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ACTA BOTANICA BARCINONENSIA 31

THE PTERIDOPHYTA
OF FERNANDO PO

(Contributions to a Flora of the island)

I: *Lycopodiaceae, Selaginellaceae, Psilotaceae, Schizaeaceae,*
Gleicheniaceae, Osmundaceae, Cyatheaceae.

by G. BENL

Botanische Staatssammlung München

DEPARTAMENT DE BOTÀNICA
FACULTAT DE BIOLOGIA
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INTRODUCTION

In 1968 a series of publications was started in this periodical which aimed towards the eventual production of a complete Flora of Fernando Po. In his preface the editor of the series, Prof. Dr. Antoni ESCARRÉ, pointed to the various problems connected with this undertaking, especially the incompleteness of available herbarium material and the impossibility of taking up prolonged residence in, or making regular travels to the island. In addition may be mentioned the inaccessibility to botanists of certain districts of Fernando Po, particularly in the southern parts. This aspect had already been complained of by Emilio GUINEA (1949 : 287), and little has changed since then.

Fernando Po (now renamed Macias Nguema's Island), Annobon (renamed Pagalú) and Río Muni on the mainland of Africa together constitute the Republic of Equatorial Guinea; the difficulties arising from the present political situation are discussed by LEGUM (1975: B 583; 1976: B 483).

Turning to the pteridophytes themselves, it is true that "the ferns... of Fernando Po are not well represented in collections in Great Britain" (ALSTON 1959 : 2) or other herbaria, compared with those of the smaller islands in the Gulf of Guinea, i.e. Principe, S. Tomé and Annobon. Because of their 'maritime' nature and their consequently richer endemism these islands have always held more attraction for botanists than the 'littoral' Fernando Po, which has traditionally been treated merely as an appendix of the African continent (EXELL 1962, 1973).

Further collections from Fernando Po were necessary before a revision of the pteridophytes could be started, and notwithstanding unusual difficulties my wife and I succeeded in visiting the island from 14 January to 6 February, 1974, and from 12 December, 1975 to 22 January, 1976, and we were able to study and collect ferns and fern-allies in the course of 28 excursions.

The first visit was sponsored by the DEUTSCHE FORSCHUNGSGEMEINSCHAFT, to whom we presented an illustrated report published afterwards by the SENCKENBERG-Institut Frankfurt/M (BENL 1975). This account gives a review of the biogeographic facts and features of Fernando Po and of the distribution of pteridophytes in different zones and areas of the island.

After the more fruitful second trip our gatherings consisted in total of 658 numbers comprising 167 taxa. From our material and that of previous collectors (VOGEL, BARTER, MANN, GUINEA, ADAMS, WRIGLEY & MELVILLE, ESCARRÉ) a sum of 209 taxa can be recorded. This is five times as many as the corresponding number from Tenerife, which has nearly the same

area as Fernando Po. It is also strikingly more than the number of pteridophyte species known from New Zealand, said to be 171 (HEATH & CHINNOCK 1974), although the latter, it is true, includes some 75 endemics.

Nevertheless, important parts of Fernando Po are botanically unexplored, and its ferns are still far from being completely collected. It was Dr. ESCARRÉ's motto "mejor es hacer lentamente que no hacer" that encouraged me to continue the series of contributions by compiling the existing material, hoping it might be a practical help to persons concerned with and longing for a visit to this marvellous Guinean island, as soon as a normal status has returned.

The contribution will be brought out in parts each comprising a number of families. In the treatment of the families I follow the papers already issued. I have taken special care to produce clear keys, in order to facilitate identifications; a general key to families will be provided at the end of the contributions. No attempt will be made to include a complete synonymy under each name; in most cases it will be sufficient to indicate works where a full synonymy is already given. Descriptions will be limited to essential characters visible without using a microscope, in most instances. For specimen citations the standard abbreviations were taken from the 6th edition of the Index Herbariorum (HOLMGREN & KEUKEN 1974).

ACKNOWLEDGEMENTS

Apart from thanking the DEUTSCHE FORSCHUNGSGEMEINSCHAFT I express my sincere appreciation to a considerable number of authorities and persons for their support in providing us visas and licences for freedom of movement in the island, for assistance in obtaining guides and vehicles, and for various aids received in collecting and preserving material. Among others I have to acknowledge the kindness of the Embassies of the German Federal Republic and the Republic of Equatorial Guinea in Yaoundé, the Embassies of the German Democratic Republic and the United Republic of Cameroon in Malabo*. Prof. Pedro OMA NKOMY, our good friend and late Secretary of the Ministerio de Finanzas, Malabo, removed a lot of difficulties and hindrances. Without the skilful help of Sr. Saturnino MALEST, officer in the Museo Nacional de Malabo, we could not have done most of our field work; to him I am particularly grateful. Thanks also to my dear wife, Mrs. Ursula BENL, for her infinite patience and understanding cooperation; moreover, I owe to her many valuable finds.

*) Officially the name Malabo is restricted to the capital, the former town of Santa Isabel; but according to our experience the people of the island, as well as their neighbours in the continent, use this name for the whole island, too.

Fern studies before, between and after the travels were rendered possible for me in the herbaria of Berlin, Geneva, Kew, London (BM), Madrid, and Paris. Prof. R. PICHI SERMOLLI (Perugia) kindly checked many of my determinations; he, Prof. R.E. HOLTUM (Kew), and Prof. E. SCHELPE (Rondebosch, Rep. S. Africa) most generously advised me in the nomenclature and taxonomy of some problematic ferns. My warmest thanks go to these gentlemen, as well as to the directors and curators of the above-cited herbaria for facilities provided during my visits. Specimens and valuable information were supplied by M. F. BADRÉ (Paris), Mr. J.A. CRABBE (London), Dr. M.R. CROSBY (St. Louis/Missouri), Mr. J.B. HALL (Legon/Ghana), Prof. H. HUBER (Hamburg) and Prof. K.U. KRAMER (Zürich). In addition I feel very much obliged to Dr. Frances KUPICHA (BM) for revising the English text.



Family LYCOPODIACEAE

- 1 - Epiphytic (rarely lithophytic) plants with ascending but finally pendent stems regularly divided into dichotomies of subequal length. Fertile leaves (sporophylls) not arranged in distinct spikes (strobili)
... .. *Huperzia* Bernhardi
- 1 - Terrestrial plants with long-creeping stems (rhizomes) and erect or sprawling aerial branches (shoots). Sporophylls aggregated into well-differentiated strobili
- 2 - Club-shaped or cylindrical strobili peduncled, upright, terminating a fertile shoot
... .. *Lycopodium clavatum* L. (6)
- 2 - Cone-shaped strobili sessile on numerous branchlets of a tree-like shoot
... .. *Lycopodiella cernua* (L.) Pic. Ser. (7)

HUPERZIA Bernhardi

- 1 - Leaves linear-subulate to needle-like, less than 1 mm broad
... .. *verticillata* (L.f.) Trevisan (1)
- 1 - Foliage leaves distinctly broader
- 2 - Fertile leaves sharply differentiated from sterile ones, which are at least 5 times longer than the sporophylls. Foliage leaves ascending to spreading, stem visible; sporophylls imbricate
- 3 - Foliage leaves lanceolate-elliptic, tapered at both ends, decurrent, 2.5 - 3 mm broad, gradually passing into sporophylls
... .. *ophioglossoides* (Lam.) Rothm. (2)
- 3 - Foliage leaves ovate-lanceolate, truncate at base, non-decurrent, 4 - 6 mm wide, abruptly differing from the small sporophylls
... .. *phlegmaria* (L.) Rothm. (3)
- 2 - Sporophylls similar in shape to sterile leaves, which are 2-to 3 times longer than sporophylls. The leaves densely imbricate, covering the light brown stem
- 4 - Foliage leaves up to 10 mm long, acute to subobtusate, not falcate, flat near base of stem
... .. *brachystachys* (Baker) Pic. Ser. (4)

4 - Foliage leaves up to 23 mm long, sharply acuminate, involute, (sub) falcate

... .. *mildbraedii* (Herter) Pic. Ser. (5)

- (1) *Huperzia verticillata* (L.f.) Trevisan, in Atti Soc. Ital. Sci. Nat. 17 : 248 (1874).

Synonymy: see TARDIEU-BLOT 1971 : 23.

The tufted slender pendent stems, repeatedly (4 - 8 times) forked and slightly curved, may attain lengths of one meter or more. Leaves light green, very dense, 3 - 5 mm long; sporophylls usually indistinguishable from vegetative leaves.

Ecological notes: The delicate clubmoss inhabits wet forests at altitudes above 1100 m, especially in *Schefflera* mountain woodland (1400 - 2000 m).

