

AN ACCOUNT OF THE FERN GENUS *BELVISIA* MIRBEL
(POLYPODIACEAE)

P. H. HOVENKAMP & N. A. P. FRANKEN

Rijksherbarium/Hortus Botanicus, Leiden, The Netherlands

SUMMARY

The genus *Belvisia* is revised. Two species are transferred from *Lemmaphyllum* to *Belvisia*, and two species are reduced to varieties. The genus now includes eight species, reaching from tropical Africa to China, Polynesia, and Australia.

Mirbel (1803a: 65; 1803b: 473) established the genus *Belvisia* for that part of the Linnean genus *Acrostichum* that is characterized by linear receptacles on both sides of the midrib, reaching to the lamina margin, and opening towards the lower surface. Mirbel included five species in *Belvisia*, but did not make any of the necessary new combinations (1803c: 114–116). The five species are “remarkably unrelated” (Cope-land, 1947) and a “meaningless jumble” (Morton, 1946), but among them was *Acrostichum spicatum* L. f. This m el ee of unnamed species was conveniently forgotten for almost a century.

In the course of that century, Kaulfuss (1824) newly established the genus *Hymenolepis*, based on *Acrostichum spicatum*, for which he substituted the name *Hymenolepis ophioglossoides*. Kaulfuss’ generic circumscription was based mainly on the linear sori and the presence of scaly paraphyses. In this sense, the genus was accepted as distinct from *Acrostichum* L. by most 19th century authors (Blume, 1828; Kunze, 1842; Presl, 1851; F ee, 1852; Moore, 1857; Kuhn, 1868; J. Smith, 1875). Dissenting views were expressed by Mettenius (1869), who linked the ferns under discussion with *Taenitis*, and Hooker (1863), who adhered to a wider view of *Acrostichum*. However, Diels (1899) and Christensen (1906) succeeded in firmly establishing the genus as distinct.

By then, several species had been added to *Hymenolepis* and one of these was again removed by Presl (1851) and used to establish *Macroplethus*. Kunze (1850) substituted *Hyalolepis* for *Hymenolepis*; however, *Hyalolepis* had been used earlier for a genus of the Compositae. That the same was true for *Hymenolepis* was later pointed out by Underwood (1899) and Becherer (1936). Becherer therefore revived Mirbel’s name *Belvisia*, and lectotypified it by *Acrostichum spicatum*, this being simply the species that came first in Mirbel’s account. Tagawa (1942) did not accept this lectotypification, and substituted Presl’s name *Macroplethus*, based on *Hymenolepis platyrhynchos* Kunze. Becherer’s arbitrary lectotypification was also disputed by Morton (1946), who chose *Acrostichum septentrionale* L. as type species, based

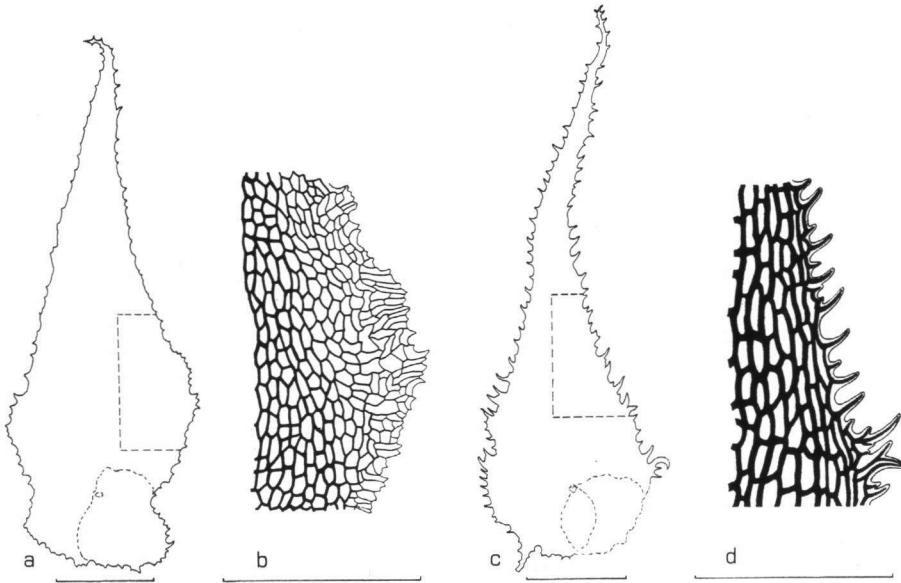


Fig. 1. Scales. — *Belvisia spicata* (L. f.) Copel., a. outline, b. detail of margin (van Steenis 18445). — *B. mucronata* (Fée) Copel., c. outline, d. detail of margin (Philipson 10429). — Dotted line in a & b = margin of overlapping basal extensions; scale bars = 1 mm.

on the fact that this species is the only one for which Mirbel cited an illustration. However, Copeland, in his influential *Genera Filicum* (1947) accepted *A. spicatum* as type of the genus, which he could accordingly name *Belvisia*. He was followed by Holttum (1949) and Pichi Sermolli (1954), who settled the argument in an exhaustive study of all the available names and type species for this genus. Since then, consensus exists that *Belvisia* Mirbel, typified by *Acrostichum spicatum* L. f., is the proper name for this group of ferns.

VARIABILITY

Fée (1852) accepted 5 species, Moore (1857) 4, and J. Smith (1875) 3. Christensen at first (1906) accepted 4 species, but later, in a monograph of the genus (1929), partly based on unpublished work by Hieronymus, he recognized 11 species and a considerable number of varieties and formae. At the same time he admitted that only two or three characters were "of value as specific ones." This was perhaps a bit pessimistic. In the present account 8 species are recognized, and 2 subspecies. This is accomplished with the aid of the following characters.

Rhizome

The rhizome is short-creeping in most species, with fronds more or less crowded, but it is long-creeping with well-spaced fronds in *Belvisia novoguineensis* and

B. abbreviata. The fronds are inserted dorsally in two (rarely more) rows. The stele is a perforated dictyostele, and a variable number of sclerenchyma strands is present.

Scales

The rhizome scales are basally attached (Fig. 1), pseudopeltate with overlapping basal extensions, clathrate, and have an entire to ciliate margin. The following scale characters have diagnostic value:

Outline — In most species, the scales have a narrow, sometimes almost filiform acumen. However, in *B. spicata* and *B. validinervis* the acumen is relatively short and wide. The apex is usually acute, but may be obtuse to rounded.

Margin — The margin of the scales may be rather irregularly entire, or more or less dentate to distinctly ciliate, with teeth that are formed by protruding thick cell walls (Fig. 1b). Independently from this marginal configuration, a variable number of multicellular hairs, usually tipped with a gland, may also be present, mainly in the basal and extremely apical region. These latter hairs have little, if any, diagnostic value.

Colour — On macroscopic inspection, the colour may vary between reddish-brown and black. A distinct iridescence is present in *B. validinervis*.

Cell structure — In most species, all cells are clathrate. In *B. spicata* and *B. validinervis*, however, there is usually a more or less distinct marginal zone with non-clathrate cells (Fig. 1a). In a less distinct form, such a marginal zone may be present in *B. abbreviata*. The luminae of the central cells vary in width from 10–30 µm wide in *B. henryi* to 30–110 µm wide in *B. platyrhynchos* and *B. dura*.

Fronds (Fig. 2)

The fronds are uniformly entire and usually monomorphic, with a distinct stipe and usually a fertile spike at the apex. A light degree of sterile/fertile dimorphism has developed only in *B. abbreviata*. The sterile part shows hardly any diagnostic characters. It is very variable in size, with a length–width index ranging from 4 to 75. The primary veins are immersed or prominent in dried material, the secondary and tertiary veins form irregular areoles with many free veinlets, which are mainly directed towards the primary vein. Mature fronds are usually glabrous, but a few scales may be found on the lamina and the midrib. A major diagnostic character is the shape of the transition between the basal sterile part of the frond ('lamina') and the apical fertile part ('spike'). In most species, the lamina is very gradually narrowed towards the spike, which itself is sharply distinct, often distinctly separated from the lamina by a constriction (Fig. 2c, e–g). In *B. annamensis* (Fig. 2a) and especially *B. henryi* (Fig. 2b) the lamina is more abruptly truncated, but not separated from the spike by a constriction. Especially in *B. annamensis* the spike is not sharply distinct from the lamina, with the sori often extending downwards into the upper, narrowed, part of the lamina. In *B. novoguineensis* (Fig. 2d), lamina and spike are not at all distinct, with a very gradual transition from the wide, sterile part of the lamina to the narrower fertile part.

