Bryophyte flora of the Czech Republic: updated checklist and Red List and a brief analysis

Bryoflóra České republiky: aktualizace seznamu a červeného seznamu a stručná analýza

Dedicated to the centenary of the Czech Botanical Society (1912–2012)

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The bryoflora of the Czech Republic is analysed using an updated version of the checklist that includes recent taxonomic and nomenclatural changes. In addition, the baseline data was completely revised using the IUCN 3.1 criteria. The main list includes 863 species of bryophytes (4 hornworts, 207 liverworts and 652 mosses) with 5 additional subspecies and 23 generally recognized varieties; 9 additional species are listed as of doubtful taxonomic status and 17 other species are evaluated as of uncertain occurrence. Of the 892 taxa evaluated, 46% qualified for inclusion in Red List categories (40 taxa in category RE, 70 in CR, 88 in EN, 93 in VU, 66 in LR-nt, 24 in DD-va and 30 in DD), while 54% are considered Least Concern (LC). We discuss the taxonomic problems that influenced our decisions when compiling both the check- and Red Lists, try to identify the alien, invasive and spreading species of bryophytes, and touch upon several phytogeographic aspects, including the questions of relictness and bryophyte endemics in the Czech bryoflora.

Keywords: central Europe, checklist, Czech Republic, endemics, relic, hornworts, liverworts, mosses, phytogeography, Red List

Introduction

The intensity with which the bryophyte flora of the Czech Republic has been studied since the end of 18th century has varied. Fortunately, the last 20 years is one of the periods of greatest bryological activity in the whole history of the states that existed at the territory of the current Czech Republic, which allows us to present a relatively complete checklist of species and assess their frequency of occurrence and list the threatened species categorized in terms of the potential threat to their survival.

Two major versions of the bryophyte checklist for the territory of the Czech Republic have been published over the last 15 years – the first by Váňa (1997, 1998) and a second by Kučera & Váňa (2003), which was followed by an updated version in Czech (Kučera & Váňa 2005). The last two checklists include Red Lists of Czech bryophytes, evaluated using the IUCN criteria in the latest version 3.1 (IUCN 2001). We continue our practice of simultaneously publishing check- and Red Lists, as this is the only way of evaluating all currently known taxa against the Red List criteria and statistically determining the current level of threat to this country's bryoflora.

Methods

For this compilation of an updated checklist, previous versions (Kučera & Váňa 2003, 2005), which were based on extensive revisions of herbarium material of critical taxa, were used as a basis. With respect to nomenclature and taxonomic considerations, such as generic and specific concepts, we attempted to update our previous concepts in accordance with recent published results except for those cases for which the last published treatments still await a broader consensus (notably the moss order *Hypnales* and moss genera *Bryum*, *Pohlia*, *Grimmia* and *Racomitrium*). In the case of mosses, our treatment mostly follows the European checklist of Hill et al. (2006), with the eventual differences listed in the synonymy or to improve the understanding explicitly commented on. The differences from the last published complete European checklists of liverworts and hornworts (Grolle & Long 2000, Söderström et al. 2002) were more numerous as a consequence of recent major systematic rearrangements based on the latest molecular studies.

The name changes of hepatics particularly affected the earlier wide delimitation of the genera *Anastrophyllum*, *Jamesoniella*, *Jungermannia* and *Lophozia* (Yatsentyuk et al. 2004, de Roo et al. 2007, Konstantinova & Vilnet 2009, Feldberg et al. 2010a, 2010b, Vilnet et al. 2011, while the genus *Apometzgeria* is no longer recognized as different from *Metzgeria* (Fuselier et al. 2011), and some of the species of the earlier defined *Marsupella* were transferred to *Gymnomitrion* following the treatment by Váňa et al. (2010). In mosses, the changes in comparison with Hill et al. (2006) applied particularly to the generic delimitations of *Amblystegiaceae*, *Calliergonaceae* (Hedenäs & Rosborg 2009, Vanderpoorten & Hedenäs 2009, Hedenäs 2011) and *Neckeraceae* (Olsson et al. 2011) and in addition different generic concepts applied to *Lescuraea*, *Hygrohypnum* and *Campylophyllum,* following Ignatov et al. (2007), *Polytrichastrum* and *Polytrichum* (Bell & Hyvönen 2010), *Dicranoweisia* (Ochyra et al. 2003), *Barbula* (Köckinger & Kučera 2011) and *Tortula*, which we understand to include *Phascum* and *Protobryum*. Other minor changes are commented on under individual taxa. For the ease of orientation, we have included cross-references (following the ⇒ sign) to generic names that differ from those used in the previous version and to the checklist of European mosses.

Author citations are mostly those used in previous versions of our checklists, over which much effort was spent tracing the correct spelling in cases when the commonly used authoritative sources (Index Muscorum, Index Hepaticarum, Grolle & Long 2000, Ochyra et al. 2003) differed. We have newly adopted the convention of Hill et al. 2006 of not citing the pre-Hedwigian names validated by Hedwig (1801). One new combination is proposed below.

The process by which we evaluated our taxa against the IUCN 3.1 criteria is described by Kučera & Váňa (2003). We continue to recognize the "Vanished" subcategory within Data Deficient taxa (DD-va), i.e. taxa not recorded for a long period of time (more than ≈30 years) but with a realistic chance of being refound, rather than distributing them into other categories, and the 'attention list' as a subcategory of Least Concern taxa (LC-att), which we use for less well known taxa for which there is limited information on their current distribution and the potential threat to them. Such taxa need to be closely monitored in the future as they might either qualify for inclusion in the Red List in future versions of the checklist or might prove not to be threatened.

Results

Composition of the moss flora

The bryoflora of the Czech Republic, based on present taxonomic concepts and current state of knowledge, contains 4 species of hornworts, 207 species of liverworts with two additional subspecific taxa and one additional variety, and 652 species of mosses with 3 additional subspecific taxa and 23 additional varieties. The hornworts are attributed to 3 genera, liverworts to 76 genera and mosses to 194 genera. Nine additional species are listed among the taxonomically problematic taxa, which occur or have been reported from the Czech Republic and 17 species and two additional infraspecific taxa that are reported but the records could not be verified based on the herbarium specimens. We were also able to exclude two additional historically reported species, in addition to 42 species excluded in previous versions of the checklist.

Red List

Of the 892 evaluated taxa, 411 (46%) qualified for Red Listing and included regionally extinct (RE), data deficient (DD) and lower risk (LR) taxa, while 480 taxa (54%) were evaluated as Least Concern and 120 of these are placed on the 'attention list'. Forty taxa are now thought to be extinct and 24 others are regarded Data Deficient-Vanished (DD-va). Thirty taxa are categorized as Data-Deficient in the strict sense (DD), i.e. those with existing recent records and 66 taxa are listed as Lower Risk-Near Threatened (LR-nt). 251 taxa (28%) are regarded as threatened, of which 70 are in the highest, Critically Endangered (CR) category, 88 in the Endangered (EN) category and 93 are regarded as Vulnerable (VU).

List of bryophyte taxa of the Czech Republic as of 2012[1]

(a) Accepted native and naturalized taxa

Hornworts

Anthoceros agrestis Paton **LC**
Anthoceros neesii Prosk. **EN** [C1]
Notothylas orbicularis (Schwein.) A. Gray **CR** [C2a(i)]
Phaeoceros carolinianus (Michx.) Prosk. **LC**

Liverworts

Anastrepta orcadensis (Hook.) Schiffn. **LC-att**
⇒ *Anastrophyllum* p. pte. – see under *Crossocalyx* and *Sphenolobus*
Anastrophyllum michauxii (F. Weber) H. Buch **EN** [B2ab(iii, iv, v); C2a(i)]
Aneura maxima (Schiffn.) Steph. **LR-nt** [D1] (annot. **1**)
Aneura pinguis (L.) Dumort. **LC**
Anthelia julacea (L.) Dumort. **VU** [D2]
Anthelia juratzkana (Limpr.) Trevis. **CR** [B1ab(iii, v)+2ab(iii, v), C2a(i, ii), D]
⇒ *Apometzgeria* – see under *Metzgeria*
⇒ *Asterella* p. pte. – see under *Mannia*
Asterella saccata (Wahlenb.) A. Evans **EN** [B2ab(iii, iv, v); C2a(i, ii); D1]
Barbilophozia barbata (Schmidel ex Schreb.) Loeske (*Lophozia barbata* (Schmidel ex Schreb.) Dumort.) **LC**
Barbilophozia hatcheri (A. Evans) Loeske (*Lophozia hatcheri* (A. Evans) Steph.) **LC**

Barbilophozia lycopodioides (Wallr.) Loeske (*Lophozia lycopodioides* (Wallr.) Cogn.) **LC**
Bazzania flaccida (Dumort.) Grolle **VU** [C1; D1]
Bazzania tricrenata (Wahlenb.) Lindb. **LR-nt** [C1]
Bazzania trilobata (L.) Gray (incl. var. *depauperata* (Müll. Frib.) Grolle) **LC**
Biantheridion undulifolium (Nees) Konst. et Vilnet (*Jamesoniella undulifolia* (Nees) Müll. Frib.) **RE**
Blasia pusilla L. **LC**
Blepharostoma trichophyllum (L.) Dumort. **LC –** only var. *trichophyllum*
Calypogeia azurea Stotler et Crotz **LC**
Calypogeia fissa (L.) Raddi **LR-nt** [D1]
Calypogeia integristipula Steph. **LC**
Calypogeia muelleriana (Schiffn.) Müll. Frib. **LC**
Calypogeia neesiana (C. Massal. et Carestia) Müll. Frib. **LC**
Calypogeia sphagnicola (Arnell et J. Perss.) Warnst. et Loeske **LR-nt** [B2ab(iii, iv, v); D1] (annot. **2**)
Calypogeia suecica (Arnell et J. Perss.) Müll. Frib. **LR-nt** [C1]
Cephalozia bicuspidata (L.) Dumort. **LC**
Cephalozia catenulata (Huebener) Lindb. **LR-nt** [B2ab(iii, iv, v); C1]
Cephalozia connivens (Dicks.) Lindb. **LC**
Cephalozia lacinulata J. B. Jack ex Spruce **RE**
Cephalozia leucantha Spruce **LR-nt** [B2ab(iii, iv, v); C1]
Cephalozia loitlesbergeri Schiffn. **VU** [D1]
Cephalozia lunulifolia (Dumort.) Dumort. **LC**
Cephalozia macrostachya Kaal. **VU** [D1]
Cephalozia pleniceps (Austin) Lindb. **VU** [B2ab(iii, iv, v); D1]
Cephaloziella divaricata (Sm.) Schiffn. **LC**
Cephaloziella elachista (J. B. Jack ex Gottsche et Rabenh.) Schiffn. **EN** [B1+2ab(iii, v); D1]
Cephaloziella elegans (Heeg) Schiffn. **CR** [D1]
Cephaloziella grimsulana (J. B. Jack ex Gottsche et Rabenh.) Lacout. **EN** [D1]
Cephaloziella hampeana (Nees) Schiffn. **LC-att**
Cephaloziella rubella (Nees) Warnst. **LC**
Cephaloziella spinigera (Lindb.) Warnst. **VU** [D1]
Cephaloziella stellulifera (Taylor ex Spruce) Schiffn. **CR** [D1]
Chiloscyphus coadunatus (Sw.) J. J. Engel et R. M. Schust. (*Lophocolea coadunata* (Sw.) Mont., *Chiloscyphus latifolius* (Nees) J. J. Engel et R. M. Schust.) **LC** (annot. **3**)

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[1] For the convenience of the readers, we briefly explain the abbreviations of the IUCN criteria used (IUCN 2001):

Criterion A (only A2a used) – reduction in population size based on (subcriterion A2) an observed, estimated, inferred or suspected population size reduction of ≈30% (category VU) over the last 10 years or 3 generations, whichever is the longer, where the reduction or its causes may not have ceased or may not be understood or may not be reversible, based on (A2a) direct observation.

Criterion B – geographic range in the form of either B1 (extent of occurrence) or B2 (area of occupancy) or both and estimates indicating at least two of the following: (B1/B2a) Severely fragmented or known to exist at only 1 (CR), <5 (EN), <10 (VU) locations; (B1/B2b) Continuing decline, observed, inferred or projected, in any of the following: (i) extent of occurrence, (ii) area of occupancy, (iii) area, extent and/or quality of habitat, (iv) number of locations or subpopulations, (v) number of mature individuals; (B1/B2c) Extreme fluctuations in any of the following: (i) extent of occurrence, (ii) area of occupancy, (iii) number of locations or subpopulations, (iv) number of mature individuals. The limits for qualifying to CR, EN and VU categories are < 100 km^2, < 5000 km^2 and < 20, 000 km^2 in B1 and <10 km^2, < 500 km^2 and < 2000 km^2 in B2, respectively.

