

A revision of *Schoenobryum* (Cryphaeaceae, Bryopsida) in Africa¹

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Abstract. The nine species and two varieties of *Schoenobryum* reported for Africa were investigated, and no characters were found that uniquely identified any of the taxa to be other than the pantropical *Schoenobryum concavifolium*. The following nine names become new synonyms of *S. concavifolium*: *Cryphaea madagassa*, *C. subintegra*, *Acrocryphaea robusta*, *A. latifolia*, *A. subrobusta*, *A. tisserantii*, *A. latifolia* var. *microspora*, *A. plicatula* and *A. subintegra* var. *idanreense*; a lectotype is selected for *Acrocryphaea latifolia* var. *microspora* P.de la Varde.

INTRODUCTION

A recent checklist of Sub-Saharan Africa (O'Shea, 1999) included nine species and two varieties of *Schoenobryum*, most of quite limited distribution. Recent collecting in both Malawi (O'Shea et al., 2001) and Uganda (Wigginton et al., 2001) has shown the genus to be not uncommon, although there was only one previously published collection from the two countries (O'Shea, 1993). Apart from one African taxon occurring in nine countries, the other 10 occurred in an average of 1.7 countries. This particular profile is typical of unrevised genera in Africa, and indicative of a possible need for revision (O'Shea, 1997), particularly

as the majority have not been examined since the type description, and many have never been illustrated.

The purpose of this paper is to provide an overview of the genus worldwide, and to review the taxonomic position of the African taxa.

CRYPHAEACEAE SCHIMP. 1856.

Cryphaeaceae Schimp., Coroll. Bryol. Eur. 97. 1856 ['1855']. Type: *Cryphaea* D.Mohr in F.Weber

A brief review of the circumscription and systematics of the family, and the distinctions from related families (e.g. Leucodontaceae) is given by Manuel (1974, 1982) and Buck (1980), and descriptions and illustrations of the family can be found in Manuel (1981, 1994).

¹ British Bryological Society Expedition to Mulanje Mountain, Malawi. 16.

Of the ten genera recognised in the family (Buck & Goffinet in Shaw & Goffinet 2000): *Cryphaea*, *Cryphidium*, *Cyrtodon*, *Cyrtodontopsis*, *Dendroalsia*, *Dendrocryphaea*, *Dendropogonella*, *Pilotrichopsis*, *Schoenobryum*, *Sphaerotheciella*, two (*Cryphaea* and *Schoenobryum*) contain over 80% of the species in the family, and it is these two genera that are found in Africa. (Manuel (1981) speculates that *Sphaerotheciella* may perhaps also be present in Africa, considering the presumed Gondwanan origin of the genus.)

Their appearance is quite distinctive, with slender, erect, terete shoots arising from a creeping main stem, on tree trunks or branches, usually with abundant sporogonia. They usually appear as tufts or as a loose mat. The two genera are distinguished as follows:

Sporophytes borne laterally, along the length of a branch, peristome double..... *Cryphaea*
Sporophytes borne terminally on branches, peristome single..... *Schoenobryum*

In practice, it is not always easy to distinguish the two genera, particularly in the field, as the perianth-bearing branches in *Schoenobryum* are often very short, making them appear lateral, but there will usually be some that are clearly terminal. An additional character is that the perianths in *Cryphaea* are usually cylindrical, as opposed to oval in *Schoenobryum*, and *Cryphaea* is usually much more slender. Plants without sporogonia may be difficult to allocate to genus.

An attempt has already been made (Bizot in Bizot & Pócs, 1982) to key out the African species of *Schoenobryum* based on the literature, concentrating mainly on leaf shape and juxtacostal cells, but this had the effect of highlighting the similarities rather than the differences, and giving undue significance to characters that have proved to be unreliable; this caused many specimens identified since 1982 to be almost randomly named, depending on which characters seemed most prominent. This paper is intended to provide more clarity by

reviewing all the taxa involved, looking where possible at type specimens.

The genus *Cryphaea* has recently been revised for Africa, with all species described and illustrated (Rao, 2001), so this paper completes the revision of the family in Africa.

SCHOENOBRYUM DOZY & MOLK.

Schoenobryum Dozy & Molk., Musci Frond. Ined. Archip. Ind. fasc. 6: 183-184. 1848. (*Acrocryphaea* Bruch, Schimp. & W.Gümbel, Bryol. Eur. 5: 35, fasc. 44-45. 1850 *nom. nud.*; *Cryphaea* sect. *Acrocryphaea* Mitt., J. Linn. Soc., Bot. 12: 410. 1869.)

