



Bryophytes of Libya. II. Musci: an annotated checklist

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Abstract

A list is given for the, hitherto, known moss flora of Libya. It includes 102 taxa, belonging to 45 genera in 16 families and 8 orders under class Bryopsida, and their distribution in 20 surveyed localities. Significant annotations are given regarding distribution of the taxa in Libya, in the Mediterranean area, dominance and rarity, old and new records, other relevant information and a list of synonyms.

Keywords: Bryoflora, Checklist, Libya, Mosses

Introduction

The, up till now known, bryoflora of Libya consists of 131 taxa; of which 29 belong to Hepatophyta and 102 to Bryophyta (Musci). An annotated checklist of the Hepatophyta has been published quite recently (Youssef 2017). An annotated checklist of the Musci (mosses) remains, therefore, mostly needed.

Work on mosses of Libya started about one and a half century ago. The first was that of Ascherson (1881), followed by many others including Bottini (1914), Pampanini (1917, 1931), Rungby (1962), Ochi (1972), Bizot (1973), Arts *et al.* (1995) and Gallego *et al.* (1999) (see Ros *et al.* 1999 for full list of references). Mosses reported, in these papers as occurring in Libya were compiled, together with mosses reported from other North-African countries, in one long list published by Ros *et al.* in 1999. In that list 110 moss taxa were reported as occurring in Libya. Shabbara & Ghanem (2006), Youssef *et al.* (2009a, b) added three new records to the moss flora of Libya but reduced the total number of mosses of this country to 107, 108 and 109 respectively, however, more corrections and nomenclatural changes resulted in a further reduction to only 91 taxa as came in the more lengthy list (which included names of mosses of all Mediterranean countries) published in 2013, also by Ros *et al.*

Information given in Ros *et al.* (2013) shows that the report of the majority of the Libyan mosses (84 out of 91 taxa) were based

on collections published before 1962, that more than one fourth of the Libyan mosses (25 taxa) represent single records (i.e. based on only one collection) and that several of the records are doubtful and require confirmation. This shows how far our knowledge of the main bulk of the moss flora of Libya is based on old collections and that the structure of this flora might be remarkably different at present necessitating, therefore, recent collection activities.

Mosses known from Libya are mainly reported from its north near the Mediterranean coast at: Tobruk, Darnah, Chersa, Al Qubbah, Mechili, Susa, Shahet (Cirene), Beida, Wadi Kouf, Tocra, Tecniz, Al Marj, Tolmetta, Benghazi, Tripoli, Borgo and Gharian (Fig. 1). There are three other moss collection localities namely Bosco Zorda, Wadi Balgader and Wadi Sambar mentioned in the literature; however we could not find them on available maps of Libya.

With the purpose of updating the moss flora of Libya on mined, S.G. Youssef (one of the authors of this paper) made recent moss collections, between the years 2004-2008, from five localities namely: Beida, Wadi Kouf, Shahet, Mas'sa and Hani'ya (Fig. 1); all belong to Al-Jabal Al-Akhdar region in the north east of Libya. Mas'sa and Hani'ya are two new localities not surveyed for mosses before these recent collections. Parts of the data on the mosses recently collected from Beida and Wadi Kouf have already been published (Shabbara & Ghanem 2006;

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Youssef et al. 2009 a, b; Youssef et al. 2017a,b and Khalil & Youssef 2017) but data on the mosses of the two new localities

Mas'sa and Hani'ya in addition to Shahet have not been published yet.