Sori

The sori are located in the apical spike, a strongly narrowed part of the frond. A long narrow spike (length–width index up to 50–120), with sori fully covering the

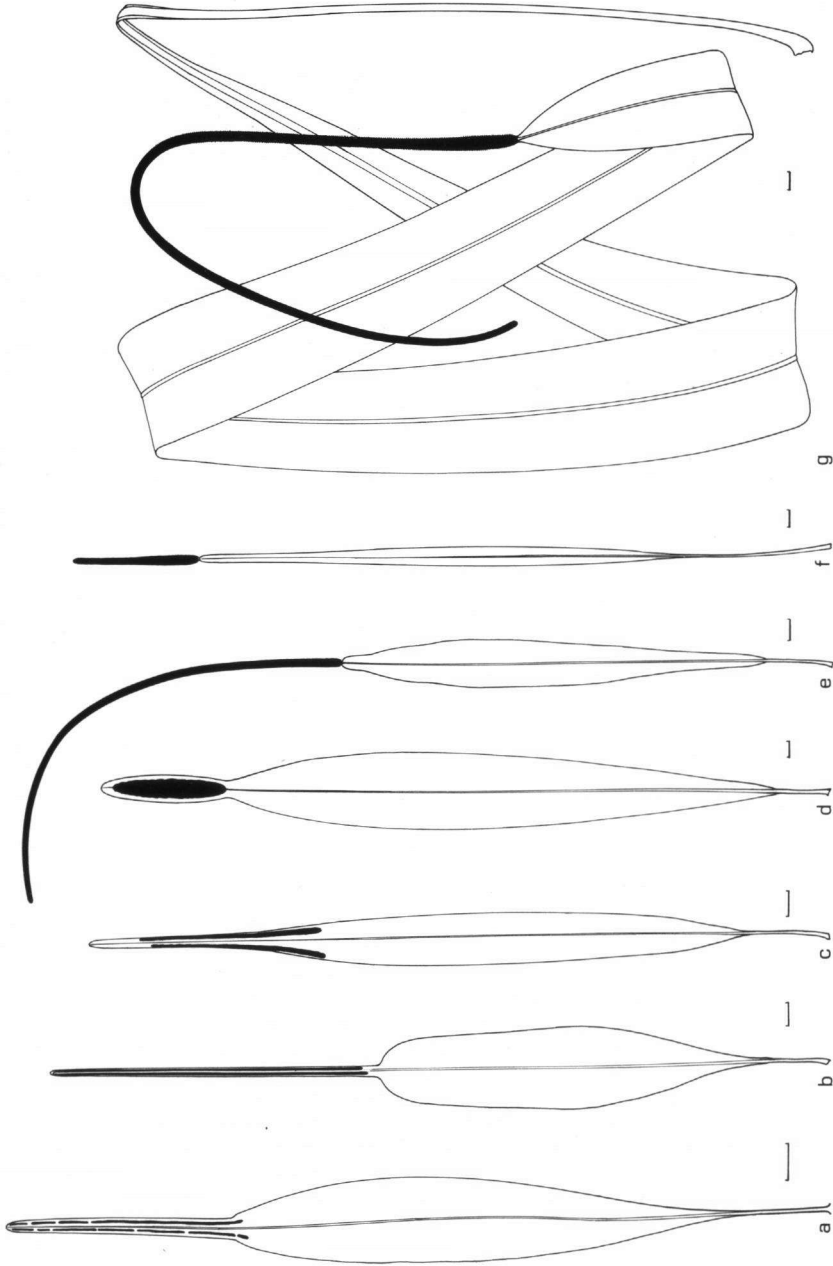


Fig. 2. Frond outlines (all specimens L). — a. *Belvisia annamensis* (C. Chr.) Tagawa (*Hennipman* 3987). — b. *B. henryi* (C. Chr.) Raymond (*Hennipman* 3376). — c. *B. novoguineensis* (Rosenst.) Copel. (*Schodde* 1535). — d. *B. platyrhynchos* (Kunze) Copel. (*Celestino* PNH 3044). — e. *B. spicata* (L. f.) Copel. (*Beaman* 7920). — f. *B. validinervis* (Kunze) Copel. (*Croft* LAE 61604). — g. *B. validinervis* (Kunze) Copel. var. *longissima* Hovenkamp & Franken (*Brass* 10647). — Scale bars = 1 cm.

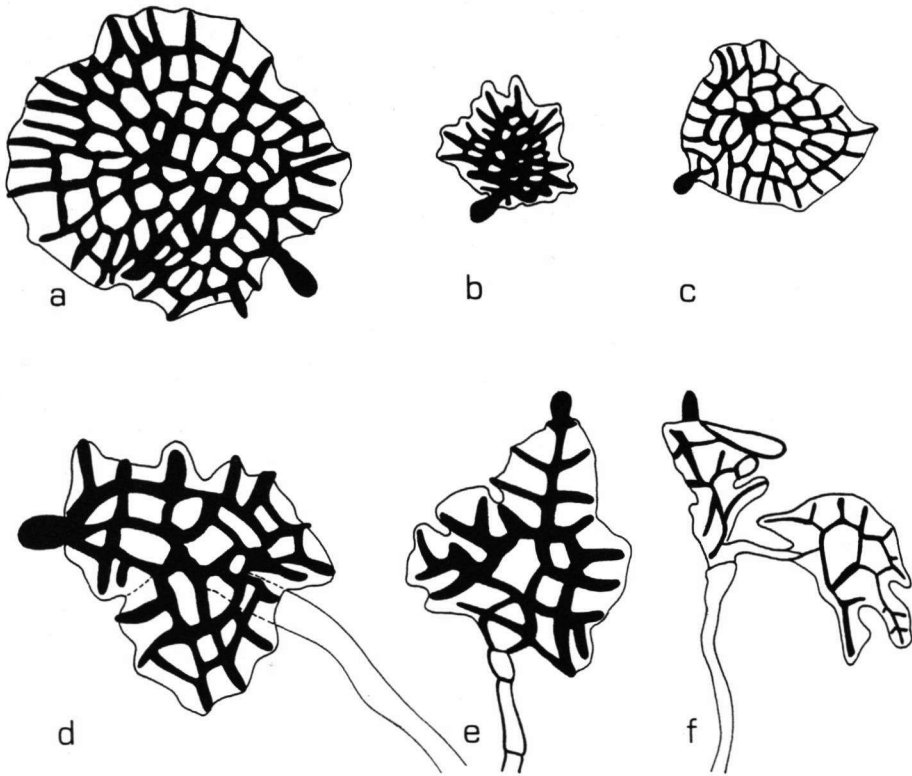


Fig. 3. Paraphyses (all $\times 125$). – a. *Belvisia abbreviata* Hovenkamp & Franken (*Gaudichaud s.n.*). – b. *B. annamensis* (C. Chr.) Tagawa (*Geesink & Santisuk 4916*). – c. *B. mucronata* (Fée) Copel. (*van Borssum Waalkes 1958*). – d. *B. novoguineensis* (Rosenstock) Copel. (*Hoogland & Pullen 5587*). – e. *B. platyrhynchos* (Kunze) Copel. (*Clemens 16300*). – f. *B. spicata* (L. f.) Copel. (*Wild 6571*).

entire width when ripe is present in most species. Wider spikes with a distinct sterile marginal zone occur in *B. annamensis* and *B. platyrhynchos*. In *B. annamensis* the sori are situated centrally between midrib and margin, with a distinct sterile zone usually present between the midrib and the sorus; in the transitional zone the sorus in this species tends to follow the margin (Fig. 2a). The short, wide spike (length–width index 2–12) of *B. platyrhynchos* (Fig. 2d) has a distinct sterile margin 4–5 mm wide.

Paraphyses (Fig. 3)

The paraphyses are sterile, scale-like structures that occur interspersed between the sporangia. They are best searched for in young sori. In older sori they tend to fall off, and particularly in *B. annamensis* and *B. henryi* paraphyses are often completely absent when the sporangia are ripe. However, in young sori on unfurling fronds the paraphyses are often not fully developed. There is much variation in the shape of the

paraphyses, and different paraphyses often occur in the same sorus. They consist of a stalk with a laterally or peltately affixed blade, which may be entire or variously incised. Like the scales, the blades of the paraphyses are clathrate. Small blades in which the walls of the central cells are so strongly thickened that the lumina are almost entirely filled are characteristic for *B. annamensis* (Fig. 3b) and *B. henryi*. Other species usually have larger blades, in which the central cells have open lumina. Paraphyses with peltately and laterally affixed blades often occur in the same sorus in most species except *B. annamensis* and *B. henryi*, which have only peltate paraphyses. The regular occurrence of irregularly branched scale-like structures (Fig. 3f) is characteristic for *B. spicata* and *B. validinervis*.

Spores

The spores of *Belvisia* have been treated separately by Van Uffelen (1992).