Holotype: *Schoenobryum julaceum* Dozy & Molk., Musci Frond. Ined. Archip. Ind. fasc. 6: 184. f.60. 1848 [*Grimmia julacea* Hornsch. in Mart., Fl. Bras. 1(2): 7. 1840, *hom. illeg.*]

Manuel (1977) described the reasons for using the name *Schoenobryum* rather than the more meaningful *Acrocryphaea*, and made all the necessary nomenclatural changes. He recognised 21 species and three varieties as valid, but made no taxonomic investigations. In addition there are five *nomina nuda*, of which two are from Africa, and are discussed under 'Excluded Taxa'. Manuel (1981) in his review of American species added an additional species (*S. mittenii* (A.Jaeger) Manuel), but made two other taxa (*S. coffeae* and *S. julacea* var. *costaricensis*) into synonyms of *S. gardneri*, and subsequently (Manuel, 1994) synonymised *S. gardneri* with *S. concavifolium*. Buck (1998) then synonymised four more taxa with *S. concavifolia*, and *S. mittenii* with *S. rubricaulis*; he also returned *S. leptopteris* to *Cryphaea*. Of the 17 remaining valid taxa, 10 are endemic to Africa, 6 endemic to Central and South America and one (*S. concavifolium*) is pantropical, although only recently recognised in Africa. These details are summarised in Table 1.

A description and illustration of the genus may be found in Manuel (1981, 1994) and Enroth (1990).

Index Muscorum (as <i>Acrocryphaea</i>)	Manuel 1977 (as <i>Schoenobryum</i>)	Manuel 1981	Manuel 1994	Buck 1998	Stat *
<i>blumenauiana</i>	<i>blumenauianum</i>				Am
<i>brachyodus</i> , nom. nud.					inv
<i>caripensis</i>	<i>caripensis</i>				Am
<i>coffea</i>	<i>coffea</i>	= <i>concavifolium</i>			
<i>coffea</i> var. <i>laxiretis</i> , nom. inval.			= <i>concavifolium</i>		
<i>concavifolia</i>	<i>concavifolium</i>				Pan
<i>costaricensis</i> , nom. nud.					inv
<i>dusenii</i> , nom. nud.					inv
<i>emarginata</i> , nom. nud.					inv
<i>evanescens</i>	<i>evanescens</i>				Am
<i>gardneri</i>	<i>gardneri</i>		= <i>concavifolium</i>		
<i>henschenii</i>	<i>henschenii</i>				Am
<i>julacea</i>	<i>julaceum</i>			= <i>concavifolium</i>	
<i>julacea</i> var. <i>costaricensis</i>	<i>julaceum</i> var. <i>costaricense</i>	= <i>concavifolium</i>			
<i>julacea</i> var. <i>subsquarrosa</i> , nom. nud.					inv
<i>kunertii</i>	<i>kunertii</i>				Am
<i>latifolia</i>	<i>latifolium</i>				Af
<i>latifolia</i> var. <i>microspora</i>	<i>latifolium</i> var. <i>microsporum</i>				Af
	<i>leiboldii</i>			= <i>concavifolium</i>	
<i>leptopteris</i>	<i>leptopteris</i>			= <i>Cryphaea</i> <i>leptopteris</i>	
<i>madagassa</i>	<i>madagassum</i>				Af
		<i>mittenii</i>		= <i>rubricaulis</i>	
<i>paraguensis</i>	<i>paraguense</i>				Am
<i>plicatula</i>	<i>plicatulum</i>				Af
<i>robusta</i>	<i>robustum</i>				Af
<i>rubricaulis</i>	' <i>rubicaule</i> '			<i>rubicaule</i>	Am
<i>subintegra</i>	<i>subintegrum</i>				Af
	<i>subintegrum</i> var. <i>idanreense</i>				Af
<i>subrobusta</i>	<i>subrobustum</i>				Af
<i>tisserantii</i>	<i>tisserantii</i>				Af
<i>welwitschii</i>	<i>welwitschii</i>			= <i>concavifolium</i>	

* Stat = Taxon status:- Am = America only, Af = Africa only; Pan = Pantropical; inv = invalid taxon.

Table 1. Accepted species of *Schoenobryum* according to various authorities

Taxonomic background

Many of the descriptions of African species were made apparently in isolation from other species in the genus, and where there is reference to other species, it is usually to only one. Looking through all the descriptions and types a great deal of overlap is visible, with very few characters being used to define the boundaries between taxa. Mitten (1886), taking the broader view, comments on *S. welwitschii*: „The specimens yet seen of this species, if indeed they all belong to one, are in too small quantity to afford sufficient means of comparison; similar forms are found in India (*C[ryphaea] concavifolium* ...), and in S. America several others. All agree in their mode of fructification, and differ chiefly in their leaves; and it may reasonably be doubted if in reality they are distinct, or states of one or two species of which *C[ryphaea] julacea* Hornsch. [= *S. concavifolium*], from Brazil, was the earliest known.“. Later taxonomists unfortunately did not show the same foresight: before 1910, plants of this genus were usually called either *S. welwitschii* or *S. madagassum*, and this covered a whole range of (overlapping) variation. Later this variation became compartmentalised into different species: from 1910, seven more taxa were described, all representing forms already included in variation seen by earlier workers.

Characters used to distinguish taxa

Degree of imbrication in dry state. All African species of *Schoenobryum* exhibit the characteristic of holding the leaves almost at right angles to the stem when wet, but a character used to distinguish *S. latifolium* is that in this species this character also applies in the dry state. This does occur in some specimens, but usually varies within a single plant, and the only characteristic that appears to be associated with it is particularly strongly recurved margins. When margins are very widely recurved, the leaf becomes distorted, and it may be this that causes the leaves to become patent, but this is not a feature restricted to wide, *latifolium*-type leaves. Patent leaves on branches that normally have imbricate leaves also occur in other species (for instance the type specimen of *S. welwitschii*),

but mainly in older leaves. Specimens from Australia, Brazil and India show the same feature. A similar form occurs rather more convincingly in *Felipponea assimilis* (*Leucodon assimilis* var. *humilis*) (O'Shea, 2001) but has never been treated as anything more than an interesting aberration.

