

FUNARIACEAE

(F. Müller)

Plants minute to medium-sized, gregarious or forming loose tufts, usually growing on soil, light-green or yellow, short-lived (annual or biennial). **Stems** erect, short, simple or with a few branches, often weakly radiculose below; in cross-section central strand present. **Leaves** reduced below, usually larger and more crowded above, often comose, usually contorted when dry, ovate- to oblong-lanceolate, obovate, oblanceolate or seldom linear-lanceolate, usually \pm concave, apex obtuse to acuminate, seldom aristate; margins plane to somewhat incurved, entire to rather crenulate, bluntly or sharply serrate, limbate or elimbate; costa single, narrow, 4/5 the lamina length to short or seldom long excurrent; laminal cells smooth, large, rather thin-walled, rather lax, poorly chlorophyllose, upper and median cells broadly rhombic to hexagonal; lower and basal cells oblong to rectangular; alar region undifferentiated. **Axillary** filaments present, with long-cylindric terminal cells. **Asexual structures** absent. **Autoicous**, rarely paroicous. **Perigonia** terminal, mostly bud-like, apex of paraphyses club-shaped. **Perichaetia** terminal, leaves somewhat enlarged. **Seta** elongate or very short, erect or somewhat curved and hygroscopic, seldom arcuate, smooth or rarely papillose. **Capsules** usually common, immersed to long-exserted, erect or curved, stegocarpous or cleistocarpous, symmetric and \pm smooth to asymmetric and striate when dry, urn pyriform or cupulate; annulus present or absent; stomata 1-celled, restricted to neck, usually superficial, seldom immersed; exothecial cells thick or thin-walled. **Operculum** present or not, if present, than flat, conic-rounded to short apiculate. **Peristome** double, single, rudimentary or absent, when double, exostome teeth 16, papillose-striolate or striate, trabeculate on adaxial surface; endostome segments 16, cilia absent, or when peristome single to reduced, represented by the exostome. **Calyptra** deciduous or persistent, mitrate or cucullate, smooth and naked, usually longly rostrate and inflated at base. **Spores** spherical or subreniform, reddish or golden-brown, seldom yellowish, variously ornamented or smooth, small to very large.

DISCUSSION. The Funariaceae contain some 13 genera and less than 300 species. It is a cosmopolitan moss family; in sub-Saharan Africa eight genera and about 50 species are present. The family is placed in the order Funariales. The majority of species are found in disturbed or open sites on bare soil.

The family placement of sterile material is usually straightforward: the broad, concave, soft leaves with large, lax leaf cells with flattened ends are very characteristic. Sterile plants are not readily identified to genus or species level; only a few species exhibit distinctive vegetative features that allows one to name them. Fortunately most members of the Funariaceae are autoicous and frequently fertile.

LITERATURE. **Fife, A. J. 1985.** A generic revision of the Funariaceae (Bryophyta: Musci). Part 1. Journal of the Hattori Botanical Laboratory 58: 149-196.

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|---|---------------------------|
| 1. Capsules immersed to emergent | 2 |
| 1. Capsules exserted on long seta | 7 |
| 2. Capsule cleistocarpic, operculum not differentiated | 3 |
| 2. Capsule stegocarpic, operculum differentiated and falling off; mouth broad | 5 |
| 3. Plants bulbiform; perichaetial leaves large, strongly concave, completely enclosing sporophyte; capsule pyriform, pendent, neck cygneous | <i>Cygnicollum</i> |
| 3. Plants with erect to spreading leaves; perichaetial leaves spreading, exposing sporophyte; capsule elliptical, erect, neck not cygneous | 4 |
| 4. Calyptra large, enclosing capsule, mitrate-rostrate, inflated below; neck present; capsules globose to elliptical, often longer than broad; exothecial cells firmer walled | <i>Physcomitrellopsis</i> |

