intertextae*.**S. nummularia**, *Warb.*, *Mons.*, I, 123.

Shoots small, creeping, the stem slender,  $\frac{1}{3}$  mm. thick, yellowish when dry, the branches simple, 1—1½ mm. long. Leaves very remote, those of the lower plane nearly orbicular, spreading, under 1 mm. long, subobtusate at the apex, broadly rotundate-truncate at the base, very minutely and remotely denticulate, those of the upper plane broadly ovate,  $\frac{1}{3}$  mm. long, somewhat oblique, erect, subcuspidate, very minutely denticulate, nearly rounded at the base. Spikes . . . . .

*Luzon.*

**S. calophylla**, *Warb.*, *Mons.*, I, 123.

Near the preceding, but the leaves of the lower plane ovate, acute, shortly hair-pointed or mucronulate, with the upper side sparingly long-ciliated in the lower half, white-margined, the lower side entire or very sparingly and minutely piloso-denticulate, the leaves of the upper plane sparingly long-ciliate, obliquely and broadly rounded at the base.

*Celebes.*

b<sup>2</sup>. *Bisulcatae*.**S. oligostachya**, *Bk.*, *Ann. of Bot.*, VIII, 132.

Shoots trailing, sparingly branched. Leaves firm; of the lower plane spreading, not contiguous, ovate, subacute, not ciliate, produced on the upper side, cordate at the base; of the upper plane ascending, small, ovate, mucronate. Spikes short; sporophyllæ of the upper plane erectopatent, contiguous, linear, obtuse; of the lower plane small, ascending, ovate, densely ciliate.

*Malacca.*

b<sup>3</sup>. *Suberosae*.

**S. reticulata**, *Spring*, *Mon.*, II, 235; *S. proniflora*, *Bk.*, *Fern All.*, 108, p. p.; *Lycopodium reticulatum*, *Hk. & Grev.*, *Enum. Fil.*, No. 185.

Shoots erect, caespitose, to 2½ cm. long, little compound, the stem slender. Leaves very minute, subdimorphous, spaced; of the lower plane ovate-oblong, acute, subentire; of the upper plane ½ as long, ovate-acuminate, spreading. Spikes proportionally very broad, 12 times as broad as the branchlets; sporophylla of the upper plane imbricated, ovate-oblong, acuminate, subentire, keeled, unequal-sided; of the lower plane somewhat smaller, ovate-lanceolate, rigidly ciliated, keeled, subspreading.

*Malaya to Br. India.*

**S. Blumel**, *Spring*, Mon., II, 127.

Shoots erect, the stem firm, slender, quadrangular, convex down the face and back, flattened down the sides; pinnae erecto-patent, suberect, straight; pinnulae flaccid, more or less compound, elongate-triangular in outline. Leaves heteromorphous, rigid; lateral leaves dark-green above, pale-glittering beneath, horizontally spreading on the main rachis, ascending on the branchlets; of the main rachis the largest, linear-oblong, subensiform, 4—5 mm. long, 1½ mm. broad, blunt, the upper side denticulate towards the rounded base, the lower side sparingly denticulate at the truncate-cordate base; of the branchlets smaller, obliquely cuneate at the base which is more rounded on the upper side; leaves of the upper plane much smaller, ⅓ as long, adpressed, ovate, divaricating, straight, aristate-acuminate, minutely denticulate, produced on the outer side at the base. Spikes 5—15 mm. long; sporophylla distinctly heteromorphous.

*Java.*

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b4. **Brachystachyae.**

**S. Wrayi**, *Bk.*, Fern All., 113.

Shoots densely tufted, 15 cm. long, 2-pinnate; branches and branchlets ascending. Leaves moderately firm in texture, bright-green, those of the lower plane oblique-ovate, 4¼ mm. long, more rounded on the upper side at the base, those of the upper plane much smaller, ascending, ovate, aristate. Spikes 4—6 mm. long; sporophylla of the upper plane erecto-patent, rigid, ovate, acute; of the lower plane more ascending, ovate, cuspidate.

*Malacca.*

**S. debilis**, *Spring*, Mon., II, 122; *S. tenera*, *Spring*, l. c., 241, p. p. (t. Warb.); *Lycopodium debile*, *Bory*, Bél., Voy. Bot., II, 8, tab. I, fig. 1.

Shoots to 45 cm. long, the stem thick, quadrangular, stramineous; pinnae unequal, erecto-patent; pinnulae 3—4 times forked from a simple base. Leaves heteromorphous, deep-green above, glaucous beneath, those of the stem remote, of the branches gradually contiguous; leaves of the lower plane horizontal on the stem, ascending on the branches, ovate-oblong,  $4\frac{1}{2}$ — $5\frac{1}{2}$  mm. long,  $3$ — $3\frac{3}{4}$  mm. broad, falcate, subacute, subentire, sparingly denticulate on the upper edge, narrowed at the base; leaves of the upper plane to  $\frac{1}{2}$  as long, adpressed, roundish or obovate, abruptly long-apiculate, ciliolate-denticulate, equally subcordate at the base, straight, rather divaricating, the cusp rather spreading. Spikes . . . . .