SYSTEMATIC POSITION

In the present circumscription, *Belvisia* includes two species not included by Christensen (1929), both of which he included in *Lemmaphyllum* (*B. abbreviata*, *B. novoguineensis*). For Christensen, the position of these species was highly ambiguous, and he expressed his doubts whether any of the two involved genera was really monophyletic. When we now place the two species in *Belvisia* this is based on the observation that the then remaining species of *Lemmaphyllum* (*L. accedens* and *L. carnosum* s.l.) both have strictly peltate scales, whereas in *Belvisia* all species now included have basifixed scales with overlapping auricles. This character, not seen by Christensen, not only separates the genera readily, but also argues against a derivation of *Belvisia* from *Lemmaphyllum*. Following Hovenkamp (1986), we consider pseudopeltate scales to be intermediate in the transformation of simple hairs to peltate scales. Under that assumption, it is not likely that a genus with pseudopeltate scales is derived from a species with peltate scales. There are, in our opinion, no arguments either to favour the opposite, a derivation of *Lemmaphyllum* from *Belvisia*. In fact, *Belvisia* and *Lemmaphyllum* share few, if any, characters with each other that are not shared also with *Lepisorus*. Only the coenosori might be used to unite the two genera, but the plethora of forms intermediate between separate and fused sori in *Lemmaphyllum carnosum* in our opinion clearly shows that the coenosorus in that species is not inherited from a single coenosoroid ancestor. It is an independent development, possibly arrived at independently several times within *Lemmaphyllum*. That coenosori are readily formed independently in unrelated groups has been made sufficiently clear (Christensen, 1929; Ravensberg & Hennipman, 1986).

References cited above:

- Becherer, A. 1936. Conservation d'homonymes génériques dans les fougères. *Candollea* 7: 137–139.
Blume, C.L. 1828. *Enumeratio Plantarum Javae*. II. Filices.
Christensen, C. 1906. *Index Filicum*.
Christensen, C. 1929. Taxonomic fern studies. I. *Dansk Bot. Ark.* 6 (3): 54–73.
Copeland, E.B. 1947. *Genera Filicum*.
Diels, L. 1899. In: Engler & Prantl, *Die natürlichen Pflanzenfamilien* 1, 4. Polypodiaceae.
Fée, A.L.A. 1852. *Genera Filicum*. 5me Mém.

- Holtum, R.E. 1949. The selection of type-species of some old genera of ferns. *Gard. Bull. Singapore* 12: 303–306.
- Hooker, W.J. 1863. *Species Filicum* V.
- Hovenkamp, P. 1986. A monograph of the fern genus *Pyrrosia* (Polypodiaceae). *Leiden Bot. Series* 9: 1–280.
- Kaulfuss, G.F. 1824. *Enumeratio Filicum*.
- Kuhn, M. 1868. *Filices Africanæ*.
- Kunze, G. 1842. *Farnkräuter*.
- Kunze, G. 1850. *Index Filicum*. *Linnaea* 23.
- Mettenius, G. 1869. In: Miquel, *Ann. Mus. Bot. Lugd.-Bat.* 4.
- Mirbel, C. 1803a. *Histoire naturelle générale et particulière des plantes*. 4.
- Mirbel, C. 1803b. *Histoire naturelle des végétaux* 3.
- Mirbel, C. 1803c. *Histoire naturelle des végétaux* 5.
- Moore, T. 1857. *Index Filicum*.
- Morton, C.V. 1946. The fern studies of Mirbel. *J. Wash. Acad. Sc.* 36: 166–169.
- Pichi Sermolli, R.E.G. 1953. The nomenclature of some fern genera. *Webbia* 9: 405–409.
- Presl, C.B. 1851. *Epimeliæ Botanicae*.
- Ravensberg, W.J. & E. Hennipman. 1986. The *Pyrrosia* species formerly referred to *Drymoglossum* and *Saxiglossum*. *Leiden Bot. Series* 9: 281–310.
- Smith, J. 1875. *Historia Filicum*.
- Tagawa, M. 1942. *Hymenolepis* Klf. should be substituted by *Macroplethus* Pr. *Acta Phytotax. Geobot.* 11: 232–235.
- Uffelen, G.A. van. 1992. Sporogenesis in Polypodiaceae (Filicales). II. The genera *Microgramma* Presl and *Belvisia* Mirbel. *Blumea* 36: 515–540.
- Underwood, L.M. 1899. A review of the ferns proposed prior to 1832. *Mem. Torrey Bot. Club* 6: 247–283.

BELVISIA

- Belvisia* Mirbel, *Hist. Nat. Gen.* 4 (1803) 65; *Hist. Nat. Vég.* 3 (1803) 473; *ibid.* 5 (1803) 111; L.M. Underw., *Mem. Torrey Bot. Club* 6 (1899) 276; Copel., *Gen. Fil.* (1947) 191; Pichi Sermolli, *Webbia* 9 (1953) 387; Holtum, *Fern Fl. Mal.* (1954) 153, f. 67 & 68; Copel., *Fern Fl. Philipp.* 3 (1961) 466; Pichi Sermolli, *Webbia* 31 (1977) 324. — Lectotype species: *Belvisia spicata* (L.f.) Copel.
- Hymenolepis* Kaulf., *Enum. Fil.* (1824) 146, pl. i: f. 9, nom. illeg., non Cassini (1817); Blume, *Enum. Pl. Jav.* (1828) 200; Endl., *Gen. Pl.* (1836) 62; Presl, *Epim. Bot.* (1851) 158; Fée, *Mém. Fougères* 5 (1852) 81, pl. 6B; T. Moore, *Ind. Fil.* (1857) 28, pl. 15A; Bedd., *Ferns S. India* (1863) 15, pl. 26; J. Sm., *Ferns Br. & For.* (1866) 91, pl. 19; *Hist. Fil.* (1875) 118; Diels in Engler & Prantl, *Nat. Pflanzenfam.* 1, 4 (1902) 305, f. 161 F–H; Copel., *Dept. Int. Bur. Gov.* 28 (1905) 110; Alderw., *Mal. Ferns* (1908) 727; Domin, *Bibl. Bot.* 85 (1915) 168; Alderw., *Mal. Ferns, Suppl.* (1917) 432; Goebel, *Ann. Jard. Bot. Buitenzorg* 36 (1926) 108, pl. 7, f. 34–43; Bower, *Ferns* 3 (1928) 222, f. 731; C. Chr., *Dansk Bot. Ark.* 6 (1929) 54, f. 1; Backer & Posth., *Varenfl. Java* (1939) 228, f. 53; C. Chr. & Tardieu, *Notul. Syst.* 8 (1939) 185; Tardieu & C. Chr., *Fl. Gén. Indochine* 7 (2) (1941) 451, f. 53: 1–2; Tardieu, *Mém. Inst. Fr. Afr. Noire* 28 (1953) 207; Alston, *Ferns W. Trop. Afr., Suppl.* (1959) 48. — Type species: *Hymenolepis ophioglossoides* Kaulf. [= *Belvisia spicata* (L.f.) Copel.].
- Hyalolepis* Kunze, *Linnaea* 23 (1850) 258, nom. illeg., non DC. (1837). — Type species: *Hyalolepis ophioglossoides* (Kaulf.) Kunze [= *Belvisia spicata* (L.f.) Copel.].
- Macroplethus* Presl, *Epim. Bot.* (1851) 141; Tagawa, *Acta Phytotax. Geobot.* 11 (1942) 232. — Type species: *Macroplethus platyrhynchus* (Kunze) Presl [= *Belvisia platyrhynchus* (Kunze) Copel.].

Note – Species of *Belvisia* have been named in *Acrostichum*, *Gymnopteris*, *Lomaria*, *Onoclea*, *Schizaea*, and *Taenitis*.

Epiphytic, rhizome short- to long-creeping, approximately terete, covered with scales, dorsally with 2 rows of fronds, ventrally and laterally densely set with roots, dictyostelic, with scattered sclerenchyma strands. Rhizome scales basifixed, pseudopeltate, ovate to linear-lanceolate, fully clathrate or with a membranaceous margin, reddish to brown, entire to dentate, with a varying number of glandular cells on the margin. *Fron*ds simple, entire. Stipes articulated to the rhizome, basally terete, upwards adaxially grooved, sometimes winged. Lamina linear-lanceolate to linear, base cuneate, apex gradually narrowed or abruptly truncate to the narrow fertile part, olivaceous to brown when dry, dull, pergamentaceous, thinly covered with scattered, mostly caducous scales. *Veins* anastomosing, forming areoles with many scattered free veinlets, free veinlets in the costal and marginal areoles all and in the other areoles predominantly directed to the costa; midrib distinct throughout the sterile and the fertile part of the lamina, secondary veins distinct or indistinct, immersed, tertiary veins and veinlets immersed. Fertile part linear-lanceolate to linear, with one elongated, sometimes interrupted, sorus at each side of the midrib usually fully covering the lamina between midrib and margin, sometimes leaving a narrow zone free along the midrib. Sporangia with 12–16 indurated annulus cells, mixed with peltate or basally attached paraphyses. *Spores* monolete, rugulate.