Citations: ADAMS 1165, Pico 1500 m (14/12/1951), BM, GC; WRIGLEY & MELVILLE 438, Moka 1380 m (2/9/1959), BM; G. & U. BENL FP 314, Carretera de Valle Moka 1350 m (29/12/1975), M; FP 578, between Residencias de Moka and Riasaca 1160 m (15/1/1976), BC, M, MO, YA.

Geogr. distribution: Cameroon, Equatorial Guinea (FP), S. Tomé, Zaïre, Rep. S. Afr., Mozambique, Rhodesia, Zambia, Malawi, Kenya; Madagascar, Réunion (holotype), Mauritius, Comoro Is. Tropical America, Polynesia.

- (2) *Huperzia ophioglossoides* (Lam.) Rothm., in Feddes Repert. 54 : 62 (1944).

Synonymy: see TARDIEU-BLOT 1971 : 40.

Stems yellowish to reddish, 2 - 3 times forked, up to 40 cm long. Slack dull green foliage leaves ascending to patent, submembranous, 10 - 15 mm long. Strobili several times dichotomously branched, occasionally interrupted by foliage leaves; sporophylls (2 - 3 x 1 - 2 mm) ovate, carinate.

Ecological notes: Found growing especially on trees at forest margins and on isolated trunks, upwards from 900 m altitude.

Citations: MANN 384 in part, Pico 900 m (1860), K; s.n. (1860), BM, K; MILDBRAED 7154, Pico above Basilé 2000 - 2300 m (16/11/1911), B, BM; ADAMS 1108, near Lago de Biaó 1680 m (9/12/1951), BM, GC; WRIGLEY & MELVILLE 535, Moka 1380 m (2/9/1959), BM; G. & U. BENL FP 160, Praderas de Moka 1230 m (28/1/1974), BM, M; FP 189, Bosque del Río Chubá 1310 m (28/1/1974), M, Hb. Pic. Ser., YA; FP 410, Pico 1680 m (6/1/1976), BC, M; FP 560, between Residencias de Moka and Riasaca 1190 m (15/1/1976), M, FR, Hb. Pic. Ser.

Geogr. distribution: Cameroon, Equatorial Guinea (FP, Annobon), Congo, Zaïre, Rep. S. Afr., Mozambique, Rhodesia, Malawi, Tanzania, Kenya, Ethiopia; Madagascar, Réunion, Mauritius (holotype), Comoro Is, Seychelles.- Tropical Africa.

- (3) *Huperzia phlegmaria* (L.) Rothm. var. *phlegmaria*, in Feddes Repert, 54 : 62 (1944).

Synonymy: *Lycopodium phlegmaria* L., Sp. Pl. 2 : 1101 (1753).

Urostachys phlegmaria (L.) Herter, in Bot. Arch. 3 : 17 (1923).

Tufted stems stramineous, simple or few-forked, up to 1 m long. Leaves dark green, glossy, subcoriaceous, 10 - 20 mm long and mostly spreading. The flaccid strobili very narrow (1 - 1,5 mm in diam.), 1 - 3times dichotomous, tassel-like; sporophylls (1 x 0,5 - 1 mm) triangular-ovate, firm, unkeeled.

Ecological notes: Settling in high forest at a great distance above the ground; up to 2800 m altitude.

Citations: BARTER 1930, "Princess Isld, Fern. Po", K; GUINEA, Pico above Basilé ("En el país de los Bubis", 1949 : 215, map 43). - Seems to be rare in the island.

Geogr. distribution: Guinea, Liberia (?), Cameroon, Equatorial Guinea (FP), S. Tomé & Príncipe, Gabon, Zaïre (?), Malawi, Tanzania. - Palaeotropics.

A var. *tardieuae* (Herter) Tardieu was described from Madagascar and adjacent islands.

- (4) *Huperzia brachystachys* (Baker) Pic. Ser., in Webbia 23 : 162 (1968).

Synonymy: *Lycopodium dacrydioides* Baker var. *brachystachys* Baker, Handb. Fern - Allies : 18 (1887).

Urostachys brachystachys (Baker) Herter ex Nessel, Bärlappgew.: 189 (1939).

Lycopodium brachystachys (Baker) Alston, in Bol. Soc. Brot. 30 (2. ser.) : 19 (1956).

Firm and often tufted shoots 2 - 4times dichotomous, at first erect (up to ca 25 cm), then forming heavy pendent cords more than 1 m long. Leaves broadly subulate, (olive-)green, fleshy, coriaceous, up to 10 mm long and 3,5 mm wide, carinate towards their base, gradually passing into the lanceolate sporophylls, these 4 - 5 mm in length and more visibly keeled. Strobili (4 - 10 cm long or more), single or in twos (rarely in threes) at the tip of a branch.

Ecological notes: Preferring trees in open positions above 1000 m altitude.

Citations: MANN 384, K; GUINEA 2685, Pico "en el límite del bosque de nieblas" (28/2/1947), BM; G. & U. BENL FP 164, Praderas de Moka 1230 m (28/1/1974), BOL, GZU, M, MO, Hb. Pic. Ser., YA; FP 171, forest above Río Iladyi ca 1180 m (28/1/1974), M; FP 181, forest margin S of Praderas 1230 m (28/1/1974), M; FP 314a, Carretera de Valle Moka 1350 m (29/12/1975), BC, M; FP 395, Pico 1800 m (4/1/1976), GC, M; FP 561, between Residencias de Moka and Riasaca 1190 m (15/1/1976), M; FP 579, between Residencias de Moka

and Riasaca 1160 m (15/1/1976), FR, M; FP 616, Laderas de Moka 1360 m (17/1/1976), BC, M.

Geogr. distribution: Guinea, Sierra Leone, Ivory Coast, Nigeria, Cameroon (holotype), Equatorial Guinea (FP). - Southernmost occurrence in Fernando Po, so far.

(5) **Huperzia mildbraedii** (Herter) Pic. Ser., in *Webbia* 23 : 163 (1968).

Synonymy *Lycopodium mildbraedii* Herter, in *Hedwigia* 49 : 90 (1909).

Urostachys mildbraedii (Herter), Herter ex Nessel, *Bärlappgew.* : 188 (1939).

Lycopodium dacrydioides Baker, *Handb. Fern-Allies*: 17 (1887), p.p.

The vigorous shoots 2 - 5 times forked, up to 2 m long or even more. Leaves patent to subappressed, linear-lanceolate, sharp-acuminate, green to dark green, coriaceous, 2 - 2.5 mm broad, more or less abruptly passing into sporophylls, up to 8 x 2.5 mm. Strobili 20 - 25 cm long, mostly in twos at the end of a branch.

Ecological notes: This clubmoss is less common in the island than the preceding one, but seems to like similar habitats.

Citations: MANN (1861), BM; MILDBRAED 6357, Pico above Basilé 600 - 800 m (16/8/1911), B; 7155, Pico 2000 - 2300 m (16/11/1911), B; GUINEA 2691, Pico "en el límite del bosque de nieblas" (28/2/1947), MO; WRIGLEY & MELVILLE 439, Moka 1380 m & 1950 m (2/9/1959), BM.

Geogr. distribution: Guinea, Sierra Leone, Liberia, Cameroon (holotype), Equatorial Guinea (FP), S. Tomé & Príncipe, Zaire. - West Tropical Africa.

(6) **Lycopodium clavatum** L. var. *borbonicum* Bory, *Voy.* 2 : 205 (1804).

Synonymy: see TARDIEU-BLOT 1971: 12.

Superficial rhizome wide-trailing; ascending to upright bright green shoots (30 - 50 cm long), dichotomously or pinnately branched, often without a main axis; finally prolonged into a sparsely leafy stalk (up to 25 cm) bearing (2-) 4 (-6) peduncled strobili 3 - 8 cm long and 4 - 7 mm in diameter. Leaves linear to subulate (5 - 7 x 0.5 - 0.7 mm), more or less patent, finely toothed toward the apex and with long hair-like tips up to 3 mm. The ovate membraneous-fimbriate and fairly imbricate sporophylls (2.5 x 2 mm) with a hyaline hair (2 mm) at apex.

The branches are less creeping, leaves (and setae) shorter, more rigid, recurved and channelled but in general less dense than in the typical form and in other varieties; the strobili may be more numerous.

Ecological notes: This temperate species settles in open grassy ground and scrub of high mountains, as well as in moist regions of uplands, at 1500 to 2900 m altitude in our island.

Citations: MILDBRAED 7156, Pico "in lichtem Gebüsch von *Ericinella*, *Agauria* etc." 2400 - 2800 m (16/11/1911), B, HBG; GUINEA 1972, "Subida al Pico Serrano" (25/1/1947), BC; 1973, Pico Serrano "en las praderas artificiales" (25/1/1947), MA; WRIGLEY & MELVILLE 506, Mte Baká "bank of road" 1500 m (31/8/1959), K; ESCARRÉ 3672, Pico 2500 m (4/1965), BC; 3673, Biaó (2/1965), BC; G. & U. BENL FP 354, Pico 1950 m, very frequent near the path above Km 15 of Eastern Highway (2/1/1976), FR, M, YA.