Criterion C – population size estimated to be a number fewer than the limiting number of individuals and either (C1) An estimated continuing decline or (C2) A continuing decline, observed, projected, or inferred, in numbers of mature individuals and at least one of the following: (C2a) Population structure in the form of (C2a(i)) no subpopulation estimated to contain more than the limiting number of individuals or (C2a(ii) at least the limiting number of mature individuals in one subpopulation; (C2b) Extreme fluctuations in number of mature individuals. The limits for qualifying for individual categories are set to the following: for CR, C1 = the decline of at least 25% within 3 years or one generation, whichever is longer, C2a(i) < 50 mature individuals, C2a(ii) at least 90% of mature individuals in one subpopulation. For EN, C1 = at least 20% within 5 years or 2 generations, C2a(i) < 250 mature individuals, C2a(ii) at least 95% of mature individuals in one subpopulation. For VU, C1 = at least 10% within 10 years or 3 generations, C2a(i) < 100 mature individuals, C2a(ii) all mature individuals in one subpopulation.

Chiloscyphus cuspidatus (Nees) J. J. Engel et R. M. Schust. (*Lophocolea bidentata* (L.) Dumort., *Lophocolea cuspidata* (Nees) Limpr.) **LC-att** (annot. **3**)
Chiloscyphus minor (Nees) J. J. Engel et R. M. Schust. (*Lophocolea minor* Nees) **LC**
Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dumort. (*Chiloscyphus polyanthos* var. *pallescens* (Ehrh. ex Hoffm.) C. Hartm.) **LC-att** (annot. **3**)
Chiloscyphus polyanthos (L.) Corda **LC**
Chiloscyphus profundus (Nees) J. J. Engel et R. M. Schust. (*Lophocolea heterophylla* (Schrad.) Dumort.) **LC**
Cladopodiella fluitans (Nees) H. Buch **EN** [B2ab(iii, iv, v); C2a(i); D1]
Cladopodiella francisci (Hook.) H. Buch ex Jörg. **CR** [B2ab(v); C2a(i); D1]
Cololejeunea calcarea (Lib.) Schiffn. **VU** [D1]
Cololejeunea rossettiana (C. Massal.) Schiffn. **VU** [D1]
Conocephalum conicum (L.) Dumort. **LC**
Conocephalum salebrosum Szweyk., Buczkowska et Odrzykoski **LC** (annot. **4**)
Crossocalyx hellerianus (Nees ex Lindenb.) Meyl. (*Anastrophyllum hellerianum* (Nees ex Lindenb.) R. M. Schust.) **EN** [B2ab(iv); C2a(i, ii); D1]
Diplophyllum albicans (L.) Dumort. **LC**
Diplophyllum obtusifolium (Hook.) Dumort. **LC**
Diplophyllum taxifolium (Wahlenb.) Dumort. **LC**
Endogemma caespiticia (Lindenb.) Konstant., Vilnet et A.V. Troitsky (*Jungermannia caespiticia* Lindenb.) **LC-att**
Fossombronia angulosa (Dicks.) Raddi **RE**
Fossombronia foveolata Lindb. **EN** [B2ab(iii, iv, v)]
Fossombronia pusilla (L.) Nees **DD-va**
Fossombronia wondraczekii (Corda) Lindb. **LC**
Frullania dilatata (L.) Dumort. **LC**
Frullania fragilifolia (Taylor) Gottsche, Lindenb. et Nees **CR** [C2a(i); D1]
Frullania inflata Gottsche **EN** [B1+2ab(iii, v); C2a(i); D]
Frullania tamarisci (L.) Dumort. **LR-nt** [C1]
Geocalyx graveolens (Schrad.) Nees **VU** [D1]
Gymnocolea inflata (Huds.) Dumort. **LC**
Gymnomitrion adustum Nees (*Marsupella adusta* (Nees) Spruce) **RE**
Gymnomitrion alpinum (Gottsche ex Husn.) Schiffn. (*Marsupella alpina* (Gottsche ex Husn.) Bernet) **EN** [D1]
Gymnomitrion brevissimum (Schleich. ex Dumort.) Warnst. (*Marsupella brevissima* (Dumort.) Grolle) **RE**
Gymnomitrion concinnatum (Lightf.) Corda **LC-att**
Gymnomitrion corallioides Nees **CR** [B2ab(iii, iv, v); C1+C2a(i); D1]
Gymnomitrion obtusum Lindb. **RE**
Haplomitrium hookeri (Sm.) Nees **CR** [B1+2ab(iv, v); C2a(i)]
Harpanthus flotovianus (Nees) Nees **VU** [C2a(i)]
Harpanthus scutatus (F. Weber et D. Mohr) Spruce **EN** [C2a(i)]
Heterogemma capitata (Hook.) Konst. et Vilnet (*Lophozia capitata* (Hook.) Macoun) **VU** [D1+D2]
Hygrobiella laxifolia (Hook.) Spruce **VU** [D2]
Isopaches bicrenatus (Schmidel ex Hoffm.) H. Buch (*Lophozia bicrenata* (Schmidel ex Hoffm.) Dumort.) **LR-nt** [D1]
⇒ *Jamesoniella* – see under *Biantheridion* and *Syzygiella*
⇒ *Jungermannia* p. pte. – see under *Endogemma*, *Liochlaena* and *Solenostoma*
Jungermannia atrovirens Dumort. **VU** [D1+D2]
Jungermannia pumila With. **LR-nt** [D1]
Kurzia pauciflora (Dicks.) Grolle **VU** [D1]
Kurzia sylvatica (A. Evans) Grolle **LC-att**
Kurzia trichoclados (Müll. Frib.) Grolle **EN** [C2a(i, ii); D1]
Leiocolea badensis (Gottsche) Jörg. (*Lophozia badensis* (Gottsche) Schiffn.) **VU** [D2]
Leiocolea bantriensis (Hook.) Jörg. (*Lophozia bantriensis* (Hook.) Steph.) **LC**
Leiocolea heterocolpos (Thed. ex Hartm.) H. Buch (*Lophozia heterocolpos* (Thed. ex Hartm.) M. Howe) **CR** [B2ab(iii, iv, v); C2a(i)]
⇒ *Lejeunea* p. pte. – see under *Microlejeunea*
Lejeunea cavifolia (Ehrh.) Lindb. **LC**
Lepidozia reptans (L.) Dumort. **LC**
Liochlaena lanceolata Nees (*Jungermannia leiantha* Grolle) **LR-nt** [D1]
Liochlaena subulata (A. Evans) Schljakov (*Jungermannia subulata* A. Evans) **CR** [B2ab(v); C2a(i); D1]

⇒ *Lophozia* p. pte. – see under *Barbilophozia*, *Heterogemma*, *Isopaches*, *Leiocolea*, *Lophoziopsis*, *Obtusifolium*, *Orthocaulis*, *Pseudolophozia*, *Schistochilopsis*, *Schljakovia* and *Schljakovianthus*
⇒ *Lophocolea* – see under *Chiloscyphus*
Lophozia ascendens (Warnst.) R. M. Schust. **EN** [C2a(i); D1]
Lophozia guttulata (Lindb.) A. Evans (*Lophozia longiflora* auct.) **LC** (annot. **5**)
Lophozia ventricosa (Dicks.) Dumort.
var. *ventricosa* **LC**
var. *silvicola* (H. Buch) E. W. Jones **LC-att**
Lophozia wenzelii (Nees) Steph. **CR** [B2ab(iii, iv, v)]
Lophoziopsis excisa (Dicks.) Konst. et Vilnet (*Lophozia excisa* (Dicks.) Dumort.) **LC-att**
Lophoziopsis longidens (Lindb.) Konst. et Vilnet (*Lophozia longidens* (Lindb.) Macoun) **LR-nt** [D1]
Lunularia cruciata (L.) Dumort. **LC**
Mannia fragrans (Balbis) Frye et L. Clark **LR-nt** [B2ab(iii, iv, v); C1]
Mannia gracilis (F. Weber) Schill et D. G. Long (*Asterella gracilis* (F. Weber) Underw.) **EN** [B2ab(iii, iv, v); C2a(i)]
Mannia triandra (Scop.) Grolle **CR** [B1ab(iii, v)+2ab(iii, v), C2a(i, ii), D]
Marchantia polymorpha L.
subsp. *polymorpha* **LC**
subsp. *montivagans* Bischl. et Boisselier **LC-att**
subsp. *ruderalis* Bischl. et Boisselier **LC**
⇒ *Marsupella* p. pte. – see under *Gymnomitrion*
Marsupella aquatica (Lindenb.) Schiffn. (*Marsupella emarginata* var. *aquatica* (Lindenb). Dumort.) **LC**
Marsupella emarginata (Ehrh.) Dumort. **LC**
Marsupella funckii (F. Weber et D. Mohr) Dumort. **LR-nt** [D1]
Marsupella sparsifolia (Lindb.) Dumort. **CR** [B2ab(iii, v); C2a(i)]
Marsupella sphacelata (Gieseke ex Lindenb.) Dumort. **LC**
Marsupella sprucei (Limpr.) Bernet **EN** [B2ab(iii, v); C2a(i)]
Metzgeria conjugata Lindb. **LC**
Metzgeria furcata (L.) Dumort. **LC**
Metzgeria pubescens (Schrank) Raddi (*Apometzgeria pubescens* (Schrank) Kuwah.) **LC-att**
Metzgeria violacea (Ach.) Dumort. **VU** [D1]
Microlejeunea ulicina (Taylor) A. Evans (*Lejeunea ulicina* (Taylor) Gottsche, Lindenb. et Nees) **CR** [D1] (annot. **6**)
Moerckia blyttii (Moerch) Brockm. **EN** [C2a(i)]
Moerckia flotoviana (Nees) Schiffn. **CR** [C2a(i); D1] (annot. **7**)
Mylia anomala (Hook.) Gray (*Leiomylia anomala* (Hook.) J. J. Engel et Braggins) **LC**
Mylia taylorii (Hook.) Gray **LC**
Nardia compressa (Hook.) Gray **VU** [D2]
Nardia geoscyphus (De Not.) Lindb. **LC**
Nardia insecta Lindb. **DD-va**
Nardia scalaris Gray **LC**
Nowellia curvifolia (Dicks.) Mitt. **LC-att**
Obtusifolium obtusum (Lindb.) S. W. Arnell (*Lophozia obtusa* (Lindb.) A. Evans) **EN** [C2a(i)]
Odontoschisma denudatum (Mart.) Dumort. **LC-att**
Odontoschisma sphagni (Dicks.) Dumort. **EN** [B2ab(iii, iv, v); C2a(i)]
Orthocaulis atlanticus (Kaal.) H. Buch (*Lophozia atlantica* (Kaal.) Müll. Frib., *Barbilophozia atlantica* (Kaal.) Müll. Frib.) **RE**
Orthocaulis attenuatus (Mart.) A. Evans (*Lophozia attenuata* (Mart.) Dumort., *Neoorthocaulis attenuatus* (Mart.) L. Söderstr., Roo et Hedd., *Barbilophozia attenuata* (Mart.) Loeske) **LC**
Orthocaulis floerkei (F. Weber et D. Mohr) H. Buch (*Lophozia floerkei* (F. Weber et D. Mohr) Schiffn., *Neoorthocaulis floerkei* (F. Weber et D. Mohr) H. Buch, *Barbilophozia floerkei* (F. Weber et D. Mohr) Loeske) **LC**
Oxymitra incrassata (Brot.) Sérgio et Sim-Sim **EN** [B2ab(iii, iv, v)]
Pallavicinia lyellii (Hook.) Carruth. **RE**
Pedinophyllum interruptum (Nees) Kaal. **LC-att**
Pellia endiviifolia (Dicks.) Dumort. **LC**
Pellia epiphylla (L.) Corda **LC**
Pellia neesiana (Gottsche) Limpr. **LC**
Plagiochila asplenioides (L.) Dumort. **LC**

