

## Taxonomic Results of the BRYOTROP Expedition to Zaire and Rwanda

### 20. Grimmiaceae, Funariaceae, Bartramiaceae (Philonotis), Amblystegiaceae, Plagiotheciaceae

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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 of the collecting sites 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).

#### GRIMMIACEAE

Key to the genera and species:

1. Plants acrocarpous, growing erect in tufts. Capsule immersed with columella falling with attached operculum after dehiscence. Annulus

absent. Central strand present. Lamina cells with straight walls, irregularly quadrate throughout and only short rectangular at the base .....*Schistidium rivulare*

1. Plants cladocarpous, prostrate in mats. Capsule exerted with operculum falling detached from columella. Annulus present. Central strand absent. Lamina cells long-linear at least below, with strongly nodose lateral walls ..... (*Racomitrium*) .....2

2. Leaf margins bistratose for 2-8 rows of cells forming fleshy borders. Hair-point always wanting. Spores large, roughly papillose, 18-28  $\mu$ m wide.....*Racomitrium lamprocarpum*

2. Lamina cells unistratose throughout. Hair-point present, at least on some uppermost leaves. Spores small, finely granular on the surface, 12-14  $\mu$ m wide.....3

3. Basal marginal border present, composed of 10-25 wide and pellucid, usually esinuose cells. Costa bistratose, with 3-4 large ventral cells in the basal part. Hair-point strongly flexuose, mostly about 0.5-1.0 mm, smooth. Alar cells not or slightly

differentiated. Perichaetial leaves not squarrose when wet....*Racomitrium crispipilum*

3. Basal marginal border absent. Costa tristrate, with 4-8 large ventral cells in the basal part. Hair-point mostly present, flexuose, to 0.5 mm long, usually obtusely low-denticulate. Alar cells orange to reddish, composed of several rows of swollen cells forming auricles. Perichaetial leaves squarrose when wet .....  
.....*Racomitrium subsecundum*

***Schistidium*** Brid., *nom. cons. prop.*

For worldwide monograph see Bremer (1980a, b, 1981). Unfortunately, this treatment is not particularly useful because the author accepted an exceedingly broad species concept and actually very many distinct and easily recognizable exotic species has simply been lumped with *S. apocarpum* (Hedw.) Bruch & Schimp. in B., S. & G. In tropical East Africa at least five distinct species have so far been recorded (Kis 1985), but it is very likely that this number will increase with progress in taxonomic study of the genus and floristic exploration of the bryologically undercollected areas.

***Schistidium rivulare*** (Brid.) Podp. (*Grimmia rivularis* Brid., *G. alpicola* Hedw. var. *rivularis* (Brid.) Wahlenb., *G. apocarpa* Hedw. var. *rivularis* (Brid.) Nees, Hornsch. & Sturm, *Schistidium apocarpum* (Hedw.) Bruch & Schimp. in B., S. & G. var. *rivulare* (Brid.) Bruch & Schimp. in B., S. & G., *S. alpicola* (Hedw.) Limpr. var. *rivulare* (Brid.) Limpr., *S. apocarpum* (Hedw.) Bruch & Schimp. in B., S. & G. fo. *rivulare* (Brid.) Loeske, *S. agassizii* auct. afr. *non* Sull. & Lesq.)

A boreal-montane species having more or less continuous geographical range throughout much of the Holarctic and occurring at some bipolar stations in Australia and New Zealand (Bremer 1980a), on the sub-Antarctic island of South Georgia (Bell 1984) and in the maritime Antarctic (Ochyra et al. 1986). In addition, it is known from the altimontane stations in the tropics in Peru (Deguchi 1987) and East Africa (Kis 1986 as *S. agassizii*). According to Bremer (1980a) the species is absent from East Africa and all previous records belong to *S. apocarpum*. Certainly, the African material of *Schistidium* is badly in need of a taxonomic

revision, but the following specimen from Mt. Karisimbi fits well into the present concept of *S. rivulare* (Deguchi 1979). As with the overwhelming majority of boreal species occurring in the tropical outposts, *S. rivulare* occurs in the subalpine belt at an elevation of 3300 m, where it was found on wet rock in a small stream.