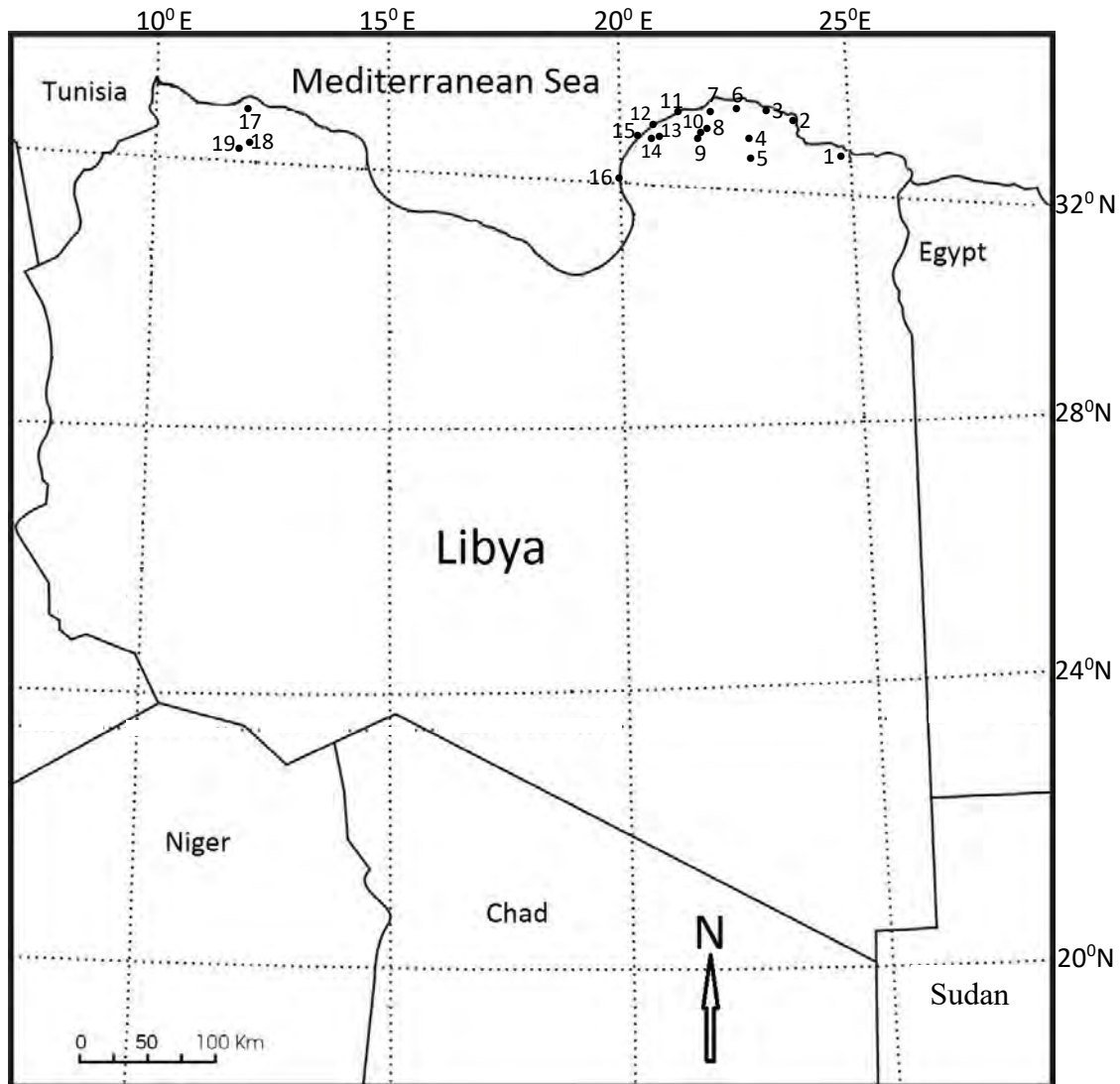


Fig. 1. Map showing sites of old and new collection of mosses in Libya. 1- Tobruk, 2- Darnah, 3- Chersa, 4- Al Qubbah, 5- Mechili, 6-Susa, 7- Shahet, 8- Beida, 9- Wadi Kouf, 10- Mas'sa, 11-Hani;ya, 12- Tobra, 13- Tecniz, 14- Al Marj, 15- Tolmetta 16- Benghazi, 17- Tripoli, 18- Borgo and 19- Gharian,