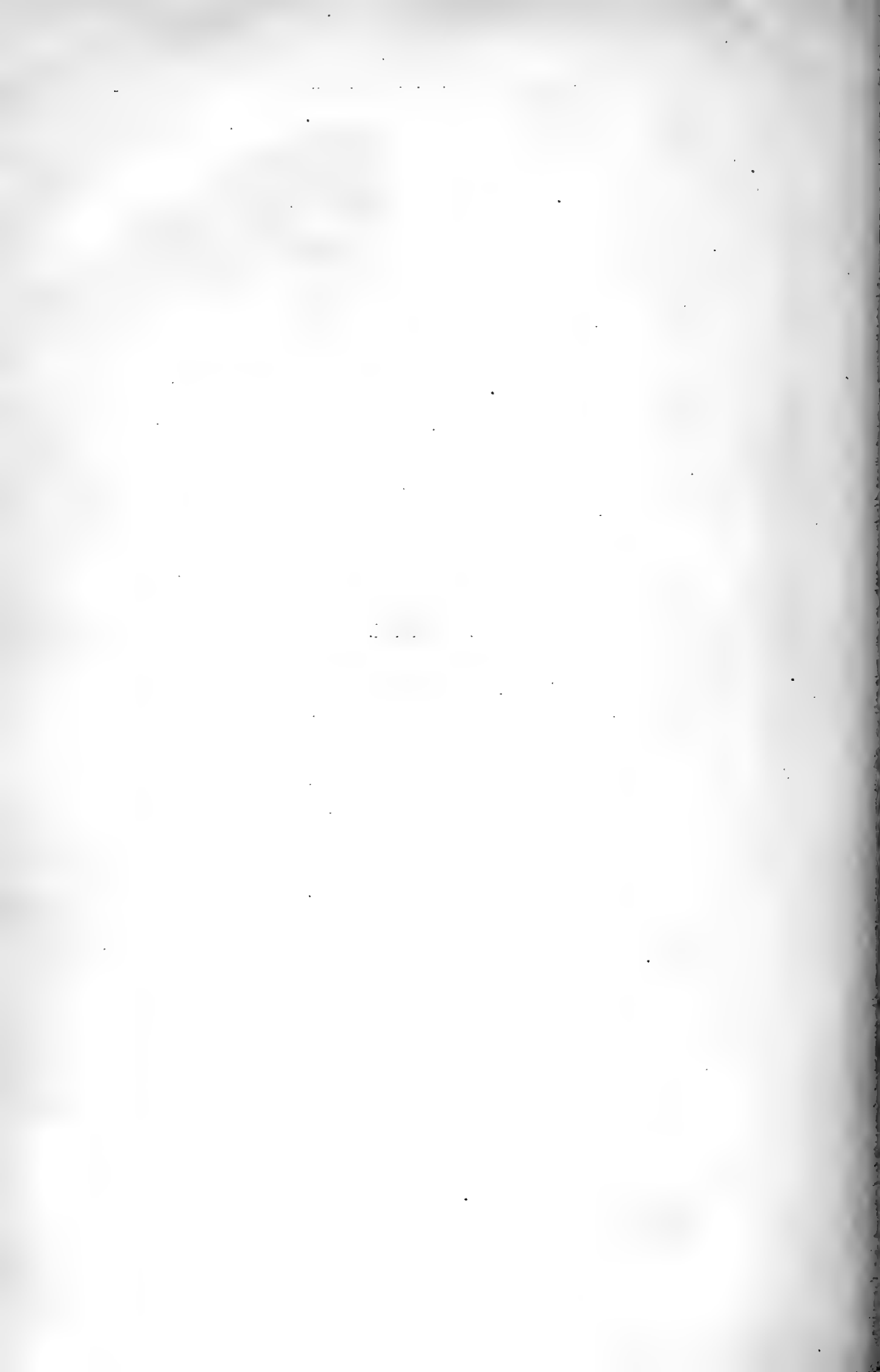
*Java; Peninsular India.*

## A<sup>2</sup>. PLEIOSTELICAE.

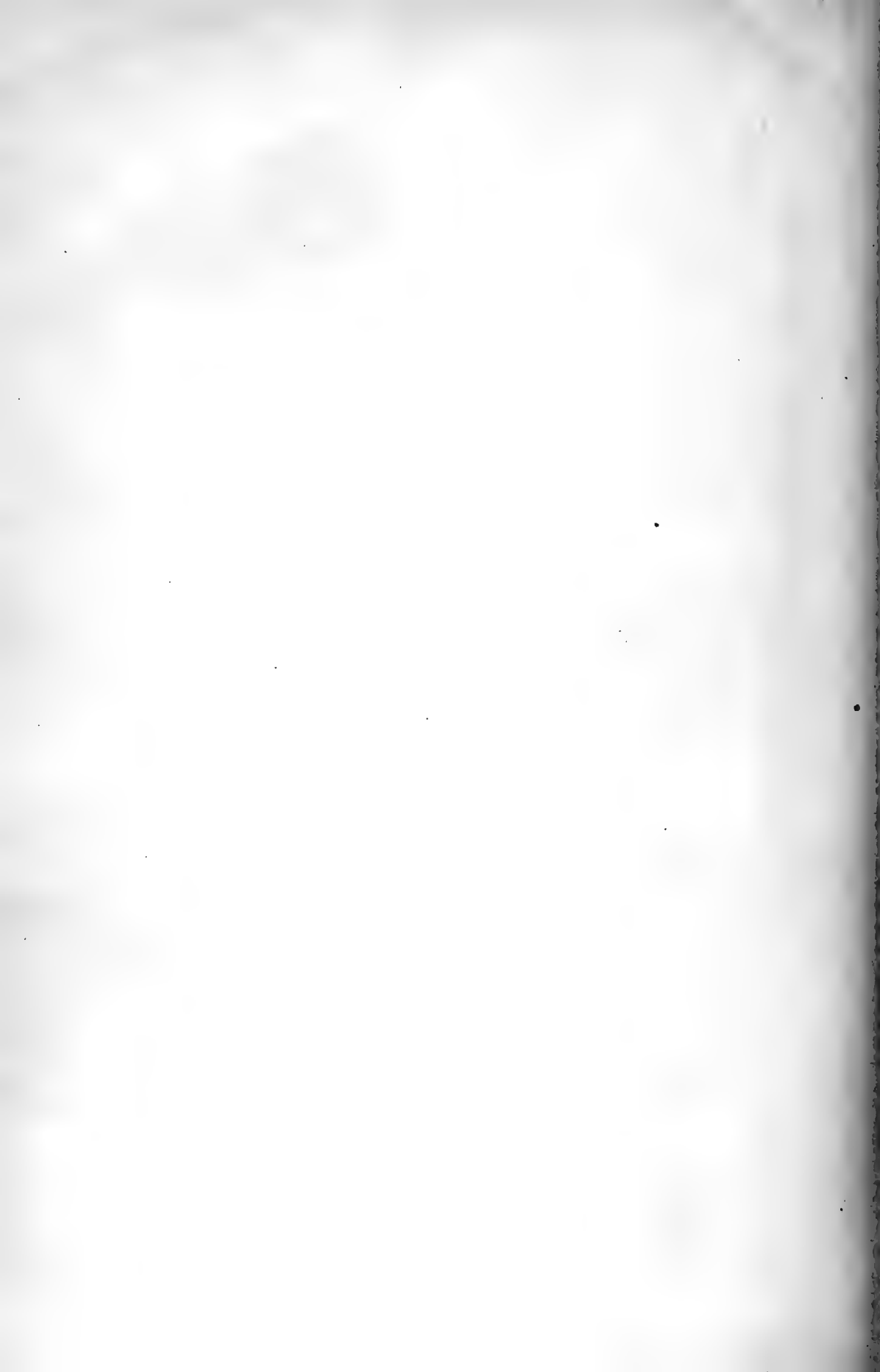
**S. Victoriae**, *Moore*, Bk., Fern All., 90.

Shoots suberect, 90—120 cm. long; branches lanceolate-deltoid, usually 15—25 cm. long, caudate, the upper branchlets erecto-patent and simple, contiguous, the lower forked or slightly pinnate. Leaves of the lower plane crowded, lanceolate-oblong, falcate, acute, 2 mm. long, dark-bright-green, firm in texture, equal-sided, obscurely petiolulate, truncate on both sides at the base, not ciliate, not imbricate over the rachis; leaves of the upper plane  $\frac{1}{4}$  as long, oblique-oblong, shortly cuspidate, much imbricated. Spikes square,  $2\frac{1}{2}$ —5 cm. long,  $2$ — $2\frac{1}{2}$  mm. diam.; sporophylla ovate, cuspidate, acutely keeled.

*Borneo (?), Moluccas (?); Polynesia.*



# APPENDIX.



# APPENDIX.

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This appendix contains modifications and additions, and treats with the new species the diagnoses of which I received too late to insert in the first part of the work.

The numbers within brackets indicate the sequence in the keys of the handbook, but only approximately for the new species (marked *a*, *b*, etc.).

BUITENZORG, January 1915.

v. A. v. R.

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## 103. SELAGINELLA, *Spring.*

### A<sup>1</sup>. MONOSTELICAE.

#### a<sup>2</sup>. *Decumbentes.*

(7) *S. ceratocaulos*, v. A. v. R. —

Omit this species here, the original description being based on an incomplete specimen. — See No. 39*a*.

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#### a<sup>3</sup>. *Radicantes.*

(11) *S. remotifolia*, *Spring.* —

Elmer's No. 14301 differs in having the lateral leaves obsoletely serrulate towards the apex, with the upper side entire at the middle, sparingly serrulate towards the base, the intermedial leaves long-acuminate, the macrospores with the ring-shaped crest indistinct.

Also in *Luzon*.

(15a) **S. Perkinsiae**, *Hieron.*, Leaflet, VI, 2010.

Shoots creeping, 30 cm. or more long, the branching between pinnate and dichotomous, the stem stramineous, compressed, flexuose, when dry copiously sulcate above,  $1\frac{1}{2}$  mm. thick, 10 mm. broad including the lateral leaves; pinnae remote, sparingly 1—2-pinnate or subdichotomous; ultimate branchlets 5 mm. broad. Leaves heteromorphous; lateral leaves dark-green above, paler and subolivaceous beneath; of the stem rather remote, subhorizontal, very unequal-sided, obliquely falcate-oblong, sub-acuminate, very minutely serrulate towards the apex, the upper side entire or subentire at the middle, minutely serrulate and rather pellucid-margined towards the broadly rounded base, the lower side entire in the lower  $\frac{3}{4}$ , provided with 2—6 minute teeth at the narrowly rotundate-truncate base, the largest leaves 5 mm. long by 2 mm. broad; of the ultimate branchlets similar, close or approximate, more narrowed at the base which is rotundate-cuneate on the upper side, to 2 mm. long by  $\frac{1}{2}$  mm. broad; intermedial leaves dark-green, erect; of the stem obliquely ovate-oblong, nearly straight, aristate, keeled, minutely serrulate, narrowly pellucid-margined, the outer base produced, distinctly auriculate-cordate, the inner base shortly rotundate-cordate, the largest leaves 3 mm. long, the cusp  $\frac{1}{3}$  as long as the blade; of the branches growing gradually smaller; of the branchlets rotundate-cuneate on the inner side at the base. Spikes quadrangular, solitary, rarely double, 3—6 mm. long,  $1\frac{1}{2}$  mm. diam.; sporophylla ovate, shortly aristate-acuminate, minutely serrulate, keeled, pellucid-margined, to 2 mm. long; macrospores white or yellowish-white, shortly rugulose to reticulate; microspores cream-yellow, provided with stipitate-capitate projections on the basal side.

*Mindanao.*

(15b) **S. negrosensis**, *Hieron.*, Leaflet, VI, 2007.

Shoots creeping, 15 cm. or more long, probably dichotomous in the lower part, otherwise pinnate, the stem somewhat compressed, stramineous, grooved when dry, 1 mm. thick, 7 mm. broad including the lateral leaves; pinnae remote, spreading, to 3 cm. long, sparingly pinnate or dichotomous; ultimate branchlets to 4 mm. broad. Leaves heteromorphous; lateral leaves subhorizontal or spreading; of the main rachis approximate, obliquely falcate-ovate or falcate-oblong, unequal-sided, bluntish, acute or shortly acuminate, black-green above, pale-olivaceous-green beneath, very minutely serrulate towards the apex, the upper side whether or not entire at the



middle, minutely serrulate and narrowly pellucid-margined in the lower part, rather broadly rounded at the base, the lower side entire in the lower part, rotundate-cuneate or narrowly truncate-rotundate at the base, the largest leaves  $3\frac{1}{2}$  mm. long by  $1\frac{1}{4}$  mm. broad; of branchlets similar but more narrowed at the base, to 2 mm. long by  $\frac{1}{2}$  as broad; inter-medial leaves erect, black-green, obliquely ovate, nearly straight, aristate-acuminate, minutely serrulate, narrowly pellucid-margined, the outer base produced, auricled, the auricle rounded, the inner base rotundate, the largest leaves  $2\frac{1}{4}$  mm. long, the cusp about  $\frac{1}{4}$ — $\frac{1}{3}$  as long as the blade. Spikes solitary or double, terminal, or apparently lateral (on rudimentary branchlets), 5—15 mm. long,  $1\frac{1}{2}$ —2 mm. diam.; sporophylla deltoid-ovate, shortly acuminate, keeled, minutely serrulate, subpellucid-margined, the largest  $1\frac{3}{4}$  mm. long; macrospores whitish, stramineous-white or black, with minute, rugiform, flexuose or branched ridges, the apical ribs encircled by a slightly elevated ring-shaped crest; microspores yellowish-white or cream-yellow, provided with bacilliform or stipitate-capitate projections.

