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Taxonomic Results of the BRYOTROP Expedition to Zaire and Rwanda

9. Pallaviciniaceae, Haplomitriaceae

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1. PALLAVICINIACEAE

Key to the genera of Pallaviciniaceae in Africa

1. Female involucre a cup-like structure surrounding the archegonial group. Within involucre, a tubular pseudoperianth several times longer than

~~Abbreviations::~~

* New record for Rwanda viz. Zaire
KB: Kahuzi-Biega (Zaire)
Ka: Karisimbi (Rwanda)
Ny: Nyungwe Forest (Rwanda)
Ak: Akagera region (Rwanda)
Ki: Kigali region (Rwanda)
100-171, number of collecting site.
For locality data and a description see the contribution by E. Fischer on the vegetation of the study area in this volume (Tropical Bryology 8: 13-37, 1993). The specimens are deposited at the Botanical Museum Berlin as well as in the herbarium of the author (except for unicates).
the involucre, developing after fertilization. Calyptra rather thin, usually wholly hidden within pseudoperianth; sterile archegonia absent from apex but remaining at base of calyptra or becoming partly scattered along its lower half. Subfam. Pallavicinioideae. 2
2. Procumbent to ascendent, with terminal branching irregular and usually infrequent (sometimes even lacking). Midrib of well-developed fronds never more than 1/3 of frond width Androecial scales (in the local species) on each side of midrib, the latter remaining free of scales (or with a few at proximal and distal end of androecium). Gynoecia arranged without correlation to branching, a single only or a few irregularly scattered along frond m i d r i b . . . . . .
. . . . . *Pallavicinia*
2. Dendroid, with 2-4 times ± regular terminal branching of aerial frond Gynoecia arranged in rather strict correlation to frond bifurcations, always situated singly above a bifurcation in lower part of aerial frond. Midrib of well-developed fronds about 1/2 of frond width. Androecial scales wholly covering midrib.....
.....*Jensenia*
1. Female involucre a deeply incised-laciniate-

ciliate scale covering the archegonial group from above and inserted only on basiscopic and lateral sides of the latter. Pseudoperianth lacking. Shoot calyptra fleshy, rigid, exposed, bearing at its apex sterile archegonia in a tuft-like group.
Subfam.Symphyogynoideae. 3
3. Cell walls of central strand incrassate, much thicker than those of surrounding parenchymatous tissue. Central strand visible from above in situ. Lobe apices of female involucral scale usually obliquely truncate to lanceolate..... ..... *Symphyogyna*
3. Cell walls of central strand not at all incrassate, clearly thinner than those of surrounding parenchymatous tissue. Central strand in situ usually invisible from above. Lobe apices of female involucral scale usually long filiform. ..... *Symphyogynopsis*

Pallavicinia S. Gray 1821, *nom, cons.*

Sole species in Africa: *P. lyellii* (Hook.) Carruth.
For synonymy see Grolle & Piippo (1986).
For description and illustration see Hässel de Menendez (1961/b) figs. 1-2; Hell (1969) p, 60, prancha 10 (figs. 69-70), 11 (figs. 76, 78, 85), 13 (fig. 99); Vanden Berghen (1972) fig. 63; Inoue & Hibino (1984) pl. III/6 (SEM micrograph of spore)
Habitat: Usually on oligotrophic boggy ground, stream banks and in swamps, sometimes also on rotten logs and rock. 1940-2300 m
General distribution: Except Australasia, worldwide in tropical to temperate regions in humid localities.
Ny: 108, *Pócs 6380* (c. pseudoper.). 112, *Pócs 6434, Frahm 6456;* 113, *Pócs 6476.* **KB:** 144, *Pócs 7781*; 152, *Pócs 7833.*

Jensenia Kindb. 1867

Sole species in Africa: *J. spinosa* (Lindenb. & Gott.) Grolle
For synonymy see Grolle (1979) p. 268; Grolle & Piippo (1986) p. 65.
Sometimes confounded with the likewise dendroid polymorphic *Symphyogyna podophylla*; For distinction see under the latter.
Growing on soil and rock in humid places. Confined to high elevations.
Known from Mascarenes (Mauritius; Reunion, 2000 m), Malawi (2100 m), Zaire (3250 m), Tanzania (2700 m), Rwanda (3650-3850 m), Transvaal, St. Helena (800 m). Not represented in the Bryotrop collection.