The part that has been, hitherto, published on these recent moss collections confirmed the existence of 25 of the old Libyan moss records (Youssef et al. 2017a, b and Khalil & Youssef 2017) and added 14 new records to the bryoflora of Libya; 1 Fabroniaceae (Shabbara & Ghanem, 2006), 2 Orthotrichaceae (Youssef *et al.* 2009a, b), 7 Brachytheciaceae (Youssef et al. 2017a), 2 Pottiaceae (Youssef *et al.* 2017b) and 2 Bryaceae (Khalil & Youssef 2017). The 3 species (1 Fabroniaceae and 2 Orthotrichaceae) were included in the list of Ros *et al.* (2013) which maintained 91 taxa, while the other 11 species (7 Brachytheciaceae, 2 Pottiaceae and

2 Bryaceae) raised the total number of the mosses known from Libya to 102 taxa.

The present paper is the seventh in this series of recent publications on the Libyan moss flora and aims to present a more up to date and annotated moss list including the 102 taxa, hitherto known from Libya. It is worthy to mention that this is the first recent list confined to only Libyan mosses since earlier important lists were too old (Pampanini, 1931) or included the bryoflora of Libya as a part of wider geographical areas e.g. North Africa (Ros *et al.* 1999); Mediterranean area (Ros *et al.* 2013).

The 102 moss taxa included in the

present list belong to 45 genera, 16 families, 8 orders, all under class Bryopsida. Names of the 8 orders and the 16 families and the number of taxa each includes are given in

Table 1, while the main list following Table 1 includes names of the 102 taxa, their families and their distribution in the 20 surveyed and published Libyan localities.

Table 1: Names of the 8 orders and 16 families representing the, up till now known, moss flora of Libya and the number of genera and taxa under each.

Order	No. of Taxa	Family	Genera	No. of Taxa
Pottiales	43	Pottiaceae	16	43
Hypnales	22	Amblystegiaceae	1	1
		Brachytheciaceae	10	18
		Fabroniaceae	1	1
		Hypnaceae	1	1
Bryales	13	Leptodontaceae	1	1
		Bryaceae	2	11
Dicranales	9	Mniaceae	1	2
		Dicranaceae	1	2
		Ditrichaceae	2	2
Funariales	5	Fissidentaceae	1	5
		Funariaceae	3	5
Orthotrichales	4	Orthotrichaceae	2	4
Grimmiales	4	Grimmiaceae,	1	3
		Ptychomitriaceae	1	1
Encalyptales	2	Encalyptaceae	1	2
	102		45	102

List of Mosses

Distribution of the 102 moss taxa in the 20 surveyed and published localities of Libya based on 1- Bottini, 1914; 2- Pampaini, 1917; 3- Pampaini, 1931; 4- Bizot, 1973; 5- Shabbara & Ghanem, 2006; 6- Ros et al., 2013; 7- Youssef et al., 2009a; 8- Youssef et al., 2009b; 9- Youssef et al., 2017a; 10- Youssef et al., 2017b and 11- Khalil & Youssef, 2017. Taxa are arranged alphabetically and referred to their families. Abbreviations: Tob= Tobruk, Dar= Darnah, Che= Chersa, Qub= Al Qubbah, Mec= Mechili, Sus= Susa, Sha= Shahet, Bda= Beida, WKf= Wadi Kouf, Toc= Tocra, Tec= Tecniz, Mrj= Al Marj, Tol= Tolmetta, Ben= Benghazi, Trp= Tripoli, Bor= Borgo, Ghn= Gharian, BoZ= Bosco Zorda, WBl= Wadi Balgader and WSm= Wadi Sambar.

Symbols

- o Report based on collections published before 1962.
- Report based on at least one collection published during or after 1962 and before 2013.
- (o) Doubtful report based on collections published before 1962.
- Recorded after 2013, but also earlier.
- ◀ Recorded only after 2013
- ◇ Reported without reference to any locality (Only Libya).
- ? Number of localities not known because available publications mentioned only Libya.