Plagiochila porelloides (Torr. ex Nees) Lindenb. **LC**
Porella arboris-vitae (With.) Grolle **LR-nt** [A2(a); C1+C2a(i); D1]
Porella cordaeana (Huebener) Moore **LR-nt** [C1+C2a(i); D1]
Porella platyphylla (L.) Pfeiff. **LC**
Preissia quadrata (Scop.) Nees **LC**
Pseudolophozia sudetica (Nees ex Huebener) Konst. et Vilnet (*Lophozia sudetica* (Nees ex Huebener) Grolle, *Barbilophozia sudetica* (Nees ex Huebener) L. Söderstr., Roo et Hedd.) **LC**
Ptilidium ciliare (L.) Hampe **LC**
Ptilidium pulcherrimum (G. Weber) Vainio **LC**
Radula complanata (L.) Dumort. **LC**
Radula lindenbergiana Gottsche ex C. Hartm. **VU** [D2]
Reboulia hemisphaerica (L.) Raddi **LR-nt** [C1; D1]
Riccardia chamedryfolia (With.) Grolle **VU** [B2ab(iii, v); D1]
Riccardia incurvata Lindb. **VU** [B2ab(iii, v); D1]
Riccardia latifrons (Lindb.) Lindb. **LC-att**
Riccardia multifida (L.) Gray **LC-att**
Riccardia palmata (Hedw.) Carruth. **LC-att**
Riccia bifurca Hoffm. **LC-att**
Riccia canaliculata Hoffm. **DD-va**
Riccia cavernosa Hoffm. **LR-nt** [B2ab(iii, iv, v)c(iii, iv); C2b]
Riccia ciliata Hoffm. (*R. crinita* Taylor, *R. canescens* Steph., *R. trichocarpa* M. Howe) **LR-nt** [C2a(i)] (annot. **8**)
Riccia ciliifera Link ex Lindenb. **LR-nt** [B2ab(iii, iv, v); C2a(i)]
Riccia fluitans L. **LC**
Riccia glauca L. **LC**
Riccia huebeneriana Lindenb. **EN** [B2ab(iii, iv, v)c(iii, iv); C2a(i)]
Riccia papillosa Moris **CR** [B1+2ab(iii, iv, v)]
Riccia rhenana Lorb. ex Müll. Frib. **LR-nt** [C2a(i)]
Riccia sorocarpa Bisch. **LC**
Riccia warnstorfii Limpr. ex Warnst. **VU** [C2a(i)]
Ricciocarpos natans (L.) Corda **LR-nt** [B2ab(iii, iv, v)c(iii, iv); C2b]
Scapania aequiloba (Schwägr.) Dumort. **LR-nt** [B2ab(iv, v)]
Scapania apiculata Spruce **CR** [B1+2ab(iii, iv, v)] (annot. **9**)
Scapania aspera Bernet et M. Bernet **VU** [B2ab(iv, v); D1]
Scapania calcicola (Arnell et J. Perss.) Ingham **EN** [B2ab(iv, v)]
Scapania carinthiaca J.B. Jack ex Lindb. (only in var. *massalongoi* Müll. Frib.) **RE**
Scapania compacta (A. Roth) Dumort. **DD-va**
Scapania curta (Mart.) Dumort. **LC**
Scapania cuspiduligera (Nees) Müll. Frib. **VU** [B2ab(iii); C2a(i); D1]
Scapania gymnostomophila Kaal. **EN** [C2a(i); D1]
Scapania helvetica Gottsche **CR** [C2a(i)]
Scapania irrigua (Nees) Nees **LC**
Scapania lingulata H. Buch **EN** [D1]
Scapania mucronata H. Buch **DD**
Scapania nemorea (L.) Grolle **LC**
Scapania paludicola Loeske et Müll. Frib. **VU** [B2ab(iii, iv, v); D1]
Scapania paludosa (Müll. Frib.) Müll. Frib. **VU** [D1]
Scapania parvifolia Warnst. **CR** [B1+2ab(iii, v); C2a(i, ii); D1]
Scapania praetervisa Meyl. **VU** [B2ab(iii); D1]
Scapania scandica (Arnell et H. Buch) Macvicar **DD**
Scapania subalpina (Nees ex Lindenb.) Dumort. **LR-nt** [D1]
Scapania uliginosa (Sw. ex Lindenb.) Dumort. **LC**
Scapania umbrosa (Schrad.) Dumort. **LC**
Scapania undulata (L.) Dumort. **LC**
Schistochilopsis grandiretis (Lindb. ex Kaal.) Konst. (*Lophozia grandiretis* (Lindb. ex Kaal.) Schiffn.) **VU** [B2ab(v)]
Schistochilopsis incisa (Schrad.) Konst. (*Lophozia incisa* (Schrad.) Dumort.) **LC**
Schistochilopsis opacifolia (Culm. ex Meyl.) Konst. (*Lophozia opacifolia* Culm. ex Meyl.) **DD-va**

Schljakovia kunzeana (Huebener) Konst. et Vilnet (*Lophozia kunzeana* (Huebener) A. Evans, *Barbilophozia kunzeana* (Huebener) Müll. Frib., *Orthocaulis kunzeanus* (Huebener) H. Buch) **EN** [B2ab(iii, iv, c; C2a(i); D1]
Schljakovianthus quadrilobus (Lindb.) Konst. et Vilnet (*Lophozia quadriloba* (Lindb.) A. Evans, *Barbilophozia quadriloba* (Lindb.) Loeske) **EN** [B2ab(iii)]
Solenostoma confertissimum (Nees) Schljakov (*Jungermannia confertissima* Nees) **VU** [D1+D2]
Solenostoma gracillimum (Mitt.) R. M. Schust. (*Jungermannia gracillima* Sm.) **LC**
Solenostoma hyalinum (Lyell) Mitt. (*Jungermannia hyalina* Lyell) **LR-nt** [D1]
Solenostoma obovatum (Nees) C. Massal. (*Jungermannia obovata* Nees) **LC**
Solenostoma sphaerocarpum (Hook.) Steph. (*Jungermannia sphaerocarpa* Hook.) **LC**
Solenostoma subellipticum (Lindb. ex Kaal.) R. M. Schust. (*Jungermannia subelliptica* (Lindb. ex Kaal.) Levier) **VU** [D1]
Sphenolobus minutus (Schreb.) Berggr. (*Anastrophyllum minutum* (Schreb.) R. M. Schust.) **LC** – only in var. *weberi* (Mart.) Schiffn.
Sphenolobus saxicola (Schrad.) Steph. (*Anastrophyllum saxicola* (Schrad.) R. M. Schust.) **VU** [D2]
Syzygiella autumnalis (DC.) Feldberg, Váňa, Hentschel et Heinrichs (*Jamesoniella autumnalis* (DC.) Steph.) **VU** [B2ab(iii, iv, v); C2a(i)]
Targionia hypophylla L. **CR** [B1+2ab(iii, v); C2a(i); D1]
Tetralophozia setiformis (Ehrh.) Schljakov **VU** [D2]
Trichocolea tomentella (Ehrh.) Dumort. **LC-att**
Tritomaria exsecta (Schmidel) Schiffn. ex Loeske **LC**
Tritomaria exsectiformis (Breidl.) Schiffn. ex Loeske **LC-att**
Tritomaria quinquedentata (Huds.) H. Buch **LC**

Mosses

Abietinella abietina (Hedw.) M. Fleisch. (*Thuidium abietinum* (Hedw.) Schimp.)
var. *abietina* **LC**
var. *hystricosa* (Mitt.) Sakurai (*Thuidium abietinum* var. *hystricosum* (Mitt.) Loeske et Lande) **DD**
Acaulon muticum (Hedw.) Müll. Hal. **LC-att**
Acaulon triquetrum (Spruce) Müll. Hal. **VU** [B2ab(iii); C2a(i)]
Alleniella besseri (Lobarzewski) S. Olsson, Enroth et D. Quandt (*Neckera besseri* (Lobarzewski) Jur.) **LC**
Alleniella complanata (Hedw.) S. Olsson, Enroth et D. Quandt (*Neckera complanata* (Hedw.) Huebener) **LC**
Aloina aloides (Koch ex Schultz) Kindb.
var. *aloides* **DD-va**
var. *ambigua* (Bruch et Schimp.) E. J. Craig (*Aloina ambigua* (Bruch et Schimp.) Limpr.) **EN** [B2ab(iii, iv, v)]
Aloina brevirostris (Hook. et Grev.) Kindb. **CR** [B2ab(iii, iv, v); C2a(i, ii)+C2b]
Aloina obliquifolia (Müll. Hal.) Broth. **LC**
Aloina rigida (Hedw.) Limpr. **LC**
Amblyodon dealbatus (Hedw.) P. Beauv. **CR** [B1+2ab(v); C2a(i, ii); D1]
⇒ *Amblystegium* p. pte. – see under *Hygroamblystegium*, *Pseudoamblystegium*, *Pseudocampylium* and *Serpoleskea*
Amblystegium serpens (Hedw.) Schimp. **LC**
Amphidium lapponicum (Hedw.) Schimp. **EN** [B1+2ab(iii, iv, v)]
Amphidium mougeotii (Bruch et Schimp.) Schimp. **LC**
Anacamptodon splachnoides (Froel. ex Brid.) Brid. **EN** [C2a(i)]
Andreaea crassinervia Bruch **CR** [B1+2ab(iii, v)]
Andreaea frigida Huebener **CR** [B1+2ab(iii, v); C2a(ii)]
Andreaea rothii F. Weber et D. Mohr
subsp. *rothii* **EN** [B2ab(iv, v); C1+C2a(i)]
subsp. *falcata* (Schimp.) Lindb. **LC-att**
Andreaea rupestris Hedw. **LC** – only in var. *rupestris*.
Anoectangium aestivum (Hedw.) Mitt. **EN** [B1+2ab(v); C2a(ii)]
Anomobryum concinnatum (Spruce) Lindb. (*Anomobryum julaceum* var. *concinnatum* (Spruce) J. E. Zetterst.) **CR** [B1+2ab(iii, v); C2a(ii)]
Anomodon attenuatus (Hedw.) Huebener **LC**
Anomodon longifolius (Schleich. ex Brid.) Hartm. **LC**
Anomodon rostratus (Hedw.) Schimp. **DD-va**
Anomodon rugelii (Müll. Hal.) Keissl. **VU** [B1+2ab(iii)]

Anomodon viticulosus (Hedw.) Hook. et Taylor **LC**
Antitrichia curtipendula (Hedw.) Brid. **LC-att**
Archidium alternifolium (Hedw.) Mitt. **CR** [B2ab(iii, v)]
Arctoa fulvella (Dicks.) Bruch et Schimp. **RE**
Atrichum angustatum (Brid.) Bruch et Schimp. **EN** [B2ab(iv); C2a(i)]
Atrichum flavisetum Mitt. (*Atrichum undulatum* var. *gracilisetum* Besch.) **DD**
Atrichum tenellum (Röhl.) Bruch et Schimp. **LR-nt** [B2ab(iii); C2a(i)]
Atrichum undulatum (Hedw.) P. Beauv. **LC**
Aulacomnium androgynum (Hedw.) Schwägr. **LC**
Aulacomnium palustre (Hedw.) Schwägr. **LC**
⇒ *Barbula* p. pte. – see under *Streblotrichum*
Barbula crocea (Brid.) F. Weber et D. Mohr) **CR** [C2a(i)] (annot. **10**)
Barbula unguiculata Hedw. **LC**
Bartramia halleriana Hedw. **LR-nt** [B2ab(iii, iv, v); C2a(i)]
Bartramia ithyphylla Brid. **LC-att**
Bartramia pomiformis Hedw. **LC**
Blindia acuta (Hedw.) Bruch et Schimp. **LC**
Brachydontium trichodes (F. Weber) Milde **LC-att**
Brachytheciastrum velutinum (Hedw.) Ignatov et Huttunen (*Brachythecium velutinum* (Hedw.) Schimp.) **LC**
⇒ *Brachythecium* p. pte. – see under *Brachytheciastrum* and *Sciuro-hypnum*
Brachythecium albicans (Hedw.) Schimp. **LC**
Brachythecium campestre (Müll. Hal.) Schimp. **LC-att**
Brachythecium capillaceum (F. Weber et D. Mohr) Giacom. **DD-va**
Brachythecium geheebii Milde **EN** [B2ab(iii, iv, v); C2a(i)]
Brachythecium glareosum (Bruch ex Spruce) Schimp. **LC**
Brachythecium laetum (Brid.) Schimp. **EN** [B2ab(iv, v)]
Brachythecium mildeanum (Schimp.) Schimp. **LC-att** – only in var. *mildeanum*
Brachythecium rivulare Schimp. **LC**
Brachythecium rutabulum (Hedw.) Schimp. **LC** – only in var. *rutabulum*
Brachythecium salebrosum (Hoffm. ex F. Weber et D. Mohr) Schimp. **LC**
Brachythecium tommasinii (Sendtn. ex Boulay) Ignatov et Huttunen (*Cirriphyllum tommasinii* (Sendt. ex Boulay) Grout)
var. *tommasinii* **LC**
var. *fagineum* (H. Müll. ex Milde) Jan Kučera, ***comb. nova***. Basionym: *Eurhynchium vaucheri* var. *fagineum* H. Müll. ex Milde, Bryologia Silesiaca 304. 1869. (*Rhynchostegiella tenuicaulis* (Spruce) Kartt., *Eurhynchium germanicum* Grebe) **CR** [B1+2ab(iii, v)] (annot. **11**)
Breidleria pratensis (W. D. J. Koch ex Spruce) Loeske (*Hypnum pratense* W. D. J. Koch ex Spruce) **LC-att**
Bryoerythrophyllum ferruginascens (Stirt.) Giacom. **LC-att**
Bryoerythrophyllum recurvirostrum (Hedw.) P. C. Chen **LC**
Bryum algovicum Sendtn. ex Müll. Hal. **DD-va**
Bryum alpinum Huds. ex With. **LR-nt** [C1]
Bryum archangelicum Bruch et Schimp. (*Bryum imbricatum* (Schwägr.) Bruch et Schimp.) **EN** [B2ab(iv, v)]
Bryum argenteum Hedw. **LC**
Bryum boreale (F. Weber et D. Mohr) Funck (*Bryum pallescens* Schleich. ex Schwägr., *Ptychostomum boreale* (F. Weber et D. Mohr) Ochyra et Bednarek-Ochyra, *Bryum lonchocaulon* Müll. Hal., *Bryum cirrhatum* Hoppe et Hornsch., *hom. illeg.*) **LC** (annot. **12**)
Bryum caespiticium Hedw. **LC**
Bryum capillare Hedw. **LC**
Bryum creberrimum Taylor **EN** [B2ab(iv, v)]
Bryum cyclophyllum (Schwägr.) Bruch et Schimp. **EN** [B2ab(iii, v)c(iii, iv); C2a(i)]
Bryum dichotomum Hedw. (*Bryum bicolor* Dicks.) **LC**
Bryum elegans Nees **LR-nt** [B2ab(iv, v)]
Bryum funkii Schwägr. (‘*funckii*’ auct.) **DD**
Bryum gemmiferum R. Wilczek et Demaret **LC-att** (annot. **13**)
Bryum intermedium (Brid.) Blandow **CR** [B2ab(v)]
Bryum klinggraeffii Schimp. **LC**
Bryum kunzei Hoppe et Hornsch. **DD**