Distribution — Tropical Africa east to tropical Asia and Polynesia, extending to South China, Tahiti, Rapa and Australia.

Note — In the following key, the term lamina refers to the sterile part of the lamina only, the term spike refers to the fertile apical part.

KEY TO THE SPECIES

- 1a. Rhizome long-creeping; fronds scattered at intervals of up to 7 cm 2
- b. Rhizome short-creeping; fronds tufted or spaced at intervals of at most 2 cm 3
- 2a. Sori short, up to 1 cm long, on a short spike which is nearly always sharply distinct from the lamina **1. B. abbreviata**
- b. Sori much longer, on a longer spike which gradually merges into the upper part of the lamina **6. B. novoguineensis**
- 3a. Paraphyses peltate only (often completely absent in old sori), usually opaque with lumina of central cells almost entirely filled with wall material; lamina usually asymmetrically truncate below the spike 4
- b. Some paraphyses with laterally affixed blades nearly always present, usually translucent; lamina usually gradually and symmetrically narrowed below the spike 5
- 4a. Spike 4–7 mm wide; sori medial between midrib and margin **2. B. annamensis**
- b. Spike up to 4 mm wide; sori close to the midrib **3. B. henryi**
- 5a. Rhizome scales with dentate to ciliate margin, all cells thick-walled 6
- b. Rhizome scales entire or almost so, central cells thick-walled, marginal cells thin-walled 7
- 6a. Sori leaving a clear marginal and sometimes also a narrow costal zone free; spike relatively wide, to 2 cm wide **7. B. platyrhynchos**

- b. Sori completely covering the spike; spike usually narrow, linear, 0.1–0.2 (rarely up to 1) cm wide 4. **B. mucronata**
- 7a. Rhizome short; leaves tufted; scales dull with a dark-brown centre and a lighter margin; lamina generally 1–2 cm wide 8. **B. spicata**
- b. Rhizome more widely creeping; fronds scattered at intervals of up to 2 cm; scales uniformly light brown, glossy or iridescent; lamina generally 3–4 (sometimes up to 6) cm wide 9. **B. validinervis**

1. *Belvisia abbreviata* (Fée) Hovenkamp & Franken, *comb. nov.* – Fig. 3a

Drymoglossum abbreviatum Fée, Mém. Fougères 5 (1852) 26, t. 10: f. 2; C. Chr., Ind. Fil. (1906) 246. — *Hymenolepis abbreviatum* Fée, Mém. Fougères 10 (1865) 12; C. Chr., Ind. Fil. Suppl. 3 (1934) 113. — *Polypodium abbreviatum* C. Chr., Ind. Fil. Suppl. 2 (1917) 25, nom. illeg., non *P. abbreviatum* Mett., Fil. Hort. Lips. (1856) 33 (= *Pyrrosia*). — *Lemmaphyllum abbreviatum* C. Chr., Dansk Bot. Ark. 6 (1929) 50. — *Macrolethus abbreviatus* Tagawa, Acta Phytotax. Geobot. 11 (1942) 234; Pichi Sermolli, Ind. Fil. Suppl. 4 (1965) 185. — Type: *Gaudichaud s.n.*, 1839, Voyage de la Bonite, Cochinchina (P; iso B, G).

Polypodium hymenolepioides Christ, J. de Bot. 19 (1905) 75; C. Chr., Ind. Fil. (1906) 534. — *Hymenolepis hymenolepioides* Ching ex C. Chr. & Tardieu, Notul. Syst. 8 (1939) 185; Tardieu & C. Chr., Fl. Gén. Indochine 7 (2) (1941) 452. — *Belvisia hymenolepioides* Ching, Acta Phytotax. Sin. 10 (1965) 301. — Type: *Cadière 97*, Annam, Quang-Binh (P).

Rhizome very slender, long-creeping, internodes 1–5 cm long. Rhizome scales ovate to ovate-lanceolate, 1.5–2.7 by 0.7–1.3 mm, index 1.2–4, margin entire or minutely dentate, apex rounded; reddish-brown, walls of central cells more strongly thickened than those of marginal cells. Fronds somewhat dimorphic. Stipes to 1 cm long, 0.3–0.7 mm thick, lamina of sterile fronds elliptic to linear-lanceolate, to 5 by 1 cm, of fertile fronds mostly longer and sometimes narrower, to 12 by 0.5–1.5 cm to linear, 4–10 by 0.3–0.8 cm, index 5–33, gradually narrowed to the base, often slightly constricted below the spike; spike ovate to ovate-lanceolate, 0.2–1 by 0.2–0.4 cm. Sori medial between midrib and margin, often interrupted (best visible in young sori), rarely a row of separate round sori present, not covering margin and costa when ripe. Paraphyses peltate, blades flat, 0.4–0.45 mm wide, entire, with thick-walled cells. Spores rugulate, 45–70 by 25–50 μm , index 1.4–1.8.

Distribution – Vietnam. Annam: *Cadière 97* (P), *Poilane 7939* (P). Cochinchina: *Gaudichaud s.n.* (P).

Habitat – Epiphytic or epilithic; altitude 425 m (*Poilane 7939*).

Note – Obviously a rare species. Its systematic position remains ambiguous. It is here included in *Belvisia* on account of the characteristics of the scales of the rhizome and the (rarely present) paraphyses.

2. *Belvisia annamensis* (C. Chr.) Tagawa – Figs. 2a, 3b

Belvisia annamensis Tagawa, Acta Phytotax. Geobot. 22 (1967) 107. — *Hymenolepis annamensis* C. Chr., Dansk Bot. Ark. 6 (1929) 68, f. 1e; C. Chr. & Tardieu, Notul. Syst. 8 (1939) 185; Tardieu & C. Chr., Fl. Gén. Indochine 7 (2) (1941) 452, f. 35: 1, 2. — *Macrolethus annamensis* Tagawa, Acta Phytotax. Geobot. 11 (1942) 234. — Type: *Poilane 8010*, Annam, Col des nuages (P).

Gymnopteris spicata (L. f.) Bedd. var. *B. latifrons* Bedd., Handb., Suppl. (1892) 104. — *Hymenolepis spicata* (L. f.) Presl var. *latifrons* Alderw., Mal. Ferns (1908) 729. — Syntypes: *King 1100*, Perak (BO; iso M); *Day s.n.*, Perak (not seen).

Hymenolepis callifolia Christ var. *paltonioides* C. Chr., Dansk Bot. Ark. 6 (1929) 67. — Syntypes: *Haviland s.n.*, Sarawak, Baram (K); *Macleay s.n.*, Borneo (K, not seen).

Rhizome short-creeping, internodes not elongated, 2–4 mm thick. Rhizome scales ovate-lanceolate to linear-lanceolate, 4.8–8.3 by 0.9–2.1 mm, index 3.8–5.6, base dentate, acumen narrowed, dentate near the base, sometimes with a narrow entire filiform apex, reddish brown to black, all cell walls strongly thickened. Stipes 1–4 cm long, 1–2 mm thick, lamina linear-lanceolate, 15–30 by 2–5 cm, index 6–9, base gradually narrowed, apex more or less abruptly truncate; spike 5–25 by 0.4–0.7 cm, index 8–60. Sori often extending downwards to well below the narrowed spike, medial between midrib and margin, leaving a medial and marginal free zone, paraphyses peltate, with circular blade, 0.1–0.4 mm diam., brownish to black, margin toothed, cell walls strongly thickened in mature paraphyses. Spores rugulate, 40–60 by 25–40 μm .

Distribution — Thailand, Laos, Vietnam, Borneo.

Habitat — Epiphytic or on rocks in evergreen forest. Sea level to 1900 m.

Note — The only clear differences between this species and *B. henryi* are the width of the spike and the relative position of the sori. The two species are reasonably well-separated geographically. However, it may well be that when more material from their contact zone becomes available, the taxonomic status of these two species will have to be reconsidered.

THAILAND. Mt Goping: *King 1100* (BO, M). Mt Khao: *Hennipman 3745, 3987* (L). Ranong: *Geesink & Santisuk 4916* (L).

LAOS. *Poilane 12210* (P).

VIETNAM. Annam: *Cadière 11* (BM, P), 787 (P); *Poilane 8010, 11001* (P). -- Tonkin: *Pételot 4477* (P).

BORNEO. *Haviland & Hose s.n.*, Aug. 1894 (K).