Leaf shape. What is unusual in African plants is the wide variety of leaf forms that appear in one plant. A single stem may show leaves typical of *S. concavifolium* as well as the widely ovate-apiculate leaf of *S. latifolium* (e.g. *Porley 9213f*, collected at 3500 m on Mt. Elgon). Although there is a degree of variation in Asian material, and plants with *latifolium*-type leaves may appear, the standard *S. concavifolium* leaf shape distinctly dominates, as it does in America. The characteristic leaf shape of *S. concavifolium* is found in several of the African taxa (for instance in *S. welwitschii*), but two species in particular, *S. latifolium* and *S. plicatulum* (the former possessing an recurved margin, the latter a flat margin) possess wider leaves, more sharply narrowed to an apiculus. One possibility is that environmental factors influence leaf shape, as plants with *latifolium*-type leaves often occur in high light environments, such as on trees in the open, or in tree canopies (many specimens labelled *S. latifolium* came from twigs and branches that had fallen from the canopy). However a specimen of *S. robustum* shows both leaf shapes on the same plant, and there is a good deal of variation in most plants, particularly in the degree of sharpness of the narrowing of the leaf near the apex. The round leaf of the *latifolium*-type plant makes the narrowing more obvious, but narrower leaves often have a very similar apiculus. A study of apiculus shape, looking at leaf width at 0.2 mm and 0.3 mm away from the apex, intended to measure the relative sharpness of the apex, showed no correlation with overall leaf shape or indeed with any particular taxon: apex shape varied both within and between each species. Similar studies of other variables such as leaf length to width ratios, percentage length of incurved margin, and the width, length and terminal branching of the costa, also showed no consistency. Buck (1998) distinguishes two apparent taxa in Africa: *S.*

welwitschii, which together with some Madagascar specimens he considers to be synonymous with *S. concavifolium*, and a taxon with broadly ovate leaves which are abruptly short-acuminate to cuspidate, with the margin recurved almost throughout which he called tentatively *S. robustum* (= the *latifolium* group). I also considered there to be two taxa when this study was first started in 1997, based on collections from both Malawi and Uganda, but it is only in trying to document the variability that I have come to believe that only one taxon must be involved. However, I have not found a 'true' *latifolium*-type leaf (widely ovate apiculate with margin recurved to the apex) outside of Africa. Buck (1998) also mentions that the '*latifolium*' taxon is similar to *S. rubricaula* of Central and South America, although this taxon (illustrated in Churchill & Linares (1995)) has very much longer and narrower apiculi than any specimen I have seen from Africa, and the leaf cells are different to those in African material.

Juxtacostal cells. The laminal cells at the base of the costa of *S. concavifolium* are considered characteristic by Buck (1998). The juxtacostal cells in African taxa vary a great deal: the size of the cell group is sometimes only 2 or 3 cells wide, and at other times 3 or 4 times this width, and cells vary greatly in both length and width, and neither length nor width seem to vary consistently (both short cells and long cells could be either thin or fat), and there is no consistent difference between *latifolium* or *concavifolium* forms. Wider and longer juxtacostal cells is a key character in the protologue of *S. latifolium*, but most '*S. latifolium*' specimens do not have such cells, and they are not confined to any particular leaf shape. Where there are both *concavifolium*-type and *latifolium*-type leaves on the same branch (e.g. in *Wigginton 8379b* from Uganda), the *latifolium*-type leaves have wider juxtacostal cells, suggesting that the width of the leaf affects the width of the cells, but although this may have some truth, it is certainly not universal. The porosity of the cells also varies greatly, from some with no pores to others with very obvious large pores. Although short and narrow juxtacostal cells seem to be the most frequent form worldwide, wider cells are also

found throughout the range (for instance in Bolivia (BM BM000667156). The possibility that squarrose leaves in the dry state might be caused by variation in juxtacostal cells was also investigated, but discounted.

Peristome. *Schoenobryum* possesses a single peristome, and the characteristics of the peristome teeth have been used to distinguish species. However, they look consistently similar, being narrow and elongate, about 0.3-0.45 mm, usually strongly papillose and very slightly trabeculate, although there is a good deal of variation in the degree of papillosity. The trabeculae are most obvious at the base, hidden by the rim of the capsule, for instance in the BM isotype specimen of *S. welwitschii*, and are easier to see on the less papillose exostome teeth.

Perichaetial leaves. Perichaetial leaves vary from the innermost (oldest) nearest to the sporophyte which are often truncate apiculate, to those on the outside, which tend to be larger and have longer apiculi, composed largely of the costa. When perichaetial leaf characters are mentioned in taxon descriptions, little distinction is made between the different origins of the leaves examined, and so this becomes an unreliable character. However, the illustrations of perichaetial leaves shown in protologues, together with those seen during this investigation, indicate that the overall pattern is common, with comparatively few differences.