*Negros.*

(20a) See No. 11.

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a<sup>4</sup>. *Ascendentes.*

(27a) **S. alligans**, *Hieron.*, Leaflet, VI, 2012.

Shoots springing from a high-scandent main shoot, 3—4-pinnate, the stem compressed, pale-ochraceous or ochraceous-green,  $1\frac{1}{2}$  mm. thick, often slightly grooved when dry; pinnae ascending, remote, the rachis 7—10 mm. broad including the lateral leaves; ultimate branchlets 4—5 mm. broad. Leaves heteromorphous; lateral leaves spreading; of the stem remote, oblique-ovate, obtuse, very minutely serrulate on both sides, the upper side gradually ciliolate at the rounded base, the lower side often ciliolate at the narrowly rounded base, the largest leaves  $4\frac{1}{2}$  mm. long,  $2\frac{1}{2}$ — $2\frac{3}{4}$  mm. broad; of the branches nearly similar, approximate to imbricate, often provided with interrupted spurious veinlets, the upper side pellucid-margined, ciliate at the base, the lower side entire except towards the obscurely serrulate apex, ciliate at the base, the ciliae continued upon the rachises; of the principal rachises 5 mm. long by 2

mm. broad; of the ultimate branchlets to  $2\frac{1}{2}$  mm. long; intermedial leaves erect; of the stem remote, oblong, blunt, the apex rounded or very shortly mucronulate, the sides very minutely serrulate, the outer base broadly auricled, the auricle rounded, slightly incurved, ciliolate, the inner base rotundate-cuneate, sparingly ciliolate, the largest leaves 5 mm. long; of the branches imbricate, obliquely falcate-ovate, long-cuspidate-acuminate, minutely serrulate, the outer base auriculate-cordate, ciliate, the inner base rotundate-subcordate, sparingly ciliate; of the principal rachises  $3\frac{3}{4}$  mm. long, with the cusp about  $\frac{1}{3}$ — $\frac{1}{2}$  as long as the blade; of the ultimate branchlets smaller. Spikes quadrangular, solitary or double, 1—6 cm. long, to 4 mm. diam.; sporophylla deltoid-ovate, acuminate, minutely serrulate, pellucid-margined, to  $2\frac{3}{4}$  mm. long; macrospores somewhat compressed, ivory-white or cream-yellow to fuscous, the basal side provided with often branched rumples, the apical ribs encircled by an ring-shaped wing; microspores yellow, the basal side provided with stipitate-capitate projections.

*Luzon, Mindanao.*

(29) **S. Quadrasii**, *Hieron.* —

Duplicates of Elmer's No. 13407, occurring in the Buitenzorg Herbarium, have the main rachis 13—14 mm. broad including the lateral leaves, the ultimate branchlets 5—8 mm. broad, the lateral leaves more distinctly serrulate towards the apex, the intermedial leaves with the cusp to  $\frac{1}{2}$  as long as the blade, the sporophylla more copiously serrulate throughout, the macrospores white to pale-yellow-brown, with the apical ribs encircled by a more or less distinct ring-shaped crest, the microspores more copiously provided with sessile or stalked capitate projections.

(39a) **S. ceratocaulos**, *v. A. v. R.*, *Bull. Botz.*, 1914, XVI, 41.

Shoots erect, or ascending from a short-creeping base, to 20 cm. long, the lower part simple or forked, reddish when dry, 1 mm. thick, terete or obtusely angular, the upper part pinnately compound, the main rachis  $3\frac{1}{2}$ —5 mm. broad including the lateral leaves; pinnae remote, ascending, pinnate, or the lower 2-pinnate at the base, the largest to 10 cm. long; ultimate branchlets to  $1\frac{1}{2}$  cm. long, the largest  $2\frac{1}{2}$ — $3\frac{1}{2}$  mm. broad. Leaves heteromorphous, the lower reddish when dry; lateral leaves nearly equal-sided, oblong, hardly falcate, shortly acuminate, minutely denticulate and more or less narrowly pellucid-margined on both sides, obliquely rotundate

or rotundate-cuneate at the base; of the main rachis 2—2<sup>3</sup>/<sub>4</sub> mm. long, to 1<sup>1</sup>/<sub>2</sub> mm. broad, somewhat remote, more or less deciduously ciliate or ciliolate at the base; of the branchlets to 2 mm. long and <sup>1</sup>/<sub>2</sub> as broad, more ascending, subcontiguous to imbricate, not or sparingly ciliate at the base; intermedial leaves erect, oblong, acuminate, minutely denticulate and more or less narrowly pellucid-margined on both sides, the inner base more or less cuneate or rotundate-cuneate, the outer base producto-rotundate or cordate and provided with 0—3 short ciliae; of the main rachis somewhat remote, 1<sup>1</sup>/<sub>2</sub> mm. long; of the branchlets imbricate, shorter. Spikes terminal, solitary, square, 1—2 mm. diam.; sporophylla triangular-ovate, acute or acuminate, keeled, minutely denticulate and pellucid-margined, at length spreading, the largest 1<sup>1</sup>/<sub>2</sub> mm. long; macrospores numerous, white, smooth; microspores . . . . .

Forma typica: Leaves less conspicuously pellucid-margined, the largest lateral ones less distinctly ciliolate at the base, less broadly rounded on the upper base. — *Java*.

Forma *madurensis*: Leaves distinctly pellucid-margined, the largest lateral ones more distinctly ciliolate or ciliate at the base, more broadly rounded on the upper base. — *Madoera Island*.

(52) **S. magnifica**, *Warb.* —

Duplicates of Elmer's Nos. 11276 and 13364, determined by Hieronymus, occurring in the Buitenzorg Herbarium, have all the lateral leaves of the main rachis contiguous and only those of the lower part of the stipe somewhat remote.

(59a) See No. 29.

(71a) **S. argusanensis**, *Hieron.*, Leaf., VI, 1998.

Shoots about 60 cm. long, simple in the lower part, 3—4-pinnate and broadly ovate in the upper part, the stem pale-ochraceous-brown, somewhat glossy, the stipe obtusely quadrangular, somewhat compressed, to 4 mm. thick; main rachis 12<sup>1</sup>/<sub>2</sub> mm. broad including the lateral leaves; pinnae to 30 cm. long and 10 cm. broad; pinnulae crowded, ascending; branchlets 2<sup>1</sup>/<sub>4</sub>—5 mm. broad. Lateral leaves remote on the stem, close on the branches; of the stipe subdeltoid, broadly adnate, subfalcate, shortly mucronate-acuminate, the upper side minutely serrulate, broadly rotundate at the base, the lower side entire or subentire, narrowly

rotundate-truncate at the base, the largest leaves  $4\frac{1}{2}$  mm. long by 3 mm. broad; of the branched portion subspreading, more ovate-deltoid, the upper base rotundate-subcordate, the lower side subentire or indistinctly denticulate, rotundate-truncate at the base; of the main rachis 5 mm. long by 4 mm. broad; of the ultimate branchlets to  $2\frac{1}{4}$ —3 mm. long and about  $\frac{1}{2}$  as broad, less broadly rounded or rotundate-cuneate at the upper base, moderately spuriously veined; intermedial leaves subdeltoid or ovate; of the stipe subaristate-acuminate, minutely serrulate, broadly and obliquely rotundate-cuneate at the base, the outer base slightly auricled, the largest leaves 5 mm. long by 3 mm. broad; of the branched portion subaristate-acuminate, the inner side minutely serrulate, rotundate-cuneate at the base, the outer side serrulate towards the apex, less so in the lower part, narrowly rotundate-auriculate at the base; of the main rachis 5 mm. long by  $2\frac{1}{2}$  mm. broad; of the branches growing gradually smaller. Spikes quadrangular,  $\frac{1}{2}$ —3 cm. long, 2 mm. or more diam.; sporophylla deltoid-ovate, at length spreading, indistinctly pellucid-margined, minutely serrulate, to 3 mm. long; macrospores ivory-white, rugulose, the rumples flexuose or branched, hardly reticulate, the apical ribs encircled by a crest-like ring; microspores whitish-ochraceous or cream-yellow, provided with conical projections on the basal side.