Bryum longisetum Blandow ex Schwägr. **RE**
Bryum mildeanum Jur. **VU** [D1+D2]
Bryum moravicum Podp. (*Bryum laevifilum* Syed) **LC**
Bryum muehlenbeckii Bruch et Schimp. **LR-nt** [D2]
Bryum pallens Sw. ex Anon. **LC**
Bryum pseudotriquetrum (Hedw.) P. Gaertn., B. Mey. et Scherb.
var. *pseudotriquetrum* **LC**
var. *bimum* (Schreb.) Lilj. (*Bryum bimum* (Schreb.) Turner) **LC-att**
var. *neodamense* (Itzigs.) Buse (*Bryum neodamense* Itzigs.) **RE** (annot. **14**)
Bryum radiculosum Brid. **LC-att**
Bryum rubens Mitt. **LC**
Bryum ruderale Crundw. et Nyholm **DD**
Bryum sauteri Bruch et Schimp. **DD**
Bryum schleicheri Schwägr. **CR** [B1+2ab(v); C2a(ii)]
Bryum subapiculatum Hampe **LC**
Bryum tenuisetum Limpr. **DD**
Bryum torquescens Bruch et Schimp. **DD**
Bryum turbinatum (Hedw.) Turner **EN** [B1+2ab(iii, iv, v); C1+C2a(i); D1]
Bryum uliginosum (Brid.) Bruch et Schimp. **EN** [C2a(i)]
Bryum violaceum Crundw. et Nyholm **LC**
Bryum weigelii Spreng. **LC-att**
Buxbaumia aphylla Hedw. **LR-nt** [C1+C2a(i)]
Buxbaumia viridis (Moug. ex Lam. et DC.) Brid. ex Moug. et Nestl. **VU** [C2a(i)]
*Calliclad*ium *haldanianum* (Grev.) H. A. Crum **VU** [B2ab(iii); C2a(i)]
Calliergon cordifolium (Hedw.) Kindb. **LC**
Calliergon giganteum (Schimp.) Kindb. **VU** [B2ab(iii, iv, v); C2a(i)]
Calliergon megalophyllum Mikut. **RE**
Calliergonella cuspidata (Hedw.) Loeske **LC**
Calliergonella lindbergii (Mitt.) Hedenäs **LC**
Campyliadelphus chrysophyllus (Brid.) R. S. Chopra **LC**
Campyliadelphus elodes (Lindb.) Kanda **DD-va**
Campylidium calcareum (Crundw. et Nyholm) Ochyra (*Campylophyllum calcareum* (Crundw. et Nyholm) Hedenäs) **LC-att**
Campylidium sommerfeltii (Myrin) Ochyra (*Campylophyllum sommerfeltii* (Myrin) Hedenäs) **LC-att** (annot. **15**)
Campylium protensum (Brid.) Kindb. **LC-att**
Campylium stellatum (Hedw.) Lange et C. E. O. Jensen **LR-nt** [B2ab(iii, iv, v)]
⇒ *Campylophyllum* p. pte. – see under *Campylidium*
Campylophyllum halleri (Hedw.) M. Fleisch. **EN** [B2ab(iii, v)]
Campylopus flexuosus (Hedw.) Brid. **LC**
Campylopus fragilis (Brid.) Bruch et Schimp. **LC-att**
Campylopus introflexus (Hedw.) Brid. **LC**
Campylopus pyriformis (Schultz) Brid. **LC-att**
Campylopus subulatus Schimp. ex Milde **VU** [D1+D2]
Campylostelium saxicola (F. Weber et D. Mohr) Bruch et Schimp. **LR-nt** [C2a(i)]
Ceratodon purpureus (Hedw.) Brid. **LC** – only on subsp. *purpureus*
Cinclidotus aquaticus (Hedw.) Bruch et Schimp. **RE**
Cinclidotus fontinaloides (Hedw.) P. Beauv. **CR** [B1+2ab(iii, iv, v)]
Cinclidotus riparius (Host ex Brid.) Arn. **VU** [D2]
⇒ *Cirriphyllum* p. pte. – see under *Brachythecium*
Cirriphyllum crassinervium (Taylor) Loeske et M. Fleisch. (*Eurhynchium crassinervium* (Taylor) Schimp.) **LC**
Cirriphyllum piliferum (Hedw.) Grout **LC**
Cleistocarpidium palustre (Bruch et Schimp.) Ochyra et Bednarek-Ochyra **VU** [B2ab(iii, iv); C2a(i)]
Climacium dendroides (Hedw.) F. Weber et D. Mohr **LC**
Conardia compacta (Müll. Hal.) H. Rob. **EN** [B2ab(iii); C2a(i)]
Coscinodon cribrosus (Hedw.) Spruce **LC**
Cratoneuron filicinum (Hedw.) Spruce **LC**
Crossidium squamiferum (Viv.) Jur. (incl. var. *pottioideum* (De Not.) Mönk.) **CR** [B2ab(iii, v)]

Ctenidium molluscum (Hedw.) Mitt. **LC**
Cynodontium bruntonii (Sm.) Bruch et Schimp. **LC-att**
Cynodontium gracilescens (F. Weber et D. Mohr) Schimp. **VU** [D2]
Cynodontium polycarpon (Hedw.) Schimp. **LC**
Cynodontium strumiferum (Hedw.) Lindb. **LC**
Cynodontium tenellum (Schimp.) Limpr. **VU** [B2ab(iv, v); C2a(i)]
Dichelyma falcatum (Hedw.) Myrin **DD-va**
Dichodontium palustre (Dicks.) M. Stech **LC-att**
Dichodontium pellucidum (Hedw.) Schimp. **LC**
Dicranella cerviculata (Hedw.) Schimp. **LC**
Dicranella crispa (Hedw.) Schimp. **DD-va**
Dicranella heteromalla (Hedw.) Schimp. **LC**
Dicranella humilis R. Ruthe **VU** [D1+D2]
Dicranella rufescens (Dicks.) Schimp. **LC**
Dicranella schreberiana (Hedw.) Dixon **LC**
Dicranella staphylina H. Whitehouse **LC**
Dicranella subulata (Hedw.) Schimp. **VU** [C2a(i)]
Dicranella varia (Hedw.) Schimp. **LC**
Dicranodontium asperulum (Mitt.) Broth. **LR-nt** [B2ab(v); C1+C2a(i)]
Dicranodontium denudatum (Brid.) E. Britton **LC**
Dicranodontium uncinatum (Harv.) A. Jaeger **EN** [B2ab(iii, iv, v); C2a(i)]
⇒ *Dicranoweisia* p. pte. – see under *Hymenoloma*
Dicranoweisia cirrata (Hedw.) Lindb. **LC**
Dicranum bonjeanii De Not. **LR-nt** [B2ab(iii, iv, v); C1]
Dicranum elongatum Schleich. ex Schwägr. **EN** [B1+2ab(iii, iv, v); C2a(i)]
Dicranum flagellare Hedw. **LC-att**
Dicranum flexicaule Brid. **LC**
Dicranum fulvum Hook. **LC-att**
Dicranum fuscescens Sm. **LC**
Dicranum majus Sm. **VU** [B1+2ab(iii, iv, v); C1+2a(i)]
Dicranum montanum Hedw. **LC**
Dicranum muehlenbeckii Bruch et Schimp. **CR** [B1+2ab(iii, iv, v); C2a(ii)]
Dicranum polysetum Sw. ex Anon. **LC**
Dicranum scoparium Hedw. **LC**
Dicranum spadiceum J. E. Zetterst. **CR** [B1+2ab(iii, iv, v); C2a(i, ii)]
Dicranum spurium Hedw. **LC-att**
Dicranum tauricum Sapjegin **LC**
Dicranum undulatum Schrad. ex Brid. **LC-att**
Dicranum viride (Sull. et Lesq.) Lindb. **LR-nt** [B2ab(iii, iv, v)]
Didymodon acutus (Brid.) K. Saito **LC-att**
Didymodon cordatus Jur. **VU** [B2ab(iii)]
Didymodon fallax (Hedw.) R. H. Zander **LC**
Didymodon ferrugineus (Schimp. ex Besch.) M. O. Hill **LC**
Didymodon glaucus Ryan **VU** [C1+C2a(i)]
Didymodon insulanus (De Not.) M. O. Hill **LC**
Didymodon luridus Hornsch. **LR-nt** [B2ab(iii, iv, v)]
Didymodon rigidulus Hedw. **LC**
Didymodon sinuosus (Mitt.) Delogne **VU** [C2a(i)]
Didymodon spadiceus (Mitt.) Limpr. **LR-nt** [B2ab(iii, iv, v); C1]
Didymodon tophaceus (Brid.) Lisa **LC-att**
Didymodon umbrosus (Müll. Hal.) R. H. Zander (*Didymodon australasiae* var. *umbrosus* (Müll. Hal.) R. H. Zander) **NE** (alien; annot. **16**)
Didymodon validus Limpr. (*Didymodon rigidulus* var. *validus* (Limpr.) Düll) **EN** [B2ab(iii, iv, v); C2a(i)] (annot. **17**)
Didymodon vinealis (Brid.) R. H. Zander **EN** [B2ab(iii); C2a(i)]
Diphyscium foliosum (Hedw.) D. Mohr **LC-att**
Discelium nudum (Dicks.) Brid. **VU** [B2ab(iii, iv, v)]
Distichium capillaceum (Hedw.) Bruch et Schimp. **LC**