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Taxa	Localities	Tob	Dar	Che	Qub	Mec	Sus	Sha	Bda	WKf	Toc	Tec	Mrj	Tol	Ben	Trp	Bor	Ghn	BoZ	WBI	WSm	Only Libya	Total no. of localities	
Pohlia Hedw. (Mniaceae)																								
<i>atropurpurea</i> (Wahlenb.) H.Lindb.																						◊,◊6	?	
<i>melanodon</i> (Brid.) A.J.Shaw																						◊,◊6	?	
Pseudocrossidium R.S.Williams (Pottiaceae)																								
<i>hornschuchianum</i> (Schultz) R.H.Zander		◊3							◻10									◊1	◊3					4
<i>revolutum</i> (Brid.) R.H.Zander								◊3	◊1,◊3										◊3					3
Pseudoscleropodium (Brachytheciaceae)																								
<i>purum</i> (Hedw.) M.Fleisch										◀9														1
Ptychostomum Hornsch. (Bryaceae)																								
<i>archangelicum</i> (Bruch & Schimp.) J.R.Spence									◀11															1
<i>boreale</i> (F.Weber & D.Mohr) Ochyra & Bednarek-Ochyra		◊3											◊3											2
<i>capillare</i> (Hedw.) Holyoak & N.Pedersen		◊3										◊3									◊3			3
<i>donianum</i> (Grev.) Holyoak & N.Pedersen							◊3																	1
<i>imbricatulum</i> (Müll.Hal.) Holyoak & N.Pedersen									◀11															1
<i>torquescens</i> (Bruch & Schimp.) Ros & Mazimpaka																◊1			◊3					2
Rhynchostegiella (Schimp.) Limpr. (Brachytheciaceae)																								
<i>curviseta</i> (Brid.) Lindb.																						◊3		1
<i>litorea</i> (De Not.) Limpr.																						◊3		1
Rhynchostegium Schimp. (Brachytheciaceae)																								
<i>confertum</i> (Dicks.) Schimp.								◊3												◊3				2
<i>megapolitanum</i> (Blandow ex F.Weber & D.Mohr) Schimp.										◀9														1
<i>riparioides</i> (Hedw.) Cardot		◊3					◊3			◻9														3
Sciuro-hypnum Hampe (Brachytheciaceae)																								
<i>plumosum</i> (Hedw.) Ignatov & Huttunen										◀9														1
<i>populeum</i> (Hedw.) Ignatov & Huttunen																				◊3				1

Annotations

- A- Based on Table 1 above, the following annotations were listed.
- 1- The 8 orders can be arranged in a descending order regarding the number of taxa representing each as follows: Pottiales (43), Hypnales (22), Bryales (13), Dicranales (9), Funariales (5), Grimmiales (4), Orthotrichales (4) and Encalyptales (2).
 - 2- The largest family is Pottiaceae with 43 taxa followed by Brachytheciaceae with 18 taxa and Bryaceae with 11 taxa.
- B- Based on the above list, the following annotations were listed.
- 1- This list is the first to show updated distribution of mosses in different Libyan localities.
 - 2- The richest localities in moss species are: Darnah, Beida, Wadi Kouf and Al Marj, (over 20 species each) while the least are Chersa, Mechili, Tocrá, and Borgo (under 4 species each). However, this is a temporal arrangement because most of these localities are under surveyed for mosses.
 - 3- The 25 taxa that are recorded "after 2013, but also earlier" came mainly from Beida; only 3 of them came from Wadi Kouf.
 - 4- *Bryum dichotomum* is the most widespread species in Libya, being recorded in 13 out of 20 surveyed localities, followed by *Didymodon luridus* and *Tortula muralis* in 9 localities each, *Bryum radiculosum* and *Trichostomum crispulum* in 8 localities each, *Crossidium squamiferum* and *Didymodon tophaceus* in 7 localities each, *Alcina ambigua*, *Scorpiurium circinatum* and *Tortula revolvens* in 6 localities each.
 - 5- Forty-nine out of the 102 moss taxa of Libya, can be considered rare being recorded in only one or two localities in addition to the 16 taxa that were not referred to any

particular locality but cited only as Libya, because they were not reported again from Libya except four of them (all from Beida) i.e. a total of 65 taxa are rare (more than 60% of the flora).

- 6- More than 50 % of the taxa of Libya have been reported before 1962 and not again.