4. Calyptra minute, covering only the beak and the uppermost part of capsule; neck absent; capsules globose; exothecial cells extremely delicate *Physcomitrella*
5. Calyptra cucullate, lacking a rostrum; leaves linear-lanceolate, acuminate-aristate; seta slender and flexuose to curved; capsule horizontal to pendent; operculum plane *Loiseaubryum*
5. Calyptra mitrate, short rostrate; leaves obovate-acuminate to -cuspidate; seta robust, erect; capsule erect; operculum plano-convex or plano-apiculate to short rostrate 6
6. Calyptra with 8 longitudinal plications; spores big (50-90 μm) *Goniomitrium*
6. Calyptra smooth; spores smaller than 50 μm *Physcomitrium*
7. Capsules sulcate when dry, asymmetric, variously inclined to subpendent; peristome double, endostome well developed or somewhat rudimentary; annulus compound and revoluble
..... *Funaria*
7. Capsules smooth when dry, mostly symmetric and erect; peristome either single, rudimentary or absent; annulus not compound and revoluble 8
8. Operculum stoutly to slenderly rostrate; capsule cupulate, mouth often flared when deoperculate, neck very short; exothecial cells isodiametric, with firm-walled cells; peristome absent; calyptra mitrate, base with three broad lobes; spores spinate *Physcomitrium*
8. Operculum plane, convex, conic, very rarely slightly rostrate; capsule cylindrical to pyriform, mouth not flared when deoperculate, neck long; exothecial cells linear-oblong, oblong or very rarely isodiametric, with firm- to thick-walled cells; peristome present, single, rudimentary or occasionally absent; calyptra cucullate and inflated; spores variously ornamented, but not spinate *Entosthodon*

Cygnicollum Fife & Magill (Fig. XX)

A genus with only one species worldwide, *C. immersum* Fife & Magill, which is probably endemic to South Africa.

Plants minute to small, bulbiform, solitary, light green. **Stems** simple, to 1 mm high; in section round, small central strand present. **Leaves** obovate-acuminate, concave, erect-spreading wet, little altered dry; leaves larger above, lower leaves obovate-apiculate, to 1.5 mm long, upper leaves oblong-obovate, acuminate, 1.5--3.0 mm long; margins plane, entire below, crenulate to bluntly serrate above; costa ending below apex in lower leaves and subpercurrent to short-excurrent in upper leaves; upper laminal cells rhomboidal to oblong-rhomboidal, thin-walled; upper marginal cells narrower, long-rectangular, but not forming distinct border; basal cells lax, rectangular. **Autoicous. Perichaetia** terminal, perichaetial leaves large, conspicuous, strongly concave, completely enclosing sporophyte. **Seta** short, erect, 0.7--1.0 mm long, yellowish. **Capsule** cleistocarpous, broadly pyriform, pendent because of cygneous neck, 1.0--1.3 mm long, yellowish-brown; exothecial cells quadrate to rectangular or occasionally rhomboidal, thin-walled; stomata present on neck, phaneropore. **Calyptra** small, narrowly campanulate, 0.6 mm long, smooth. **Spores** subreniform, 25--35 μm , yellowish, irregularly papillose.

HABITAT. Terricolous on soil in small open areas in shrublands. Only known from one locality in the north western Cape region, in an area with high rainfall at elevations of ca. 800 m.

DISCUSSION. The family placement is uncertain. A monotypic genera, which is very distinct in the bulbiferous habit and the completely enclosed, pendent, cleistocarpous capsules. The genus appears distinct from other genera of the Funariaceae.

LITERATURE. Fife, A.J. & Magill, R.E. 1982. *Cygnicollum immersum*, a new genus and species of Funariaceae from the Cape of Good Hope. *Bryologist* 85: 99-103 [description, illustration]. Magill, R.E. 1987. - see general ref. [description, illustration].

Entosthodon Schwägr. (Fig. XX)

Over 20 species in the area, many of them needing confirmation. A taxonomic treatment for the genus is not available, except for the southern African taxa (Magill 1987).

Plants small, solitary or forming small tufts, glossy green to golden-reddish brown. **Stems** erect, simple or few branched by innovations. **Leaves** distally comose, lower stem parts leafless or with few leaves, leaves ovate, oblong, or obovate, 0.8--3.5 mm long, apex acute, short acuminate or obtuse; margins plane, entire or bluntly to rather sharply serrate above; costa ending below the apex to subpercurrent or short excurrent; upper and median cells large, broadly rhombic, short to long hexagonal; lower and basal cells oblong to rectangular, lax; marginal cells forming a border of longer cells or not. **Autoicous. Perichaetia** terminal, leaves similar or somewhat larger. **Seta** elongate, 3--20 mm long, smooth or papillose distally or throughout. **Capsule** erect to inclined, symmetric, 1--4 mm long, narrowly pyriform, with a well-marked neck up to twice as long as the urn; annulus absent; exothecial cells linear-oblong, oblong or very rarely isodiametric, with firm- to thick-walled cells. **Operculum** flat to convex-conic. **Peristome** absent or present with exostome teeth straight or sigmoid; endostome usually not well developed, often peristome reduced and usually inserted well below the mouth. **Calyptra** cucullate, long-rostrate, inflated at base, smooth. **Spores** spherical, variously ornamented.