Distichium inclinatum (Hedw.) Bruch et Schimp. **EN** [B2ab(iii, iv, v)]
Ditrichum flexicaule (Schwägr.) Hampe **LC**
Ditrichum gracile (Mitt.) Kuntze **LC-att**
Ditrichum heteromallum (Hedw.) E. Britton **LC**
Ditrichum lineare (Sw.) Lindb. **LC-att**
Ditrichum pallidum (Hedw.) Hampe **VU** [B2ab(iii, iv, v)]
Ditrichum pusillum (Hedw.) Hampe **LC-att**
Ditrichum zonatum (Brid.) Kindb. **EN** [B2ab(iii, iv, v); C2a(i)]
Drepanocladus aduncus (Hedw.) Warnst. (*Drepanocladus polycarpos* (Blandow ex Voit) Warnst.) **LC**
Drepanocladus longifolius (Mitt.) Paris (*Drepanocladus capillifolius* (Warnst.) Warnst.) **DD-va**
Drepanocladus lycopodioides (Brid.) Warnst. (*Pseudocalliergon lycopodioides* (Brid.) Hedenäs) **RE**
Drepanocladus polygamus (Schimp.) Hedenäs **VU** [B2ab(iii, iv, v); C2a(i)]
Drepanocladus sendtneri (Schimp. ex H. Müll.) Warnst. **CR** [B2ab(iii, v)]
Drepanocladus sordidus (Müll. Hal.) Hedenäs **RE**
Drepanocladus trifarius (F. Weber et D. Mohr) Broth. ex Paris (*Pseudocalliergon trifarium* (F. Weber et D. Mohr) Loeske) **CR** [B2ab(iii, v); C2a(ii)]
Encalypta affinis R. Hedw. **RE**
Encalypta ciliata Hedw. **VU** [C2a(i)]
Encalypta rhaptocarpa Schwägr. (annot. **18**)
  var. *rhaptocarpa* **EN**
  var. *leptodon* Lindb. (*Encalypta trachymitria* Ripart) **DD**
  var. *spathulata* (Müll. Hal.) Husn. (*Encalypta spathulata* Müll. Hal.) **DD-va**
Encalypta streptocarpa Hedw. **LC**
Encalypta vulgaris Hedw. **LC**
Entodon concinnus (De Not.) Paris **LC-att**
Entodon schleicheri (Schimp.) Demet. **DD**
Entosthodon fascicularis (Hedw.) Müll. Hal. **VU** [C2a(i)]
Entosthodon muhlenbergii (Turner) Fife (*Funaria muhlenbergii* Turner) **CR** [B1+2ab(iii)c(iv)]
Entosthodon pulchellus (H. Philib.) Brugués (*Funaria pulchella* H. Philib.) **EN** [B1+2ab(iii)c(iii, iv); C2a(i)] (annot. **19**)
Ephemerum cohaerens (Hedw.) Hampe **DD-va**
Ephemerum minutissimum Lindb. **LC**
Ephemerum recurvifolium (Dicks.) Boulay **VU** [B2ab(iii)c(iii); C2a(i)]
Ephemerum serratum (Hedw.) Hampe **DD**
Eucladium verticillatum (With.) Bruch et Schimp. **LC**
Eurhynchiastrum pulchellum (Hedw.) Ignatov et Huttunen (*Eurhynchium pulchellum* (Hedw.) Jenn.) **LC-att**
⇒ *Eurhynchium* p. pte. – see under *Cirriphyllum*, *Eurhynchiastrum*, *Kindbergia*, *Microeurhynchium*, *Oxyrrhynchium*, *Plasteurhynchium*, and *Sciuro-hypnum*
Eurhynchium angustirete (Broth.) T. J. Kop. **LC**
Eurhynchium striatum (Hedw.) Schimp. **LC-att**
Exsertotheca crispa (Hedw.) S. Olsson, Enroth et D. Quandt (*Neckera crispa* Hedw.) **LC**
Fissidens adianthoides Hedw. **LC-att**
Fissidens arnoldii R. Ruthe **EN** [B1+2ab(iii, iv, v)c(iii, iv); C2a(i, ii)]
Fissidens bambergeri Milde **EN** [B2ab(iii, v); C2a(ii)] (annot. **20**)
Fissidens bryoides Hedw. **LC** – only in var. *bryoides*
Fissidens crassipes Wilson ex Bruch et Schimp. **DD-va** – only in subsp. *crassipes*
Fissidens dubius P. Beauv.
  var. *dubius* **LC**
  var. *mucronatus* (Breidl. ex Limpr.) Kartt., Hedenäs et L. Söderstr. **LC**
Fissidens exilis Hedw. **LC**
Fissidens fontanus (Bach. Pyl.) Steud. (*Octodiceras fontanum* (Bach. Pyl.) Lindb.) **LR-nt** [B2ab(iii)]
Fissidens gracilifolius Brugg.-Nann. et Nyholm **LC**
Fissidens gymnandrus Buse **LC**
Fissidens limbatus Sull. **DD** (annot. **21**)
Fissidens osmundoides Hedw. **LC-att**
Fissidens pusillus (Wilson) Milde **LC-att**
Fissidens rufulus Bruch et Schimp. **LR-nt** [B2ab(iii)c(iii, iv)]

Fissidens taxifolius Hedw. **LC** – only in subsp. *taxifolius*
Fissidens viridulus (Sw. ex Anon.) Wahlenb.
var. *viridulus* **LC**
var. *incurvus* (Starke ex Röhl.) Waldh. (*Fissidens incurvus* Starke ex Röhl.) **LC-att**
Fontinalis antipyretica Hedw. **LC** (annot. **22**)
Fontinalis hypnoides Hartm. **EN** [B2ab(iii)] – only in var. *hypnoides*
Fontinalis squamosa Hedw. **LC**
⇒ *Funaria* p. pte. – see under *Entosthodon*
Funaria hygrometrica Hedw. **LC**
Grimmia alpestris (Schleich. ex F. Weber et D. Mohr) Schleich. **VU**
Grimmia anodon Bruch et Schimp. **EN** [B2ab(iii, iv, v); C2a(i)]
Grimmia anomala Hampe ex Schimp. **VU** [D2]
Grimmia atrata Miel. ex Hornsch. **VU** [D2]
Grimmia caespiticia (Brid.) Jur. **DD**
Grimmia crinita Brid. **EN** [B2ab(iii, iv, v)]
Grimmia dissimulata E. Maier **DD** (annot. **23**)
Grimmia donniana Sm. **LC**
Grimmia elatior Bruch ex Bals.-Criv. et De Not. **CR** [B2ab(iii, v); C1+C2a(i, ii); D1]
Grimmia elongata Kaulf. **LR-nt** [D2]
Grimmia funalis (Schwägr.) Bruch et Schimp. **LC-att**
Grimmia hartmanii Schimp. **LC**
Grimmia incurva Schwägr. **LC**
Grimmia laevigata (Brid.) Brid. **LC**
Grimmia longirostris Hook. **LC**
Grimmia montana Bruch et Schimp. **LC-att**
Grimmia muehlenbeckii Schimp. **LC**
Grimmia orbicularis Bruch ex Wilson **LC-att**
Grimmia ovalis (Hedw.) Lindb. **LC**
Grimmia plagiopodia Hedw. **RE**
Grimmia pulvinata (Hedw.) Sm. **LC**
Grimmia ramondii (Lam. et DC.) Margad. **LC-att**
Grimmia sessitana De Not. (*Grimmia reflexidens* Müll. Hal. fide Muñoz (1998)) **VU** [D2]
Grimmia teretinervis Limpr. **CR** [B1+2ab(v); C2a(i, ii); D1]
Grimmia tergestina Tomm. ex Bruch et Schimp. **LC-att**
Grimmia torquata Hook. ex Drumm. **VU** [C2a(i)]
Grimmia trichophylla Grev. **LC-att**
Grimmia unicolor Hook. **RE**
Gymnostomum aeruginosum Sm. **LC** – only in var. *aeruginosum*
Gymnostomum calcareum Nees et Hornsch. **DD**
Gymnostomum viridulum Brid. **VU** [C2a(i)]
Gyroweisia tenuis (Hedw.) Schimp. **VU** [C2a(i)]
Hamatocaulis vernicosus (Mitt.) Hedenäs **VU** [A2(a); B2ab(iii, iv, v)]
Hedwigia ciliata (Hedw.) P. Beauv. (incl. var. *leucophaea* Bruch et Schimp.) **LC**
Hedwigia stellata Hedenäs **DD**
Helodium blandowii (F. Weber et D. Mohr) Warnst. **EN** [B2ab(iii, iv, v)]
Hennediella heimii (Hedw.) R. H. Zander **DD-va** – only in var. *heimii*
Herzogiella seligeri (Brid.) Z. Iwats. **LC**
Herzogiella striatella (Brid.) Z. Iwats. **LR-nt** [D2]
Heterocladium dimorphum (Brid.) Schimp. **LR-nt** [B2ab(iii)]
Heterocladium heteropterum (Brid.) Schimp. **LC**
Hilpertia velenovskyi (Schiffn.) R. H. Zander **CR** [B1+2ab(v); C2a(ii)]
Homalia trichomanoides (Hedw.) Schimp. **LC**
Homalothecium lutescens (Hedw.) H. Rob. (incl. var. *fallax* H. Philib. ex Schimp.) **LC**
Homalothecium philippeanum (Spruce) Schimp. **LC**
Homalothecium sericeum (Hedw.) Schimp. **LC**
Homomallium incurvatum (Schrad. ex Brid.) Loeske **LC**
Hookeria lucens (Hedw.) Sm. **LR-nt** [B2ab(iii)]

Hygroamblystegium fluviatile (Hedw.) Loeske (*Amblystegium fluviatile* (Hedw.) Schimp.) **LC** (annot. **24**)
Hygroamblystegium humile (P. Beauv.) Vanderp., Goffinet et Hedenäs (*Amblystegium humile* (P. Beauv.) Crundw.) **LC-att**
Hygroamblystegium tenax (Hedw.) Jenn. (*Amblystegium tenax* (Hedw.) C. E. O. Jensen) **LC-att**
Hygroamblystegium varium (Hedw.) Mönk. (*Amblystegium varium* (Hedw.) Lindb.) **LC**
Hygrohypnella ochracea (Turner ex Wilson) Ignatov et Ignatova (*Hygrohypnum ochraceum* (Turner ex Wilson) Loeske) **LC**
⇒ *Hygrohypnum* p. pte. – see under *Hygrohypnella* and *Ochyraea*
Hygrohypnum luridum (Hedw.) Jenn. **LC**
Hylocomiastrum pyrenaicum (Spruce) M. Fleisch. (*Hylocomium pyrenaicum* (Spruce) Lindb.) **VU** [B1+2ab(iii)]
Hylocomiastrum umbratum (Hedw.) M. Fleisch. (*Hylocomium umbratum* ([Ehrh. ex] Hedw.) Schimp.) **LC-att**
⇒ *Hylocomium* p. pte. – see under *Hylocomiastrum* and *Loeskeobryum*
Hylocomium splendens (Hedw.) Schimp. **LC**
Hymenoloma crispulum (Hedw.) Ochyra (*Dicranoweisia crispula* (Hedw.) Milde) **LC**
Hymenostylium recurvirostrum (Hedw.) Dixon **VU** [C2a(i)] – only in var. *recurvirostrum*
⇒ *Hypnum* p. pte. – see under *Breidleria*
Hypnum andoi A. J. E. Sm. **LC**
Hypnum callichroum Brid. **EN** [C2a(i)]
Hypnum cupressiforme Hedw. (annot. **25**)
  var. *cupressiforme* **LC**
  var. *filiforme* Brid. **LC**
  var. *heseleri* (Ando et Higuchi) M. O. Hill (*Hypnum heseleri* Ando et Higuchi) **DD** (annot. **26**)
  var. *lacunosum* Brid. **LC**
  var. *subjulaceum* Molendo **LR-nt** [D1]
Hypnum fertile Sendtn. **CR** [B1+2ab(v); C1+C2a(i, ii); D1]
Hypnum imponens Hedw. **CR** [B1+2ab(v); C1+C2a(i, ii); D1]
Hypnum jutlandicum Holmen et E. Warncke **LC**
Hypnum pallescens (Hedw.) P. Beauv. **LC-att**
Hypnum recurvatum (Lindb. et Arnell) Kindb. **CR** [B1+2ab(v); C1+C2a(i, ii); D1]
Hypnum revolutum (Mitt.) Lindb. **RE** – only in var. *dolomiticum* (Milde) Mönk.
Hypnum sauteri Schimp. **CR** [B1+2ab(v); C1+C2a(i, ii); D1]
Hypnum vaucheri Lesq. **LC-att**
Isopterygiopsis muelleriana (Schimp.) Z. Iwats. **CR**
Isopterygiopsis pulchella (Hedw.) Z. Iwats. **CR**
Isothecium alopecuroides (Lam. ex Dubois) Isov. **LC**
Isothecium myosuroides Brid. **LC-att** – only in var. *myosuroides*
Kiaeria blyttii (Bruch et Schimp.) Broth. **LC**
Kiaeria falcata (Hedw.) I. Hagen **EN** [B1+2ab(iii, iv, v); C1+C2a(i)]
Kiaeria glacialis (Berggr.) I. Hagen **RE**
Kiaeria starkei (F. Weber et D. Mohr) I. Hagen **LC**
Kindbergia praelonga (Hedw.) Ochyra (*Eurhynchium praelongum* (Hedw.) Schimp.) **LC**
Leptobryum pyriforme (Hedw.) Wilson **LC**
Leptodictyum riparium (Hedw.) Warnst. **LC**
Lescuraea incurvata (Hedw.) E. Lawton (*Pseudoleskea incurvata* (Hedw.) Loeske) **LC**
Lescuraea mutabilis (Brid.) Lindb. ex I. Hagen **EN** [C2a(i)]
Lescuraea patens Lindb. (*Pseudoleskea patens* (Lindb.) Kindb.) **EN** [C2a(i); D1]
Lescuraea plicata (Schleich. ex F. Weber et D. Mohr) Lindb. (*Ptychodium plicatum* (Schleich. ex F. Weber et D. Mohr) Schimp.) **EN** [B1+2ab(iii, iv, v)]
Lescuraea radicosa (Mitt.) Mönk. (*Pseudoleskea radicosa* (Mitt.) Macoun et Kindb.) **EN** [B1+2ab(iv, v); C2a(i); D1]
Lescuraea saxicola (Schimp.) Molendo **DD-va**
Leskea polycarpa Hedw. **LC**
Leucobryum glaucum (Hedw.) Ångstr. **LC**
Leucobryum juniperoideum (Brid.) Müll. Hal. **LC** (annot. **27**)
Leucodon sciuroides (Hedw.) Schwägr. **LC** – only in var. *sciuroides*
Loeskeobryum brevirostre (Brid.) M. Fleisch. (*Hylocomium brevirostre* (Brid.) Schimp.) **LR-nt** [D2]
Meesia longiseta Hedw. **RE**
Meesia triquetra (L. ex Jolycl.) Ångstr. **CR** [B2ab(iii, iv, v); C1+C2a(i)]