Geogr. distribution of variety: Cameroon, Equatorial Guinea (FP), S. Tomé, Zaïre, Rep. S. Afr. (incl. Lesotho), Mozambique, Rhodesia, Zambia, Malawi, Tanzania, Kenya, Uganda, Ethiopia, Sudan; Madagascar, Réunion (holotype of variety), Mauritius, Comoro Is.

(7) *Lycopodiella cernua* (L.) Pic. Ser., in *Webbia* 23 : 166 (1968).

Synonymy: *Lycopodium cernuum* L., Sp. Pl. 2 : 1103 (1753).

Palhinhaea cernua (L.) Franco & Vasc., in *Bol. Soc. Brot.* 41 (2. ser.) : 25 (1967).

For other synonyms see SCHELPE 1970 : 20.;

A truly underground rhizome produces numerous stiff, dull green aerial shoots with a woody axis 3 - 5 mm in diam., erect or sprawling, ramifying mostly (but not always) like "a miniature pine tree", up to 1.2 m tall or more; ultimate branchlets often drooping. Fresh green leaves subulate to needle-like, curved upwards, rigid, spreading to ascending, 2 - 4 mm long and very narrow (0.1 - 0.5 mm wide). Strobili less than 1.5 cm long and 0.3 cm in diam., terminal on (upper) branchlets, finally recurved; sporophylls reduced, densely crowded and overlapping, ovate at base, fringed to ciliate at the margins.

Ecological notes: This highly polymorphic clubmoss is also very variable ecologically. It frequently colonizes in groups on exposed slopes, roadside banks and other places, disturbed by man such as clearings, grasslands (Praderas!), areas of brush. In drier regions it prefers swampy sites. In Fernando Po from near sea-level to 1500 m alt. or more.

Citations: MANN (1860), BM; KALBREYER 224 (5/1877), BM, K; MILDBRAED 6280, Basilé 400 - 500 m (9/1911), B, HBG; TESSMANN 2835, Moka grassland (10/1920), B; EXELL 826, Moka 1200 m (31/1/1933), BM; ADAMS 1049, Moka - Iladyi Falls 1200 m (8/12/1951), GC, MA; WRIGLEY & MELVILLE 402, Moka 1380 m (29/8/1959), BM; ESCARRÉ 3674, Parador de Musola (12/1964), BC; 2008, Lago de Biaó (1/1965), BC; MALEST 2202, Lago de Biaó (17/1/1968), BC; G. & U. BENL FP 17, Western Highway Malabo-Luba ca 10 m (19/1/1974), M; FP 566, between Residencias de Moka and Riasaca 1180 m (15/1/1976), M, YA; FP 608, descent to Mioko Fountain 1430 m (17/1/1976), M.

Geogr. distribution: Senegal, Gambia, Guinea Bissau, Guinea, Mali, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Benin, Nigeria, Cameroon, Centr. Afr.

Rep., Equatorial Guinea (Río Muni, FP), S. Tomé & Príncipe, Gabon, Congo, Zaire, Angola, Rep. S. Afr., Mozambique, Rhodesia, Zambia, Malawi, Kenya, Ethiopia, Sudan; Madagascar, Mascarene Is, Comoro Is, Seychelles. - Pantropical and extending to subtropics.

Family SELAGINELLACEAE

SELAGINELLA Beauv.

1 - Climber with twining stems and primary branches. Strongly developed rhizophores up to 1 m long or more. (Rhizophores are leafless prop-like organs growing out from the axils of branches, and producing roots at their tips when reaching the soil.)

... .. *myosurus* (Swartz) Alston (1)

1 - No twining stems; rhizophores to 15 cm maximum

2 - Stems and (primary) branches prostrate; rhizophores may rise from nodes throughout the whole branch-systems. Sporophylls uniform

3 - The flattened stems articulated at thickened nodes where branches occur; 1.3 mm in diam. at base, up to 1 m long

... .. *kraussiana* (G. Kunze) A. Braun (2)

3 - The angular stems continuous, 0.5 mm in diam. at base, up to 12 cm long

... .. *cathedrifolia* Spring (3)

2 - Stems ascending (sometimes from a prostrate base), suberect or erect; rhizophores restricted to lower nodes or to the basal part of the main stem

4 - Plants producing filiform runners near stem-base (soboles) with tiny leaflets

5 - Stem and rachis pale; ramifications diverging at ca 60°. Lateral leaves dark green above, showing two false nerves. Sporophylls uniform

... .. *versicolor* Spring (4)

5 - Glossy stem and rachis may be reddish or straw-coloured; ramifications diverging at ca 30°. Pale green leaves without false nerves. Sporophylls dimorphic

... .. *goudotana* Spring

var. *abyssinica* (Spring) Bizzarri (5)

4 - Plants not soboliferous

6 - Plants more or less regularly proliferous. Sporophylls uniform

7 - Adult plants (30 cm) may produce elongated, overhanging branches, sparsely leafy and proliferous at their apex. Leaves very crowded on

normal branches (especially in proliferations), long-ciliate towards their base, paler beneath, and with a reddish hue in age. Stem base (of adult plants!) normally greenish straw-coloured; stem, rachis, and branches glabrous

... .. *kalbreyeri* Baker (6)

- 7 - Stem base pink when dry; stem with rhizophores, rachis, and branches pubescent throughout. A creeping axis gives rise to erect frond-like branch-systems, 30 - 80 cm high. Lateral leaves spaced, never contiguous nor ciliate. Main stem rarely proliferous at tip

... .. *vogelii* Spring (7)

- 6 - Proliferous shoots unknown; stems and branches glabrous. Sporophylls dimorphic

- 8 - Stem straw- to orange-coloured, up to 50 cm long, fragile; ramifications diverging at ca 30°. Lateral stem leaves subulate, distant (ca four leaf-breadths apart), up to 4.5 mm long; median leaves abruptly and long aristate, arista often reflexed. Sporophylls not markedly ciliate; megaspores whitish turning brown, microspores yellowish

... .. *soyauxii* Hieron. (8)

- 8 - Not this combination of characters. Lateral leaves shorter, subobtusate, closer on main stem, 1-2 leaf-breadths apart; median leaves tapering into the arista

- 9 - Stem greenish to straw-coloured, up to 8 cm tall (rarely more); ramifications diverging at ca 60°. Median leaves distinctly ciliate, arista almost equalling lamina. Only the upper sporophylls carinate. Megaspores sulphur-coloured, microspores minium red

... .. *molleri* Hieron. (9)

- 9 - Stem reddish (-brown) when fresh, turning pale straw-coloured when dry, up to 35 cm tall; ramifications diverging at ca 45°. Median leaves ciliolate to serrulate, arista ca 1/3 the length of lamina. Ripe sporophylls carinate throughout. Megaspores grey or yellowish, microspores minium red

... .. *molliceps* Spring (10)

- (1) *Selaginella myosurus* (Swartz) Alston, in J. Bot. 70 : 64 (1932).

Synonymy: *Stachygynandrum scandens* Beauv., Mag. Encycl. 5: 483 (1804).

For further synonyms see ALSTON 1957 : 29.

The straw-coloured flexuous and much-branched stem often winding counter-clockwise up to 2 m in length, climbing on neighbouring plants, and producing numerous long rhizophores. Distant acuminate leaves (3 mm long) on

main axis and base of side branches, showing two acute auricles. Frond-like side branches often repeatedly divided; ultimate parallel-spaced systems 2 - 4 cm long. Lateral branch leaflets (3 - 4 x 1 - 1.8 mm) spreading, contiguous, subfalcate, acute, sometimes exhibiting iridescent blue-green colours when fresh, owing to microscopic structures on the upper surfaces (Fox & Wells 1971 : 137). Median leaves (1 x 0.5 mm) oblong-lanceolate, denticulate, cuspidate. The long terminal strobili up to 40 mm in length and 2.5 mm in diam., in our collections. Sporophylls ovate-deltate, acuminate, serrulate, carinate.

Ecological notes: Prefers sunny sites on road banks and at forest margins, as well as along paths in plantations and secondary woodland. A lowland element, rarely up to 1200 m elevation.