Taxonomic treatment

It has been pointed out (Buck, pers. comm.) that 'lumping' can have the effect of obscuring information, which may later need to be unpicked. However, in looking at the wide variety of (non-type) material now available, it is clear that existing taxon boundaries are artificial, and from the above observations the overall conclusion is that there is but one taxon in Africa, which must be called by the oldest available name, *Schoenobryum concavifolium* (Griff.) Gangulee. However, it does appear that that the degree of variation from the norm is more extreme in Africa. A fuller list of synonyms may

be found in Manuel (1994), and a discussion of each of the African taxon names can be found below.

Schoenobryum concavifolium (Griff.)

Gangulee, Mosses E. India 5: 1209. 1976.

Basionym: *Orthotrichum concavifolium*

Griff., Calcutta J. Nat. Hist. 2: 484.

1842. (≡ *Cryphaea concavifolia*

(Griff.) Mitt., J. Proc. Linn. Soc., Bot.

Suppl. 1: 125. 1859; ≡ *Acrocryphaea*

concavifolia (Griff.) Bosch & Sande

Lac., Bryol. Jav. 2: 106. 1864.)

Type: INDIA. Mumbree, Khasiya Hills,

Griffith s.n. [about 15 km WSW of

Shillong, Meghalaya] (specimen

lost?) (see Gangulee (1976), pp 1208-

1211)

= *Cryphaea welwitschii* Duby, Mém. Soc.

Phys. Genève 21: 426. pl.2, f.1. 1871. (≡

Acrocryphaea welwitschii (Duby) Broth.

in Engl. & Prantl, Nat. Pflanzenfam. 1(3):

738. 1905; ≡ *Schoenobryum welwitschii*

(Duby) Manuel, Bryologist 80: 524.

1977.) *vide* Buck 1998: 163.

Type: ANGOLA. Ad ramulos extremos

arborum in sylvis primitivis montis

Cungolongulo ad 2400-2500 pedes

alt. imprimis ad Coffeam arabicam et

Diospyri speciem collegit cel. Welw.

Welwitsch s.n. (holo - G !; iso - BM

BM000667148 !)

= *Cryphaea madagassa* Müll.Hal. in

Müll.Hal. & Geh. in Buchenau, Abh.

Naturwiss. Vereine Bremen 7: 210.

1881. (≡ *Acrocryphaea madagassa*

(Müll.Hal.) Broth., Nat. Pflanzenfam.

1(3): 739. 1905; ≡ *Schoenobryum*

madagassum (Müll.Hal.) Manuel,

Bryologist 80: 523. 1977.) **syn. nov.**

Type: MADAGASCAR. Wald von

Ambatondrazaka, in dürrtigen

Pröbchen, *Rutenberg s.n.*, 6

December 1877 (type not located).

= *Cryphaea subintegra* Renauld & Cardot

in Renauld, Rev. Bot. Bull. Mens. 9:

397. 1891. (≡ *Acrocryphaea subintegra*

(Renauld & Cardot) Cardot, in

Grandid., Hist. Phys. Madagascar,

Mousses 39: 327. 1915; ≡

Schoenobryum subintegrum (Renauld

& Cardot in Renauld) Manuel,

Bryologist 80: 524. 1977.) **syn. nov.**

Type: MADAGASCAR. Ampérifery,

Campeon s.n. (type not located).

= *Acrocryphaea robusta* Broth. in Mildbr.,

Deutsch. Zentr. Afr. Exp. 1907-8 2:

158. 15f.43. 1910. (≡ *Schoenobryum*

robustum (Brotherus in Mildbraed)

Manuel, Bryologist 80: 523. 1977.) **syn.**

nov.

Type: (DR Congo?). Rugege-Wald:

Stämme und Äste von *Hagenia*, an

Waldrändern, ca. 1200 m ü. M.,

Mildbraed 836, August 1907 (type

not seen).

= *Acrocryphaea latifolia* Broth. & P.de la

Varde in P.de la Varde, Bull. Soc. Bot.

France 72: 357. 8. 1925. (≡

Schoenobryum latifolium (Broth. &

P.de la Varde in P.de la Varde) Manuel,

Bryologist 80: 523. 1977.) **syn. nov.**

Holotype: CENTRAL AFRICAN REPUBLIC.

Haut-Oubangui: Yalinga, branches

d'une arbre de 25 cm, *Le Testu*

4814B, 11 October 1921 („Det. Br.

et P.V. no. 1056“) (PC!).

= *Acrocryphaea subrobusta* Broth. & P.de

la Varde in P.de la Varde, Bull. Soc. Bot.

France 72: 358. 9. 1925. (≡

Schoenobryum subrobustum (Broth. &

P.de la Varde in P.de la Varde) Manuel,

Bryologist 80: 524. 1977.) **syn. nov.**

Holotype: CENTRAL AFRICAN REPUBLIC.

Haut Oubangui. Yalinga. Galerie

forestière. Sur les branches d'un arbre,

G. Le Testu 4857, 21 March 1921

(„Det. Br. et P.V. 1099“) (PC!).

= *Acrocryphaea tisserantii* Thér. & P.de la

Varde in P.de la Varde, Bull. Soc. Bot.