Meesia uliginosa Hedw. **CR** [B1+2ab(v); C1+C2a(i, ii); D1]
⇒ *Metaneckera* – see under *Neckera*
Microbryum curvicollum (Hedw.) R. H. Zander ('*curvicolle*' auct.) **LC-att**
Microbryum davallianum (Sm.) R. H. Zander
var. *davallianum* **VU** [B2ab(iii); C2a(i)]
var. *conicum* (Schleich. ex Schwägr.) R. H. Zander **CR** [B2ab(iii)]
Microbryum floerkeanum (F. Weber et D. Mohr) Schimp. **VU** [C1+C2a(i)]
Microbryum starckeanum (Hedw.) R. H. Zander **DD-va**
Microeurhynchium pumilum (Wilson) Ignatov et Vanderp. (*Oxyrrhynchium pumilum* (Wilson) Loeske, *Eurhynchium pumilum* (Wilson) Schimp.) **DD** (annot. **28**)
Mielichhoferia mielichhoferiana (Funck) Loeske **CR** [B1+2ab(iii, v); C2a(i, ii)]
Mnium hornum Hedw. **LC**
Mnium lycopodioides Schwägr. (*Mnium ambiguum* H. Müll.) **LC-att**
Mnium marginatum (Dicks.) P. Beauv. **LC** – only in var. *marginatum*
Mnium spinosum (Voit) Schwägr. **LC**
Mnium spinulosum Bruch et Schimp. **LC**
Mnium stellare Hedw. **LC**
Mnium thomsonii Schimp. **CR** [B1+2ab(iii, v); C2a(i)]
Myurella julacea (Schwägr.) Schimp. **EN** [B1+2ab(iii, v); C2a(i)]
⇒ *Neckera* p. pte. – see under *Alleniella* and *Exsertotheca*
Neckera menziesii Drumm. (*Metaneckera menziesii* (Drumm.) Steere) **CR** [C2a(i)]
Neckera pennata Hedw. **VU** [C2a(i)]
Neckera pumila Hedw. **RE**
Nyholmiella gymnostoma (Bruch ex Brid.) Holmen et E. Warncke (*Orthotrichum gymnostomum* Bruch ex Brid.) **RE** (annot. **29**)
Nyholmiella obtusifolia (Brid.) Holmen et E. Warncke (*Orthotrichum obtusifolium* Brid.) **LC**
Ochyraea duriuscula (De Not.) Ignatov et Ignatova (*Hygrohypnum duriusculum* (De Not.) D. W. Jamieson, *Hygrohypnella duriuscula* (De Not.) Ignatov et Ignatova) **LR-nt** [C2a(i)] (annot. **30**)
Ochyraea mollis (Hedw.) Ignatov (*Hygrohypnum molle* (Hedw.) Loeske) **DD**
Ochyraea smithii (Sw.) Ignatov et Ignatova (*Hygrohypnum smithii* (Sw.) Broth.) **RE**
⇒ *Octodiceras* – see under *Fissidens*
Oligotrichum hercynicum (Hedw.) Lam. et DC. **LC**
Oncophorus wahlenbergii Brid. **RE** – only in var. *wahlenbergii*
Orthodontium lineare Schwägr. **LC**
Orthothecium intricatum (Hartm.) Schimp. **LC**
Orthothecium rufescens (Dicks. ex Brid.) Schimp. **RE**
⇒ *Orthotrichum* p. pte. – see under *Nyholmiella*
Orthotrichum affine Schrad. ex Brid.
var. *affine* **LC**
var. *bohemicum* Plášek et Sawicki **DD** (annot. **31**)
Orthotrichum alpestre Hornsch. ex Bruch et Schimp. **CR** [B2ab(iii, v); C2a(i, ii); D1]
Orthotrichum anomalum Hedw. **LC**
Orthotrichum cupulatum Hoffm. ex Brid.
var. *cupulatum* **LC**
var. *riparium* Huebener **RE**
Orthotrichum diaphanum Schrad. ex Brid. **LC**
Orthotrichum lyellii Hook. et Taylor **LC-att**
Orthotrichum moravicum Plášek et Sawicki **DD** (annot. **32**)
Orthotrichum pallens Bruch ex Brid. **LC**
Orthotrichum patens Bruch ex Brid. **LR-nt** [D1]
Orthotrichum pulchellum Brunt. ex Sm. **LC-att** (annot. **33**)
Orthotrichum pumilum Sw. ex Anon. **LC**
Orthotrichum rogeri Brid. **VU** [D1]
Orthotrichum rupestre Schleich. ex Schwägr. **VU** [B2ab(iv, v); C2a(i)]
Orthotrichum scanicum Grönvall **CR** [B1+2ab(iii, v); C2a(ii)]
Orthotrichum speciosum Nees **LC**
Orthotrichum stellatum Brid. **CR** [C2a(i)]

Orthotrichum stramineum Hornsch. ex Brid. **LC**
Orthotrichum striatum Hedw. **LC-att**
Orthotrichum tenellum Bruch ex Brid. **DD** (annot. **34**)
Orthotrichum urnigerum Myrin **VU** [B2ab(iii); C1]
Oxyrrhynchium hians (Hedw.) Loeske (*Eurhynchium hians* (Hedw.) Sande Lac.) **LC**
Oxyrrhynchium schleicheri (R. Hedw.) Röll (*Eurhynchium schleicheri* (R. Hedw.) Milde) **LC**
Oxyrrhynchium speciosum (Brid.) Warnst. (*Eurhynchium speciosum* (Brid.) Jur.) **LC-att**
Oxystegus tenuirostris (Hook. et Taylor) A. J. E. Sm. (*Trichostomum tenuirostre* (Hook. et Taylor) Lindb.) **LC-att**
Paludella squarrosa (Hedw.) Brid. **EN** [B2ab(iii, iv, v)]
Palustriella commutata (Hedw.) Ochyra **LC**
Palustriella decipiens (De Not.) Ochyra **LC-att**
Palustriella falcata (Brid.) Hedenäs **LC**
Paraleucobryum longifolium (Hedw.) Loeske **LC**
Paraleucobryum sauteri (Bruch et Schimp.) Loeske **RE** (annot. **35**)
⇒ *Phascum* – see under *Tortula*
Philonotis caespitosa Jur. **LC-att**
Philonotis calcarea (Bruch et Schimp.) Schimp. **LC-att**
Philonotis capillaris Lindb. (*Philonotis arnellii* Husn.) **EN** [B2ab(iii, iv, v); C2a(i)]
Philonotis fontana (Hedw.) Brid. **LC**
Philonotis marchica (Hedw.) Brid. **CR** [B1+2ab(iii, iv, v)c(iii)]
Philonotis seriata Mitt. **LC**
Philonotis tomentella Molendo **VU** [C2a(i); D2]
Physcomitrella patens (Hedw.) Bruch et Schimp. **LC-att**
Physcomitrium eurystomum Sendtn. **VU** [B2ab(iii)c(iii, iv)]
Physcomitrium pyriforme (Hedw.) Brid. **LC**
Physcomitrium sphaericum (C. F. Ludw. ex Schkuhr) Fürnr. **VU** [B2ab(iii)c(iii, iv)]
Plagiobryum zieri (Hedw.) Lindb. **EN** [B2ab(iii, iv, v); C2a(i)]
Plagiomnium affine (Blandow ex Funck) T. J. Kop. **LC**
Plagiomnium cuspidatum (Hedw.) T. J. Kop. **LC**
Plagiomnium elatum (Bruch et Schimp.) T. J. Kop. **LC-att**
Plagiomnium ellipticum (Brid.) T. J. Kop. **LC-att**
Plagiomnium medium (Bruch et Schimp.) T. J. Kop. **LR-nt** [C2a(i)]
Plagiomnium rostratum (Schrad.) T. J. Kop. **LC**
Plagiomnium undulatum (Hedw.) T. J. Kop. **LC** – only in var. *undulatum*
Plagiopus oederianus (Sw.) H. A. Crum et L. E. Anderson **VU** [B2ab(iv, v); C2a(i)]
Plagiothecium cavifolium (Brid.) Z. Iwats. **LC**
Plagiothecium curvifolium Schlieph. ex Limpr. **LC**
Plagiothecium denticulatum (Hedw.) Schimp.
var. *denticulatum* **LC**
var. *obtusifolium* (Turner) Moore (*Plagiothecium donnianum* (Sm.) Mitt.) **VU** [B2ab(iii); C1; D]
var. *undulatum* R. Ruthe ex Geh. (*Plagiothecium ruthei* Limpr.) **LC-att**
Plagiothecium laetum Schimp. **LC**
Plagiothecium latebricola Schimp. **VU** [B2ab(iv, v); D1]
Plagiothecium neckeroideum Schimp. **EN** [B2ab(iii)]
Plagiothecium nemorale (Mitt.) A. Jaeger **LC**
Plagiothecium platyphyllum Mönk. **LC-att**
Plagiothecium succulentum (Wilson) Lindb. **LC**
Plagiothecium undulatum (Hedw.) Schimp. **LC**
Plasteurhynchium striatulum (Spruce) M. Fleisch. (*Eurhynchium striatulum* (Spruce) Schimp.) **LC-att**
Platydictya jungermannioides (Brid.) H. A. Crum **CR** [B1+2ab(iii, v); C2a(i, ii)]
Platygyrium repens (Brid.) Schimp. **LC**
⇒ *Platyhypnidium* – see under *Rhynchostegium*
Pleuridium acuminatum Lindb. **LC-att**
Pleuridium subulatum (Hedw.) Rabenh. **LC**
⇒ *Pleurochaete* – see under *Tortella*
Pleurozium schreberi (Willd. ex Brid.) Mitt. **LC**
Pogonatum aloides (Hedw.) P. Beauv. **LC**