**Ka:** 159, *Frahm* 8274.

***Racomitrium*** Brid.

For a survey of African species see De Sloover (1977); in addition, for some African taxa the taxonomic treatments of Frisvoll (1988) and Ochyra et al. (1988) should be consulted.

***Racomitrium lamprocarpum*** (C. Muell.) Jaeg. [*Grimmia lamprocarpa* C. Muell., *Grimmia pseudoacicularis* C. Muell., *Racomitrium pseudoaciculare* (C. Muell.) Par., *Grimmia nigroviridis* C. Muell., *Racomitrium nigroviride* (C. Muell.) Par., *Grimmia nigroviridis* C. Muell. var. *robusticula* C. Muell., *Racomitrium nigroviride* (C. Muell.) Par. var. *robusticulum* (C. Muell.) Par., *R. defoliatum* Dix.]

This is a very distinct and almost unmistakable species which can be immediately distinguished from all other species of *Racomitrium* in Africa on the basis of a set of both gametophytic and sporophytic characters. It is vegetatively distinct by its leaves having clear, fleshy bistratose limbia composed of 2-8 rows of cells and extending from well below the mid-leaf to the apex. Moreover, the leaves are always epilose and strongly folded on one side below. The upper lamina cells are quadrate to short rectangular, while the angular cells are large, isodiametric, yellow-brownish, forming swollen, pellucid and decurrent auricles. The sporophytes are occasionally produced in East Africa and the most important and peculiar sporophytic feature of the species are its roughly papillose, large spores, reaching 18-28 µm in diameter, being the largest known in the genus *Racomitrium*.

*Racomitrium lamprocarpum* is a rheophilous species growing on rocks in streams as well as on rock faces sprinkled with water. In Africa it is widely distributed but scattered in the mountains of south-western and southern Cape and subsequently extending to Central (Mitumba, Virunga,

Ruwenzori) and East African mountains (Kilimanjaro, Mt. Elgon, Mt. Kenya), where it infrequently occurs in the subalpine and alpine belts from 2150 to 4800 m. Outside Africa *R. lamprocarpum* is widespread in southern South America ranging along the western fringes of the continent from the Juan Fernandez Islands to Tierra del Fuego, on the Falkland Islands and on Gough Island in the Tristan da Cunha group on the South Atlantic. Some disjunct and highly isolated stations of the species are known from Portugal and Spain on the Iberian Peninsula in Europe (Ochyra et al. 1988).

**Ka:** 161, *Frahm 8095*; 163, *Frahm 8202*.

\**Racomitrium crispipilum* (Tayl.) Jaeg. (*Grimmia crispipila* Tayl.)

A species new to Africa which does not seem to have been described here earlier under another local name. Hitherto, it has been known to be widely distributed in Central and South America, ranging along the Cordillera chain from Mexico to Tierra del Fuego, although its occurrence in the southernmost tip of South America needs confirmation. Judging from the excellent illustrations of the type specimens of several species considered to be conspecific with *R. crispipilum* by Deguchi (1984) it is evident they differ markedly from the type of the present species in the structure of their costae which is a critical character for the delimitation of *Racomitrium* species, especially in section *Laevifolia*. On the other hand, the African material coincides perfectly with the American type of *R. crispipilum* as well as other non-type collections. Thus, the discovery of *R. crispipilum* on Mt. Karisimbi increased by one distinct species the number of the common Afro-American moss species. The species is readily known by its entirely unistratose leaves with very long, smooth and strongly flexuose hair-points and its basal marginal band of wide, pellucid and esinuose cells extending in one row along the margin for 10-25 cells.

*Racomitrium crispipilum* is probably scattered in most Central and East African mountains, but its real distribution will be presented in the ongoing revision of the genus in Africa after examination of extensive collections. The present material was collected on dry rocks in the afroalpine belt at an elevation of 4300-4500 m.