France 72: 358. 10. 1925. (≡

Schoenobryum tisserantii (Thér. & P.de

la Varde in P.de la Varde) Manuel,

Bryologist 80: 524. 1977.) **syn. nov.**

Holotype: CENTRAL AFRICAN REPUBLIC.

Sur arbre Riv. Dangara, Moroubas,

Tisserant 1497, 20 November 1923

(PC!).

= *Acrocryphaea latifolia* var. *microspora*
P.de la Varde, Rev. Bryol. Lichénol. 7:
235. 1935. (≡ *Schoenobryum latifolium*
var. *microsporum* (P.de la Varde)
Manuel, Bryologist 80: 523. 1977.)

Lectotype (**selected here**): CENTRAL

AFRICAN REPUBLIC. Sur hautes
branches d'arbres Riv. Gbaco
[‘Gbaoro’ on packet] 5 km. S.
Bozoum, Tisserant M.628, 28
August 1932 (PC!);

Paratype: CENTRAL AFRICAN REPUBLIC.
Sur branch haute d'un grand arbre
abatt., Galerie 7 km. S. Bozoum,
Tisserant M622, 14 August 1932
(PC!).

= *Acrocryphaea plicatula* Dixon & Thér.,
Rev. Bryol. Lichénol. 12: 72. 1942.
[„Mélanges Bryol. Lichénol.“] (≡
Schoenobryum plicatulum (Dixon &
Thér.) Manuel, Bryologist 80: 523. 1977.)
syn. nov.

Holotype: D.R. CONGO (ZAIRE). Barumbu,
sur branches mortes, Bequaert 1.114,
s.d. (BM BM000667142!)

= *Acrocryphaea subintegra* var. *idanreense*
P.W.Richards & S.R.Edwards, J. Bryol.
7: 55. 3,4:a.1972. (≡ *Schoenobryum*
subintegrum var. *idanreense*
(P.W.Richards & S.R.Edwards)
Manuel, Bryologist 80: 524. 1977.) **syn.**
nov.

Holotype: NIGERIA. Ondo: Idanre, SW
face of Carter Peak, 550 m,
Richards R 3760 (BM
BM000667143!)

Discussion of African taxa

***Schoenobryum concavifolium* (Griff.)
Gangulee.** This taxon has long been regarded
as the only species of *Schoenobryum* in Asia,
and recently (Manuel, 1994), a number of central
American species were also synonymised with
it. All the African taxa are also conspecific with
this taxon, and must take the earlier name.

***Schoenobryum latifolium* (Broth. & P.de la
Varde in P.de la Varde) Manuel.** This is one
of the two most frequently collected taxa of the
genus in Africa. The authors of this taxon
distinguished it from *S. welwitschii* on the leaf
shape (wider and shortly apiculate) and on the
larger basal juxtacostal cells, together with the
leaves being held more open in the dry state.
As discussed above: the leaf shapes of the two
types do differ, but overall the variation in leaf
shape between the two shows no discontinuity,
there are many plants similarly that bridge the
size of the basal juxtacostal cells, and leaves
being held open in the dry state is neither
absolute nor confined to *S. latifolium*.

***Schoenobryum latifolium* var. *microsporum*
(P.de la Varde) Manuel.** This taxon was
described from two Tisserant collections from
Central African Republic, based on a spore size
of „barely 27 µm“, rather than 33-36 µm in the
type. Examination of a number of collections
named *S. latifolium*, including the type specimen,
show that spores of both sizes can be found on
the same plant depending on the level of
maturity, the spores getting larger as they mature,
and indeed one of the specimens given this name
by Potier de la Varde possessed spores larger
than those of the species. Both specimens
mentioned in the protologue have been
examined, and the first mentioned has been
selected as the lectotype.

***Schoenobryum madagassum* (Müll.Hal.)
Manuel.** The original description of this plant is
inadequate, and Cardot (Renauld & Cardot,
1915) stated that the type specimen consisted of
only a single stem. There exists no description
or illustration of the plant. Cardot preferred to
keep this taxon distinct from *S. subintegrum*
based on the latter's denticulate leaf apex, but
still showed the two taxa as being possible
synonyms. There are other specimens of *S.*
madagassum, as mentioned by Richards &
Edwards (1972), and these were examined (see
specimens examined) and were found to conform
to the description, but there is no guarantee that
they were identified against the type.
Unfortunately the type has not been located.

The source reference of the type description seems to have caused some confusion in providing an appropriate author, and Manuel confused the issue further by ignoring corrections made by Index Muscorum and by a spelling error. The taxon was published (Müller & Geheeb, 1881) as part of a paper covering other groups than mosses, and although no overall author is mentioned, it is attributed to Fr. Buchenau (not Bechenau as quoted by Manuel) who was also the author for some flowering plant families in the paper, although 13 of the 18 pages were concerned with mosses. The moss section of the paper names Müller and Geheeb as the authors, although the paper was clearly put together by Geheeb, as discussed by Geheeb in the introduction. It appears that Hampe (before his death in 1880) described two new taxa, Geheeb provided the illustrations and may have done some of the identifications and then Müller identified or described the rest of the taxa, and provided the comments which Geheeb quotes in the paper. This would indicate that the correct authority for *A. madagassum* should thus be Müll.Hal. in Müll.Hal. & Geh. in Buchenau, which would be abbreviated as Mull.Hal., rather than as Geh., as proposed by Index Muscorum, or Mull.Hal in Bechanau, as proposed by Manuel.