HABITAT. Terricolous on exposed soil, especially in moist open areas, e.g. slopes, peat banks, banks of streams; from sea level to 4200 m.

DISCUSSION. The genus is characterised by an erect and elongate seta, a symmetric, pyriform capsule with the mouth little altered when deoperculate, a flat or convex operculum, when present a single rather well developed or rudimentary peristome inserted well below the mouth, and an inflated, cucullate calyptra.

The separation of *Entosthodon* and *Funaria* is not altogether clear. An apparent gradation in peristome reduction is evident. For that reason, the genus has been, and still is, placed in *Funaria* by some authors. The treatment here follows that of Fife (1985).

LITERATURE. **Fife, A.J. 1985.** - see family ref. **Magill, R.E. 1987.** - see general refs. [descriptions, illustrations (as *Funaria* species)].

Funaria Hedw. (Fig. XX)

About 18 species recorded for the area, probably far fewer in fact. A taxonomic revision of the African species is not available.

Plants small to medium sized, gregarious or forming loose tufts, green to yellowish-green or brown. **Stems** erect, to 1.5 cm tall, simple or with a few branches, dark red, radiculose; in cross-section hyalodermis present, outer cortical layer of 1-2 rows of smaller, incrassate cells, inner cortical cells thin-walled, central strand well developed; rhizoids appearing smooth. **Leaves** contorted when dry, patent to widespreading when wet; larger above and comose distally, often leafless below, loosely erect, oblong- to obovate-lanceolate, to 4 mm long, to 1.5 mm wide, concave, apex short acuminate to acute; margins plane or rather broadly incurved, entire to bluntly or strongly serrulate distally; costa ending below apex to percurrent, occasionally excurrent; median laminal cells large, rectangular to short or long oblong-hexagonal, lax, smooth; basal cells oblong-rectangular; marginal cells generally narrower, forming a somewhat distinct border. **Autoicous. Perigonia** on lateral branches or not, leaves smaller. **Perichaetia** terminal. **Seta** single, elongate, 5--55 mm long, yellow or golden-yellow, smooth, slender and wiry, usually hygroscopic. **Capsule** exserted, inclined to subpendent, strongly curved-asymmetric or rarely suberect, dark red or reddish-brown, 1.5--3.5 mm long, urn pyriform, strongly asymmetric, widest at mouth, deeply striate, mouth oblique, neck rather long, \pm flattened; exothecial cells oblong-rectangular, thick-walled; stomata in neck region, superficial; annulus revoluble. **Operculum** low convex or conic. **Peristome** double, exostome

teeth broadly lanceolate, slightly curved and joined at tip by a central disk, oblique or vertically striate-papillose below, distally papillose, strongly appendiculate and trabeculate on back; endostome hyaline, lightly papillose, basal membrane high, segments narrowly lanceolate, keeled. **Calyptra** rostrate-cucullate, inflated at base, smooth. **Spores** spherical, smooth or variously ornamented.

HABITAT. On soil, on rocks and cliffs covered with thin soil, frequent in disturbed or open sites, including those recently burnt; in subtemperate areas in lowland and premontane zone, in tropical areas restricted to montane and subalpine altitudes, from near sea level to 4000 m.

DISCUSSION. The genus is characterised by a long, slender, often hygroscopic seta, often a striate, subpendent to inclined, asymmetric capsule, often oblique mouth, double peristome with a well developed or slightly rudimentary endostome, and rostrate-cucullate, inflated calyptra. *Funaria hygrometrica* Hedw., the most common species in the area, is present in the region in two varieties, which are separated by several authors at species level: var. *hygrometrica* and var. *calvescens* (Schwägr.) Mont. (= *F. calvescens* Schwägr.) The two taxa can be separated by the following sporophytic characters: var. *calvescens* - capsules suberect to inclined, nearly straight or only slightly curved, neck often flattened (compressed), setae straight and erect, not or very little arcuate and var. *hygrometrica* - capsules horizontal to pendent, clearly curved, neck not flattened, setae slender, often strongly curved-flexuose.