Citations: MANN 150 (12/1859), K; s.n. (1860), BM; LOPE DEL VAL 231, 232, 233, Rebola (3/3/1939), MA; GUINEA 985, above Musola ca 600 m (9/1/1947), MA; 989, above Musola ca 600 m (9/1/1947), BM; BARLEICÓN 2033, "Bajada a la playa de Ureka" (5/1965), BC; G. & U. BENL FP 1, road to Basilé ca 200 m (15/1/1974), BM, GZU, M; FP 154, Eastern Highway near Río Bososo 280 m (26/1/1974), M; FP 222, Río Consul 40 m (17/12/1975), M; FP 240, between Río Togecha and Río Co 15 m (29/12/1975), M; FP 289, above Musola path to Belebú-Balachá 350 m (29/12/1975), FR, M, YA; FP 439, above Belebú-Balachá path to Ureka 700 m (8/1/1976), BC, M; FP 530, above Basakato de Oeste 120 m (14/1/1976), BC, M.

Geogr. distribution: Senegal, Gambia, Guinea, Sierra Leone (holotype), Liberia, Ivory Coast, Ghana, Togo, Nigeria, Cameroon, Equatorial Guinea (Río Muni, FP), Gabon, Congo, Zaïre, Angola, Kenya.- Tropical African element.

(2) *Selaginella kraussiana* (G. Kunze) A. Braun, Ind. Sem. Hort. Bot. Berol. 1859, append. 1860 : 22.

Synonymy: see BIZZARRI 1975 : 575 - 578.

Wide-creeping stem not very firm, with straggling and sometimes interwoven branches, copiously pinnate but with irregular outlines. Lateral leaves (2.5 - 4 x 0.7 - 1.7 mm) oblong-lanceolate, minutely serrate along the margins, spaced like the median leaves except towards the apices of the subflabellate branchlets. Median leaves (2 - 2.5 x 0.8 mm) with a distinct pale medium line, asymmetrically ovate, subauricled, denticulate, acute but not aristate. Strobili (rarely to be seen) 1 - 3 mm long in our specimens; sporophylls similar to median leaves, but narrower and keeled. Spores whitish; megaspores reticulate, microspores echinate.

This polymorphous species is characterized by its stem joints.

Ecological notes: Frequent on moist sunny or shady ground, often beside paths in lowland and mountain rain forest. We saw the continuous carpets of this spikemoss between 600 and 2140 m altitude in the island.

Citations: MANN 383, Pico 1200 m, K; GUINEA 2018, "ascensión al Pico Serrano" (25/1/1947), BM, MA; ADAMS 1080, near Iladyi Falls "in *Cyathea*-woodland" 1140 m (8/12/1951), BM, GC, MA; ESCARRÉ 2037. "Bajada al Lago de Biaó" (12/1964), BC; G. & U. BENL FP 95, Biaó inside the crater border 1800 m (22/1/1974), FR, M; FP 304a, Oloita [or Oloitia] 610 m (29/12/1975), M, YA; FP 358, Pico 2140 m (2/1/1976), BC, M; FP 557, Mte Baká 1460 m (15/1/1976), M; FP 574, between Residencias de Moka and Riasaca 1160 m (15/1/1976), M; FP 593, descent to Mioko Fountain 1360 m (17/1/1976), BC, M.

Geogr. distribution: Sierra Leone, Cameroon, Equatorial Guinea (FP), Congo, Zaïre, Rep. S. Afr. (holotype), Mozambique, Rhodesia, Malawi, Tanzania, Kenya, Rwanda, Burundi, Uganda, Ethiopia, Sudan. Canary Is, Madeira, Azores. - Tropical Africa, naturalized in South and West Europe.

(3) *Selaginella cathedriformis* Spring, Monogr. Fam. Lycopod. 2 : 112 (1849).

Synonym: *Selaginella zenkeri* Hieron. ex Bonap., Notes Ptéridol. 7 : 253 (1918), n. n.

The lighth green main stem decumbent, and the copiously compound branches (often longer than the main stem) appressed to ground. Lateral leaves (2 x 1.5 mm) ovate-lanceolate, unequal-sided, strongly ciliate on the upper side at base, spreading and contiguous or even imbricate on the branchlets. Median leaves much smaller, suborbicular, apiculate, minutely serrate. Strobili 8 - 12 mm long, the crowded sporophylls ovate-acuminate, carinate, with dentate margins. Megaspores yellowish, microspores vermilion.

This often dwarf species is easily recognized by its ciliate lateral leaves combined with the prostrate habit.

Ecological notes: Occurring on rocks and stones beside or in running water in wet forest. Probably the commonest representative of the smaller-growing taxa in continental West Africa, this species seems to be rare in the island (ADAMS 1957 : 484).

Citation: MILDBRAED 6281, Basilé 400 - 500 m (9/1911), B (lost during the Second World War), HBG.

Geogr. distribution: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Nigeria, Cameroon, Equatorial Guinea (Río Muni, FP), Principe (holotype), Gabon, Congo, Zaïre, Angola. - Tropic regions in West and Central Africa.

(4) *Selaginella versicolor* Spring, in Bull. Acad. Roy. Belg. 10 : 143 (1843).

Synonym: *Selaginella nitens* Baker, in J. Bot. 23 : 48 (1885).

Adult plants with erect, frond-like shoots up to ca 40 cm high, simple in

the lower part (often longer than half of shoot length), copiously compound in the broadly triangular or irregularly-shaped upper part, the linear-lanceolate to elongate-deltate partial branch-systems up to 18 cm long being 1 - 3-pinnate. Lateral leaves (3 - 5 x 1.5 - 3 mm) oblong, subfalcate, subacute, unequal-sided, rounded, and serrulate towards the base on upper side, of dark green colour in the upper, light green in the under surface, deflexed and widely spaced towards the base of the main stem, spreading on the rachis, (sub)contiguous, sometimes imbricate on the branchlets. Median leaves about half as long, (broadly) obliquely obovate, denticulate, with an abrupt arista up to half as long as the lamina (1 mm). Mature green strobili 5 - 30 mm long, occasionally producing larger sterile leaves at their tips. Sporophylls ovate-lanceolate, acuminate, carinate, minutely serrulate; megaspores cream-coloured, microspores orange.

This attractive spikemoss, fairly abundant in the island, is easily recognized at any stage of development by the presence of false nerves and soboles.

Ecological notes: On the ground and on rocks in shady moist forests; also on stream banks in plantations. Rarely epiphytic. In very dark and wet sites the long strobili may not ripen, giving rise to vegetative leaves. Sea-level to 1700 m altitude.

Citations: MANN 149 (1859), K; MÖNKEMEYER 83 (5/1885), B; MILD-BRAED 6283, Basilé 400 - 500 m (9/1911), B, HBG; 6339, Pico above Basilé 800 - 1000 m (16/8/1911), B, HBG; EXELL 794, Moka grassland region 1200 - 1500 m (29/1/1933), BM; THOROLD TF 33, Ureka, on cocoa (18/8/1951), BM; WRIGLEY & MELVILLE 462, Moka "sides of stream" 1380 m (5/9/1959), BM, P; ESCARRÉ 2039, Belebú-Balachá (3/1965), BC; BARLEICÓN 2038, Ureka (5/1965), BC; G. & U. BENL FP 24, Río Musola near mouth (19/1/1974), M; FP 178, Río Iladyi ca 1180 m (28/1/1974), FR, M, YA; FP 197, S of Bococo between Río Bama and García ca 120 m (29/1/1974), M; FP 226, Río Consul 70 m (17/12/1975), M; FP 288, above Musola path to Belebú-Balachá 280 m (29/12/1975), M; FP 491, above Ruiché path to Caldera 820 m (10/1/1976), M; FP 512, Balea 500 m (12/1/1976), BC, M.

Geogr. distribution: Senegambia (holotype), Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Nigeria, Cameroon, Equatorial Guinea (FP), Gabon, Congo, Zaïre, Angola, Malawi, Uganda, Sudan. - A tropical African element.

- (5) *Selaginella goudotana* Spring var. *abyssinica* (Spring) Bizzarri, in *Webbia* 29 : 585 (1975).

Synonymy: see BIZZARRI 1975 : 585 - 590.

Ascending to erect (sometimes suffruticose) frond-like plants up to 40 cm high, with an ovate, oblong-lanceolate or triangular, but often irregular, outline. Short rhizophores usually at the base only, but occasionally a trailing main stem with ascending branches may also produce rhizophores from higher nodes.

Branch-system 1 to 3pinnate. Lateral leaves (1,5 - 3 x 1 - 2 mm) ovate-oblong, carinate, acute or shortly mucronate, serrulate, asymmetrical, in general with the upper side rounded at base, often well spaced even on the branchlets, bright (yellow-)green. Median leaves (on the dorsal side) about half as long, obliquely ovate-lanceolate, keeled, (strongly) aristate, decurrent, margins ciliate-denticulate, distinctly imbricate in ultimate branchlets. Strobili 1 - 3,5 mm long and (very) inconspicuous; median sporophylls similar to median leaves, but arranged on lower side. Megaspores lemon- to sulphur-coloured, microspores orange to minium-coloured.

The somewhat variable species is characterized by its soteles rising from the stem base, or from whip-like ends of lower branches; false veins are never present.