***Schoenobryum plicatum* (Dixon & Thér.) Manuel.** The authors of this taxon distinguished it from *S. subrobustum* by its plane leaf margins, its leaf shape (broad with a long apiculus), the attenuated inner perichaetial leaves, and the strongly papillose peristome teeth, and trabeculae almost invisible. Plane leaf margins are known throughout the range of *Schoenobryum* (for instance Gangulee (1976) mentions them in Asia in *S. concavifolium*), inner perichaetial leaves are always long-attenuate, and peristome teeth are typically strongly papillose, with trabeculae that are often inconspicuous.

***Schoenobryum robustum* (Broth. in Mildbr.) Manuel.** Brotherus' quite lengthy description of this taxon includes many characters common within the genus, but also some key ones which link it to *S. subintegrum* and *S. madagassum*. I

can find no characters other than size that distinguish this plant from *S. madagassum*. Collections from throughout East Africa have been given this name, including a number from the BBS expeditions to Malawi and Uganda (see O'Shea et al, 2001; Wigginton et al., 2001). The variation in plant size is not great between *S. robustum* and *S. madagassum*, and it is also of a similar size to *S. latifolium*. Plants identified as *S. robustum* also varied in size. The leaves show some variability and although some are rather wide, all are quite typical of *S. concavifolium*.

***Schoenobryum subintegrum* (Renauld & Cardot in Renauld) Manuel.** The original description of this taxon in Renauld (1891) is brief and not very specific, but there is a fuller description by Cardot (Renauld & Cardot, 1915) with illustrations. However, following the description Cardot comments that the taxon differs from *S. madagassum* only in that 'the leaves of our moss are often a little denticulate at the apex' - a common feature of *S. concavifolium*. Type not located - see Richards and Edwards (1972). Very few collections appear to have been made of the taxon, perhaps because Brotherus (1905[1898-1909]) said the taxon appeared to be the same as *S. madagassum*, and thus collectors chose Müller's earlier name.

***Schoenobryum subintegrum* var. *idanreense* (P.W.Richards & S.R.Edwards) Manuel.** Richards and Edwards (1972) provide a full description of this taxon and its relationship with var. *subintegrum*, based on their single collection. They justified the creation of the variety having compared it with a single collection of var. *subintegrum*, and also with the original description of Renauld and Cardot (Renauld, 1891), and with the figure and fuller description in Renauld & Cardot (1915). In an addendum Richards & Edwards mention two more specimens of *S. subintegrum* they saw subsequently which showed characters bridging the gap between the two varieties. They also noted characters which cause them tentatively to support Brotherus' (1905) view that the taxon was probably conspecific with *S. madagassum*. Nevertheless, in the interim, they recommended maintaining their new variety. Their only

mention of *S. robustum* is that it is „a much larger species with a widely recurved leaf margin with more marked serrations towards the apex“.

***Schoenobryum subrobustum* (Broth. & P.de la Varde in P.de la Varde) Manuel.** The protologue gives no comparison with other species of the genus, but the description and illustration clearly show a flat margined *S. concavifolium*. The peristome teeth are comparatively less papillose, making the trabeculae more prominent.

***Schoenobryum tisserantii* (Thér. & P.de la Varde in P.de la Varde) Manuel.** This was described in the same paper as *S. latifolium* and *S. subrobustum*, and although it was not compared with *S. latifolium*, it was seen to be different from *S. subrobustum* in its greater papillosity, particularly of the peristome teeth. This is within the variation shown across African *Schoenobryum*.

***Schoenobryum welwitschii* (Duby) Manuel.** When Mitten (1886) discussed the distribution of this plant in Africa, it is possible that it was the only African species of the genus of which he was aware, as *S. madagassum* was only described in 1881, and (see above) the single stem on which *S. madagassum* was based was given only a very perfunctory description. Mitten's comments are quoted above in the taxonomic background: he was convinced that the variation he saw belonged probably to a single, pantropical, taxon. It is possible that his identification was based only on the type description and illustration, but a type specimen is available in BM, and duplicates were widely distributed by Welwitsch.

Excluded species

Acrocryphaea dusenii M.Fleisch., *nom. nud.*, Hedwigia 55: 281. 1914.

Original collection: CAMEROON. in *Dusén M. Camer. n. 675*.

Fleischer's (1914) publication is one of a series bringing Müller's names up to date (in this case

moving *Cryphaea dusenii* Müll.Hal., *nom. nud.* to *Acrocryphaea*). In the original publication (Müller in Paris, 1894), the source of the specimen is given as Cameroon („in *Dusén M. Camer. n. 675*“). I have not seen this specimen, and so this taxon is for the time being excluded from further consideration.

Acrocryphaea emarginata Thér. & Naveau. ex P. de la Varde, *nom. nud.*, Rev. Bryol. Lichénol. 11: 182. 1939.

Original collection: CENTRAL AFRICAN REPUBLIC. Galerie O. de Berbérati, R.P.C. *Tisserant*.