*Mindanao.*

(73a) See No. 71a.

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a<sup>b</sup>. ***Caulescentes.***

(94) ***S. cupressina*, Spring;** — var. *aristulata*, Hieron., Leafl., VI, 1994.

**Var. *aristulata*:** Intermedial leaves with the cusp  $\frac{1}{3}$ — $\frac{1}{2}$  as long as the blade; shoots 15—20 cm. long, the stipe 7—10 cm. long, the branched portion broadly ovate. — *Leyte Island.*

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b<sup>1</sup>. ***Intertextae.***

(113a) ***S. cuernosensis*, Hieron.,** Leafl., VI, 2027.

Shoots creeping, to 10 cm. long, dichotomous in the lower part,

pinnate or subpinnate in the upper part, the stem filiform, 4—4½ mm. broad including the lateral leaves; ultimate branchlets short, 3 mm. broad. Leaves heteromorphous; lateral leaves distinctly, though not very, remote; of the main stem horizontal, unequal-sided, roundish or broad-oblong, bluntish, subentire or sparingly and very minutely serrulate towards the apex, the upper side very minutely serrulate in the lower half, rounded or broadly rotundate-cuneate at the base, the lower side subentire towards the rotundate-cordate base, the largest leaves 2 mm. long by 1¾ mm. broad; of the branchlets smaller, ovate, relatively narrower, somewhat more distinctly serrulate on the upper side, narrower at the base; intermedial leaves erect, more or less remote, ovate, long-subcuspidate-acuminate, more or less sparingly and minutely serrulate, obliquely rounded or rotundate-cuneate at the base, the largest leaves 1 mm. long. Spikes solitary, 1—1¼ cm. long, 2—2½ mm. broad; sporophylla of the upper plane spreading, unequal-sided, subsemiovate, acute or shortly acuminate, rather sparingly and minutely serrulate, keeled, the largest 1½ mm. long; of the lower plane suberect, triangular-ovate, long-acuminate, sparingly and minutely serrulate; macrospores cream-yellow or yellowish-white, densely and minutely punctulate-verruculose; microspores . . . . .

*Negros.*

(120a) **S. apoensis**, *Hieron.*, Leaflet, VI, 2023.

Shoots creeping and repeatedly dichotomous in the lower part, subascending and sparingly pinnate in the upper part, the stem very slender, under ½ mm. thick, compresso-subterete; ultimate branchlets 2—2¾ mm. broad including the lateral leaves. Leaves heteromorphous; lateral leaves of the lower part of the stem remote, ascending, to 1 mm. long by ¾ mm. broad, oblique-oblong, shortly mucronulate, the upper side long-ciliate, minutely serrulate at the apex, slightly pellucid-margined in the lower part, rounded or rotundate-cuneate at the base, the lower side minutely serrulate, sparingly ciliolate at the rotundate-cuneate and broadly adnate base; of the branches larger, to 2 mm. long by 1 mm. broad, approximate or somewhat remote, obliquely rotundate-truncate at the base, the lower side less serrulate; intermedial leaves small, ovate, unequally (obliquely) cuneate or rotundate-cuneate at the base, sparingly ciliate, cuspidate-acuminate, the cusp hair-pointed. Spikes solitary on the branchlets, ½—2 cm. long, 1½ mm. broad; sporophylla of the upper plane ovate, to 1¾ mm. long, acute, rostrate, minutely serrulate at the apex, long-ciliate,

keeled, the keel minutely serrulate; of the lower plane deltoid-ovate, minutely serrulate towards the apex, sparingly ciliate; macrospores yellow, densely provided with very minute papilliform projections; microspores minium-red or orange, smooth.

*Mindanao.*

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b<sup>2</sup>. ***Bisulcatae.***

(137a) **S. Mearnsii**, *Hieron.*, Leaflet, VI, 2018.

Shoots creeping, dichotomous in the lower part, the secondary shoots 3-pinnate or sub-4-pinnate, the main rachises subquadrangular, compressed, grooved when dry, stramineous or subochraceous, hardly more than 1½ mm. thick, 7—10 mm. broad including the lateral leaves; pinnae remote, to 5 cm. long; pinnulae to 5 on a side, less remote, forked or sparingly pinnate to sub-2-pinnate; ultimate branchlets short, 4—5 mm. broad. Leaves heteromorphous; lateral leaves remote on the stem, approximate or subcontiguous on the branchlets; of the stem horizontal, obliquely suboblong-ovate, shortly mucronulate, the upper side sparingly serrulate, rather broadly rounded at the base, the lower side entire, narrowly rotundate-truncate at the base, the largest leaves 3½—5 mm. long by about ½ as broad; of the ultimate branchlets subhorizontal, very sparingly serrulate on the upper side, unequally rotundate-cuneate at the base, to 2½ mm. long; intermedial leaves erect, obovate-oblong, abruptly cuspidate, moderately ciliate, unequally rotundate-cuneate at the base or the inner base more rounded; of the stem 3½—4 mm. long, with the cusp ¼—½ as long as the blade; of the branchlets smaller, imbricate. Spikes short, about 5—7 mm. long, 3 mm. broad; sporophylla of the upper plane spreading, oblique-ovate-lanceolate, shortly mucronate-acuminate, remotely and shortly ciliate, gradually serrulate towards the apex, to 3 mm. long; of the lower plane suberect, deltoid-ovate, acuminate, shortly ciliate, gradually serrulate towards the apex, hardly keeled, the lower much the largest; macrospores white or yellow to castaneous, very minutely punctulate, soon smooth; microspores pale dirty-ochraceous, densely but very minutely verruculose.

*Luzon.*

(137b) **S. pervaga**, *Hieron.*, Leaflet, VI, 2021.

Shoots wide-creeping, 3-pinnate, probably dichotomous in the lower part, the stem quadrangular, reddish, stramineous-brown when dry, to 2 mm. thick, 12—13 mm. broad including the lateral leaves; pinnae remote, to about 12½ cm. long, the rachis 10—12 mm. broad; pinnulae few, partly pinnate, partly repeatedly forked; ultimate branchlets 5—6 mm. broad. Leaves heteromorphous; lateral leaves of the stem horizontal or nearly so, the lower remote, the higher more approximate, hardly falcate-oblong, shortly mucronulate, minutely serrulate towards the apex, the upper side subappresso-serrulate-ciliolate, rather broadly rounded at the base, the lower side entire, narrowly rotundate-truncate at the base, the largest leaves 7 mm. long by 2¾ mm. broad; of the branchlets more ascending, subsimilar, crowded, the upper side rotundate-cuneate at the base; intermedial leaves erect; of the stem remote, deltoid-oblong, subacute, long-cuspidate, ciliolate, the outer base shortly rotundate-auriculate, the inner base narrowly rounded, the largest leaves 4—4½ mm. long, the cusp about ½ as long as the blade; of the branchlets imbricate, smaller, obovate, very abruptly cuspidate, the cusp longer, the base obliquely cuneate. Spikes 4—9 mm. long, 4 mm. broad; sporophylla of the upper plane oblique, oblong, to 4 mm. long, shortly mucronulate-acuminate, minutely serrulate towards the apex, for the rest shortly appresso-ciliolate, keeled, the keel serrulate; of the lower plane less oblique, deltoid-ovate, unequal-sided, shortly cuspidate-mucronate, ciliolate, the lower much the largest; macrospores when young ivory-white or cream-yellow, when ripe yellow-brown or castaneous, minutely punctulate with deciduous, hyaline, papilliform projections; microspores ochraceous, densely but very minutely verruculose.

*Negros.*

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b<sup>3</sup>. **Suberosae.**

(140a) See No. 162a.

(144a) **S. Vidalii**, *Hieron.*, Leaflet, VI, 2032.

Shoots ascending or erect, subtufted, to 6 cm. long, 1—3 cm. broad, 2-pinnate from the base, the stem to ¾ mm. thick, 2½ mm. broad

including the lateral leaves; ultimate branchlets  $1\frac{3}{4}$  mm. broad. Leaves heteromorphous; lateral leaves rather remote on the stem, contiguous on the branchlets; of the stem spreading or more ascending, ovate-oblong, blunt or bluntish, the upper side minutely serrulate towards the apex, gradually shortly spinuloso-ciliate towards the rotundate-cuneate base, the lower side obscurely serrulate towards the apex, entire towards the gradually narrowed base, the largest leaves 2 mm. long by 1 mm. broad; of the branchlets smaller, suberect; intermedial leaves erect, subfalcate-ovate, shortly mucronate-acuminate, very minutely serrulate, the inner side narrowly pellucid-margined, the base adnate, obliquely rotundate-cuneate, or narrowly rotundate-truncate on the outer side; of the stem the largest, 1 mm. long. Spikes solitary, 3—6 mm. long,  $1\frac{3}{4}$  mm broad; sporophylla of the upper plane spreading, elongate-oblong, bluntish, to  $1\frac{1}{4}$  mm. long, keeled, the upper side narrowly pellucid-margined, sparingly and minutely serrulate towards the apex, ciliolate towards the base, the keel minutely serrulate; of the lower plane ascending, triangular-ovate, long-acute, spinuloso-ciliolate, slightly keeled; macrospores bright-yellow or yellow-white, or ochraceous-white, smooth, opaque; microspores minium-red or ferrugineous, smooth.