3. *Belvisia henryi* (C. Chr.) Raymond — Fig. 2b

Belvisia henryi Raymond, Mém. Jard. Bot. Montréal 55 (1962) 32; Panigrahi & Patnaik, Curr. Sci. 34 (1965) 127; Tagawa, Fl. E. Himalaya (1966) 490. — *Hymenolepis henryi* C. Chr., Dansk Bot. Ark. 6 (1929) 67, f. 1d; C. Chr. & Tardieu, Notul. Syst. 8 (1939) 185; Tardieu & C. Chr., Fl. Gén. Indochine 7 (2) (1941) 451. — *Macroleptus henryi* Tagawa, Acta Phytotax. Geobot. 11 (1942) 234. — Type: *Henry 11461a*, Yunnan (B, iso US, W).

Rhizome short-creeping, internodes not elongated, 2–4 mm thick. Rhizome scales ovate-oblong to ovate-lanceolate, 2.7–5.2 by 0.8–1.4 mm, index 2.7–1.5, above the base constricted to a long acumen, base dentate, acumen narrowed, dentate near the base, sometimes with an entire filiform apex, cells with strongly thickened walls. Stipes to 4 cm long, 1–2 mm thick, lamina linear-lanceolate, 7–27 by 1.5–5 cm, index 4–9, base gradually narrowed, apex usually abruptly truncate (sometimes asymmetrically) to the spike, sometimes narrowed more gradually, spike linear, 5–35 by 0.1–0.4 cm, index 15–115. Sori usually completely covering the lamina, paraphyses peltate, with circular blade, 0.1–0.3 mm diam., margin toothed, cell walls strongly thickened in mature paraphyses. Spores rugulate, 40–75 by 25–50 μm .

Distribution – China (Yunnan), Bhutan, Sikkim, India (Assam), Burma, Thailand, Vietnam.

Habitat – Epiphytic; altitude 1200–2000 m.

CHINA. Yunnan: *Henry 11461a* (B, W), *11461b* (B, BM), *11461c* (B, BM, K, L, W).

BHUTAN. *Cooper 1109* (BM); *Ludlow 7231* (BM).

SIKKIM. *Levinge s.n.*, 10-7-1829 (G); *Clarke 25086* (BM, P); *Jerdon s.n.* (B).

INDIA. Jaintea: *Clarke 1003* (M), *18334* (P); *G. Mann s.n.*, Sep. 1886 (G, M, US), April 1889 (M). — Assam: *Parish (herb. Hope) s.n.* (P); *G. Mann s.n.*, Apr. 1887 (L), Dec. 1889 (M); June 1890 (BO); *Thakur Rup Chand 4808* (MICH, UC), *6067* (MICH).

BURMA. *Kingdon Ward 20655*, *21391* (BM).

THAILAND. North-Eastern: *Hennipman 3376* (L).

VIETNAM. Tonkin: *Pételot 4207* (BM, P, UC).

4. *Belvisia mucronata* (Fée) Copel. var. *mucronata* – Figs. 1c, d, 3c

Belvisia mucronata (Fée) Copel., Gen. Fil. (1947) 192; Wagner & Grether, Occ. Papers B. P. Bish. Mus. 19 (1948) 87; Holttum, Fern Fl. Mal. (1954) 155; Copel., Fern Fl. Philipp. 3 (1961) 469; Brownlie, Fl. Nouv.-Caléd. et Dépend. 3 (1969) 283, pl. 38, f. 4; Morton, Amer. Fern J. 6 (1970) 43; De Vol & Kuo, Fl. Taiwan 1 (1975) 168, pl. 57. — *Hymenolepis mucronata* Fée, Mém. Fougères 5 (1852) 81, pl. 6, f. 1; C. Chr., Dansk Bot. Ark. 6 (1929) 62; Copel., Occ. Papers B. P. Bish. Mus. 14 (1938) 69; Backer & Posth., Varenfl. Java (1939) 230. — *Macroplethrus mucronatus* Tagawa, Acta Phytotax. Geobot. 11 (1942) 234. — Lectotype [C. Chr., Dansk Bot. Ark. 6 (1929)]: *Cuming 92*, Philippines, Luzon (P; iso BM, G, UC, US, W).

Hymenolepis callifolia Christ, Ann. Jard. Bot. Buitenzorg II, 5 (1905) 128 ('*callaefolia*'); Alderw., Mal. Ferns (1908) 729; Copel., Sarawak Mus. J. 2 (1917) 410; C. Chr., Dansk Bot. Ark. 6 (1929) 66, f. 1b, c; Backer & Posth., Varenfl. Java (1939) 230, Holttum, Fern Fl. Mal. (1954) 156, f. 68. — *Macroplethrus callifolius* Tagawa, Acta Phytotax. Geobot. 11 (1942) 234. — *Belvisia callifolia* Copel., Gen. Fil. (1947) 192. — Type: *Hallier 632*, Borneo, Gunung Damoes (BO, photograph in BM).

Hymenolepis spicata (L. f.) Presl forma *longipaleacea* Alderw., Bull. Jard. Bot. Buitenzorg II, 7 (1912) 19; Mal. Ferns Suppl. (1917) 432; Nova Guinea 14 (1924) 26. — Type: *Docters van Leeuwen 11*, Java, Trètès (BO).

Hymenolepis spicata (L. f.) Presl var. *squamulifera* Alderw., Bull. Jard. Bot. Buitenzorg II, 7 (1912) 19; Mal. Ferns Suppl. (1917) 433; Nova Guinea 14 (1924) 26. — Type: *Gjellerup 805*, New Guinea, near Tenem River (BO).

Hymenolepis spicata (L. f.) Presl var. *graminifolia* Rosenstock, Feddes Rep. 12 (1913) 530; Alderw., Mal. Ferns, Suppl. (1917) 433. — *Hymenolepis mucronata* Fée forma *graminifolia* C. Chr., Dansk Bot. Ark. 6 (1929) 64 (see Note 1). — Type: *Keysser 290* (BO).

Acrostichum spicatum L. f. var. *schneideri* F.M. Bailey, Comp. Cat. (1913) 649, 849, f. 613. — *Hymenolepis spicata* (L. f.) Presl forma *schneideri* Alderw., Mal. Ferns, Suppl. (1917) 432. — Syntypes: *Tryon & Schneider s.n.*, Australia, Queensland, Macpherson Range (BRI, not seen); *F.M. Bailey s.n.*, Australia, Queensland, Taylor's Range (BRI, not seen).

Hymenolepis spicata (L. f.) Presl var. *novoguineensis* Rosenstock, Hedwigia 56 (1915) 353; Alderw., Mal. Ferns, Suppl. (1917) 433. — Type: *Bamler 60* (B; iso L, P).

Hymenolepis spicata (L. f.) Presl var. *bakhuizenii* Alderw., Mal. Ferns, Suppl. (1917), 432, corr. 59; Bull. Jard. Bot. Buitenzorg II, 28 (1918) 27. — Type: *Bakhuizen van den Brink s.n.*, Java, Preanger, Cibeber (not located).

Hymenolepis mucronata Fée forma *australiensis* C. Chr., Dansk Bot. Ark. 6 (1929) 64. — Type: *Hill s.n.*, Queensland, Moreton Bay (B; iso K, L).

- Hymenolepis mucronata* Fée forma *helocharidioides* C. Chr., Dansk Bot. Ark. 6 (1929) 64. — Type: *F. von Mueller s.n.*, New Hebrides (K).
- Hymenolepis mucronata* Fée var. *nigropunctata* C. Chr., Dansk Bot. Ark. 6 (1929) 64. — Type: *Ledermann 13068*, Papua, Kaiserin Augusta Fluss (B).
- Hymenolepis vaupelii* C. Chr., Dansk Bot. Ark. 6 (1929) 65. — *Macroplethus vaupelii* Tagawa, Acta Phytotax. Geobot. 11 (1942) 235. — *Belvisia vaupelii* Copel., Gen. Fil. (1947) 192. — Type: *Vaupel 321*, Samoa, Savaii I. (B; iso K, MICH, P, US).
- Hymenolepis mucronata* Fée var. *nigropunctata* C. Chr. forma *latior* C. Chr., Dansk Bot. Ark. 6 (1929) 65. — Syntypes: *Kaudern s.n.*, Celebes, Bolaang Mongondon, Modajag (not located); *Korthals 109*, locality not given (B).
- Hymenolepis formosana* Ogata, J. Jap. Bot. 11 (1935) 28, f. 1; Ic. Fil. Jap. 6 (1935) 274. — *Belvisia formosana* Ching, Acta Phytotax. Sin. 10 (1965) 301. — Syntypes: *Ogata s.n.*, 27 Dec. 1925, Formosa, Arisan, Toroen (TI, not seen); *Asahina & Ogata s.n.*, 23 Dec. 1933, Formosa, Taityu prov., Keitau (TI).
- Hymenolepis minor* Copel., Occ. Papers B.P. Bish. Mus. 14 (1938) 69, pl. 19. — *Belvisia minor* Copel., Gen. Fil. (1947) 192. — Type: *Fosberg 11783*, Raivavae, Mt Turvao (BISH; iso UC).
- Belvisia melanesica* Brownlie, Pt. Fl. Fiji (1977) 369. — Type: *Brownlie 1760*, Mt Victoria (not seen).
- Acrostichum spicatum* auct. non L. f.: Benth., Fl Austral. 7 (1878) 78; Baker, Ann. Bot. 5 (1892) 113; F.M. Bailey, Queensl. Fl. (1902) 1994.
- Hymenolepis ophioglossoides* auct. non Kaulf.: Kaulf., Enum. Fil. (1824) 146, pl 1: 9, p.p.; Blume, Enum. (1828) 200; Kunze, Linnaea 23 (1850) 258.