**Ka:** 164, *Frahm 8144*; 165, *Frahm 8286*.

*Racomitrium subsecundum* (Hook. & Grev. in Hook. ex Harv.) Mitt. & Wils. [*Trichostomum subsecundum* Hook. & Grev. in Hook. ex Harv., *Grimmia alaris* Broth., *Racomitrium alare* (Broth.) Par., *Grimmia dura* Broth., *Racomitrium durum* (Broth.) Par.]

This seems to be the commonest species of *Racomitrium* in tropical Africa, from where it is better known under the local names *R. alare* (Broth.) Par. and *R. durum* (Broth.) Par. According to the unpublished observations of the author both names must be considered synonymous with *R. subsecundum* (Ochyra & Pócs 1992). Detailed taxonomic discussion and African distribution of this species will be presented in the ongoing revision of *Racomitrium* for this continent. *R. subsecundum* is a widely distributed species, from one hand in the tropical Asia and in the Himalayan Yunnan region, and from the other hand in the Neotropics, so its African occurrence was rather expected. The species shows considerable variability and it is likely to be confused with other African species of *Racomitrium*. Some epilose modifications have often very broad leaves with the margin folded on one side below and may resemble *R. lamprocarpum*, with which additionally can grow in mixed stands. Nonetheless, *R. subsecundum* is at once recognizable by its wholly unistratose leaves and, when fertile, by its much smaller and only finely papillose spores. On the other hand, some ecads with unusually long hair-points may be confused with *R. crispipilum*. The safest character enabling the unmistakable recognition of both species is the presence of the long basal marginal border of pellucid, esinuose cells in the latter which is lacking in *R. subsecundum* as well as the structure of the costa, which is very broad and flat below and has 4-8 ventral cells in the basal part in *R. subsecundum*, whereas in *R. crispipilum* the costa is narrower, less flat and rather reniform below and consist only of 3 or sometimes 4 ventral cells in the basal part. In addition, the hair-point in *R. subsecundum* is obscurely low dentate and the angular cells form swollen and decurrent auricles, while in *R. crispipilum* the hair-point is entirely smooth and the angular cells differ only slightly from the adjacent basal cells. *Racomitrium subsecundum*

grows on soil and rocks in dry situations as well as in wet places on rocks along streams. The present collections came from subalpine and alpine belt at 3000-4450 m.

**Ka:** 159, *Frahm 8217*; 161, *Frahm 8178*; 165, *Frahm 8276*.

#### FUNARIACEAE

This is a cosmopolitan moss family which is quite well represented in Africa south of the Tropic of Cancer. No taxonomic revision of this family for the whole area is available, but the regional treatment of the southern African taxa (Magill 1987) and the key to the African genera of the Funariaceae (Ochyra 1983) may prove useful.

1. Capsules cupulate, symmetric. Exothecial cells quadrate to hexagonal. Calyptra mitrate. Annulus none. Peristome none. Leaves with distinct border of narrow, thin-walled cells .....

.....*Physcomitrium subspathulatum*

1. Capsules subpyriform, very asymmetric. Exothecial cells rectangular. Annulus present, large and revoluble. Peristome present, double. Calyptra inflated-cucullate. Leaves without border .....

.....*Funaria hygrometrica* var. *calvescens*

*Physcomitrium* (Brid.) Fuernr.

No revision of the genus in Africa is available; for a treatment of southern African taxa see Magill (1987).

*Physcomitrium subspathulatum* Thér. & Nav. in Nav.

A rare species confined to Central Africa, known from Zaire (Rutshuru, type collection) and Rwanda (*De Sloover 18754*, KRAM). It is a terricolous submontane species, growing in moist situations. Taxonomically, the species is very closely related to southern African *Ph. spathulatum* (Hornsch.) C. Muell. and it is very likely that both species are identical. The specimen cited below was collected from soil in swamp at an elevation 2300 m.

**KB:** 144, *Frahm 7578*.

*Funaria* Hedw.