*Mindanao.*

(145) **S. philippina**, *Spring*; — var. *longiciliata*, Hieron., Leaf., VI, 2032.

**Var. longiciliata:** Lateral leaves longer acuminate; sporophylla of the lower plane longer ciliated. — *Luzon.*

(145a) See No. 149b.

(149a) **S. Moseleyi**, *Hieron.*, Leaf., VI, 2034.

Shoots erect, or ascending from a short-creeping base, 8—10 cm. long, 3-pinnate from the base, the stem compresso-terete, stramineous, grooved when dry,  $\frac{1}{2}$ — $\frac{3}{4}$  mm. thick,  $2\frac{1}{2}$  mm. broad including the lateral leaves; pinnae to 3 cm. long, the rachis  $1\frac{1}{2}$ —2 mm. broad; ultimate branchlets very short, to 1 mm. broad. Leaves heteromorphous; lateral leaves oblique, remote; of the stem oblique-ovate or ovate-oblong, acute or subacuminate, pellucid-margined, the upper side minutely serrulate towards the apex, otherwise remotely ciliate, rotundate at the base, the lower side entire or subentire, obsoletely denticulate towards the apex,



rotundate-cuneate at the base, the largest leaves 2 mm. long by  $\frac{3}{4}$ —1 mm. broad; of the branchlets similar but more ascending, smaller, more narrowed at the base; intermedial leaves erect, oblique-ovate, acutely subcuspidate-acuminate, narrowly pellucid-margined and more or less sparingly serrulate on both sides, the outer base narrowly rounded, the inner base rotundate-cuneate; of the stem the largest,  $1\frac{1}{4}$  mm. long. Spikes solitary, terminal, or apparently lateral (on rudimentary branchlets), 4—7 mm. long,  $1\frac{1}{2}$  mm. broad; sporophylla of the upper plane oblique-ovate, to  $1\frac{1}{4}$  mm. long, acute, keeled, the upper side rather pellucid-margined, remotely ciliolate; of the lower plane suberect, deltoid-ovate, acuminate, remotely ciliate; macrospores ivory-white or yellowish-white, opaque, very minutely granulate; microspores red or saffrony, smooth.

*Negros.*

(149b) **S. Llanosii** (*Llanoiis*), *Hieron.*, Leaf., VI, 2039.

Shoots erect, or ascending from a short-creeping base, 5—15 cm. long,  $1\frac{1}{2}$ — $3\frac{1}{2}$  cm. broad, the lower part simple (stipitiform) or sparingly branched, the upper part 2-pinnate, the stem subcompresso-terete,  $1\frac{1}{2}$  mm. thick, stramineous-green or pale-yellow-brown, when dry more or less distinctly grooved down the upper side,  $2\frac{1}{2}$  mm. broad including the lateral leaves; pinnae sparingly pinnate; ultimate branchlets  $1\frac{1}{2}$  mm. broad. Leaves heteromorphous; lateral leaves remote on the stem, contiguous or approximate on the branchlets; of the stem subspreading, oblong, nearly equal-sided, subacuminate, the upper side minutely serrulate towards the apex, otherwise deciduously ciliate, broadly rounded at the base, the lower side entire or very minutely or indistinctly serrulate, provided with 0—2 very short ciliae at the rotundate-cuneate base, the largest leaves  $1\frac{1}{2}$  mm. long by about  $\frac{1}{2}$  as broad; of the branchlets more oblique, smaller, nearly equally rotundate-cuneate on both sides at the base; intermedial leaves erect; of the stem rather remote, ovate, acuminate, very minutely or indistinctly serrulate towards the apex, the outer side minutely serrulate, provided with 0—2 very short ciliae at the produced, narrowly rotundate-truncate and subauriculate base, the inner side remotely deciduously ciliate, rotundate-cuneate at the base, the largest leaves  $1\frac{1}{2}$  mm. long; of the branchlets imbricate, smaller, sparingly ciliate and serrulate, obliquely subrotundate-cuneate at the base. Spikes solitary, 3—7 mm. long, 1 mm. broad; sporophylla of the upper plane oblique, obliquely and shortly deltoid-oblong, acute, keeled, to 1 mm. long, the upper

side sparingly ciliate in the lower part, remotely serrulate in the upper part; of the lower plane ascending, broadly deltoid-ovate, acuminate, ciliate, somewhat keeled; microspores minium-red or subferruginous, smooth; macrospores . . . . .

*Sibuyan Island.*

(150a) **S. Hombronii**, *Hieron.*, Leaflet, VI, 2037.

Shoots ascending or suberect from a short-creeping base, to 10—15 cm. long, 2½—4½ cm. broad, the lower part sparingly branched, the upper part 3-pinnate, the stem compressed, convex beneath, when dry copiously grooved above, stramineous or stramineous-green, ¾—1 mm. thick, 3½ mm. broad including the lateral leaves; ultimate branchlets 2—2½ mm. broad. Leaves heteromorphous; lateral leaves remote, much ascending; of the stem obliquely ovate-oblong, bluntish or subacute, unequal-sided, the upper side remotely and minutely serrulate, very sparingly ciliate towards the rotundate-cuneate base, narrowly pellucid-margined, the lower side entire or subentire, or very minutely serrulate towards the apex, narrow at the base, the largest leaves 2½ mm. long by 1 mm. broad; of the branchlets similar but smaller, more narrowed at the base; intermedial leaves erect, oblique-ovate, acute or acuminate, remotely and minutely serrulate, very narrowly pellucid-margined, the outer base cuneately produced, the inner base rounded or rotundate-cuneate; of the main stem the largest, 1¾ mm. long. Spikes 4—7 mm. long, 2—3 mm. broad; sporophylla of the upper plane much spreading, elongate-lanceolate-oblong, to 2½ mm. long, acute or acuminate, keeled, the upper side remotely ciliate, sparingly serrulate at the apex, the keel sparingly serrulate; of the lower plane suberect, deltoid-ovate, acute, remotely ciliate, sparingly serrulate at the apex, slightly keeled; macrospores ochraceous-white or yellow, smooth; microspores red or subferruginous, smooth.

*Luzon.*

(159a) **S. Eschscholzii**, *Hieron.*, Leaflet, VI, 2041.

Shoots flaccid, erect from a short-creeping base, 15—30 cm. long, 2—4 cm. broad, the lower part simple or sparingly branched, the upper part 2-pinnate, or rarely forked with 2-pinnate fork-branches, the stem 1 mm. thick, compresso-terete, when dry often grooved above, stramineous, 3½—4½ mm. broad including the lateral leaves; pinnae ascending, pinnate

with 1—3 branchlets on a side; ultimate branchlets  $2\frac{1}{2}$  mm. broad. Leaves heteromorphous; lateral leaves remote on the stem, less so on the branches, whether or not contiguous on the branchlets; of the stem oblique-ovate, horizontal or spreading, bluntish, unequal-sided, the upper side pellucid-margined, minutely serrulate, broadly rounded or subcordate at the base, the lower side subentire, or obsoletely serrulate-denticulate towards the apex, truncate-rotundate at the base, the largest leaves  $2\frac{1}{2}$  mm. long,  $1\frac{1}{2}$  mm. broad; of the branchlets more oblique, smaller, nearly equal-sided, rotundate-cuneate at the base; intermedial leaves erect; of the stem ovate, more or less sparingly serrulate, narrowly pellucid-margined towards the shortly cuspidate-acuminate apex, the cusp  $\frac{1}{4}$ — $\frac{1}{3}$  as long as the blade, the base obliquely rounded or subcordate, the largest leaves  $1\frac{1}{2}$  mm. long; of the branchlets smaller, with the cusp proportionally longer. Spikes solitary, short,  $1\frac{1}{2}$  mm. broad; sporophylla of the upper plane spreading, oblong, subacute, minutely serrulate, keeled, narrowly pellucid-margined on the upper side, to 2 mm. long; of the lower plane erect or suberect, deltoid-ovate, acuminate, minutely serrulate; macrospores yellowish-white or yellow, opaque, very minutely punctulate-verruculose, nearly smooth; microspores minium-red or orange, the projections crowded, tuberculate or subcapitate. — A duplicate of Elmer's No. 14267, received as *S. Wormskioldii* Hieron., agrees nearly absolutely with this.

*Luzon.*

(159b) **S. Wormskioldii**, Hieron., Leaf., VI, 2064.

Hieronymus gives no description of this. — A duplicate of Elmer's No. 14267 differs from that, mentioned under *S. Eschscholtzii* Hieron., in having the stem 7 mm. more or less broad including the lateral leaves, the ultimate branchlets 3— $3\frac{1}{2}$  mm. broad, consequently the lateral leaves larger, those of the stem  $3\frac{1}{2}$  mm. long by 2 mm. broad, the macrospores more distinctly provided with numerous minutely verruculiform or shortly ruguliform projections.