LITERATURE. Magill, R.E. 1987. - see general refs. [description, illustration (Southern Africa species only)].

Goniomitrium Wilson (Fig. XX)

One species in Africa, *G. africanum* (Müll.Hal.) Broth., which is restricted to the southern part (South Africa, Namibia, Lesotho). An additional African taxon, *G. spelunca* P.de la Varde, was described on the basis of sterile material from the Central African Republic (Potier de la Varde 1946). The description and illustrations in the original paper reveal that the taxon does not belong to *Goniomitrium*.

DESCRIPTION. **Plants** small, scattered or gregarious, dark green. **Stems** short, simple, 1--2 mm high; in section round, weak central strand present. **Leaves** crowded and larger above, infolded and appressed when dry, erect-spreading when wet, broadly elliptical to obovate or subspathulate, 1.5--2.5 mm long, lower leaves smaller than upper ones; margins plane, entire; apex apiculate to cuspidate; costa short-excurrent; upper laminal cells hexagonal to rhomboidal, thin-walled; marginal cells smaller and longer; basal cells quadrate to rectangular. **Paroicus.** **Perichaetia** terminal, perichaetial leaves slightly larger. **Seta** short, 0.5--2.0 mm long. **Capsule** emergent to exserted, erect, stegocarpic, gymnostomous, globose to somewhat pyriform with broad mouth, 1 mm long, neck weakly developed, irregularly sulcate when dry, reddish below; exothecial cells quadrate to rectangular, thin-walled, with 5-6 rows of transversely rectangular cells just below mouth; stomata present at base of urn, phaneropore. **Peristome** absent. **Operculum** plano-convex, 0.7--0.8 mm in diameter, apiculate. **Calyptra** mitrate, vesiculose-campanulate, rostrate, 1.5 mm long, 8-plicate. **Spores** ovoid, large (50--75 µm), golden-brown, minutely verrucate.

HABITAT. Terricolous on open soil in dry rocky regions, forming large patches after periods of rain; from sea level to 1800 m.

DISCUSSION. The genus is recognised in the field by large-mouthed capsules, large, 8-sided, plicate calyptra and spreading, dark green, cuspidate leaves. Fife (1985) reduced the African taxa *G. africanum* (Müll.Hal.) Broth. to a subspecies of the Australian *G. acuminatum* Hook. & Wilson, but this is not always accepted. The genus is easy to overlook and is probably undercollected in the area.

LITERATURE. **Fife, A.L. 1985.** - see family ref. **Magill, R.E. 1987.** - see general refs. [description, illustration] **Potier de la Varde, R. 1946.** Bryophyta nova. Revue Bryologique et Lichénologique 15: 141-146.

Loiseaubryum Bizot (Fig. XX)

A monotypic genus consisting only of *L. nutans* (Wilson ex Mitt.) Fife, only known in Africa from Chad and Nigeria in the surroundings of Lake Chad and from Sudan. Outside the African continent there are additional records from India and Bangladesh.

Plants minute, bright green to green, gregarious or scattered, protonema persistent, ephemeral. **Stems** erect, 1.5--2.5 mm high, radiculose below, rhizoids smooth, central strand present. **Leaves** around ten per stem, lanceolate to linear-lanceolate, acuminate-aristate, 0.3--0.5 x 1.5--2 mm, smaller in the lower part, larger and more clustered in the upper part, irregularly shrunken when dry, erect to erect-spreading when wet; perichaetial leaves forming terminal rosette, linear-lanceolate, the apex tapering into a long, capillary point; costa ending below the base of the acumen in vegetative leaves and reaching up to the slender acumen in perichaetial leaves; margin plane, bluntly serrate to serrulate towards apex, lower margins entire. Leaf cells laxly oblong-hexagonal to rectangular, 20--40 x 100--140 μm , thin-walled, narrower towards margin and larger and more elongated near base. **Autoicous.** **Seta** pale-brown, 0.7--2 mm, very slender and flexuose, arcuate. **Capsules** exerted, hemispheric, lacking a neck, operculate, gymnostomous, horizontal to pendent by the curvature of the seta, 0.5--0.8 mm in diameter, wide-mouthed, light brown in color; exothecial cells delicate, quadrate to rounded-hexagonal, thin-walled, 40--75 x 47--62 μm , oblate in 2-5 rows near mouth; stomata present near base. **Annulus and peristome** lacking. **Operculum** plane. **Calyptra** very small, covering only the uppermost portion of the capsules, short-rostrate, cucullate, not inflated, lacking a rostrum, slightly split into two lobes at base. **Spores** reddish-brown, ellipsoidal to spherical, 27--42 μm , densely papillose-spinose.