Symphyogyna Nees & Mont 1836

1. Dendroid, but less well-developed phases sometimes ascendent or almost procumbent, frond margin dentate with ± coarse, acute teeth; marginal slime-hairslacking..... . ..... *S. podophylla*
1. Procumbent frond margin entire (rarely with a few small broadly hump-shaped processes with a rounded tip)..... 2
2. Marginal slime-hairs lacking. Frond green to yellowish green, often slightly tinted with orange or ruddiness, with usually weakly-incurved margins, 2.5-4 5(5.5) mm wide. Spores distally with many small short, ± curved ridges.
..... *S. brasiliensis*
2. Marginal slime-hairs present (often, however, soon disappearing at some distance from shoot tip). Frond grass-green (without secondary pigmentation), usually flat, (3)5-9(10) mm wide. Spores distally with few coarse long sinuate ridges ..... *S. volkensii*

S. podophylla (Thunb,) Mont. & Nees
For synonymy see Grolle (1979) p. 267.
For description and illustration see Hässel de Menendez (1961/a) p. 255 figs. 9-10 (as S, hymenophyllum); Vanden Berghen (1965) p. 157 fig. 9; Hell (1969) p. 76 prancha 10 (figs. 66, 68), 11 (fig, 87), 12 (fig. 93), 13 (fig, 100).
A widespread, locally common, polymorphic species, which within *Symphyogyna* is usually easily distinguished by the dendroid habit. Sometimes, however, less well developed phases are merely ascendent or even almost procumbent. These are nevertheless also easy to recognise by the acute teeth of the aerial frond and the lack of marginal slime-hairs However, if sterile, *Jensenia spinosa*, the sole other dendroid species of Pallaviciniaceae in Africa, has to be carefully

distinguished by the following opposing characters:

Branches of aerial frond (2)2.5-3(4) mm wide, usually elongate-obovate, unistratose for (0.5)0.7-0.75 of width. Margin dentate to ± shortly spinose. Inframarginal cells of unistratose area of frond branches 50-60(65)x50-75 µm. Cuticle of frond branches smooth. Female involucre a ± deeply laciniate scale, ...*Symphyogyna podophylla*

Branches of aerial frond 1-2 mm wide, usually ± lingulate to slightly tapering, unistratose for 0.5-6.5 of width. Margin dentate to coarsely spinose. Inframarginal cells of unistratose area of frond branches 21-27x24-35(42) µm. Cuticle of marginal and inframarginal cells of frond branches finely punctate to striatulate or striate. Female involucre a deeply laciniate cup. .... *Jensenia spinosa*

Habitat: On soil and rock along streams or near waterfalls in montane rainforest, bamboo forest, *Erica* heath and *Senecio refractisquamatus* páramo. 2000-3600 m.

General distribution: Eury-circum-subantarctic with far extensions to the North (in South America from Falkland Islands to Costa Rica, in Australia from Tasmania to Queensland, in Africa from Cape to Ethiopia).

Ny: 104, *Pócs 6191*. 108, *Frahm 6331* (+ *S. brasiliensis*). 112, *Pócs 6444*. **KB:** 128, *Frey & Kürschner 7334*. 148, *Pócs 7748* (+ *Calypogeia*). 149, *Frahm 7685* (+ *S. volkensii*). **Ka:** 161, *Frahm 8074*. 162, *Pócs 8059, 8243* (c. sp.).