For a survey of southern African taxa see Magill

(1977).

*Funaria hygrometrica* Hedw. var. *calvescens* (Schwaegr.) Mont.

(*Funaria calvescens* Schwaegr.)

A weedy moss, exceedingly common in tropical and subtropical areas throughout the world. This variety differ from the type variety in the seta being straight and erect and not or very little arcuate and the capsules not or only slightly curved with a wide mouth being very oblique and usually almost parallel to the longitudinal axis of the capsule.

*Funaria hygrometrica* var. *calvescens* is a weed, growing in a variety of disturbed habitats, preferably on soil, but also on rocks and cliffs covered with thin soil. All collections cited below came from lower montane and subalpine belts between 2300 and 3560 m.

**KB:** 128, *Frahm 7582*. **Ka:** 158, *Frahm 8267*; 159, *Frahm 8260*; 161, *Frahm 8323* & *8339*; 162, *Frahm 8081*.

#### BARTRAMIACEAE

*Philonotis* Brid.

Like elsewhere in the world, the genus is well represented in tropical Africa south of the Tropic of Cancer. So far, no less than fourteen species have been recorded for Zaire, Rwanda and Burundi (Demaret 1940, 1944), twenty for tropical West Africa (Schultze-Motel 1975) and twenty-six for tropical East Africa (Kis 1985). These figures seem to be overestimated and the future taxonomic study should doubtless considerably reduce the number of species of this genus. No revision of *Philonotis* in tropical Africa is available, except for a treatment of the southern African taxa in which only six species are recognized in this area (Magill 1987).

1. Leaf cells smooth; costa ending below leaf apex; leaves blunt .....

.....*Philonotis hastata*

1. Leaf cells papillose; costa percurrent to long excurrent; leaves acuminate.....2

2. Leaves ovate-lanceolate, tapering to acute to acuminate apex; leaf margins plane to slightly recurved.....

.....*Philonotis falcata*

2. Leaves narrowly lanceolate, tapering to acuminate to subulate apex; margins distinctly recurved

- to reflexed.....3  
 3. Leaves imbricate when dry; plants slender to medium-sized.....*Philonotis tomentella*  
 3. Leaves widely patent when dry; plants very delicate.....*Philonotis mniobryoides*

***Philonotis hastata*** (Duby in Moritzi) Wijk & Marg. (*Hypnum hastatum* Duby in Moritzi, *Ph. laxissima* C. Muell., *Ph. imbricatula* Mitt.)

A palaeotropical species widely distributed in tropical Africa (common in lowland and lower montane stations) and on East African Indian Ocean islands, Asia and Oceania, extending northwards to the temperate regions of continental Asia (India, China) and Japan. It is very likely, however, that *Ph. hastata* is in fact a pantropical species, since *Ph. gracillima* Aongstr. from the Americas seems to be practically inseparable from *Ph. hastata*. Magill (1987) indicated indeed the Neotropics as a part of its range, but without identifying the source of information and/or citing the relevant collections. *Ph. hastata* is quite variable, especially in leaf size and shape of the apex, but its smooth lamina cells; areolation of lax, rectangular to oblong-hexagonal cells; blunt leaves; and subpercurrent costa enable its immediate recognition.

**Ny** 101, *Frahm* 6488; 113, *Pócs* 6005.

***Philonotis falcata*** (Hook.) Mitt. (*Bartramia falcata* Hook., *Philonotis afrofontana* (C. Muell.) Par.)

A palaeotropical species widely distributed in tropical and temperate Asia and rare on the Hawaiian Islands in Oceania (Miller *et al.* 1978). In Africa, the species is quite common in the southern part of the continent (Magill 1987) and rare in East Africa, whence it was only once recorded from Malawi (Bartram 1953 as *Ph. afrofontana*). The following two records are the first from the East African volcanic area.