*Luzon.*

(161) **S. aristata**, Spring; — var. *brevifolia*, Hieron., Leaf., VI, 2045; — var. *obtusifolia*, Hieron., l. c., 2046.

**Var. *brevifolia*:** Lateral leaves shorter, oblique-ovate, less unequal-sided, subacute; spikes somewhat narrower, 2 mm. broad; sporophylla of the upper plane shorter, subacute. — *Luzon, Negros.*

**Var. obtusifolia:** Lateral leaves shorter, oblique-ovate, blunt, less unequal-sided, not pellucid-margined; sporophylla of the upper plane longer. — *Negros.*

(162a) **S. Plekringii, Hieron.,** Leaflet, VI, 2046.

Shoots erect, or ascending from a short-creeping base, 5—12 cm. long, the lower part simple or dichotomous, the upper part 2—3-pinnate, the stem compresso-terete, to 1 mm. thick, stramineous-green or pale-brown, when dry grooved, 4—5 mm. broad including the lateral leaves; branchlets very short, 2 mm. broad. Leaves heteromorphous; lateral leaves horizontal on the stem, ascending on the branchlets; of the stem remote, obliquely ovate, unequal-sided, indistinctly spuriously veined, bluntish, both sides minutely serrulate and very narrowly subpellucid-margined, the upper base broadly rounded or cordate, the lower base narrowly rotundate-truncate, the largest leaves 2½ mm. long, 1½ mm. broad; of the branchlets smaller, less remote, nearly equally rotundate-cuneate at the base; intermedial leaves erect, ovate, long-cuspidate-acuminate, the cusp ½ as long to as long as the blade, the sides minutely serrulate, very narrowly subpellucid-margined, the base obliquely rotundate-cuneate; of the stem the largest, 1½—1¾ mm. long. Spikes solitary, 5—15 mm. long, 1½—2 mm. broad; sporophylla of the upper plane spreading, to 1½ mm. long, oblique-ovate, bluntish or subacute, keeled, the upper side minutely serrulate and very narrowly pellucid-margined; of the lower plane suberect, broadly deltoid-ovate, long-acuminate, minutely serrulate, keeled; macrospores sublilacinous-white or pale-brownish, very minutely punctulate-verruculose, nearly smooth, opaque; microspores minium-red or subferruginous, smooth.

*Negros.*

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## A<sup>2</sup>. PLEIOSTELICAE.

(182a) **S. davaoensis, Hieron.,** Leaflet, VI, 2053.

Shoots erect or ascending from a creeping base, 60—75 cm. long, the lower part simple, stipitiform, not rarely provided with a few short, distant branchlets, the upper part 2-pinnate, the stem 3-stelical, to 1½ mm. thick, when dry grooved and stramineous-brown; pinnae remote,

oblique, lanceolate, to 10—20 cm. long, 2—5 cm. broad, the rachis 4 mm. broad including the lateral leaves; branchlets 4 mm. broad at the base, narrowed rather gradually towards the apex. Leaves heteromorphous; lateral leaves very remote on the stem, less so on the secondary rachises, approximate on the branchlets; of the stem oblique, obliquely suboblong-ovate, hardly unequal-sided, shortly acuminate, entire, the upper base rounded, the lower base rotundate-truncate, the largest leaves 3 mm. long,  $1\frac{1}{4}$  mm. broad; of the branches suboblique-oblong, obsoletely denticulate towards the mucronulate apex, very narrowly pellucid-margined, the upper side rotundate-cuneate in the lower half, plicate-subauriculate at the base, the lower side subcordate-truncate or truncate-rotundate, the largest leaves  $2\frac{1}{2}$  mm. long, 1 mm. broad; of the branchlets smaller, more narrowed and hardly plicate at the base; intermedial leaves erect; of the stem remote, subfalcate-ovate, acuminate, entire, shortly 2-auriculate at the base, the outer auricle a little produced, subhamate-incurvate; of the branches falcate-ovate, long-acuminate, subcuspidate, entire, narrowly pellucid-margined, very obliquely adnate at the base, the outer base rounded and more or less decurrent, the inner base narrowed; of the branchlets imbricate, cuneate-decurrent on the outer side at the base. Spikes solitary, 5—15 mm. long,  $1\frac{1}{2}$  mm. diam.; sporophylla deltoid-ovate, to 2 mm. long, acuminate, slightly keeled, narrowly pellucid-margined; microspores cream-yellow, provided with crowded stipitate-capitate projections; macrospores . . . . .

*Mindanao.*

(194a) **S. Whitfordii**, *Hieron.*, Leaf., VI, 2061.

Shoots divaricating-scandent, 1—3 m. long, the lower part probably one or more times forked, the stem to 2 cm. thick, 3—5-stelical, fragile, pale-ochraceous or stramineous-green, the secondary shoots sub-4-pinnate; pinnae ovate, the rachis 4 mm. broad including the lateral leaves; ultimate branchlets  $1\frac{1}{2}$ —3 mm. broad. Leaves entire; leaves of the stem remote, the lower subisomorphous; lateral leaves obliquely falcate-ovate, more or less acute, unequal-sided, narrowly 2-auriculate-cordate at the base, to  $4\frac{1}{2}$  mm. long, to 2 mm. broad; intermedial leaves nearly similar but less unequal-sided, to  $4\frac{1}{2}$  mm. long, to  $1\frac{3}{4}$  mm. broad; leaves of the branches heteromorphous; lateral leaves very oblique and somewhat remote on the secondary rachises, less oblique and close or imbricate on the ultimate branchlets; of the secondary rachises falcate-ovate, bluntly

short-acuminate, the upper base plicate-auriculate, the lower base truncate-cordate to truncate-cuneate, the largest leaves 3 mm. long,  $1\frac{1}{4}$  mm. broad; of the branchlets smaller, blunt or bluntish, not or only slightly plicate on the upper base; intermedial leaves erect, remote on the secondary rachises, imbricate on the ultimate branchlets; of the secondary rachises falcate-oval, bluntish, obliquely truncate-subcordate at the base, to 2 mm. long, to  $\frac{3}{4}$  mm. broad; of the branchlets smaller, bluntly short-acuminate, the outer base rotundate-truncate, the inner base narrowed. Spikes solitary,  $\frac{1}{2}$ — $1\frac{1}{2}$  cm. long,  $1\frac{3}{4}$  mm. diam.; sporophylla rather broadly deltoid-ovate, shortly acuminate, hardly keeled, entire or subentire, or obsoletely denticulate towards the base; macrospores whitish to dark-yellow-brown, densely verrucose; microspores whitish or cream-yellow, densely verruculose, the projections tuberculiform or shortly cylindrical, the latter not rarely thickened at the apex. — A form received as var. *mindorensis* Hieron. differs from the type principally by its proportionally longer and narrower leaves on the stem and principal rachises.

*Mindanao, Negros, Mindoro.*

(201a) **S. Usterl.**, *Hieron.*, Leaf., VI, 2055.