HABITAT. On wet mud soil and on silt on banks of waters (rivers, creeks, ditches, ponds etc.), often associated with *Riccia* species; 300--320 m.

DISCUSSION. *Loiseaubryum* is the most phenetically distinctive genus in the Funariaceae. Probably undercollected because of its small size and short life cycle.

LITERATURE. **Bizot, M. 1976.** Enumeratio muscorum novarum, II. Revue Bryologique et Lichénologique 42: 843-855 [description (in French), illustration]. **Ochyra, R. 1983.** The rediscovery of *Loiseaubryum ephemeroide*s Bizot (Musci: Funariaceae) in Nigeria. Acta Botanica Hungarica 29: 173-179 [description, illustration].

Physcomitrella Bruch, Schimp. & W.Gümbel (Fig. XX)

One taxon in Africa, *P. patens* (Hedw.) Schimp. ssp. *magdalenae* (De Sloover) B.C.Tan. The taxon is obviously very rare, and is known only from three localities (Rwanda, Uganda, Zaire). Because of the very small size the taxon is probably overlooked and therefore undercollected in the area.

Plants small, gregarious, growing in small isolated tufts, green. **Stems** erect, ca. 3 mm high, branched at the base, with numerous brown red, finely papillose rhizoids; central strand present. **Leaves** about 10 per stem, plane to weakly concave, obovate to spatulate, acumen short; in upper 1/2 or 1/3 leaf margin serrate to serrulate; lower leaves about 2 x 0.8 mm, nerve reaching 2/3 of leaf length, margin plane; upper leaves up to 4-6 x 2.2 mm, nerve percurrent, margin revolute in the lower half; cells lax, walls thin and smooth; upper cells irregular hexagonal, 35--60 x 20-40 μm , marginal cells 70--120 x 25 μm ; lower leaf cells rectangular, 120--190 x 35 μm . **Autoicous.** **Seta** c. 0.25 mm long. **Capsule** erect, immersed to short emergent, cleistocarpic, globose, 0.8--1.2 mm in diameter, neck lacking, brown in mature condition; capsule beak strong, 0.3--0.45 mm long; exothecial cells irregular, 20--45

µm, thin-walled, stomata present near the base, phaneroporous. **Operculum** not developed. **Calyptra** 0.7--1.1 mm, covering the capsule beak and upper 1/4 of the capsule, split to lobe at base. **Spores** globose, ferruginous brown, strongly papillose, papillae mostly echinate, 25--30 µm.

HABITAT. On open, wet to moist habitats, e.g. on recent alluvium, on compacted bare soil of forest tracks and roadside banks; 1100--2100 m.

DISCUSSION. The main differences of the African subspecies from the northern hemispheric ssp. *patens* are: the African subspecies is in all features bigger (stem leaves, capsule diameter, calyptra); the capsule beak is more strongly developed. The presence of spores with many echinae, papillae or processes is another unique character for ssp. *magdalanae*.

LITERATURE. **De Sloover, J.L. 1975.** Note de bryologie africaine III. - *Physcomitrella magdalanae* sp. nov. Bulletin du Jardin Botanique National Belgique 45: 131-135 [key to genus, description (in French), illustration]. **Tan, B.C. 1979.** A new classification for the genus *Physcomitrella* B.S.G. Journal of the Hattori Botanical Laboratory 46: 327-336 [review of genus, key to subspecies].

Physcomitrellopsis Broth. & Wager in Dixon (Fig. XX)

One species in Africa, *P. africana* Broth. & Wager in Dixon, restricted to Cape and Natal regions of South Africa and with some doubt also reported from one locality in Tanzania.