**KB**: 122, *Frahm* 6645; **Ka**: 159, *Frahm* 8155.

***Philonotis tomentella*** Mol. in Lor. (*Ph. fontana* (Hedw.) Brid. var. *pumila* (Turn.) Brid., *Ph. alpicola* Lor., *Ph. angustifolia* Kindb., *Ph. osterwaldii* Warnst.)

A boreal-montane species widely distributed but scattered throughout the Holarctic, where it has

an almost continuous, circumpolar range. As with many northern species of mosses, it also occurs at altimontane elevations in tropical mountains in East Africa, including Kilimanjaro Mts., Mt. Kenya and Mt. Elgon, where it was frequently recorded from 3400–4300 m. The present records are new to Zaire and Rwanda and all came also from higher elevations of 2450–3200 m, with only a single collection from a lower elevation of 1500 m.

**Ny**: 170, *Pócs* 8385; 101, *Pócs* 6005 & 6091 and *Frahm* 6092. **KB**: 137, *Frahm* 6956; 148, *Frahm* 7693.

**\**Philonotis mniobryoides*** Broth.

A West African endemic species, widely distributed but scattered in Cameroon, Gabon, Benin and Central African Republic (Schultze-Motel 1975). Here, it is reported for the first time from the Kivu Province in Zaire which is an area occupying a transitional position between the West and East African floras and being an eastern limit for many West African species.

**KB**: 123, *Pócs* 6754.

#### AMBLYSTEGIACEAE

This predominantly Northern Hemisphere moss family is poorly represented in the tropical regions, where its members occur mainly at higher elevations in the mountains in the subalpine and alpine belts. According to the unpublished results of a taxonomic revision of this family, it is represented in tropical Africa by seven species. Of these, only one was collected during the course of the BRYOTROP expedition to Rwanda and Zaire.

***Warnstorfia*** Loeske

For a survey of this genus in other parts of the tropics see Ochyra *et al.* (1991).

***Warnstorfia fluitans*** (Hedw.) Loeske in Nitardy (*Hypnum fluitans* Hedw., *Drepanocladus fluitans* (Hedw.) Warnst.)

A nearly cosmopolitan and highly polymorphous species, common in the Northern Hemisphere and rather infrequent in the tropics and in the temperate regions in the Southern Hemisphere. In Africa the species is confined to the Central African volcanic

region including Ruwenzori and Virunga. The specimen cited below came from a swamp at an elevation of 3350 m.

**Ka:** 160, *Frahm* 8333.

#### PLAGIOTHECIACEAE

This family is now generally interpreted as a monotypic taxon including only *Plagiothecium* Schimp. in B., S. & G., which is a relatively large genus predominantly occurring in temperate regions of the world, while in the tropics its species are rare and restricted in their distribution to montane areas. In tropical Africa the genus is represented by a few species which need a modern taxonomic treatment.

1. Leaf cells mostly 10-14 µm wide. Decurrencies small, inconspicuous. Nematogen cells none  
.....*Plagiothecium nitens*

1. Leaf cells mostly 5-7 µm wide. Decurrencies prominent, large. Nematogen cells present  
.....*Plagiothecium mildbraedii*

#### *Plagiothecium nitens* Dix.

A rare afro-montane species occurring in Central and East African mountains including Virunga, Kilimanjaro, Mt. Kenya and Uluguru Mts. It occurs from lower montane to subalpine belts at an elevation of 1800-3460 m. The species thrives epiphytically on tree boles as well as on ground and litter in montane forests.

**KB:** 143, *Pócs* 7603 & *Frahm* 7756.

#### *Plagiothecium mildbraedii* Broth. in Mildbr.

A relatively frequent species occurring in most Central and East African massifs from the lowlands to the subalpine belt at 220-3950 m. It grows on a variety of substrates, especially on ground, but it was also collected from rocks with dripping water. Taxonomically, the species is closely related, and possibly identical, to the mostly Holarctic *P. neckeroideum* Schimp. in B., S. & G. which so far has not been recorded from Africa, but it is scattered in tropical south-east Asia (Enroth 1991).

**Ka:** 167, *Fischer* 8338.

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