S. brasiliensis Nees & Mont.

For synonymy see Grolle (1981) p. 330

For description and illustration see Evans (1927) p. 307 figs. 1-2, pl. I (figs. 1-2); Vanden Berghen (1965) p. 161 fig. 11, (1972) p. 152 fig. 64 (as *S. lehmanniana*); Hell (1969) p. 67 prancha 9 (figs. 60, 63), 11 (fig. 77), 12 (fig. 92), 13 (fig. 98); Jones (199O) p. 37 fig. 1/a-c; Perold (1992) (S~E micrograph of spore).

Habitat: Road cut. 2450 m.

General distribution: Galapagos Islands (rare), Andes (Bolivia to Mexico), E. Brazil (Rio Grande do Sul to Espiritu Santo), Ascension I., St. Helena, continental Africa (from Cape north to Sierra Leone in the West and to Uganda in the East), Madagascar, Mascarenes.

Ny: 101, *Pócs 6007* (c. calypt.).

S. volkensii Steph.

For description and illustration see Vanden Berghen (1965) p. 162 fig. 12.

Habitat: On soil. 3200 m.

General distribution: Endemic to East-African high mountains (Ruwenzori, Kilimanjaro, Mt. Kahuzi, Mt. Elgon, Mt. Meru, Mt. Kenya) at elevations of 2300-3900 m.

KB: 148, *Frahm 7684*.

Symphyogynopsis Grolle 1986

Sole species: *S. gottscheana* (Mont & Nees) Grolle.

For synonymy see Grolle & Piippo (1986), Grolle (1987).

For description and illustration see Grolle & Piippo (1986) p. 73 fig. 5 (as *S. filicum*).

Growing especially on the base of tree-fern trunks, but also on decaying wood and soil in sheltered wet places.

Known from Melanesia, Indonesia, Mascarenes, Comores, Madagascar, Cameroun.

Not represented in the Bryotrop collection.

2. HAPLOMITRIACEAE

Haplomitrium Nees 1833, nom. cons.

This strongly isolated genus is here recorded for the first time from Africa. Since Schuster (1963) it is generally treated as including *Calobryum* Nees, thus being the single extant genus of the Haplomitriaceae (1) and Calobryales (2), with scattered occurrence in (cool to) temperate zones of both hemispheres and in permanantly humid areas of the tropics.

In recent times it has been monographically studied by Schuster (1967) and Bartholomew-Began (1991). In 1967 eight species were recognized by Schuster. Since then seven further ones have been described by various authors. But in 1991 a total of only

seven species, among them merely doubtfully *H. oblongifolium* Schust., were accepted by Bartholomew-Began. The two monographers however agree that the species of this genus often display utmost malleabilily and frequently offer problems in satisfactory delimitation. This, of course, is the more true, if the available material of a species is scanty and incomplete.

The available material of the *Haplomitrium* species, which appeared surprisingly at three localities in tropical Africa during the Bryotrop expedition, is scanty, but yet rather polymorphous. It exhibits some gynoecia, a few with mature calyptra, and a single androecium. Oil bodies and spore ornamentation, however, both often providing important characters for the taxonomy of *Haplomitrium* species, are unknown.
In the tropics two species of *Haplomitrium* have traditionally been recognized: *H. blumii* (Nees) Schust. in tropical Asia and *H andinum* (Spruce) Schust. in tropical America. Bartholomew-Began (1991) however treats *H. andinum* as a synonym of *H. blumii*, the latter thus becoming the sole species in the tropics.

A lot of Haplomitrium specimens from tropical Asia and a few from tropical America in G, JE and U have been checked by us to clarify, wether this broad concept of *H. blumii* is justified. But some uncertainty remains. On the other hand, neither for restoring the separation of *H. andinum* from *H. blumii* nor for establishing an African species, were reasonably clear differences apparent. The African *Haplomitrium* therefore is here somewhat hesitatingly treated under *H. blumii s. amplo*, and provided with a description and illustration based on the African plants.