Plants small, gregarious, green. **Stems** erect, unbranched, 1.0--2.0 mm; central strand small. **Leaves** crowded above, spreading wet, weakly contorted dry; spatulate-acuminate, 4--5 mm long; margins plane, entire below, strongly serrulate to bluntly serrate above base; costa ending just below apex to subpercurrent; laminal cells lax, rectangular below to oblong-rhomboidal above, smooth. **Autoicous.** **Perichaetia** terminal, leaves larger. **Seta** 0.5--0.8 mm long, yellowish. **Capsule** exposed, sessile, erect, cleistocarpic, globose to elliptical, 1.0--1.2 mm long, smooth, with very short, obtuse tip, reddish yellow; exothecial cells angular, subquadrate to hexagonal; stomata at base of urn, phaneropore. **Operculum** not differentiated. **Calyptra** large, swollen, completely enclosing capsule, smooth, mitrate-rostrate, 1.3 mm long. **Spores** rounded, weakly papillose, 30 µm.

HABITAT. Terricolous. In Natal and Transkei it was found at the edge of coastal forests. The Tanzanian plants were growing in a montane forest at elevations of 1800--2050 m.

DISCUSSION. A monotypic genus, the only species restricted to Africa. The lax, spatulate-acuminate leaves with dentate margins are good features in sterile condition. Fertile material is easily recognised by the short seta, exposed, globose to elliptical, cleistocarpous capsules and large calyptra. Dry specimens are easily overlooked.

LITERATURE. **Magill, R.E. 1987.** - see general refs. [description, illustration].

Physcomitrium (Brid.) Fühnr. (Fig. XX)

Ten species are recorded for the area, but possibly only 5 or fewer are valid; 80 species worldwide, mostly associated with temperate moist regions.

Plants mostly small, solitary or forming loose tufts, light green to yellowish-green. **Stems** erect, to ca. 10 mm, with a few branches, radiculose below; in cross-section outer 1-2 rows of cells slightly differentiated, somewhat smaller, firm-walled, inner cells large, thin-walled, central strand mostly weak. **Leaves** progressively larger distally, often crispate when dry, erect-spreading to spreading when wet, oblong to obovate-oblong, mostly 1--4.5 mm long, acuminate to acute or acute-rounded; margins plane or erect below, entire to more commonly serrate, limbate or elimbate; costa rather strong, ending well below apex to percurrent or short excurrent; laminal cells large, smooth, mostly thin-walled, median cells rectangular to oblong-hexagonal; basal cells more elongate, lax; margins

sometimes differentiated by narrower cells. **Autoicous. Perichaetia** terminal, leaves similar to stem leaves but often larger. **Seta** very short to elongate, to 10 mm long, smooth. **Capsule** immersed to long-exserted, erect, symmetrical, urn cupulate, mostly 1--2 mm long (including neck), often flared at mouth when dry, neck usually distinct, short; stomata in neck region, superficial; exothecial cells isodiametric; annulus persistent or not. **Operculum** apiculate or shortly to moderately rostrate. **Peristome** absent. **Calyptra** mitrate, inflated or not below, long beaked above, base irregularly lobed, smooth and naked. **Spores** spherical to subreniform, coarsely papillose or spiculose.

HABITAT. On exposed soil, often associated with wet sites, e.g., along streams or rivers, by lakes, in swamps, on alluvial mud and river banks; from near sea level to ca. 2500 m.

DISCUSSION. The genus is characterised by an elongate, erect, cupulate capsule, often flared at the mouth when deoperculate, mitrate calyptra and the absence of a peristome. The African species can be separated into two subgenera. The members of these two subgenera are habitually very different. The species of subgenus *Cryptopyxis* (Müll.Hal.) Broth. are characterised by immersed capsules, which in dry conditions are cyathiform with little or no neck; the exothecial cells are thin-walled and delicate in the lower portions and not markedly thickened in corners. The species of subgenus *Physcomitrium* have exserted, hemispheric or pyriform capsules with a distinct neck, the exothecial cells are firm-walled throughout and have thickened corners.

LITERATURE. **Magill, R.E. 1987.** - see general refs. [description, illustration (Southern Africa taxa)].