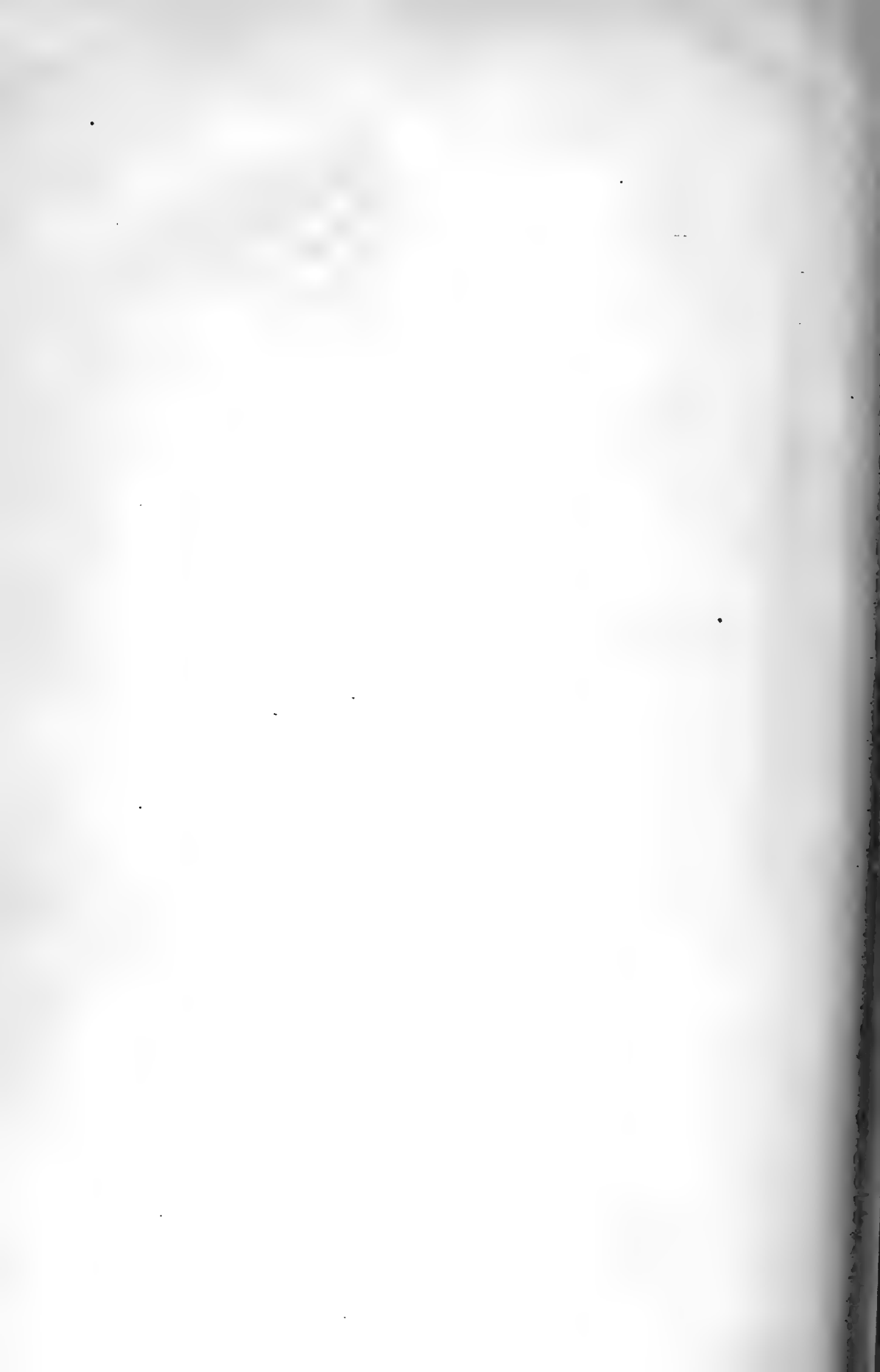
Shoots ascending or erect, to 100 cm. long, the lower part simple, stipitiform, to 4 mm. thick, smooth or somewhat roughish, 5—9-stelical, laterally grooved when dry, greenish, stramineous or pale-brown, the upper part copiously 3-pinnate or sub-4-pinnate, not rarely provided with accessory pinnae springing from the axils of the pinnae; pinnae ascending, rather remote, to 25 cm. long by  $7\frac{1}{2}$  cm. broad, the rachis 5 mm. broad including the lateral leaves; accessory pinnae articulated at the base; ultimate branchlets 3—4 mm. broad at or towards the base, narrowed gradually towards the apex. Leaves entire; leaves of the stipe very remote, subisomorphous, erect or suberect, nearly straight or falcate, oblong-ovate or triangular-oblong, bluntish or subacute, 2-auriculate at the base, the auricles more or less hamate-incurvate, the largest leaves to 3 mm. long, to  $\frac{1}{2}$  as broad; leaves of the branches heteromorphous; axillary leaves 2-auriculate at the base, the lower broadly deltoid-cordate or ovate-cordate with the auricles slightly incurved, the higher cuneate-spathulate or cuneate-obovate with the auricles plicate; lateral leaves approximate or contiguous, subspreading or suberecto-patent; of the secondary rachises falcate-ovate, unequal-sided, bluntish to subacuminate, the upper side cuneate-rotundate in the lower half, auricled at the base,

the auricle broadly adnate, decurrent, conspicuously plicate, the lower side truncate-rotundate or truncate-cordate at the base, the largest leaves 4 mm. long by  $1\frac{1}{2}$ — $1\frac{3}{4}$  mm. broad; of the branchlets smaller, the auricle less conspicuously plicate; intermedial leaves erect; of the pinnae obliquely subfalcate-ovate, bluntish, the base obliquely adnate, produced and auriculate-cordate on the outer side, rounded or slightly rotundate-cordate on the inner side, the largest 2 mm. long; of the branchlets smaller, bluntly acuminate, subauriculate-rotundate on the outer side at the base. Spikes solitary, 5—20 mm. long, 2 mm. diam.; sporophylla broadly deltoid-ovate, to 2 mm. long, shortly acuminate, entire, keeled; macrospores cream-yellow, verruculose; microspores white or yellowish-white, provided with reticulated, but often interrupted, wing-shaped crests.

*Mindanao, Leyte.*

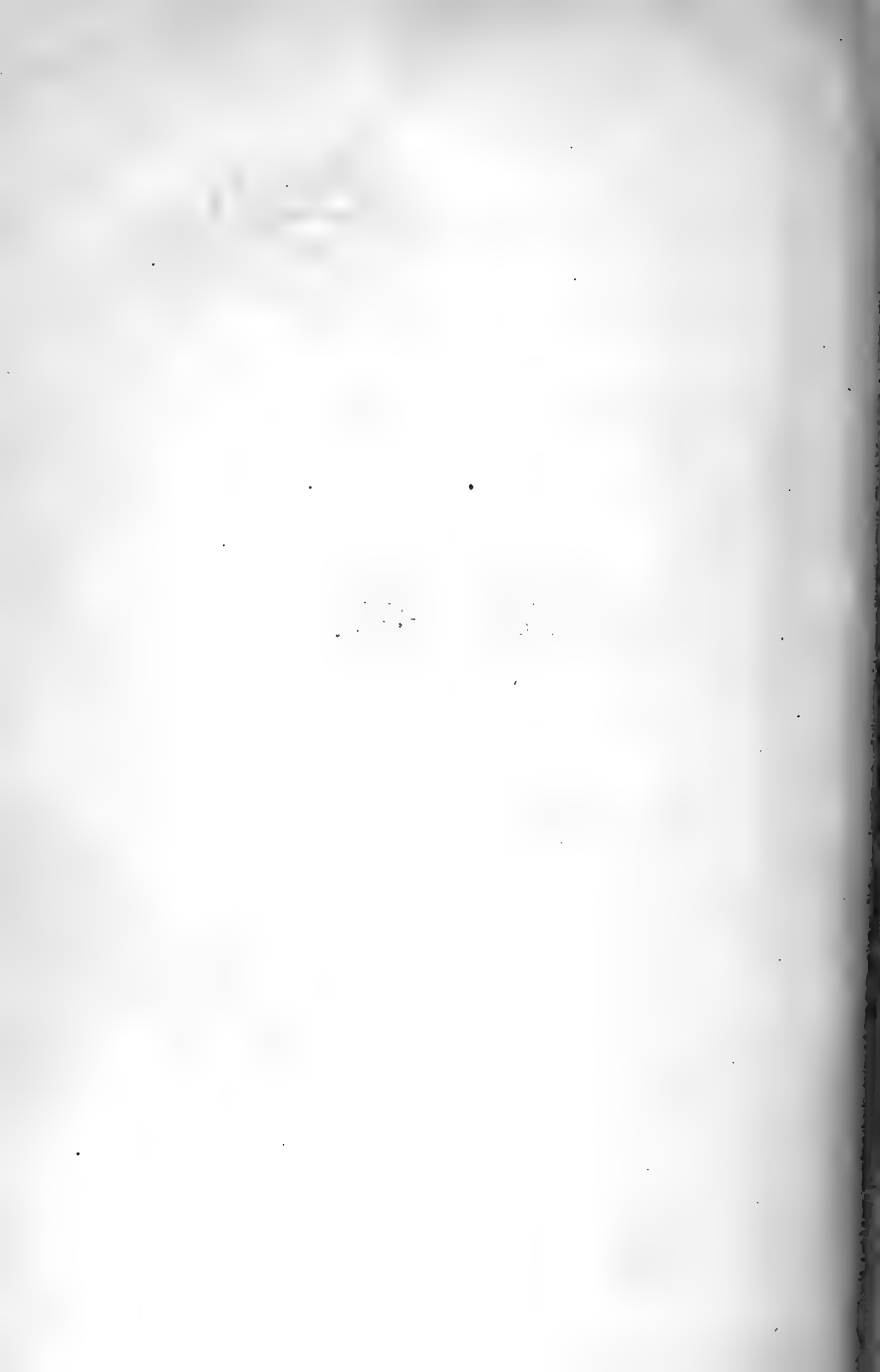
(201b) See No. 194a.