This taxon is mentioned in Potier de la Varde (1939) in a list of collections from Central African Republic. Potier de la Varde refers to what he considers an existing Thériot and Naveau name, but there is no indication of the source of the name, or where the specimen is. Until the specimen can be examined, this taxon is excluded from further consideration. It was not found amongst material loaned by PC.

Malawi and Uganda specimens examined

As this document covers all the material collected by the British Bryological Society expeditions to Malawi and Uganda, a full list is given of these before the 'selected' list. Some of these have already been published under the names of either *S. robustum* or *S. latifolium* (see O'Shea *et al.*, 2001; Wigginton *et al.*, 2001). All specimens det. B.J. O'Shea.

MALAWI: **Mulanje Mt.** Near Forest Dept. Staff Quarters, Sombani Basin, 2080 m, 15°53'18"S 35°42'46"E, twig of shrub by dried out stream bed in open forest, 21 Jun 1991, *O'Shea 7258a* (E); Upper Thichila valley, 1900 m, 15°55'02"S 35°33'49"E, epiphyte on trunk of broadleaf evergreen in woodland, 26 Jun 1991, *Longton 8468a* (E); Lichenya R. tributary, 0.5 km S of Lichenya Hut, 1730 m, 15°58'18"S 35°33'18"E, 26 Jun 1991, *Russell 6094c* (E); 1 km SE of Lichenya Hut, by Lichenya River, 1730 m, 15°58'18"S 35°33'18"E, tree branch in forest

patch in grassland, 26 Jun 1991, *Russell 6103a* (E); Lichenya River, 1720 m, 15°58'50"S 35°33'19"E, bamboo in riverine forest, 27 Jun 1991, *Kungu 3332a* (E); Lichenya Plateau, 1860 m, 15°58'50"S 35°33'19"E, on shrub at edge of forest patch, 28 Jun 1991, *Hodgetts 2579c* (E).

UGANDA: **MASINDI. Budongo FR.** Pabidi Hill (10c), 1010 m, 1°54'N 31°43'E, trunk of *Combretum molle* in open scrub-forest, 25 Jan 1997, *Wigginton 3138a* (E); N of Busingiro Ecotourism site (13), 1000 m, 1°43'N 31°28'E, twigs by path, 25 Jan 1997, *O'Shea 2694a* (E). **KABAROLE. Kibale FR, Sebitole.** S of Mpanga R., N of Fort Portal-Kampala Rd. (31a), 1400 m, 0°38'N 30°23'E, fallen twig, growing with *Pseudocypbellaria*, 28 Jan 1997, *O'Shea 2791a, 2794a* (E); (31a), 1320 m, 0°38'S 30°23'E, twigs fallen from canopy, 28 Jan 1997, *Porley 473a, 473i* (E). **Itwara FR.** (23, 24), 1300 m, 0°48'S 30°29'E, fallen branch, 20 Jan 1997, *O'Shea 2831a* (E). **Fort Portal.** Mountains of the Moon Hotel (19), 1555 m, 0°40'24"S 30°16'57"E, shrub in hotel garden, 30 Jan 1997, *O'Shea 2854a* (E); **Kibale NP.** Trail along R. Kanyanchu, W of Bigodi road (38), 1220 m, 0°26'18"S 30°23'25"E, tree branch, 31 Jan 1997, *O'Shea 2896a* (E); fallen twigs from canopy, 31 Jan 1997, *Porley 518a* (E); Kanyawara, MUBFS, (32a), 1493 m, 0°33'N 30°21'E, at height of ca 1.8 m on well-lit trunk of smooth-barked ornamental tree on field station, 30 Jan 1998, *Bates 8532a* (E). **RUKUNGIRI. Bwindi NP.** Buhoma, main path (70), 1480 m, 1°00'S 29°37'E, on branches of shrub in forest, 31 Jan 1996, *Porley 214a* (E); 1 km west of Kayonza (67), 1150 m, 0°55'S 29°39'E, tree trunk, in well-illuminated site by road and stream, 1 Feb 1996, *Wigginton 5083c* (E); Buhoma, main path (71), 1500 m, 0°59'S 29°36'E, on branch of shrub in moist, sheltered forest edge by track, about 200 m from forest entrance, 2 Feb 1996, *Bates 2346b* (E). Buhoma, Munyaga River Trail (72), 1420 m, 0°58'50"S 29°37'08"E, stone by path, 7 Feb 1997, *O'Shea 5468a* (E); tree bark by track to river, 7 Feb 1997, *O'Shea 5470a* (E); near

National Park Office (72), 1440 m, 0°58'50"S 29°37'08"E, bark of tree in open area, 7 Feb 1997, *O'Shea 5471a, Wigginton 8302b* (E). **BUSHENYI. Kalinzu FR.** E of FR, near Forest Dept. offices (51), 1450 m, 0°22'S 30°06'E, trunk of well-illuminated tree at forest edge, 4 Feb 1997, *Wigginton 8090a* (E). **KISORO. Mgahinga NP.** (89a), 2470 m, 1°21'S 29°36'E, on rotting tree trunk in forest, 10 Feb 1997, *Wigginton 8379b* (E). **KAPCHORWA. Mt. Elgon NP.** Piswa to Hunter's Cave trail (115), 3500 m, 1°16'N 34°33'E, on tree-heath, 13 Jul 1998, *Porley 9213f* (E).