Other annotations

- 1- Only five taxa, namely: *Bryum argenteum*, *B. dichotomum*, *Funaria hygrometrica*, *Tortula muralis* and *Trichostomum crispulum* exist in all 34 Mediterranean countries and islands whereas 93 exist in 33-10 of these countries and islands. Only four taxa namely: *Bryum valparaisense*, *Encalypta raptocarpa* var. *leptodon*, *Entosthodon angustifolius*, and *Zygodon catarinoides* exist in less than 10 of these countries and islands (see Ros *et al.* 2013).
- 2- Ros *et al.* (2013) mentioned that the seven taxa; *Didymodon rigidulus* var. *brevifolius* Zodda, *D. tophaceus* fo. *lingulatus* (Boulay) Mönk., *D. tophaceus* var. *cucullatus* Bott., *Gymnostomum calcareum* var. *obtusum* Boulay, *Hyophila pampanini* Zodda, *Hypnum cyrenaicum* Müll. Hal. ex E. Durand & Barratte and *Tortella nitida* var. *obtusata* (Boulay) Jelenc, were reported from Libya but "their identities have not been revised since", therefore, not included in our present list.
- 3- Publications based on the recent moss collections (made between 2004 and 2008) resulted in the report of 39 taxa; 14 of which represented new records published between 2006 and 2017 while 25 confirmed the existence of old records (given the symbol □ in the present list).

It is expected that the investigation of the remaining part of the recent collections will result in many new records to the Libyan moss flora as well as confirm many of its old

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records. The present article will, however, save all other future workers the time and effort they would have to spend on searching for the old, scattered and not easy

to find publications dealing with the Libyan bryoflora; they can build up directly basing on the data compiled in the present checklist.

List of Synonyms

Synonyms given below are only those mentioned in publications related to Libya (based on Bottini, 1914, Pampanini, 1917, 1931, Bizot, 1973, Ros et al. 1999 and Ros et al. 2013).