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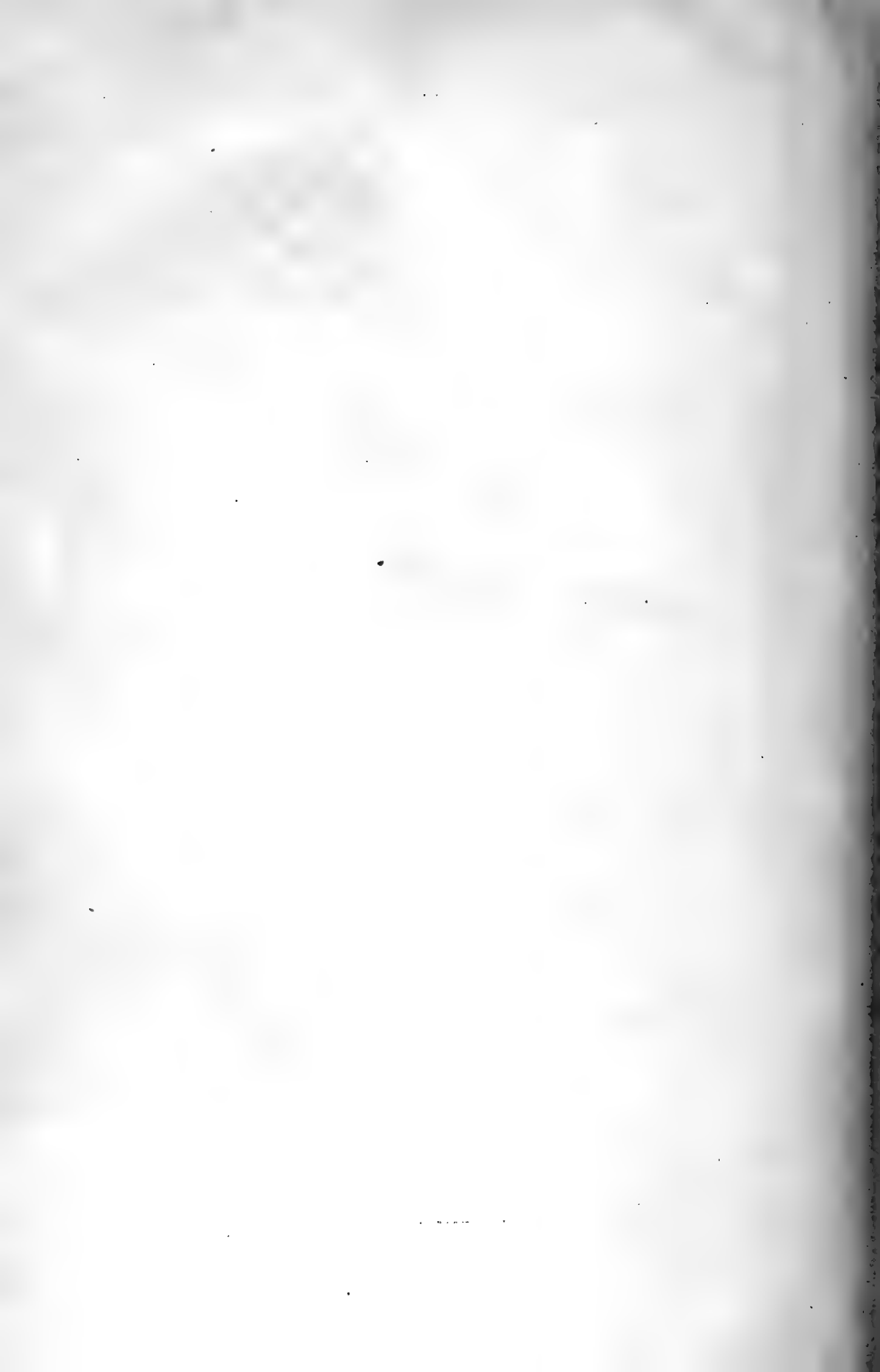
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# CORRECTIONS, ADDITIONS

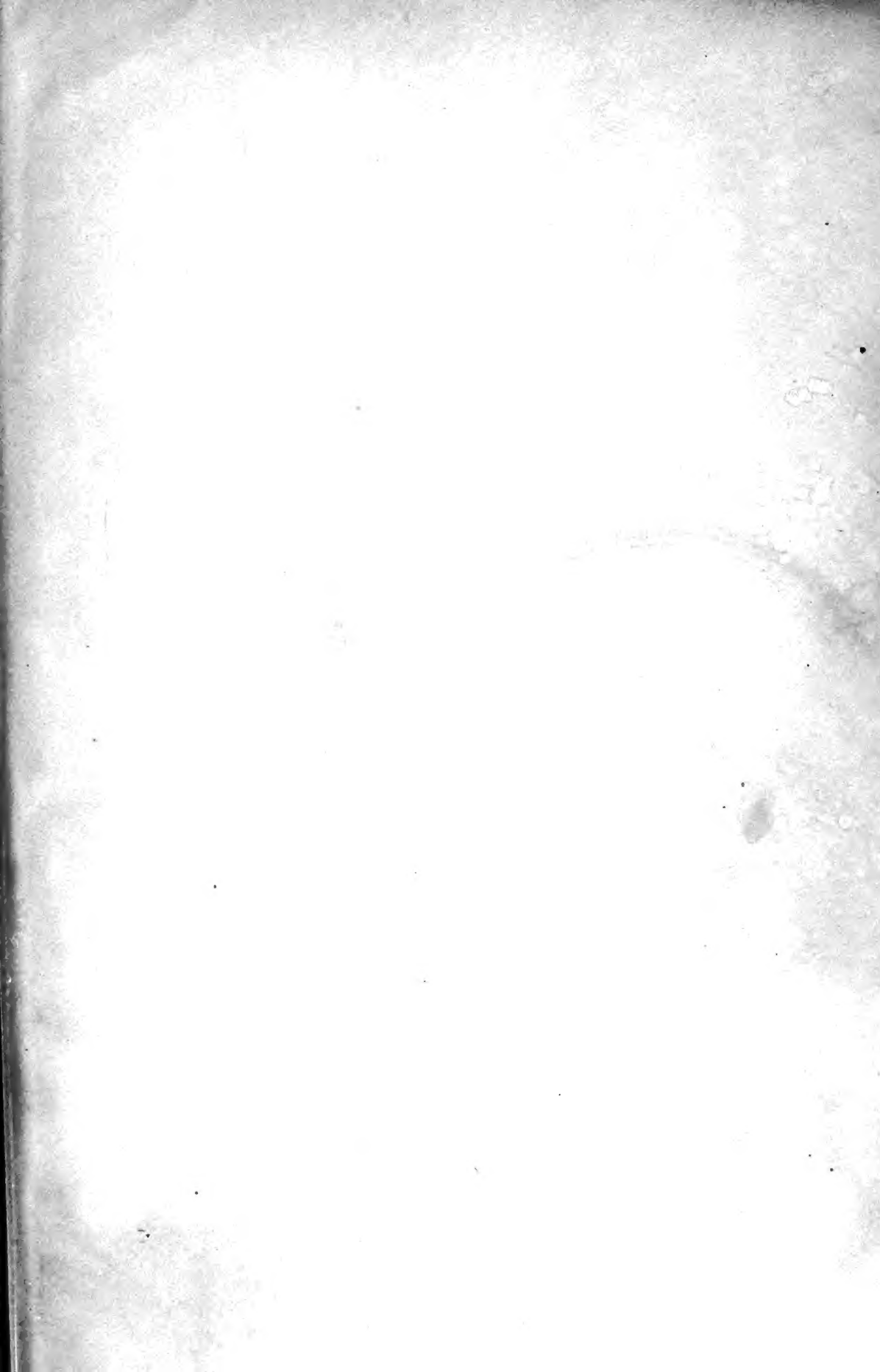
AND

## EXPLANATIONS.

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- P. 5, l. 3 fr. b.; for **ZALUSIANSKAYA**. — read **ZALUSIANSKYA**.
- P. 52, l. 10 fr. b.; for rows; — read planes;
- P. 65, l. 9 et passim; for of the branchlets similar . . . . . etc.  
read of the branchlets similar to those of the  
stem (or the stipe, the main rachis, etc.)  
. . . . . etc.
- P. 66; **S. ceratocaulos**. — Insert See the Appendix.
- P. 68, l. 11 fr. b; for Desv., — read *Desv.*,
- P. 70, l. 2—1 fr. b. et passim; for sporophylla uniform (or isomorphous,  
subisomorphous) but those of the  
lower plane (or the ventral, the  
posterior) somewhat larger, . . . etc.  
read sporophylla . . . . . etc. . . . .  
somewhat larger than the others  
(or the dorsal, the anterior),  
. . . . . etc.
- P. 71; **S. remotifolia**. — Insert See the Appendix.
- P. 84, l. 13 and 11 fr. b. should be modified as follows:  
○ *Lateral leaves spuriously veined.*  
○○ *Lateral leaves not spuriously veined.*
- P. 88; **S. Quadrasil**. — Insert See the Appendix.
- P. 108; **S. magnifica**. — Insert See the Appendix.
- P. 191, l. 6; for *S. debilis*, — read ? *S. debilis*,
- P. 194, l. 11 fr. b.; for *S. brachystachya*, — read *S. brachystachya*,  
l. 10 fr. b.; for var. *ornata*, — read var. *ornata*,
- P. 229, l. 2 fr. b.; for *S. proniflora*, — read *S. proniflora*,
- P. 237, l. 18 et passim. — „(20a) See No. 11.” means that No. 11 shows  
characteristics urging a place for it in the  
keys as No. 20a as well.
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