Selected specimens examined

AFRICA

- ANGOLA. Cungolongulo. *Welwitsch s.n.* (isotype of *S. welwitschii*, BM BM000667148).
- CENTRAL AFRICAN REPUBLIC. Haut-Oubangui: *Le Testu 4814B*, (holotype of *S. latifolium*, PC); Bozoum, *Tisserant M.628* (lectotype of *S. latifolium* var. *microsporum*, PC); Bozoum, *Tisserant M622* (paratype of *S. latifolium* var. *microsporum*, PC)
- D.R. CONGO (ZAIRE). Barumbu, *Bequaert 1.114*, s.d. (holotype of *S. plicatula*, BM BM000667142)
- ETHIOPIA. Lechemti, *P.W. Bazzacco 7* (as *S. welwitschii*, BM000667145)
- GHANA. Aburi Gardens, *W.H. Johnson 37* (as *S. welwitschii*, BM000667144)
- MADAGASCAR. *G.W. Parker* (as *S. welwitschii*, BM BM000667147); Ankafina, *s.l.* (as *Cryphaea madagassa*, BM BM000667152); Imerina, Andrangoloaka, *Hildbrandt s.n.* (as *Acrocryphaea madagassa*, BM BM000667153)
- MALAWI. Zomba Mt., *R.E. Magill 10840* (as *S. robustum*, BM BM000667154)
- NIGERIA. Ondo: Idanre, *Richards R 3760* (holotype of *S. subintegrum* var. *idanreense*, BM BM000667143)
- RWANDA. Gisenyi, *J.L. De Sloover 18.717* (as *S. robustum*, BM BM000667155)
- TANZANIA. Usagara, *Bishop Hannington* (as *S. welwitschii*, BM BM000667146)

AMERICA

BOLIVIA. Mapiri, *R.S. Williams* 1987 (as *Acrocryphaea julacea*, BM BM000667156)

BRAZIL. Serra d'Effretta, *s.l.* (as *Acrocryphaea julacea*, BM BM000667157)

ASIA

INDIA. Angarai Shola, Palni Hills, *G. Foreau* 677 (BM BM000667159)

JAVA. *Korthals* (BM BM000667150)

PHILIPPINES. Luzon, *Father M. Vaurvertergle* (?) 1011 (BM BM000667151)

SRI LANKA. Central Province, *Thwaites* 249 (BM BM000667158)

AUSTRALASIA

AUSTRALIA. Atherton Plateau, N. Queensland, *Rev. N.E.G. Cruttwell* 1172 (BM BM000667149)

CONCLUSION

As a result of this review, *Schoenobryum concavifolium* is now the only species of the genus in Africa, and there are now only eight species in *Schoenobryum* worldwide, all but *S. concavifolium* endemic to tropical America. A revision of these seven American species needs to take place, although Buck (1998) says that there are only two species in America. See the Appendix for a summary of all the names used in the genus, and their current disposition.

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Appendix

Synopsis of taxa

Notes:

- bold** = accepted taxon
italic = invalid taxon not yet synonymised
 roman = synonyms / excluded taxa
- Ending of each species name relates to the genus in which it was last used (*Acrocryphaea* or *Schoenobryum*).
 - Distribution data: Am2 = Central America; Am4,5 = Northern South America; Am5 = Brazil.

- blumenauianum** (Am5)
brachyodus nom. nud. (Am5)
brevidens nom. nud. in synonym. = *brachyodus* (Paris 1894)
caripensis (Am5)
coffea = *concavifolium* (Manuel 1981)
coffea laxiretis nom. inval. = *concavifolium* (Manuel 1994)
concavifolium (Pantropical)
corymbosa nom. inval. err. pro = *corymbosula* (= *concavifolium*)
corymbosula nom. nud. = *gardneri* (Hampe 1879) (= *concavifolium*)
costaricensis nom. nud. (Am2)

dusenii *nom. nud.* = Excluded (this paper)
emarginata *nom. nud.* = Excluded (this paper)
evanescens (Am5)
ferruginea = gardneri (Paris 1894) (= concavifolium)
gardneri = concavifolium (Manuel 1994)
henschenii (Am5)
javanica *nom. nud.* = concavifolium (Paris 1894)
julaceum = concavifolium (Buck 1998)
julaceum costaricense = concavifolium (Manuel 1981)
julacea subsquarrosa nom. nud. (Am5)
kunertii (Am5)
latifolium = concavifolium (this paper)
latifolium microsporum = concavifolium (this paper)
leiboldii = concavifolium (Buck 1998)
leptopteris = Cryphaea leptopteris (Buck 1998)
madagassum = concavifolium (this paper)
mexicana *nom. illeg. incl. sp. prior.* = concavifolium (Manuel 1994)
mittenii = rubricaule (Manuel 1994)
paraguense (Am5)
plicatum = concavifolium (this paper)
robustum = concavifolium (this paper)
rubricaule (Am4,5)
squarrosula = caripensis (Paris 1894)
subintegrum = concavifolium (this paper)
subintegrum var. idanreense = concavifolium (this paper)
subrobustum = concavifolium (this paper)
tisserantii = concavifolium (this paper)
welwitschii = concavifolium (Buck 1998)