Ecological notes: In open well-grazed pasture of higher ground (Adams 1957 : 490) as well as in evergreen forest on wet rocks near streams and waterfalls. From ca 800 m to 2400 m elevation in the island.

Citations: MANN 667, Pico 2400 m (12/1860), K; ADAMS 1067, near Iladyi Falls 1140 m (8/12/1951), BM, GC; 1104, Mioko heights (9/12/1951), BM, K, MA; WRIGLEY & MELVILLE 468, near Biaó heathland 1950 m (10/9/1959), BM, P; G. & U. BENL FP 122a, Ríó Iladyi 1180 m (24/1/1974), BOL, M, YA; FP 138, Pico 860 m (26/1/1974), M; FP 359, Pico 2140 m (2/1/1976), BC, GZU, M.

Geogr. distribution: Ghana, Nigeria, Cameroon, Equatorial Guinea (Ríó Muni, FP), Congo, Zaíre, Angola, Rep. S. Afr., Mozambique, Rhodesia, Zambia, Malawi, Tanzania, Kenya, Burundi, Uganda, Somalia, Ethiopia (holotype), Sudan. - African tropics.

Selaginella goudotana Spring var. *goudotana* is endemic to Madagascar.

(6) *Selaginella kalbreyeri* Baker, in J. Bot. 22 : 276 (1884).

Light green plants producing vigorous stems up to 45 cm in length and 2,5 mm in diam., ascendent or erect from a decumbent base, usually bearing rhizophores in the basal quarter as well as on proliferous tips of prolonged and pendent branches. Branch-system 2 - 4pinnate, ovate or lanceolate in outline; ramifications diverging at 45°. Lateral leaves (3.5 x 1.5 mm), oblong-ovate, falcate, unequal-sided, strongly ciliate towards their rounded base especially on the upper side, well spaced at stem base and on primary branches, but conspicuously imbricate throughout upper branches. Median leaves small, orbicular ovate, carinate, with a ciliate base and a (curved) arista at least half as long as the lamina. Strobili (4 x 1.3 mm) with deltate-acuminate, carinate and serrulate sporophylls, these becoming hyaline; megaspores yellow, microspores red.

Adventitious plants growing from whip-like branch-ends differ in some respects from young specimens of the typical form produced by spores (Biz-

zarri 1975 : 574), e.g. they are stouter in habit, the leaves, dark green above, greyish green beneath, are very closely imbricate, and the stem is purplish.

Characteristic features of the species are the occasional elongated proliferous branches, the falcate lateral leaves (without false nerves) contiguous on all branchlets, and the strikingly ciliate leaf base.

Ecological notes: Wet rocks and banks of water-courses in more or less shaded districts in montane woodland up to 1450 m alt. seem to be favourite sites of this spikemoss, which is new to Fernando Po.

Citations: G. & U. BENL FP 172, Río Iladyi 1180 - 1190 m (28/1/1974), FR, K, M, det. Bizzarri; FP 338, Río Mioko near Carretera de Valle Moka between Km 20 and 21, 1450 m (31/12/1975), BC, M.

Geogr. distribution: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Nigeria, Cameroon (holotype), Equatorial Guinea (FP), Gabon, Congo, Zaïre, Uganda, Ethiopia. -Tropical regions in Africa.

(7) *Selaginella vogelii* Spring, Monogr. Fam. Lycopod. 2 : 170 (1849).

Synonymy: see REED 1965-66 : 235 (excl. *Selaginella eublepharis* A. Braun ex Hieron., s. SCHELPE 1970 : 27).

Creeping pink rhizome with stout erect aerial stems up to 4.5 mm in diameter. Long lower part of stems simple, bearing distant, appressed, uniform leaflets, these finely fringed or ciliate (as on the rhizome); upper part of stems compound, frondose, width very variable, up to 40 cm. Rhizophores confined to the very base. Lower pinnae petiolate, 3 - 4-pinnate, deltate in outline. Lateral leaves light or dark green, (oblong-)lanceolate, 3.5 x 1.5 mm, subacute at apex, truncate at base, more or less ascending, distantly spaced even on ultimate branchlets. Median leaves small (1 mm long) with a long arista, somewhat auricled at their decurrent base, imbricate on the branchlets. The strobili short (ca 5 mm), light green. The strongly keeled sporophylls broadly ovate-acuminate; megaspores cream-coloured, microspores purplish.

Sometimes similar in habit to well-developed specimens of *Selaginella versicolor*, which however is neither pink at the stem base nor pubescent in any part, but shows false nerves and produces longer spires.

Ecological notes: A common plant of damp forest floors, especially near running or stagnant water; locally very abundant. From sea-level to 1300 m alt. or higher.

Citations: VOGEL 182 (11/1841), K; BARTER 1398, B, K; 2044, K; DALTON (1857), B; MANN 149 (12/1859), K; (1860), BM; LOPE DEL VAL 234, Rebola (3/3/1939), MA; GUINEA 359, "Monte Balea"* (28/12/1946),

*) "Monte Balea" is an elevation of 50 meters above the "Laguneta de Balea", 490 m altitude, not very far from Km 16 of the Eastern Highway. The site will be called "Balea" in this contribution.

BM, MA; ADAMS 1007, Basakato del Oeste "by pathside on cocoa farm" 90 m (6/12/1951), GC; 1024, Lago Loreto "on steep crater bank above lake" 900 m (6/12/1951), GC; ESCARRÉ 2006, Lago Loreto (1/1965), BC; BARLEICÓN 2034, Ureka (5/1965), BC; MALEST 2208, Valle Moka (16/1/1968), BC; G. & U. BENL FP 6, Playa de Carboneras (16/1/1974), M; FP 14, mouth of Río Mirupururú (16/1/1974), M; FP 42, Río Ruma 20 m (21/1/1974), M; FP 180, Río Iladyi, ca 1180 m (28/1/1974), M; FP 253, Highway Malabo - Airport Km 2-3, ca 10 m (23/12/1975), M; FP 531, above Basakato del Oeste 130 m (14/1/1976), FR, M.

Geogr. distribution: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Benin, Nigeria, Cameroon, Equatorial Guinea (FP holotype), Gabon, Congo, Zaïre, Angola, Tanzania, Kenya; Zanzibar, Madagascar. - African tropics.

(8) *Selaginella soyauxii* Hieron., in Engler & Prantl, Natürl. Pflanzenfam. 1(4) : 697 (1901).

Stems prostrate-ascending or erect from a creeping base, up to 2 mm in diam.; the numerous rhizophores up to 15 cm long. Frondose part 2 - 3pinnate with a very irregular outline, primary branches patent-erect, up to 15 cm long. Lateral leaves (up to 4.5 x 2 mm on stems, 2 x 0.8 mm on ultimate branches) oblong-lanceolate, acute, truncate at base, distant on stems and primary branches, subimbricate only in ultimate fan-shaped branchlets. Median leaves (2.5 x 1.5 mm and 1.5 x 0.6 mm respectively) obovate-elliptic, imbricate and decurrent on the branches, with an arista almost as long as the lamina. Strobili short (up to 8 x 3.5 mm); sporophylls unequal-sided, carinate: the dorsal pale green, oblong-lanceolate, acute, the ventral hyaline, obliquely deltate, ciliolate. Megaspores whitish turning brown, microspores yellowish to light brown.

Immediately distinguished from other species by its median leaves bearing a long and abrupt arista often reflexed almost at right angles to axis; other distinctive features are the stem colour and the large lateral leaves lacking false nerves and cilia.

Ecological notes: Preferring moist and shady sites (rocks, banks) in more or less open woodland between 200 and 1200 m elevation.

Citations: GUINEA 1090, SE of Musola (10/1/1947), MA; 1313, near Musola (13/1/1947), BM, MA; G. & U. BENL FP 38a, between Maule and Parador de Musola Km 10-11, 660 m (21/1/1974), M, Hb. Pic. Ser., YA; FP 122, Río Iladyi 1180 m (24/1/1974), M; FP 129, Forest near Río Iladyi ca 1180 m (24/1/1974), BM, K, M; FP 286, below Laka 225 m (27/12/1975), BC, FR, M; FP 461, above Belebú-Balachá path to Río Lombé 810 m (8/1/1976), BC, M; FP 488, above Ruiché path to Caldera 800 m (10/1/1976), M.

Geogr. distribution: Guinea, Sierra Leone, Liberia, Ivory Coast, Benin, Cameroon, Equatorial Guinea (FP), Gabon (holotype), Congo, Zaïre, Uganda. - Tropical regions in Africa.

- (9) *Selaginella molleri* Hieron. in Engler & Prantl, Natürl. Pflanzenfam. 1(4) : 697 (1901).