- Aloina ericaefolia* (Lindb.) Kindb. nom. illeg. incl. spec. prior. = *Aloina ambigua* (Bruch & Schimp.) Limpr.
Aloina rigida var. *ambigua* (Bruch & Schimp.) E.J. Craig = *Aloina ambigua* (Bruch & Schimp.) Limpr.
Aloina stellata Kindb. nom. illeg. incl. spec. prior. = *Aloina rigida* (Hedw.) Limpr.
Aloina stellata var. *pilifera* (de Not.) Schiffn. = *Aloina bifrons* (De Not.) Delgad.
Anisothecium rubrum (Huds.) Lindb. nom. illeg. incl. spec. prior. = *Dicranella varia* (Hedw.) Schimp.
Anisothecium rubrum var. *tenuifolium* (Bruch & Schimp.) Braithw. = *Dicranella howei* Renauld & Cardot
Anisothecium varium (Hedw.) Mitt. = *Dicranella varia* (Hedw.) Schimp.
Barbula acuta (Brid.) Brid. = *Didymodon acutus* (Brid.) K. Saito
Barbula fallax Hedw. = *Didymodon fallax* (Hedw.) R.H. Zander
Barbula fallax var. *brevicaulis* (Schwägr.) Huebener = *Didymodon fallax* (Hedw.) R.H. Zander
Babula fiorii (Venturi) G. Roth = *Tortula revolvens* (Schimp.) G. Roth
Barbula hornschuchiana Schultz = *Pseudocrossidium hornschuchianum* (Schultz) R.H. Zander
Barbula nitida (Lindb.) Jur. = *Tortella nitida* (Lindb.) Broth.
Barbula revoluta Brid. = *Pseudocrossidium revolutum* (Brid.) R.H. Zander
Barbula revolvens Schimp. = *Tortula revolvens* (Schimp.) G. Roth
Barbula rigidula (Hedw.) Mitt. = *Didymodon rigidulus* Hedw.
Barbula vinealis Brid. = *Didymodon vinealis* (Brid.) R.H. Zander
Barbula vinealis var. *cylindrica* (Taylor) Boulay nom. illeg. = *Didymodon insulanus* (De Not.) M.O. Hill
Brachythecium populeum (Hedw.) Schimp. = *Sciuro-hypnum populeum* (Hedw.) Ignatov & Huttunen
Bryum bicolor Dicks. = *Bryum dichotomum* Hedw.
Bryum bicolor var. *dolioloides* (Solms) Warnst. = *Bryum dichotomum* Hedw.
Bryum capillare var. *meridionale* Schimp. = *Ptychostomum capillare* (Hedw.) Holyoak & N. Pedersen
Bryum capillare var. *platyloma* (Schwägr.) Schimp. = *Ptychostomum capillare* (Hedw.) Holyoak & N. Pedersen
Bryum capillare var. *rufifolium* (Dixon) Podp. = *Ptychostomum capillare* (Hedw.) Holyoak & N. Pedersen
Bryum donianum Grev. = *Ptychostomum donianum* (Grev.) Holyoak & N. Pedersen
Bryum murale Wilson ex Hunt. hom. illeg. = *Bryum radiculosum* Brid.
Bryum obconicum Hornsch. = *Ptychostomum boreale* (F. Weber & D. Mohr) Ochyra & Bednarek-Ochyra
Bryum pallescens Schleich. ex Schwägr. = *Ptychostomum boreale* (F. Weber & D. Mohr) Ochyra & Bednarek-Ochyra
Bryum torquescens Bruch & Schimp. = *Ptychostomum torquescens* (Bruch & Schimp.) Ros & Mazimpaka
Camptothecium aureum (Spruce) Schimp. = *Homalothecium aureum* (Spruce) H. Rob.
Ceratodon chloropus (Brid.) Brid. = *Cheilothela chloropus* (Brid.) Broth.
Crossidium griseum (Jur.) Jur. = *Crossidium squamiferum* (Viv.) Jur. var. *pottioideum* (De Not) Mönk.
Crossidium squamigerum (Viv.) Jur. nom. inval. err. orthogr. = *Crossidium squamiferum* (Viv.) Jur.
Dicranella varia var. *tenuifolia* (Bruch & Schimp.) Schimp. = *Dicranella howei* Renauld & Cardot
Didymodon rigidulus var. *gracilis* (Schleich. ex Hook. & Grev.) R.H. Zander = *Didymodon acutus* (Brid.) K. Saito
Didymodon tophaceus var. *acutifolius* Limpr. nom. illeg. incl. var. prior. = *Didymodon tophaceus* (Brid.) Lisa
Drepanocladus kneiffii (Schimp.) Warnst. = *Drepanocladus aduncus* (Hedw.) Warnst.
Encalypta raptocarpa var. *trachymitria* (Ripart) Wijk & Margad. = *Encalypta raptocarpa* Schwägr. var. *leptodon* Lindb.
Encalypta vulgaris var. *mutica* Brid. = *Encalypta vulgaris* Hedw.
Entosthodon subpallescens Müll. Hal. nom. inval. = *Entosthodon angustifolius* Jur. & Milde
Eucladium verticillatum var. *angustifolium* Lindb. = *Eucladium verticillatum* (With.) Bruch & Schimp.
Eurhynchium circinatum (Brid.) Schimp. = *Scorpiurium circinatum* (Bruch) M. Fleisch. & Loeske
Eurhynchium pumilum (Wilson) Schimp. = *Microeurhynchium pumilum* (Wilson) Ignatov & Vanderp.
Fissidens cyprius Jur. = *Fissidens crispus* Mont.
Fissidens incurvus (Starke ex Röhl.) Waldh. = *Fissidens viridulus* (Sw. ex Anon.) Wahlenb. var. *incurvus* (Starke ex Röhl.) Waldh.
Fissidens incurvus var. *tamarindifolius* (Turner) Braithw. = *Fissidens viridulus* (Sw. ex Anon.) Wahlenb. var. *incurvus* (Starke ex Röhl.) Waldh.
Fissidens limbatus Sull. = *Fissidens crispus* Mont.
Fissidens mouretii Corb. = *Fissidens crassipes* Wilson ex Bruch & Schimp. subsp. *warnstorffii* (M. Fleisch.) Brugg.-Nann.
Funaria dentata Crome = *Entosthodon muhlenbergii* (Turner) Fife
Funaria hygrometrica var. *calvescens* (Schwägr.) Mont. = *Funaria hygrometrica* Hedw.
Funaria mediterranea Lindb. = *Entosthodon muhlenbergii* (Turner) Fife
Funaria muhlenbergii Turner = *Entosthodon muhlenbergii* (Turner) Fife
Funaria hygrometrica var. *calvescens* (Schwägr.) Mont. = *Funaria hygrometrica* Hedw.
Gymnostomum calcareum var. *muticum* Boulay = *Gymnostomum calcareum* Nees & Hornsch.
Hypnum cupressiforme var. *tectorum* Brid. = *Hypnum cupressiforme* Hedw. var. *lacunosum* Brid.
Leptodon smithii var. *filescens* Renauld nom. nud. = *Leptodon smithii* (Hedw.) F. Weber & D. Mohr
Oxyrrhynchium pumilum (Wilson) Loeske = *Microeurhynchium pumilum* (Wilson) Ignatov & Vanderp.
Oxyrrhynchium rusciforme (Neck.) Warnst. = *Rhynchostegium riparioides* (Hedw.) Cardot