Rhizome short-creeping, internodes not elongated, 2–5 mm thick. Rhizome scales ovate-oblong, ovate-lanceolate to linear-lanceolate, 2.5–8.5 by 0.5–2 mm, index 3–8, margin minutely to distinctly dentate, acumen contracted, apex acute, reddish-brown to black, all cells with thickened walls. Stipes up to 6 cm long, 1–2 mm thick, lamina linear to linear-lanceolate, 10–50 by 1–5 cm, index 5–22, narrowed towards base and apex, spikes linear, 3–25 by 0.3–0.7 cm, index 3–85. Sori close to the midrib, completely covering the lower surface when ripe, paraphyses with laterally affixed or peltate blades, peltate blades round, 0.1–0.65 mm diam., brownish to black, margin entire to toothed, cells with thick walls. Spores rugulate, 40–90 by 60 μm .

Distribution – Ceylon, Indochina, Taiwan, throughout Malesia, Australia. Pacific islands: Palau Is., Marianas, Fiji, Tonga, Samoa, Cook Is., Tahiti, Tubuai, Raivavae, Marquesas.

Habitat – Epiphytic on all kinds of trees or on rocks. In primary and secondary forest; altitude 0–1500 (rarely 4000) m.

Notes – 1. Christensen erroneously indicated *Bamler 60* as type of *Hymenolepis mucronata* Fée forma *graminifolia*. This taxon is based on *H. spicata* (L. f.) Presl var. *graminifolia* Rosenstock, typified by *Keysser 290*.

2. The paraphyses are excellently illustrated by Fée in his original publication. He illustrated the paraphyses that are characteristic for *Belvisia mucronata* (fig. 6B: 1') as well as those characteristic for *B. spicata* and *B. validinervis* (fig. 6B: 1'').

3. A very variable species, particularly in the width of the fronds. A few specimens from New Guinea with extremely narrow fronds, 0.3–0.9 cm wide, have been described as var. *graminifolia* Rosenstock. They do not differ from normal specimens in any other character.

5. *Belvisia mucronata* (Fée) Copel. var. *dura* (Copel.) Hovenkamp & Franken, *stat. nov.* – Figs. 1c, d, 3c

Hymenolepis dura Copel., Occ. Pap. B. P. Bish. Mus. 14 (1938) 69, pl. 20. — *Belvisia dura* Copel., Gen. Fil. (1947) 192. — Type: *St. John & Maireau 15621* (BISH; iso BO, MICH, US, W).

Differs from the type variety: Rhizome scales 6.6–10.5 by 1.5–3 mm, index 3–5. Stipes 2–3 cm long, lamina lanceolate to linear lanceolate, 7–12 by 2–3 cm, index 3–5; spike lanceolate, 1.5–4 by 0.8–1 cm, index 2–4. Paraphyses with laterally affixed or peltate blades, blades 0.4–0.7 × 0.08–0.6 mm, entire. Spores 100–120 by 75–90 µm.

Distribution – Rapa Isl.: *St. John & Maireau 15621* (BISH, BO, MICH, US, W).

Habitat – Ledge of high basalt precipice, at 330 m altitude.

Notes – 1. *Belvisia dura* was described on the basis of one specimen, and no other collections are known so far. The extremely large spores and paraphyses suggest that this aberrant specimen is a polyploid.

2. Judging by the description, *B. melanesica* Brownlie, described from Fiji, is rather similar. No authentic specimen of *B. melanesica* could be located.

6. *Belvisia novoguineensis* (Rosenstock) Copel. – Figs. 2c, 3d

Belvisia novoguineensis Copel., Gen. Fil. (1947) 192. — *Paltonium novoguineense* Rosenstock, Nova Guinea 8 (1912): 729. — *Lemmaphyllum novoguineense* C. Chr., Dansk Bot. Ark. 6 (1929) 51. — *Hymenolepis novoguineensis* C. Chr., Ind. Fil. Suppl. 3 (1934) 113. — *Macroleptus novoguineensis* Tagawa, Acta Phytotax. Geobot. 11 (1942) 234. — Type: *von Römer s.n.*, Helliwig Mts, West New Guinea, 1350–1600 m., Nov. 1909.

Rhizome long-creeping, internodes 2–7 cm long, slender, 0.8–1.5 mm thick. Rhizome scales 2.5–5 by 0.9–1.3 mm, thin, translucent, red-brown to fuscous, margin minutely toothed, apex rounded to acute, all cells thin-walled. Stipes 2–7 cm long, 0.7–1.2 mm thick, lamina ovate-lanceolate to linear, 5–30 by 1–3 cm, index 4–20, gradually narrowed to the base and apex, glabrous or with a few scales on abaxial side of stipe and costa; spike from a wide base gradually narrowed, 4–17 by 0.5–1.5 cm (basal width). Sori sometimes interrupted, marginal, leaving a sterile zone near midrib and margin, especially in the lower, widened part of the spike, paraphyses with laterally affixed or peltate blades, laterally affixed blades 20–30 by 5–30 µm, sometimes irregularly lobed; peltate blades 0.3–0.5 mm diam.; brownish, margin entire. Spores rugulate, 60–80 by 50–60 µm.

Distribution – Malesia: New Guinea, from West to East, many collections. New Ireland: *Croft 277* (L); *LAE 68366* (L).

Habitat – Epiphytic in mid-montane, wet or mossy forest, 1100–3000 m.

Note – This species resembles *Lemmaphyllum* in the long-creeping rhizome and the broad base of the spike.

7. *Belvisia platyrhynchos* (Kunze) Copel. – Figs. 2d, 3e

Belvisia platyrhynchos Copel., Gen. Fil. (1947) 192; Fern Fl. Philipp. 3 (1961) 467. — *Gymnopteris platyrhynchos* J. Sm., Hook. J. Bot. 3 (1841) 403, *ibid.* 4 (1842) 156, *nom. nud.* —

Hymenolepis platyrhynchos Kunze, Farnkr. 1 (1842) 101; Fée, Mém. Fougères 5 (1852) 82; Moore, Ind. Fil. (1857) 28; J. Sm., Hist. Fil. (1875) 119; Diels in Engler & Prantl, Nat. Pflanzenfam. 1, 4 (1902) 305; Copel., Dep. Int. Bur. Gov. 28 (1905) 110; Christ, Bull. Herb. Boiss. 2 (1906) 990; Alderw., Mal. Ferns (1908) 729; Mal. Ferns, Suppl. (1917) 433; C. Chr., Dansk Bot. Ark. 6 (1929) 68; Copel., Univ. Calif. Publ. Bot. 16 (1929) 101. — *Macroplethus platyrhynchos* Presl, Epim. Bot. (1851) 142; Tagawa, Acta Phytotax. Geobot. 11 (1942) 234. — *Acrostichum platyrhynchos* Hook., Sp. Fil. 5 (1864) 280; Baker in Hooker & Baker, Syn. Fil. Ed. 2 (1874) 424; Harrington, J. Linn. Soc. Bot. 16 (1878) 34; Christ, Ann. Jard. Bot. Buitenzorg 15 (1898) 180; Bull. Herb. Boiss. 6 (1898) 206. — *Taenitis platyrhynchos* Mett. in Miquel, Ann. Mus. Bot. Lugd.-Bat. 4 (1864) 173. — Type: *Cuming 196*, Luzon, Tayabas (B; iso G, K, L, P, W).

Hymenolepis platyrhynchos (Kunze) Copel. var. *glauca* Copel, Leafl. Philipp. Bot. 3 (1910) 847. — *Hymenolepis glauca* C. Chr., Dansk Bot. Ark. 6 (1929) 62. — *Macroplethus glauca* Tagawa, Acta Phytotax. Geobot. 11 (1942) 62. — *Belvisia glauca* Copel., Gen. Fil. (1947) 192; Fern Fl. Philipp. 3 (1961) 467. — Type: *Elmer 11444*, Mindanao, Mt Apo (K; iso BM, BO, G, L, P, US, W).