Stems suberect to erect from a very small creeping, often dichotomous base; pinnately branched upwards, the 5 - 12 alternate side branches (0.5 - 4.5 cm long, including strobili) simple, (bi)pinnate or forked, the ultimate branchlets very short (0.3 - 0.7 cm). Lateral leaves (1.8 - 2.8 x 0.8 - 1.2 mm) blue-green on upper, pale green on under surface, unequal-sided, obliquely elongate-ovate, rounded at base on upper side (with ciliate margin) and very shortly truncate on lower side. Median leaves ovate to elliptic, ca 2/3 as long as the lateral leaves. Strobili up to 5 mm long by 2 mm broad, sporophylls heteromorphic: the dorsal ones green, unequal-sided, cymbiform, the ventral ones hyaline, equal-sided, subovate.

This spikemoss is distinctive in its dwarf habit and in the median leaves which are regularly and strongly ciliate throughout the margins.

Ecological notes: In S. Tomé the plant has been found growing on banks in virgin forest and near a waterfall; from Fernando Po it is known as an "epiphyte on tree ferns and other trees".

Citations: WRIGLEY & MELVILLE 662, 2 miles SW of Lago de Biaó 1200 m (24/9/1959), BM, det. Crabbe. - Not previously reported from this island.

Geogr. distribution: Liberia, Nigeria, Equatorial Guinea (FP), S. Tomé (holotype).

- (10) *Selaginella molliceptis* Spring, Monogr. Fam. Lycopod. 2 : 257 (1849).

Synonymy: see ALSTON in EXELL 1944 : 97.

Suberect tufted stems with patent-erect bi- or tripinnate branches; branch-system elongate-pyramidal, branchlets relatively short. Lateral leaves (2.5 - 3 x 1 - 1.3 mm) dark green on upper surface, light green and sometimes with a metallic blue shine beneath, very unequal-sided, obliquely ovate-oblong, rounded at base on upper side with some cilia, auricled on lower side, spreading at right angles, subcontiguous on ultimate branchlets. Median leaves ovate-lanceolate, only to a third as long as the lateral leaves. Strobili 5 - 15 x 2 - 3 mm with two kinds of sporophylls markedly different in colour and shape from each other and also from the sterile leaves, the latter not grading into fertile ones. Larger upper sporophylls green, oblong, (sub)obtuse, with a (denticulate to) ciliate keel, very unequal-sided; lower sporophylls hyaline, ovate-lanceolate, long-acuminate to aristate, with the margins strongly ciliate.

This species is characterized by its narrow, often delicate branch-systems, the purplish stem-colour when fresh, as well as by the long-ciliate ventral sporophylls of the resupinate spikes. A regular ramification may also occur in *S. goudotana* var. *abyssinica*; in this plant, however, the strobili are inconspicuous,

whilst in the non-soboliferous *S. molliceps* a strobilus is sharply differentiated from the basal part of its branchlet, and therefore easily observed.

Ecological notes: Usually growing on boulders and on banks of water-courses in shady forest, but we frequently found it also in light positions, especially along paths and roads. Rarely epiphytic. Primarily reported from rain forest below 1000 meters.

Citations: BARTER 1392, B; DALTON (1857), B; GUINEA 495, Balea (28/12/1946), BM, MA; 511, Balea (28/12/1946), BM; THOROLD TF 33A, Ureka, on cocoa, 150 m (18/8/1951), BM; ADAMS 1006, Basakato del Oeste 90 m (6/12/1951), GC; G & U. BENL FP 18, Western Highway Malabo - Luba ca 10 m (19/1/1974), BC, M, Hb. Pic. Ser.; FP 38, between Maule and Parador de Musola Km 10 - 11, 660 m (21/1/1974), M, Hb. Pic. Ser.; FP 154a, Eastern Highway near Río Bososo 280 m (26/1/1974), M, Hb. Pic. Ser.; FP 196, S of Bococo between Río Bama and García ca 120 m (29/1/1974), BC, FR, M, Hb. Pic. Ser.; FP 229, Río Borabaabo ("Borabecho") ca 10 m (18/12/1975), M; FP 247, Eastern Highway Km 4 ca 20 m (21/12/1975), M; FP 259, Road to Basupú del Este ("Fishtown") 50 m (26/12/1975), BM, GZU, M, MO, YA; FP 272, Basilé 460 m (27/12/1975), M; FP 449, above Belebú-Balachá path to Ureka 730 m (8/1/1976), M; FP 515, Balea 510 m (12/1/1976), M; FP 533, above Basakato del Oeste 130 m (14/1/1976), M.

Geogr. distribution: Guinea, Liberia, Ivory Coast, Ghana, Togo, Nigeria, Cameroon, Centr. Afr. Rep., Equatorial Guinea (Río Muni, FP), S. Tomé & Príncipe (holotype?), Gabon, Congo, Zaire, Angola, Rhodesia. - Tropical regions in West and Central Africa.

Family PSILOTACEAE

PSILOTUM Swartz

***Psilotum nudum* (L.) Beauv., Prodr. Aethéog.: 112 (1805).**

Synonymy: see REED 1966 : 81.

From a rootless rhizomatous system (mycorrhizal, clothed with rhizoid hairs) arise erect, shoot-like fronds, these green, perennial, slender (ca 1.5 mm in diam.), triquetrous towards apex, 10 to 60 cm or even more tall, often densely clustered. From above their middle the fronds (simple in lower, profusely forked in distal parts) bear sterile scale-like pinnae, spirally arranged along the three ridges and replaced in upper regions of the dichotomies by subglobose "appendages" (yellow when mature, brown in age). These were analysed as fertile branched pinnae, each producing three fused but individual sporangia

(Bierhorst 1971). The plants may develop small bulbils on the rhizome. - *Psilotum*, the whisk-fern, with its simplicity and conspicuous primitiveness, probably represents the oldest type of living vascular plants.

Ecological notes: In West tropical Africa *Psilotum nudum* is generally found "among adventitious roots of oil and coconut palms; at sea-level to 4,000 ft.", according to ALSTON (1959), and more recently raphia palms have also been reported to serve as host trees (phorophytes). In addition, *Psilotum* is known from lava fields (e.g. of the Nyamuragira volcano N of the Kivu lake), and it was discovered in rock fissures near Algeciras in southern Spain (see BELLOT RODRIGUEZ 1966). In Fernando Po the only collection, which was fertile, was found growing epiphytically on tree fern trunks at 45 to 60 cm from the ground.

Citation: WRIGLEY & MELVILLE 631, S of Moka 1260 m (21/9/1959), K. - First record from the island.

Geogr. distribution: Senegal, Liberia, Ghana, Nigeria, Equatorial Guinea (FP), S. Tomé, Gabon, Congo, Zaïre, Rep. S. Afr. (incl. Lesotho), Mozambique, Rhodesia, Zambia, Madagascar, Mascarene Is, Comoro Is; widely diffused in tropical to subtropical regions of both hemispheres, usually in wet areas but locally rare. - Cape Verde Is, S. Spain.

Family SCHIZAEACEAE

LYGODIUM Swartz

Lygodium smithianum C. Presl ex Kuhn, Fil. Afr.: 169 (1868).

Synonymy: see LAWALRÉE 1970 : 4.

Underground rhizome creeping, wiry, dichotomously branched, with a brown-hairy apex. Leaves scandent by twining stipes and rachises, attaining several meters in length. Leaves showing the peculiar branching characteristic of the genus *Lygodium*, which is described here following Holtum (1966 : 53). The stramineous to light brown climbing main rachis (up to 3 mm in diam.) with its continuous apical growth produces alternate, very short "primary rachis-branches" (10 - 15 cm distant from each other and only 2 - 3 mm long) ending in a dormant bud covered with ferruginous hairs; just below this apex lateral "secondary rachis-branches" are attached, oppositely paired, up to 30 cm long and bearing pinnately arranged "leaflets". The primary branches correspond with the pinna-rachises (costae), the leafy secondary branches (occasionally branched again) are really pinnule-rachises (costules), and the leaflets match the pinnules of an ordinary compound fern frond. If the slender, sinuous main rachis is broken, the resting scaly bud next below will start to grow and to produce another branch-system.

In Smith's Climbing Fern all kinds of axis are rather pubescent, the main rachis soon becoming glabrous. The alternate pinnules, up to more than 20 cm long by 3 cm wide, are linear-oblong with an obtuse or acute apex and a truncate, slightly decurrent base; the terminal similarly-shaped pinnule (sometimes with a basal lobe) may be somewhat longer. Veins free, 2 - 3 times furcate. Sterile pinnules and sterile parts of fertile pinnules with finely toothed margins. Fertile parts fringed with small finger-like lobes of 3 - 5 mm in length (Benl 1975 : fig. 7) bearing a double row of egg- to pear-shaped sporangia, individually hidden beneath overlapping indusia. The spore cases exhibit a cap-like annulus round their narrowed end, which opens vertically; their structure is characteristic of the family. The climbing fronds as well as their manner of branching are unique among the ferns.