Phascum cuspidatum var. *piliferum* (Hedw.) Hook. & Taylor = *Tortula acaulon* (With.) R.H.Zander var. *pilifera* (Hedw.) R.H. Zander
Phascum piliferum Hedw. = *Tortula acaulon* (With.) R.H.Zander var. *pilifera* (Hedw.) R.H. Zander
Platyhypnidium rusciforme M. Fleisch. nom. illeg. incl. spec. prior. = *Rhynchostegium riparioides* (Hedw.) Cardot
Platyhypnidium rusciforme var. *atlanticum* (Brid.) Machado-Guim. = *Rhynchostegium riparioides* (Hedw.) Cardot
Pleurochaete squarrosa (Brid.) Lindb. = *Tortella squarrosa* (Brid.) Limpr.
Pottia commutata Limpr. = *Microbryum davallianum* (Sm.) R.H. Zander
Pottia davalliana (Sm.) C.E.O. Jensen = *Microbryum davallianum* (Sm.) R.H. Zander
Pottia starckeana (Hedw.) Müll. Hal. = *Microbryum starckeanum* (Hedw.) R.H. Zander
Pottia starckeana var. *brachyodus* (Bruch & Schimp.) Müll. Hal. = *Microbryum starckeanum* (Hedw.) R.H. Zander
Rhynchostegium rusciforme (F.W. Weiss ex Brid.) Schimp. nom. illeg. = *Rhynchostegium riparioides* (Hedw.) Cardot
Syntrichia intermedia Brid. = *Syntrichia montana* Nees
Timmiella barbula Limpr. nom. illeg. = *Timmiella barbuloides* (Brid.) Mönk.
Tortula fiorii (Venturi) G. Roth = *Tortula revolvens* (Schimp.) G. Roth
Tortula laevipila (Brid.) Schwägr. = *Syntrichia laevipila* Brid.
Tortula montana (Nees) Lindb. hom. illeg. = *Syntrichia montana* Nees
Tortula muralis var. *incana* (Bruch & Schimp.) Wilson = *Tortula muralis* Hedw.
Tortula muralis var. *obcordata* (Schimp.) Limpr. = *Tortula muralis* Hedw.
Tortula revolvens var. *obtusata* Reimers = *Tortula revolvens* (Schimp.) G. Roth
Trichostomum barbula Schwägr. nom. illeg. = *Timmiella barbuloides* (Brid.) Mönk.
Trichostomum brachydontium subsp. *mutabile* (Bruch) Giacom. = *Trichostomum brachydontium* Bruch
Trichostomum convolutum Brid. = *Tortula atrovirens* (Sm.) Lindb.
Trichostomum inflexum Bruch = *Tortella inflexa* (Bruch) Broth.
Trichostomum nitidum (Lindb.) Schimp. = *Tortella nitida* (Lindb.) Broth.

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