H. blumii (Nees) Schust. (= *H. andinum* (Sruce) Schust.; syn. fide Bartholomew-Began (1991) p. 250) Figs. 1 + 2

For further synonymy see Bartholomew-Began (1991) p, 250 and Grolle & Piippo (1984) p. 68.
For description and illustration see Schiffner (1893) fig. 35/A-C (as *Calobryum mnioides*), fig.. 35/D-E (as *C. blumii)*. Fulford (1963) fig. 1 (as *C. andinum*), Schuster (1967) p. 55 (as *H. andinum*), p, 57 (as *H. blumii*), Bartholomew-Began (1991) p. 250, figs. 63-67, 326-330 (as *H. andinum*), figs. 56-62, 331-332 (as *H. blumii*)

Dioicous. - Grass-green, becoming pale green or pale brownish in the herbarium, without secondary pigmentation, rhizomatous at base; rhizomatous axes pale, leafless, creeping, freely branched, thus giving rise to thin stolons bearing some very scattered slime-papillae. In the lower part of erect shoots, similar thin leafless, geotropic stolons sometimes also arise from axils of leaves. - Rhizoids lacking. From rhizomatous base usually a sole erect shoot, up to 5 cm tall and up to 6 mm wide. Stem of erect shoot fleshy, (0.6) 0.85 (-1.1) mm in width. Lateral and dorsal leaves rather similar, transversely inserted, clearly longer than broad, with rounded, but mostly slightly acutate, a little laterally displaced apex. Lateral leaves in the basa1 third somewhat ventricose, in dry condition ± carinate; margin with very scattered slime-papillae. - Cells very thin-walled, without trigones, colourless, mostly isodiametric, sometimes predominantly ± quadrate, at margin often with a row of irregular tangentially-elongated, rectangular, ± narrow, often almost empty cells (fig. 1e), In basal 1/2(-2/3) part of leaf ± large median area of strongly enlarged, elongate, almost empty stiff cells, which in a considerable part of the area are bistratose (Fig. 1g). Asexual reproduction unknown. - A single very slender plant seen, bearing terminally a group of at least six still undehisced, colourless antheridia, loosely bud-like surrounded by the male bracts and the bracteole. Stem apex without disc-like broadening, conical. Male bracts and dorsal bracteole similar, hardly larger than leaves. Below a male bract of the bud a further group of three slightly larger, somewhat brownish antheridia inserted on stem in equal distance between acroscopically a male bract and basiscopically a leaf, one with already empty body, the other two still with firmly intact bodies . A further merophyte below occurs a group of three antheridial stalks on the stem, whose respective antheridial bodies are apparently broken off. Antheridial body ellipsoid, 187 x 204 µm, stalk only slightly shorter, straight, 4-seriate, 2-4 cells long, atleast the cells of the two upper storeys considerably rectangularly elongated. -