Ecological notes: This species, looking superficially more like a vine than a true fern, climbs up and over neighbouring shrubs and low trees, occurring in scrub at margins of secondary forest where there is sufficient sunlight, at elevations up to about 500 meters. We found it at roadsides on the NW coast of the island, and S. MALEST has seen it on the embankment of the Rio Consul near its mouth.

Citations: VOGEL 66, K; BARTER (6/1857), K, P; MANN 136 (12/1859), K; s.n. (1860), BM; KALBREYER 43 (3/2/1877), BM, K; MALEST 3666, "Playa de Fishtown" (1/1966), BC; G. & U. BENL FP 193, Bococo Drumen at sea-level (29/1/1974), BC, BM, FR, GZU, M, YA.

Geogr. distribution : Guinea, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon, Centr. Afr. Rep., Equatorial Guinea (FP), Gabon, Congo (holotype), Zaïre, Angola. - Tropical regions in West and Central Africa.

Family GLEICHENIACEAE

DICRANOPTERIS Bernhardt

Dicranopteris linearis (N. L. Burm.) Underw. var. *linearis*, in Bull. Torrey Bot. Club 34 : 250 (1907).

Synonymy: see HOLTUM 1959 : 33; PICHI SERMOLLI 1962 : 41.

Widely spaced, stiff, straggling leaves borne along a slender creeping rhizome (with brown hairs at apex) grow pseudo-dichotomously for an indefinite period, commonly reaching lengths of 1 to 1.2 meters. The main rachis (70 - 80 cm long, to 4 mm in diam.) bears a periodically resting hairy bud at its apex and a pair of lateral branch-systems, each consisting of a "primary rachis-branch" with a terminal, permanently dormant bud, and a pair of "secondary rachis-branches", this

ramification being successively repeated. Ultimate branches leafy, with a deeply pinnatifid lamina (pinna), linear-oblong, tapering to both ends, ca 20 cm long by 5 cm wide, thinly coriaceous; lamina-segments (pinnules) up to 50 on either side, each ca 4 mm wide, subglabrous, slightly glaucous on the under surface. Usually some nodes of the system with a pair of deflexed foliaceous "accessory branches" (just above the fork), resembling the ultimate branches, i.e. bearing a pinnatifid lamina. In addition a pair of lobed stipular leaflets (ca 1 cm long) may be present at lower rachis forkings. Free lateral veinlets twice-divided. Exindusiate sori, with up to 8 (-12) pear-shaped sporangia, borne superficially over the middle of a veinlet; each sporangium having a thickened ring running obliquely horizontally round the sporangium wall, dehiscing longitudinally.

This "umbrella-fern" is instantly recognizable by the peculiar forked habit of its bright green fronds.

Ecological notes: The scrambling, thicket-forming but not high-climbing fern usually thrives in open, exposed places, e.g. on roadside banks and on sunny edges of clearings in secondary forest. In Fernando Po this sun-fern is recorded from near sea-level to 1350 m elevation and characteristic of the "Praderas de Moka".

Citations: VOGEL 84, "ad littus" (11/1841), K; BARTER (6/1857), K; MANN 138, "at the beach" (12/1859), B, K; BRADLEY GREGORY (1874), BM; KALBREYER 223 (5/1877), B, BM, K; WRIGLEY & MELVILLE 676, Moka 1320 m (26/9/1959), BM, K; ESCARRÉ 3662, Parador de Musola (12/1964), BC; 3663, Valle Moka (3/1965), BC; G. & U. BENL FP 65, above Moka-Malabo ca 1350 m (22/1/1974), M; 273, Basilé 460 m (27/12/1975), M.

Geogr. distribution of variety: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon, Equatorial Guinea (Río Muni, FP. Annobon), S. Tomé & Príncipe, Gabon, Congo, Zaïre, Angola, Rep. S. Afr., Mozambique, Rhodesia, Zambia, Malawi, Tanzaniaia, Kenya, Ethiopia; Madagascar, Mascarene Is, Comoro Is, Seychelles.

The species is fairly polymorphic (more than a dozen varieties being known from Malaysia, for example) and has a wide distribution throughout the Old World tropics and wet subtropics.



Family OSMUNDACEAE

OSMUNDA L.

Osmunda regalis L. var. *regalis*, Sp. Pl. 2 : 1065 (1753).

Synonymy: *Aphyllocalpa regalis* (L.) Lag., García & Clem., in Anal. Cienc. Nat. 5(14) : 165 (1802).

For more synonyms see SCHELPE 1970 : 44.

Rhizome massive, up to 30 cm high, densely clad with persistent leaf bases and a thick mantle of fibrous roots. Fronds bipinnately compound, dimorphic, of leathery texture, with yellowish tomentum when young, glabrous when mature, tufted in a crown, about 1 to 1.8 m tall (or more in favourable situations); the stipe flattened into two stipule-like flaps at base. Sterile leaves nodding outwards, the stipe up to 1/3 their length, the lamina lanceolate-ovate to triangular in outline, ca 120 x 50 cm; pinnae shortly stalked, up to 9 (sub-)opposite on either side, ovate-lanceolate, to 30 - 40 cm long, pinnate; pinnules shortly petiolate or (sub-)sessile, up to 15 pairs, ovate to elliptic-oblong, 2 - 7 x 1 - 2 cm, often unequally lobed at their base, with margins entire or minutely serrulate; lateral veins free-forking. Partially fertile fronds upright, the stipe 1/2 their length; 2 - 4 lower pairs of sterile pinnae (similar to those of vegetative leaves) followed by 7 - 14 pairs of fertile pinnae, without a green lamina and much narrower than sterile ones; strongly reduced, slender pinnules more or less densely covered with exindusiate clusters of sporangia, these not arranged in definite sori; fertile distal portion soon turning rust-brown and withering. The two parts of a reproductive frond may be imperfectly differentiated, some of the lower segments bearing sporangia and/or some of the upper being developed like sterile ones. Sporangia spheroidal, with a primitive annulus (a mere patch of thick-walled cells at one side of the apex), the greenish spores shed through a stomium opening vertically over the top of the sporangium.

The "Royal fern", though very variable in details of its habit, is most quickly identified in the field by its fertile frond parts which resemble panicles.

Ecological notes: Occurs in constantly damp habitats, e.g. in marshy ground close to lakes or along open or wooded stream banks on rocks, stretching out into the water. Shows particular preference for situations where there are alternating periods of partial shade and full sunshine; it is never found in dark forests. Locally rare; in Fernando Po above 1000 m altitude.

Citations: TESSMANN 2893, Lago de Biaó (10/1920), B; EXELL 812, Biaó ca 1800 m "in the swamp fringing the crater lake" (30/1/1933), BM; ESCARRÉ 2009, Lago de Biaó (1/1965), BC; MALEST 2203, Lago de Biaó (17/1/1968), BC; G. & U. BENL FP 169, tributary to Río Iladyi 1190 m (28/1/1974), M.

Geogr. distribution: Guinea, Sierra Leone, Liberia, Nigeria, Cameroon, Centr. Afr. Rep., Equatorial Guinea (FP), Congo, Zaïre, Angola, Rep. S. Afr. (incl. Lesotho), Mozambique, Rhodesia, Zambia, Malawi, Tanzania, Kenya, Burundi, Rwanda, Uganda, Ethiopia, Sudan; Madagascar, Mascarene Is. - A subcosmopolitical element, preferring temperate regions.

Var. *abyssinica* (Kuhn) Pic. Ser. has been described from Ethiopia.

Family CYATHEACEAE

ALSOPHILA R. Br.

1 - Fronds bipinnatifid to bipinnate. Stipe with some rudimentary spines at base only. Upper surface of pinnae hairy on the costa

... .. *camerooniana* (Hooker in Hooker & Baker) Tryon
var. *camerooniana*

1 - Fronds tripinnatifid to tripinnate

2 - Stipe bearing sharp spines up to 4 mm long or more; old stipe bases persistent, remaining entire; rachis muricate. Costae and costules densely hairy above

... .. *manniana* (Hooker in Hooker & Baker) Tryon

2 - Stipe unarmed, merely muricate-tuberculate towards the base; old stipe bases finally lacerate; rachis non-muricate. Costules glabrous above

... .. *dregei* (G. Kunze) Tryon var. *dregei*

Alsophila camerooniana (Hooker in Hooker & Baker) Tryon var. *camerooniana*, in Contr. Gray Herb. 200 : 30 (1970).

Synonymy: *Cyathea camerooniana* Hooker in Hooker & Baker, Syn. Fil. : 21 (1865).

Alsophila congoensis Bonap., Notes Ptéridol. 14 : 241 (1923-24).

Cyathea aethiopica auct., non Domin.