Pogonatum nanum (Hedw.) P. Beauv. **VU** [C2a(i)]
Pogonatum urnigerum (Hedw.) P. Beauv. **LC**
Pohlia andalusica (Höhn.) Broth. **LC-att**
Pohlia annotina (Hedw.) Lindb. **LC**
Pohlia bulbifera (Warnst.) Warnst. **LC**
Pohlia camptotrachela (Renauld et Card.) Broth. **LC-att**
Pohlia cruda (Hedw.) Lindb. **LC**
Pohlia drummondii (Müll. Hal.) A. L. Andrews **LC**
Pohlia elongata Hedw. **LC-att** – only in var. *elongata*
Pohlia filum (Schimp.) Mårtensson **VU** [D2]
Pohlia lescuriana (Sull.) Ochi **LC-att**
Pohlia longicolla (Hedw.) Lindb. (‘*longicollis*’ auct.) **EN** [B2ab(iii, iv, v); C2a(i); D1]
Pohlia ludwigii (Spreng. ex Schwägr.) Broth. **VU** [B1+2ab(iii, iv, v); D2]
Pohlia lutescens (Limpr.) H. Lindb. **DD**
Pohlia melanodon (Brid.) A. J. Shaw **VU** [B2ab(iii, iv, v); C2a(i)]
Pohlia nutans (Hedw.) Lindb.
subsp. *nutans* **LC**
subsp. *schimperi* (Müll. Hal.) Nyholm **LR-nt** [D2]
Pohlia obtusifolia (Vill. ex Brid.) L. F. Koch **RE**
Pohlia proligera (Kindb.) Lindb. ex Broth. **LC**
Pohlia tundrae A. J. Shaw **CR** [B1+2ab(iii, v); C2a(i, ii)] (annot. **36**)
Pohlia wahlenbergii (F. Weber et D. Mohr) A. L. Andrews **LC** (annot. **37**)
⇒ *Polytrichastrum* p. pte. – see under *Polytrichum* (annot. **38**)
Polytrichastrum alpinum (Hedw.) G. L. Sm. **LC**
Polytrichastrum sexangulare (Flörke ex Brid.) G. L. Sm. **RE**
Polytrichum commune Hedw. **LC**
Polytrichum formosum Hedw. (*Polytrichastrum formosum* (Hedw.) G. L. Sm.) **LC**
Polytrichum juniperinum Hedw. **LC**
Polytrichum longisetum Sw. ex Brid. (*Polytrichastrum longisetum* (Sw. ex Brid.) G. L. Sm.) **LC**
Polytrichum pallidisetum Funck (*Polytrichastrum pallidisetum* (Funck) G. L. Sm.) **LC-att**
Polytrichum perigoniale Michx. **LC**
Polytrichum piliferum Hedw. **LC**
Polytrichum strictum Menzies ex Brid. **LC**
Polytrichum uliginosum (Wallr.) Schriebl **LC-att** (annot. **39**)
Pottiopsis caespitosa (Bruch ex Brid.) Blockeel et A. J. E. Sm. (*Trichostomum caespitosum* (Bruch ex Brid.) Jur., *Trichostomum pallidisetum* H. Müll., *Trichostomum triumphans* De Not.) **CR** [B1+2ab(iii, v); C2a(ii)] (annot. **40**)
⇒ *Protobryum* – see under *Tortula*
Pseudephemerum nitidum (Hedw.) Loeske **LC**
Pseudoamblystegium subtile (Hedw.) Vanderp. et Hedenäs (*Serpoleskea subtilis* (Hedw.) Loeske, *Amblystegium subtile* (Hedw.) Schimp.) **LC-att** (annot. **41**)
Pseudobryum cinclidioides (Huebener) T. J. Kop. **EN** [B2ab(iii, iv, v); C2a(i)]
⇒ *Pseudocalliergon* – see under *Drepanocladus*
Pseudocampylium radicale (P. Beauv.) Vanderp. et Hedenäs (*Amblystegium radicale* (P. Beauv.) Schimp.) **LC-att** (annot. **42**)
Pseudocrossidium hornschuchianum (Schultz) R. H. Zander **LC**
Pseudocrossidium revolutum (Brid.) R. H. Zander **EN** [B2ab(iii); C2a(i)]
⇒ *Pseudoleskea* – see under *Lescuraea*
Pseudoleskeella catenulata (Brid. ex Schrad.) Kindb. **LC**
Pseudoleskeella nervosa (Brid.) Nyholm **LC**
Pseudoleskeella rupestris (Berggr.) Hedenäs et L. Söderström **VU** [D2]
Pseudoleskeella tectorum (Funck ex Brid.) Kindb. ex Broth. **CR** [C2a(i)]
Pseudoscleropodium purum (Hedw.) M. Fleisch. (*Scleropodium purum* (Hedw.) Limpr.) **LC**
Pseudotaxiphyllum elegans (Brid.) Z. Iwats. **LC**
Pterigynandrum filiforme Hedw. **LC**
Pterygoneurum lamellatum (Lindb.) Jur. **EN** [B1+2ab(iii)]
Pterygoneurum ovatum (Hedw.) Dixon **LC**

Pterygoneurum subsessile (Brid.) Jur. **VU** [B1+2ab(iii)]
Ptilium crista-castrensis (Hedw.) De Not. **LC-att**
⇒ *Ptychodium* – see under *Lescuraea*
Ptychomitrium polyphyllum (Sw.) Bruch et Schimp. **RE**
Pylaisia polyantha (Hedw.) Schimp. **LC**
Pyramidula tetragona (Brid.) Brid. **CR** [B1+2ab(iii)c(iii, iv)]
Racomitrium aciculare (Hedw.) Brid. **LC**
Racomitrium affine (Schleich. ex F. Weber et D. Mohr) Lindb. **LC-att**
Racomitrium aquaticum (Brid. ex Schrad.) Brid. **LC**
Racomitrium canescens (Hedw.) Brid. **LC** – only in subsp. *canescens*
Racomitrium elongatum Ehrh. ex Frisvoll **LC**
Racomitrium fasciculare (Hedw.) Brid. **LC**
Racomitrium heterostichum (Hedw.) Brid. **LC**
Racomitrium lanuginosum (Hedw.) Brid. **LC**
Racomitrium macounii Kindb.
subsp. *macounii* **EN** [B1+2ab(iii), C2a(i)]
subsp. *alpinum* (E. Lawton) Frisvoll **LC**
Racomitrium microcarpon (Hedw.) Brid. **LC**
Racomitrium sudeticum (Funck) Bruch et Schimp. **LC**
Rhabdoweisia crenulata (Mitt.) H. Jameson **EN** [B1+2ab(v)]
Rhabdoweisia crispata (Dicks.) Lindb. **LR-nt** [C2a(i)]
Rhabdoweisia fugax (Hedw.) Bruch et Schimp. **LC**
Rhizomnium magnifolium (Horik.) T. J. Kop. **LC-att**
Rhizomnium pseudopunctatum (Bruch et Schimp.) T. J. Kop. **EN** [B2ab(iii); C2a(i)]
Rhizomnium punctatum (Hedw.) T. J. Kop. **LC**
Rhodobryum ontariense (Kindb.) Kindb. **LC-att**
Rhodobryum roseum (Hedw.) Limpr. **LC**
⇒ *Rhynchostegiella* p. pte. – see under *Brachythecium* (annot. **11**)
Rhynchostegiella tenella (Dicks.) Limpr. **LR-nt** [C2a(i)] – only in var. *tenella*
Rhynchostegiella teneriffae (Mont.) Dirkse et Bouman **EN** [B2ab(iii, v)]
Rhynchostegium confertum (Dicks.) Schimp. **LC-att**
Rhynchostegium megapolitanum (Blandow ex F. Weber et D. Mohr) Schimp. **VU** [C2a(i)] (annot. **42**)
Rhynchostegium murale (Hedw.) Schimp. **LC**
Rhynchostegium riparioides (Hedw.) Cardot (*Platyhypnidium riparioides* (Hedw.) Dixon) **LC**
Rhynchostegium rotundifolium (Scop. ex Brid.) Schimp. **EN** [B2ab(iii, v); C2a(i)]
Rhytidiadelphus loreus (Hedw.) Warnst. (*Rhytidiastrum loreum* (Hedw.) Ignatov et Ignatova) **LC** (annot. **43**)
Rhytidiadelphus squarrosus (Hedw.) Warnst. (*Rhytidiastrum squarrosum* (Hedw.) Ignatov et Ignatova) **LC**
Rhytidiadelphus subpinnatus (Lindb.) T. J. Kop. (*Rhytidiastrum subpinnatum* (Lindb.) Ignatov et Ignatova) **LC-att**
Rhytidiadelphus triquetrus (Hedw.) Warnst. **LC**
Rhytidium rugosum (Hedw.) Kindb. **LC**
Saelania glaucescens (Hedw.) Broth. **EN** [B2ab(iii, v); C2a(i)]
Sanionia uncinata (Hedw.) Loeske **LC**
Sarmentypnum exannulatum (Schimp.) Hedenäs (*Warnstorfia exannulata* (Schimp.) Loeske) **LC**
Sarmentypnum sarmentosum (Wahlenb.) Tuom. et T. J. Kop. (*Warnstorfia sarmentosa* (Wahlenb.) Hedenäs) **LR-nt** [D2]
Schistidium apocarpum (Hedw.) Bruch et Schimp. **LC**
Schistidium brunnescens Limpr. **LC** – only in subsp. *brunnescens*
Schistidium confertum (Funck) Bruch et Schimp. **VU** [D2]
Schistidium confusum H. H. Blom **LC-att**
Schistidium crassipilum H. H. Blom **LC**
Schistidium dupretii (Thér.) W. A. Weber **LC**
Schistidium elegantulum H. H. Blom **LC-att** – only in subsp. *elegantulum*
Schistidium flaccidum (De Not.) Ochyra **EN** [B2ab(iii, v)]
Schistidium helveticum (Schkuhr) Deguchi (*Schistidium singarense* (Schiffn.) Laz.) **LC-att**
Schistidium lancifolium (Kindb.) H. H. Blom **LC-att**
Schistidium papillosum Culm. **LC**
Schistidium pruinosum (Wilson ex Schimp.) G. Roth **LC-att**

Schistidium rivulare (Brid.) Podp. **LC-att**
Schistidium robustum (Nees et Hornsch.) H. H. Blom **LC**
Schistidium trichodon (Brid.) Poelt
var. *trichodon* **LC-att**
var. *nutans* H. H. Blom **LC-att**
Schistostega pennata (Hedw.) F. Weber et D. Mohr **LC**
Sciuro-hypnum curtum (Lindb.) Ignatov (*Brachythecium curtum* (Lindb.) Limpr.) **LC** (annot. **44**)
Sciuro-hypnum flotowianum (Sendtn.) Ignatov et Huttunen (*Eurhynchium flotowianum* (Sendtn.) Kartt.) **DD**
Sciuro-hypnum plumosum (Hedw.) Ignatov et Huttunen (*Brachythecium plumosum* (Hedw.) Schimp.) **LC**
Sciuro-hypnum populeum (Hedw.) Ignatov et Huttunen (*Brachythecium populeum* (Hedw.) Schimp.) **LC**
Sciuro-hypnum reflexum (Starke) Ignatov et Huttunen (*Brachythecium reflexum* (Starke) Schimp.) **LC**
Sciuro-hypnum starkii (Brid.) Ignatov et Huttunen (*Brachythecium starkii* (Brid.) Schimp.) ('*starkei*' auct.) **LC**
⇒ *Scleropodium* p. pte. – see under *Pseudoscleropodium*
Scorpidium cossonii (Schimp.) Hedenäs **LR-nt** [C2a(i)]
Scorpidium revolvens (Sw. ex Anon.) Hedenäs **EN** [B2ab(iii, v)]
Scorpidium scorpioides (Hedw.) Limpr. **EN** [B2ab(iii, iv); C2a(i)]
Seligeria acutifolia Lindb. **VU** [C2a(i); D2]
Seligeria calcarea (Hedw.) Bruch et Schimp. **EN** [B2ab(iii, iv)]
Seligeria campylopoda Kindb. **VU** [B2ab(iii, iv, v); C2a(i)]
Seligeria donniana (Sm.) Müll. Hal. **LC**
Seligeria patula (Lindb.) I. Hagen **DD-va**
Seligeria pusilla (Hedw.) Bruch et Schimp. **VU** [C2a(i)]
Seligeria recurvata (Hedw.) Bruch et Schimp. **LC**
⇒ *Serpoleskea* p. pte. – see under *Pseudoamblystegium*
Serpoleskea confervoides (Brid.) Loeske (*Amblystegium confervoides* (Brid.) Schimp.) **LC-att**
Sphagnum affine Renauld et Cardot **VU** [B2ab(iii, iv, v)]
Sphagnum angustifolium (C. E. O. Jensen ex Russow) C. E. O. Jensen **LC-att**
Sphagnum auriculatum Schimp. (*Sphagnum denticulatum* Brid.) **LC**
Sphagnum austinii Sull. ex Austin **RE**
Sphagnum balticum (Russow) Russow ex C. E. O. Jensen **LC-att**
Sphagnum capillifolium (Ehrh.) Hedw. **LC**
Sphagnum centrale C. E. O. Jensen **LC-att**
Sphagnum compactum Lam. et DC. **LC**
Sphagnum contortum Schultz **LR-nt** [B2ab(iii); C1]
Sphagnum cuspidatum Ehrh. ex Hoffm. **LC**
Sphagnum fallax (H. Klinggr.) H. Klinggr. (incl. *Sphagnum brevifolium* (Lindb. ex Braithw.) Röll) **LC**
Sphagnum fimbriatum Wilson **LC** – only in subsp. *fimbriatum*
Sphagnum flexuosum Dozy et Molk. **LC**
Sphagnum fuscum (Schimp.) H. Klinggr. **LR-nt** [A2(a); B2ab(iv)]
Sphagnum girgensohnii Russow **LC**
Sphagnum inundatum Russow **DD** (annot. **45**)
Sphagnum lindbergii Schimp. **LC**
Sphagnum magellanicum Brid. **LC**
Sphagnum majus (Russow) C. E. O. Jensen **LC** – only in subsp. *majus*
Sphagnum molle Sull. **RE**
Sphagnum obtusum Warnst. **LR-nt** [B2ab(iii); C1]
Sphagnum palustre L. **LC**
Sphagnum papillosum Lindb. **LC**
Sphagnum platyphyllum (Lindb. ex Braithw.) Sull. ex Warnst. **CR** [B1+2ab(iii, v); C2a(i, ii); D1]
Sphagnum quinquefarium (Lindb. ex Braithw.) Warnst. **LC**
Sphagnum riparium Ångstr. **LC**
Sphagnum rubellum Wilson **LC**
Sphagnum russowii Warnst. **LC**
Sphagnum squarrosum Crome **LC**
Sphagnum subnitens Russow et Warnst. **LC-att** – only in subsp. *subnitens*
Sphagnum subsecundum Nees **LC**
Sphagnum tenellum (Brid.) Pers. ex Brid. **LC**