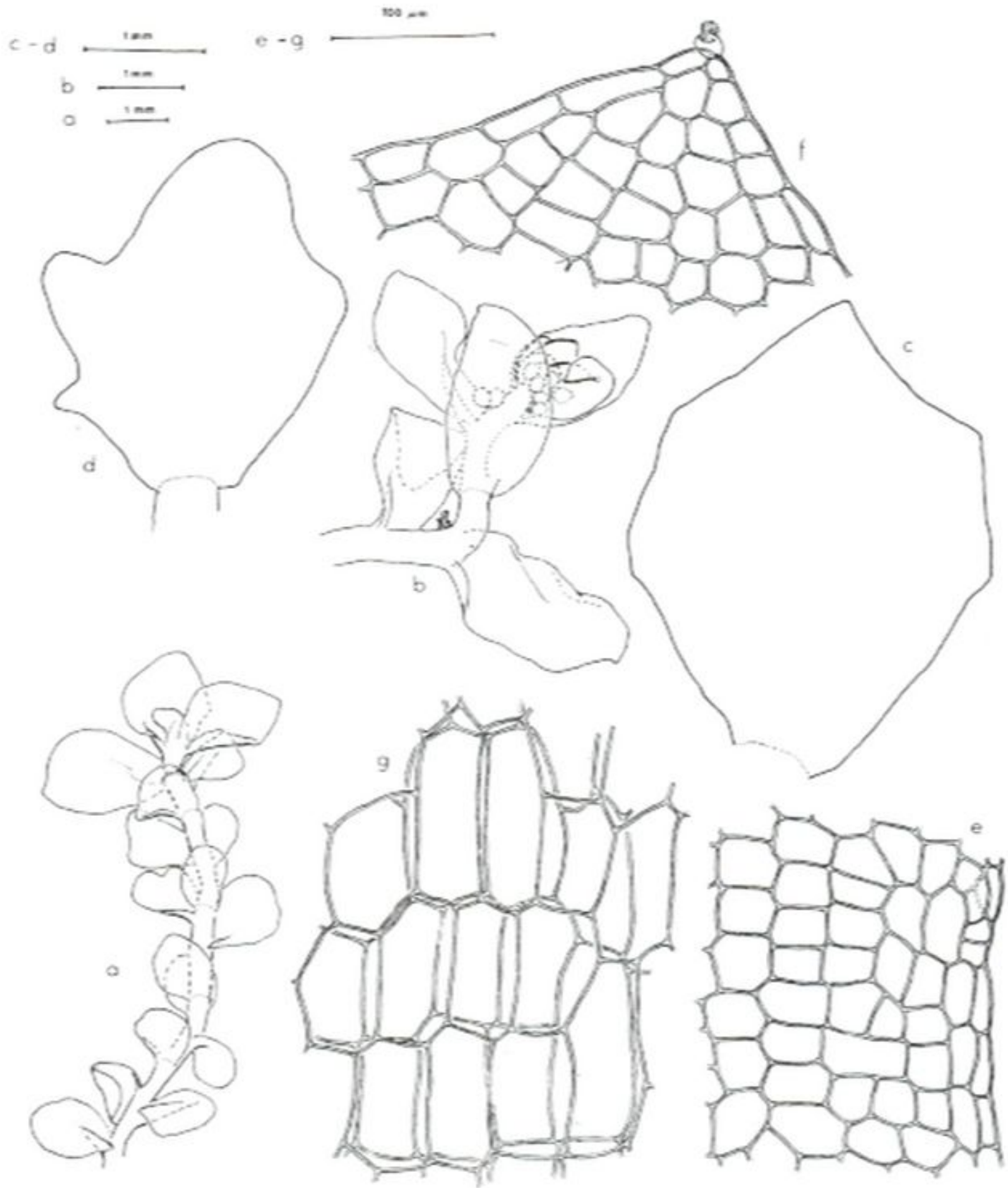

Fig. 1. *Haplomitrium blumii* (Nees) Schust. (Frahm 6503). a. weak sterile shoot, at top broken off and with short branch. b. Upper part of male shoot with groups of antheridia, merely antheridial stalks remaining from the lowermost group. c. Subgynoecial leaf. d. Gynoecial leaf. e. Cell pattern near margin of subgynoecial leaf. f. Cell pattern of the lobe apex of subgynoecial leaf. g. Suprabasal cells of subgynoecial leaf.

Fig. 2. *Haplomitrium blumii* (Nees) Schust. (Frahm 6503). - a. Decomposed main axis of female plant bearing destroyed leaves, a decaying calyptra. (stippled) after exsertion of its sporophyte and two innovating branches, the upper one with a few archegonia at its base. b. Upper part of shoot with archegonia scattered in loose groups along stem, among them apically a. single one developed into a juvenile calyptra (stippled). c. Upper part of female shoot bearing an apical gynoecium with a group of archegonia around immature calyptra with young sporophyte. d. Apical gynoecium with mature calyptra including a still pale sporophyte. e. Apical gynoecium with calyptra broken off except the lower part (stippled), which bears three archegonia at its base and a single one inserted behind and somewhat elevated.