Tree fern with a short slender stem up to 2 m tall. Fronds 0.6 - 2.6 m (rarely more) in length; stipe brown to violaceous, slightly verrucose, scaly at the persistent base; lamina ovate-lanceolate, ca 60 cm wide; rachis more or less tuberculate, covered with appressed, decaying, hair-like scales on both sides. Pinnae sessile, linear-lanceolate, 20 - 30 cm long by 3 - 4 cm wide, pinnate to pinnatifid towards apex, the lower ones reduced. Segments linear, subacute or obtuse, serrulate (especially at their ends), up to 3 x 0.5 cm, dark green on upper surface, paler beneath. Costae and costules on both surfaces paleaceo-hirsute like the rachis. The small sori (up to 28 or more per segment), being arranged at the forking of the nerves, thus form parallel rows.

Ecological notes: Local in wet shady forest (virgin and secondary) beside water-courses and on lake banks, at elevations between 500 and 1800 m, often among *Alsophila manniana*.

Citations: MÖNKEMEYER (5/1885), B; MILDBRAED 6270, Pico 600 - 800 m (1911), B; 7022, above Musola ca 650 m (11/1911), B, HBG; GUINEA 388, Balea (28/12/1946), MA; 2086 & 2090, Moka - Concepción (28/1/1947), MA; 2092, "Las Costeras" (28/1/1947), BM; 2094, "Las Costeras" (28/1/1947), MO; WRIGLEY & MELVILLE 668, SW of Lago de Biaó 1200 m (24/9/1959), BM; G. & U. BENL FP 71, Biaó inside the crater border 1800 m (22/1/1974), M; FP 482, Laguna Lombé 840 m (10/1/1976), BOL, FR, M: FP 514, Balea 510 m (12/1/1976), M; FP 549 & 551, Mte Baká 1460 m (15/1/1976), M.

Geogr. distribution: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon (holotype), Centr. Afr. Rep., Equatorial Guinea (Río Muni, FP), S. Tomé & Príncipe, Gabon, Congo (?).- Tropical regions in West and Central Africa.

Var. *zenkeri* (Diels) Benl comb. nova is known so far from Ivory Coast, Cameroon, and Río Muni. - Basionym: *Alsophila zenkeri* Hieron. ex Diels in Engler & Prantl, Natürl. Pflanzenfam. 1 (4) : 135 (1899-1900).

Alsophila manniana (Hooker in Hooker & Baker) Tryon, in Contr. Gray Herb. 200 : 30 (1970).

Synonymy: *Cyathea manniana* Hooker in Hooker & Baker, Syn. Fil. : 21 (1865).

For further synonyms see TARDIEU-BLOT 1964 : 52.

The largest tree fern in West tropical Africa, with slender trunks 6 - 10 m high and up to 15 cm in diameter. Fronds horizontal or arching, up to 3,5 m long, the lamina reaching 1 m in width; stipe scaly (scales with pale ciliate margins) and extremely spiny at its base, muricate upwards; rachis brown or purplish like the stipe, muriculate when young. Primary pinnae lanceolate and shortly petiolate, 50 - 60 x 20 cm; secondary pinnae sessile, approximately 12 x 1.5 cm, with a caudate-acuminate apex, pinnate or pinnatifid with segments narrowly oblong, somewhat falcate and subacute, the margins slightly serrulate; upper surface more or less glaucous. Costae and costules densely pilose, the hairs being light brown on lower surface, dark brown above. Sori (up to 9 per segment) relatively thick (0.8 mm in diam.), intermingled with large fringed scales.

Ecological notes: This splendid palm-like tree fern forms the famous "Cyathea" groves in the misty zone of the Pico de Malabo (at ca 1350 - 1900 m altitude) and is a particularly characteristic constituent of the upland vegetation of Fernando Po, both in the grassland regions of Moka, where large patches of tree ferns occur in secondary formations along streams and in ravines and gullies, and in the virgin forest near the monsoon coast. In tropical regions with high rainfall

arborescent ferns are usually restricted to the montane zone, but in Fernando Po one can find many juvenile plants of *Alsophila manniana* at much lower elevations, near and within the Valle Moka from ca 600 m upwards (BENL 1977: 46).

Spaces between the persistent stipe bases are often colonized by certain epiphytic ferns, such as *Blechnum attenuatum* and *Asplenium hypomelas*. "The translucent crowns of these gigantic ferns permit a certain amount of light to penetrate to the ground creating a most uniform light intensity. On a sunny day the light intensity at ground level is around three times greater in a tree fern forest than in a high forest" (JOHANSSON 1974 : 64).

Citations: MANN 41, B; 363, 1000 m (1860), K; s.n. (1861, 1862), BM; EXELL 843, Moka 1200 - 1350 m (1/2/1933), BM; LOPE DEL VAL 238, Rebola (3/3/1939), MA; GUINEA 1006, Musola Monkey Bush (9/1/1947), MO; 1007, Musola (9/1/1947), BC; 1008, Musola Monkey Bush (9/1/1947), BM; 1012, Musola Monkey Bush (9/1/1947), MA; ADAMS 1081, near Iladyi Falls 1140 m (8/12/1951), BM, GC; 1121, near Lago de Biaó in mist forest 1650 m (9/12/1951), BM; ESCARRÉ 2041, "Bajada al Lago de Biaó" (1/1965), BC; 2042, Belebú-Balachá (3/1965), BC; G. & U. BENL FP 36, between Maule and Parador de Musola Km 10 - 11, 660 m (21/1/1974), M; FP 292, above Musola path to Belebú-Balachá 360 m (29/12/1975), M; FP 323, between Maule and Parador de Musola 700 m (31/12/1975), M; FP 406, Pico 1700 m (6/1/1976), M; FP 419, Pico 1600 m (6/1/1976), M; FP 518, "Pantano del Km 35" of the Western Highway Malabo - Luba 10 m! (14/1/1976), FR, M.

Geogr. distribution: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon, Centr. Afr. Rep., Equatorial Guinea (Río Muni, FP - lectotype, Annobon), S. Tomé, Gabon, Congo, Zaire, Angola, Rep. S. Afr., Mozambique, Rhodesia, Zambia, Malawi, Tanzania, Kenya, Uganda, Ethiopia, - Widespread in tropical Africa.

Alsophila dregei (G. Kunze) Tryon var. *dregei*, in Contr. Gray Herb. 200 : 30 (1970).

Synonym: *Cyathea dregei* G. Kunze, in Linnaea 10 : 551 (1836).

For further synonymy see SCHELPE 1970 : 74.

Arborescent fern with stout trunks up to 6 (8?) m high and 25 - 50 cm in diameter. The arching fronds about 3 m long; stipe bases tuberculate and fusco-paleaceous, the scales of uniform colour, longer (5.5 cm) and narrower than those of *Alsophila manniana*. Lamina ovate to elliptic, lighter on lower surface; rachis pale brown to castaneous like the stipe, hairy, becoming subglabrous. Primary pinnae oblong-lanceolate and shortly petiolate, 60 cm or more long, 30 cm broad, lower pinnae reduced; secondary pinnae sessile, linear, long-acuminate, up to 15 x 2 cm, pinnate or pinnatifid with segments subfalcate, acute or subobtuse, entire or crenate (subserrate) towards apex, margins often inflexed. Costae and costules generally glabrous above like the whole lamina, on

lower surface often covered with ferruginous scales. Sori (up to 12 per segment) rather thick (1 mm diam.), sometimes intermingled with hair-like scales.

Ecological notes: This species, which is new to the island, generally prefers relatively open situations. We found it at the margin of the primary forest on the outer slope of Loreto crater, together with *Alsophila manniana*.

Citation: G. & U. BENL FP 97, Loreto 980 m (24/1/1974), M. - The habit of this tree fern varies widely, apparently as a response to conditions of exposure and humidity. Our plant is very similar to a specimen of C.D. ADAMS' no 1586, Mamfe-Bamenda road (Cameroon), BM, M, and resembles in some respects M. NICKEL's no 23, Bayangam - Bafousam (Cameroon) 1400 m, P.

Geogr. distribution: Guinea, Sierra Leone, Ghana, Nigeria, Cameroon, Equatorial Guinea (FP), Congo, Zaire, Angola, Rep. S. Afr. (holotype), Mozambique, Rhodesia, Zambia, Malawi, Tanzania, Kenya, Uganda; Madagascar.- African tropics.

From Madagascar two endemic varieties are known: *Alsophila dregei* Tryon var. *polyphlebia* (Baker) Benl comb. nova - Basionym: *Cyathea polyphlebia* Baker, in J. Linn. Soc. 20 : 303 (1883) -, and *Alsophila dregei* Tryon var. *segregata* (Baker) Benl comb. nova - Basionym: *Cyathea segregata* Baker, in J. Linn. Soc. 20 : 303 (1883).

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