Rhizome short-creeping, internodes not elongated, 2–6 mm thick. Rhizome scales ovate-oblong to ovate-lanceolate, 6.8–10.5 by 1.5–3 mm, index 3–5, sometimes narrowed towards the acumen, apex acute; margin long-dentate; reddish-brown, cells with thickened walls. Fronds sessile to clearly stalked, stipe up to 1(–4) cm long, 2–4 mm thick; lamina linear-lanceolate to linear, 5–75 by 1–5 cm, index 5–20; narrowed towards base and apex, somewhat constricted below the spike; spike lanceolate to linear-lanceolate, 2–10 by 0.5–2 cm, index 3–11.5. Sori close to the midrib, when ripe covering the midrib and leaving a marginal zone 1–5 mm wide free, paraphyses with laterally affixed or peltate blades, laterally affixed blades flat or cylindrical, 0.15–0.4 by 0.04–0.3 mm, peltate blades 0.25–0.65 mm wide, margin entire, cells with thick walls. Spores rugulate, 40–90 by 25–60 µm.

Distribution – Philippines, New Guinea.

Habitat – Epiphytic, in primary and secondary forest; sea level to 2300 m.

PHILIPPINES. Luzon: many collections. Mindoro: *Merrill 6001* (MICH, P). Mindanao: *Copeland s. n.*, 5 Sep. 1932 (UC, US); *Elmer 11444* (BM, BO, G, L, MICH, P, US), *13818* (BM, BO, L, MICH).

NEW GUINEA. Japen I.: *Cheesman 1345, 1395* (BM).

8. *Belvisia spicata* (L. f) Mirbel ex Copel. – Figs. 1a, b, 2e, 3f

Belvisia spicata Mirbel ex Copel., Gen. Fil. (1947) 192; Tardieu, Mém. Inst. Fr. Afr. Noire 28 (1953) 207; Alston in Hutch. & Dalziel, Fl. West Trop. Afr. Ed. 2, Suppl. (1959) 48; Tardieu in Humbert, Fl. Madag. 2 (1960) 107, f. 23: 1-2; Tardieu in Aubrév., Fl. Gabon 8 (1964) 203, pl. 32: f. 1; in Aubrév., Fl. Cameroun 3 (1964) 342, pl. 54: f. 1; Schelpe, Contr. Bolus Herb. 1 (1969) 104. — *Acrostichum spicatum* L. f., Suppl. Pl. (1781) 444; Smith, Plant. Ic. Hact. Ined. (1790) pl. 46; Cav., Descr. (1801) 237; Thwaites, Enum. Pl. Zeyl. (1864) 381; Hook. in Hook. & Baker, Syn. Fil. Ed. 2 (1874) 424; Christ, Ann. Jard. Bot. Buitenzorg 15 (1898) 180; Bull. Herb. Boiss. 6 (1898) 206; Racib., Pterid. Fl. Buitenzorg (1898) 51. — *Schizaea spicata* Smith, Mém. Acad. Sci. Turin 5 (1793) 43. — *Onoclea spicata* Sw., Schrader's J. Bot. (1800) 299; Syn. Fil. (1806) 110, 303. — *Lomaria spicata* Willd., Sp. Pl. 5 (1810) 289. — *Hymenolepis spicata* Presl, Epim. Bot. (1851) 159; Moore, Ind. Fil. (1857) 28, pl. 15, f. A; Bedd., Ferns S. India (1863) 15, pl. 46; Hook., Sp. Fil. 5 (1864) 280; J. Sm., Ferns Br. & For. (1866) 92,

- f. 19; Kuhn, Fil. Afr. (1868) 49; J. Sm., Hist. Fil. (1875) 119; Bedd., Suppl. Ferns S. India & Br. India (1876) 27; Diels in Engler & Prantl, Nat. Pflanzenfam. 1, 4 (1902) 305, f. 161: F-H; Copel., Dep. Int. Bur. Gov. 28 (1905) 110; Alderw., Mal. Ferns (1908) 728; Copel., Leaflet Philipp. Bot. 3 (1910) 848; Domin, Bibl. Bot. 85 (1915) 168; Alderw., Mal. Ferns, Suppl. (1917) 432, corr. 59; Copel., Sarawak Mus. J. 2 (1917) 410; Alderw., Nova Guinea 14 (1924) 26; Bonap., Notes Pt. 16 (1925) 113; Ridley, J. Mal. Br. Roy. As. Soc. 4 (1926) 113; C. Chr., Dansk Bot. Ark. 6 (1929) 57; Copel., Univ. Cal. Publ. Bot. 16 (1929) 101; C. Chr., Dansk Bot. Ark. 7 (1932) 160; Ching, Sunyatsenia 5 (1940) 259. — *Taenitis spicata* Mett. in Miquel, Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 173. — *Gymnopteris spicata* Presl, Tent. Pterid. (1936) 244; J. Sm., Hook. J. Bot. (1842) 156; Bedd., Handb. Ferns Br. India (1883) 431, f. 261. — *Macroleptus spicata* Tagawa, Acta Phytotax. Geobot. 11 (1942) 235. — Type: *Commerson s.n.*, Mauritius (P).
- Hymenolepis ophioglossoides* Kaulf., Enum. Fil. (1824) 146, pl. 1, f. 9 (nom. superfl.); Sprengel, Syst. Veg. 4 (1827) 66; Blume, Enum. Pl. Javae (1828) 200; Kunze, Farnkr. 1 (1842) 99, pl. 47, f. 1; Fée, Mém. Fougères 5 (1852) 81, pl. 60: f. 1", 2, 2', 2"; Presl, Epim. Bot. (1851) 160; Carruthers in Seem., Fl. Vit. (1871) 374. — *Hyalolepis ophioglossoides* Kunze, Linnaea 23 (1850) 258. — *Taenitis ophioglossoides* Mett., Fil. Hort. Lips. (1856) 28, pl. 15, f. 13–16. — *Taenitis spicata* (L. f.) Mett. forma *lata* Mett. in Miquel, Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 173. — *Oetosis ophioglossoides* Kuntze, Rev. Gen. Pl. 2 (1891) 817. — Type: *Chamisso s.n.*, Guam (not seen).
- Hymenolepis revoluta* Blume, Enum. Pl. Jav. (1828) 201; Kunze, Farnkr. 1 (1842) 101, pl. 47, f. 2; Bot. Zeit. 4 (1846) 441; Fée, Mém. Fougères 5 (1852) 82; Presl, Epim. Bot. (1851) 160; Moore, Ind. Fil. (1857) 28, C. Chr., Dansk Bot. Ark. 6 (1929) 58; Backer & Posth., Varenfl. Java (1939) 229, f. 53; C. Chr. & Tardieu, Notul. Syst. 8 (1939) 185; Copel., Occ. Pap. B. P. Bish. Mus. 14 (1939) 69; Tardieu & C. Chr., Fl. Gén. Indochine 7 (2) (1941) 452. — *Hyalolepis revoluta* Kunze, Linnaea 23 (1850) 258. — *Taenitis revoluta* Mett., Fil. Hort. Lips. (1856) 28; Ettingsh., Farnkr. Jetztwelt (1865) 28, pl. 18, f. 16. — *Taenitis spicata* (L. f.) Mett. forma *angustata* Mett. in Miquel, Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 173. — *Macroleptus revoluta* Tagawa, Acta Phytotax. Geobot. 11 (1942) 234. — *Belvisia revoluta* Copel., Gen. Fil. (1947) 192, Holttum, Fern Fl. Mal. 2 (1954) 155, f. 67; Copel., Fern Fl. Philipp. 3 (1961) 468. — Type: *Blume s.n.*, Java (BO; iso L).
- Hyalolepis revoluta* Kunze var. *planuscula* Kunze, Linnaea 23 (1850) 258. — *Taenitis revoluta* (Blume) Mett. var. *planuscula* Mett., Fil. Hort. Lips. (1856) 28, pl. 15, f. 13–16. — *Hymenolepis revoluta* Blume var. *planuscula* C. Chr., Dansk Bot. Ark. 6 (1929) 58; Morton, Amer. Fern J. 6 (1970) 44. — Type: cult. in Hortus Bonn, Leipzig, Berlin, from Java.
- Hymenolepis rigidissima* Christ, Bull. Herb. Boiss. 2 (1906) 990; Rosenstock, Feddes Rep. 5 (1908) 370; Alderw., Mal. Ferns (1908) 728; Mal. Ferns, Suppl. (1917) 432. — Type: *Loher s.n.*, 18 Apr. 1905, Luzon, Batay (P).
- Hymenolepis spicata* (L. f.) Presl var. *tenella* Alderw., Mal. Ferns (1908) 729. — Type: *Zollinger s.n.* (BO, L).
- Hymenolepis spicata* (L. f.) Presl var. *costulata* Alderw., Bull. Jard. Bot. Buitenzorg II, 7 (1912) 19; Mal. Ferns, Suppl. (1917) 433. — *Hymenolepis revoluta* Blume var. *costulata* C. Chr., Dansk Bot. Ark. 6 (1929) 59. — Type: *Burck s.n.*, Sumatra (BO).
- Hymenolepis spicata* (L. f.) Presl forma *minima* Alderw., Mal. Ferns, Suppl. (1917) 432. — Type: not indicated.
- Hymenolepis spicata* (L. f.) Presl var. *occultivenia* C. Chr., Dansk Bot. Ark. 6 (1929) 57; *ibid.* 7 (1932) 160. — Syntypes: *Palm & Afzelius s.n.*, Madagascar, Moramanga (S, C, not seen); *Pool s.n.*, *Meller s.n.*, Madagascar (K, not seen); *d'Alleizette 117*, Madagascar, Betsitra (P); *Horne 206*, *Thomasset s.n.*, *de l'Isle s.n.*, Seychelles, Mah (K, not seen); *Quinston s.n.*, St. Thom, Africa (K).]
- Hymenolepis spicata* (L. f.) Presl var. *usambarensis* C. Chr., Dansk Bot. Ark. 6 (1929) 57. — Syntypes: *Holst 143*, *7485*, Usambara Mts (B); *Holst 9095*, Usambara Mts (B, BM, P).