Female Plants much more vigorous. Gynoecia on erect shoots with gradually enlarged leaves, which often are crowded at the top of the shoot, but stem apex without disc-like dilation. Archegonia up to 30, initially (at least) in an apical group (i e. acrogynous; fig. 2c-d), situated fundamentally in the axils of the three uppermost leaves. Apical growth of shoot after fertilization apparently ceasing. Decaying old gynoecium with already vanished sporophyte however exhibiting two small innovating branches depicted in fig. 2a. In absence of fertilization shoot proliferating and the forming of archegonia and leaves continued, thus the archegonia become ± scattered along stem mostly in ± small groups (i.e. anacrogynous; fig. 2b). The three leaves surrounding the apical group of archegonia similar, completely free, in their basal third ± sheating, strongly varied in shape, sornetimes subentire, more often angular, but mostly with 3-5 ± irregular shallow lobes with broad obtuse apices. — Apparently only a single sporophyte developing in a gynoecium. Mature calyptra very long-tubular, smooth, only at the top around the base of tne archegonial neck sometimes rugose; sometimes 2-3 unfertilized archegonia slightly elevated on the very base of the calyptra. - Only immature sporophyte seen, still enclosed in the calyptra.

Habitat: In the African localities in sheltered humid places on " swampy soil" (2) and "litter on slope beside swamp" (1) . 2200-230n m. - In tropical Asia and the neotropics also in sheltered, humid places, but mostly on rotten wood and occasionally on boulders and humus-covered rock, A particularly wide amplitude of habitats including even open grasslands with scattered treeferns is reported from New Guinea by Piippo (1984) p. 22. As has been pointed out by Schuster (1967) p, 23, all species of *Haplomitrium* are mesophytes and none appears to tolerate desiccation. Fulfilling such requirements is probably a common background of the various habitats mentioned above.

General distribution: China (Hainan Isl.), Malaya, Sumatra, Java (1300-2250 m), New Guinea (1100-3550 m), Bougainville, Philippines; Costa Rica, Ecuador (1300-3900 m), Peru (1500 m), Guadeloupe (450-700 m), Martinique (4-700 m), Dominica,

Ny: 114, *Frahm 6503* (female with mature calyptra + male). Rwanda, Pref. Gisenyi, foret de Gishwati, Gakeri. 2200 m. *Cyperus - Lobelia mildbraedii* swamp, on swampy soil, 4.10.91, Fischer 8999 (very scanty). **KB:** 139, Pocs 7312 (female).

(1) Haplomitriaceae Dedecek, Arch. Prir. Proskoumani Cech 5(4): 71, 1884,
The printed date on the outer frontispiece is 1884, and merely on the inner one 1883 as cited by Grolle (1975), p. 252. In former times usually cited from the German version of this journal (Arch. Naturw. Landesdurchforsch. Böhmen), which came out only in 1886.

(2) Calobryales D. H. Campbell ex Hamlin (D. H. Campbell, Ann. Bot. 34: 12. 1920; nom. nud.: Art. 32.1c), Records Dominion Museum (Wellington) 7: 315. 28 Mar 1972.
= Haplomitriales Buch ex Schljakov (Buch, Suomen Maksasammalet 116. 1936; nom. nud.: Art. 36.1), Bot. Zhurn. (Leningrad) 57: 491. 7 Apr 1972.
In our view the name Calobryales appears preferential, because it is older than Haplomitriales, and its use by far prevailing. For names of taxa above family rank, however, the principle of priority is not mandatory (Art, 11.1).

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