Rhizome short-creeping, internodes not elongated, 2–4 mm thick. Rhizome scales ovate, ovate-lanceolate or narrowly triangular, 1.7–4.1 by 1–1.5 mm, index 1.7–3, apex acute to rounded, often recurved; margin usually entire, rarely dentate; central cells with thickened walls, marginal cells in a 0.2–0.3 mm wide membranaceous zone with thin walls. Stipes 0.5–4 cm long, 1–2 mm thick; lamina linear-lanceolate to linear, 8–30 by 0.3–2 cm, index 5–70; narrowed towards base and apex; spikes linear, 2–25 by 0.2–0.4 cm, index 5–100. Sori covering the lamina when ripe, situated close to the midrib; paraphyses with irregularly branched and lobed blades, cells with thick walls. Spores rugulate, 40–90 by 25–60 μm , index 1.5–1.7.

Distribution — Tropical Africa, Ceylon, Indochina, throughout Malesia; Australia: Queensland; Pacific: New Caledonia, Fiji, Tahiti.

Habitat — Epiphytic or epilithic in primary or secondary forest. Common in mountainous areas. Up to 3000 m altitude.

Notes — 1. In Malesia this widespread species is often very close to *B. validinervis*, and may be hybridizing with the latter.

2. Superficially, this species is very similar to *B. mucronata*. The main difference is found in the rhizome scales, and Christensen (1929), noting that *B. spicata* and *B. mucronata* often are mixed in a single collection, even expressed his doubts whether the two species really could be kept separate. We believe that the differences in structure of the scales are in fact sufficient to do so, and we find a supporting character in the irregular paraphyses in *B. spicata*.

9. *Belvisia validinervis* (Kunze) Copel. var. *validinervis* — Fig. 2f

Belvisia validinervis Copel., Gen. Fil. (1947) 192; Fern Fl. Philipp. 3 (1961) 467. — *Hymenolepis validinervis* Kunze, Bot. Zeit. 6 (1848) 122; Presl, Epim. Bot. (1851) 160; Fée, Mém. Fougères 5 (1852) 82; C. Chr., Dansk Bot. Ark. 6 (1929) 60; Backer & Posth., Varenfl. Java (1939) 229. — *Taenitis validinervis* Mett. in Miquel, Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 173, t. 7, f. 7–10. — *Macroplethus validinervis* Tagawa, Acta Phytotax. Geobot. 11 (1942) 235. — *Hymenolepis spicata* (L. f.) Presl var. *validinervis* Alderw., Mal. Ferns, Suppl. (1917) 432, corr. 59. — Type: Zollinger 2312, Java (B; iso BM, BO, G, P).

Hymenolepis spicata (L. f.) Presl var. *brachystachys* Hook., Gard. Ferns (1862) t. 3; Spec. Fil. 5 (1864) 280; Baker in Hook. & Baker, Syn. Fil. Ed. 2 (1874) 424. — *Hymenolepis brachystachys* (Hook.) J. Sm., Ferns Br. & For. (1866) 92; Diels in Engler & Prantl, Nat. Pflanzenfam. 1, 4 (1902) 305; Alderw., Mal. Ferns (1908) 729; Bull. Jard. Bot. Buitenzorg II, 28 (1928) 51. — *Acrostichum brachystachys* Racib., Pterid. Fl. Buitenzorg (1898) 51. — Type: Hook., Gard. Ferns (1862) t. 3.

Hymenolepis brachystachys (Hook.) J. Sm. var. *mirabilis* Alderw., Bull. Jard. Bot. Buitenzorg II, 28 (1918) 28, t. 4. — Type: l.c., t. 4 (Wigman cult.).

Hymenolepis squamata C. Chr., Dansk Bot. Ark. 6 (1929) 59. — *Macroplethus squamata* Tagawa, Acta Phytotax. Geobot. 11 (1942) 235. — *Belvisia squamata* Copel., Gen. Fil. (1947) 192; Fern Fl. Philipp. 3 (1961) 468. — Type: Mearns 4205, Luzon (B; iso MICH, US, W).

Hymenolepis squamata C. Chr. var. *borneensis* C. Chr., Dansk Bot. Ark. 6 (1929) 60. — Type: Clemens 10664, Borneo, Mt Kinabalu (B; iso MICH, US).

Hymenolepis validinervis Kunze var. *celebica* C. Chr., Dansk Bot. Ark. 6 (1929) 61. — Type: Bunnemeijer 12032, Celebes, G. Bonthain (B; iso BM, BO, L, M, P).

Rhizome creeping, internodes 0.5–2 cm long, 2–6 mm thick. Rhizome scales large, ovate-oblong to ovate-lanceolate, 2–6 by 1–3 mm, attenuate to an acute or

rounded apex, margin entire or minutely dentate; light red- or grey-brown, glossy and often iridescent, cell walls thin, central cells with slightly more thickened walls than the marginal cells. Fronds subsessile to clearly stalked, stipes up to 15 cm long, 1–2.5 mm thick, lamina linear, 5–60 by 0.3–4 cm, narrowed to base and apex, glabrous or with a few to many, often irregularly shaped scales, especially along the costa. Spike continuous with lamina, not constricted at the base, relatively broad to linear, 2–25 by 0.2–0.8 cm, index 5–85. Sori close to the midrib but covering the entire lamina when ripe. Paraphyses with laterally affixed or peltate blades or irregularly lobed, laterally affixed blades flat or cylindrical, 0.10–0.30 by 0.04–0.20 mm, peltate blades 0.25–0.65 mm wide, margin entire or incised. Spores rugulate, 40–90 by 25–60 μm .

Distribution – Throughout Malesia, New Ireland, New Hebrides, New Caledonia.

Habitat – Epiphytic or epilithic in primary and secondary montane forest.; altitude 1200 (rarely lower) to 4000 m.

Notes – 1. *Belvisia validinervis* is not always sharply distinct from *B. spicata*, and may be hybridizing with the latter.

2. As here construed, typical *B. validinervis* is best recognized by the scales, and the moderately spaced leaves, and, less typical, by wide spikes and a subsessile lamina. As may be clear from the above description, especially the shape of the lamina, length of the stipe and the presence of scales on the leaves is variable. This has given rise to the recognition of several taxa:

- a) *Hymenolepis squamata* and its var. *borneensis*. Based on the presence of rather permanent scales. These are most often found on Philippine specimens.
- b) *Hymenolepis brachystachys*, based on forms with a subsessile, broad and fleshy lamina with a short spike.

However, there are numerous transitions between these forms and the typical form all over the range of the species. Alderwerelt's *Hymenolepis brachystachys* var. *mirabilis* is a monstrosity.

In New Guinea a well-delimited form can be segregated as a variety:

10. *Belvisia validinervis* (Kunze) Copel. var. *longissima* (Holttum) Hovenkamp & Franken, *stat. nov.* – Fig. 2g

Belvisia longissima Holtum, Blumea 14 (1966) 328. — Type: Pullen 5356, Papua New Guinea, Western Highlands, Kubor Range (K; iso L).

Differs from the type variety: Fronds larger, stipes to 40 cm long, lamina 65–220 by 2–6 cm, suddenly narrowed to the spike, which is up to 60 by 0.4–0.6 cm wide.

Distribution – New Guinea, many collections; Celebes: Sopu Valley, Hennipman 5652 (L).

Habitat – Epiphytic, especially on *Pandanus* in montane forest; 2200–3500 m.