Sphagnum teres (Schimp.) Ångstr. **LC**
Sphagnum warnstorfii Russow **LC-att**
Splachnum ampullaceum Hedw. **LR-nt** [C2a(i)]
Splachnum sphaericum Hedw. **LR-nt** [C2a(i)]
Stegonia latifolia (Schwägr.) Venturi ex Broth. **RE**
Straminergon stramineum (Dicks. ex Brid.) Hedenäs **LC**
Streblotrichum commutatum (Jur.) Hilp. (*Barbula commutata* Jur., *Barbula convoluta* var. *sardoa* Schimp.) **DD** (annot. **9**, **46**)
Streblotrichum convolutum (Hedw.) P. Beauv. (*Barbula convoluta* Hedw.) **LC**
Streblotrichum enderesii (Garov.) Loeske (*Barbula enderesii* Garov.) **RE**
Syntrichia calcicola J. J. Amann **LC**
Syntrichia caninervis Mitt. **DD-va** – only in var. *gypsophila* (J. J. Amann ex G. Roth) Ochyra (*Syntrichia caninervis* var. *spuria* (J. J. Amann) R. H. Zander)
Syntrichia fragilis (Taylor) Ochyra **CR** [B1+2ab(iii)] (annot. **47**)
Syntrichia laevipila Brid. **DD-va**
Syntrichia latifolia (Bruch ex Hartm.) Huebener **LR-nt** [B2ab(iii)]
Syntrichia montana Nees (*Syntrichia intermedia* Brid.) **LC**
Syntrichia norvegica F. Weber **CR** [C2a(i)]
Syntrichia papillosa (Wilson) Jur. **LC**
Syntrichia ruralis (Hedw.) F. Weber et D. Mohr (*Syntrichia densa* (Velen.) J.-P. Frahm)
var. *ruralis* **LC**
var. *ruraliformis* (Besch.) Delogne (*Syntrichia ruraliformis* (Besch.) Cardot) **LC-att**
Syntrichia virescens (De Not.) Ochyra **LC**
Taxiphyllum wissgrillii (Garov.) Wijk et Margad. **LC**
Tayloria serrata (Hedw.) Bruch et Schimp. **EN** [B2ab(iii, iv, v)]
Tayloria splachnoides (Schleich. ex Schwägr.) Hook. **RE**
Tayloria tenuis (Dicks.) Schimp. **EN** [B2ab(iii, iv, v)]
Tetraphis pellucida Hedw. **LC**
Tetraplodon angustatus (Hedw.) Bruch et Schimp. **VU** [C2a(i); D2]
Tetraplodon mnioides (Hedw.) Bruch et Schimp. **VU** [C2a(i); D2]
Tetrodontium brownianum (Dicks.) Schwägr. **LR-nt** [C2a(i); D2]
Tetrodontium ovatum (Funck) Schwägr. **DD**
Tetrodontium repandum (Funck) Schwägr. **LR-nt** [C2a(i)]
Thamnobryum alopecurum (Hedw.) Gangulee **LC**
Thamnobryum neckeroides (Hook.) E. Lawton **EN** [B1+2ab(iii, v)]
⇒ *Thuidium* p. pte. – see under *Abietinella*
Thuidium assimile (Mitt.) A. Jaeger (*Thuidium philibertii* Limpr.) **LC**
Thuidium delicatulum (Hedw.) Schimp. **LC-att**
Thuidium recognitum (Hedw.) Lindb. **LC**
Thuidium tamariscinum (Hedw.) Schimp. **LC**
Timmia austriaca Hedw. **RE**
Timmia bavarica Hessl. **EN** [B2ab(iii, iv, v); C2a(i)]
Tomentypnum nitens (Hedw.) Loeske **LR-nt** [C1+C2a(i)]
Tortella bambergeri (Schimp.) Broth. **LC**
Tortella inclinata (R. Hedw.) Limpr. **LC** (annot. **48**)
Tortella squarrosa (Brid.) Limpr. (*Pleurochaete squarrosa* (Brid.) Lindb.) **LR-nt** [C1] (annot. **49**)
Tortella tortuosa (Hedw.) Limpr. (incl. var. *fragilifolia* (Jur.) Limpr.) **LC**
Tortula acaulon (With.) R. H. Zander (*Phascum cuspidatum* Hedw.)
var. *acaulon* **LC**
var. *pilifera* (Hedw.) R. H. Zander (*Phascum cuspidatum* var. *piliferum* (Hedw.) Hook. et Taylor) **LC**
Tortula atrovirens (Sm.) Lindb. **CR** [B1+2ab(v)]
Tortula caucasica Lindb. ex Broth. (*Tortula modica* R. H. Zander, *Pottia intermedia* (Turner) Fürnr.) **LC**
Tortula cernua (Huebener) Lindb. (*Desmatodon cernuus* (Huebener) Bruch et Schimp.) **RE**
Tortula hoppeana (Schultz) Ochyra (*Tortula euryphylla* R. H. Zander, *Desmatodon latifolius* (Hedw.) Brid.) **EN** [B2ab(iii, iv, v); C2a(i)] (annot. **50**)
Tortula inermis (Brid.) Mont. **CR** [B1+2ab(iii, v); C2a(i)]
Tortula lindbergii Kindb. ex Broth. (*Tortula lanceola* R. H. Zander, *Pottia lanceolata* (Hedw.) Müll. Hal.) **LC**

Tortula lingulata Lindb. **CR** [B1+2ab(iii, v); C2a(i, ii)] (annot. **51**)
Tortula mucronifolia Schwägr. **CR** [B1+2ab(iii, v); C2a(i, ii)]
Tortula muralis Hedw.
subsp. *muralis* var. *muralis* **LC**
subsp. *muralis* var. *aestiva* Hedw. **LC**
Tortula protobryoides R. H. Zander (*Protobryum bryoides* (Dicks.) J. Guerra et M. J. Cano, *Pottia bryoides* (Dicks.) Mitt.) **LC-att**
Tortula schimperi M. J. Cano, O. Werner et J. Guerra (*Tortula subulata* var. *angustata* (Schimp.) Limpr.) **DD** (annot. **52**)
Tortula subulata Hedw. **LC**
Tortula truncata (Hedw.) Mitt. (*Pottia truncata* (Hedw.) Bruch et Schimp.) **LC**
Trematodon ambiguus (Hedw.) Hornsch. **CR** [B1+2ab(iii, v)]
Trichodon cylindricus (Hedw.) Schimp. **LC**
⇒ *Trichostomum* p. pte. – see under *Oxystegus* and *Pottiopsis*
Trichostomum brachydontium Bruch **DD-va**
Trichostomum crispulum Bruch
var. *crispulum* **LC-att**
var. *angustifolium* Bruch et Schimp. (*Trichostomum viridulum* Bruch) **LC-att** (annot. **53**)
Ulota bruchii Hornsch. ex Brid. **LC**
Ulota coarctata (P. Beauv.) Hammar **CR** [B2ab(iv, v); C2a(i)]
Ulota crispa (Hedw.) Brid. **LC**
Ulota drummondii (Hook. et Grev.) Brid. **RE**
Ulota hutchinsiae (Sm.) Hammar **EN** [B2ab(iii); C2a(i); D1]
⇒ *Warnstorfia* p. pte. – see under *Sarmentypnum*
Warnstorfia fluitans (Hedw.) Loeske **LC**
Warnstorfia pseudostraminea (Müll. Hal.) Tuom. et T. J. Kop. **EN** [C2a(i)]
Weissia brachycarpa (Nees et Hornsch.) Jur. **LC**
Weissia condensa (Voit) Lindb. **LC** – only in var. *condensa*
Weissia controversa Hedw. (incl. var. *densifolia* (Bruch et Schimp.) Wilson) **LC**
Weissia fallax Sehlm. (*Weissia controversa* var. *crispata* (Nees et Hornsch.) Nyholm) **LC-att**
Weissia longifolia Mitt. **LC**
Weissia rostellata (Brid.) Lindb. **DD-va**
Weissia rutilans (Hedw.) Lindb. **EN** [B2ab(iv, v); C2a(i)]
Weissia squarrosa (Nees et Hornsch.) Müll. Hal. **VU** [B2ab(iv, v)]
Weissia wimmeriana (Sendtn.) Bruch et Schimp. (*Weissia controversa* var. *wimmeriana* (Sendtn.) Blockeel et A. J. E. Sm.) **VU** [D2]
Zygodon dentatus (Limpr.) Kartt. **LR-nt** [D2]
Zygodon rupestris Schimp. ex Lorentz **LR-nt** [D2]
Zygodon viridissimus (Dicks.) Brid. **EN** [B2ab(v); C2a(i)]

(b) Doubtful, uncertain and excluded taxa (not evaluated for the Red List)

(i) Doubtful taxonomic status

In addition to *Andreaea alpestris* (Thed.) Schimp., *Bryum dunense* A. J. E. Sm. et H. Whitehouse, *Bryum stirtonii* Schimp., listed, commented on and placed in this category by Kučera & Váňa (2003) and *Bryum badium* (Bruch ex Brid.) Schimp., which was appended in the Erratum part of the list (Preslia 75: 384), following additional taxa need to be taxonomically studied before they can be accepted for inclusion in the checklist:

Metzgeria simplex Lorb. ex Müll. Frib. – this taxon was defined based on the haploid chromosome number (n = 9) and its slightly smaller thallus cells, as opposed to its diploid counterpart (n = 18) *M. conjugata*. Schumacker & Váňa (2005) regard *M. simplex* as conspecific with the Asian-American *M. lindbergii* Schiffn., which needs to be confirmed, and hesitate to distinguish this taxon from *M. conjugata*. Cytometric screening combined with a morphometric evaluation is necessary to ascertain the value of this taxon.

Porella ×*baueri* (Schiffn.) C. E. O. Jensen – this taxon is now thought to be an allopolyploid hybrid of *P. platyphylla* and *P. cordaeana* (Boisselier-Dubayle et al. 1998, Heinrichs et al. 2011). As the reported morphological differences between *P. platyphylla* and *P.* ×*baueri* do not hold for a considerable proportion of our material, the nothotaxon cannot be safely recognized at present and virtually nothing is known about the extent of hybridization between the parental taxa and the occurrence and morphology of hybridogeneous populations.

Riccia gougetiana Durieu et Mont. – this taxon should differ from *R. ciliifera* in its larger dimensions and other essentially quantitative characteristics (with some overlap) despite the same reported chromosome number (n = 8, rarely n = 16). Nevertheless, we discovered only diploid plants (n ≈ 16) during a limited cytometric screening of southern-Moravian populations of *R. ciliifera* s.l. with an intermediate morphology between *R. ciliifera* and *R. gougetiana*. The extent of polyploidization and the morphometric differences between populations need to be evaluated before applying these names to these populations.

Bryum barnesii J. B. Wood ex Schimp. – recent authors differ in their opinion on the value of this taxonomically doubtful species of the *B. dichotomum* complex; while Vanderpoorten & Zartman (2002) and Müller (2004) accept it, the monographer of the genus (Holyoak 2003) is sceptical about its value. Plants corresponding to the description were twice recently reported from the Czech Republic (Kučera et al. 2005, Kučera 2009a).

Platyhypnidium grolleanum Ochyra et Bednarek-Ochyra – a doubtful aquatic taxon described from one historical specimen, based on its multistratose leaves. As recent searches for this plant at the type locality all proved futile, the taxon can probably best be interpreted as a rare mutation of the common *Rhynchostegium riparioides*, as is the case of *Platyhypnidium mutatum* Ochyra et Vanderp. and other pleurocarpous mosses, which develop pluristratose laminae in rheophytic habitats.

(ii) Doubtful or uncertain occurrence

Fossombronia caespitiformis De Not. ex Rabenh., *Riccia beyrichiana* Hampe ex Lehm., *Bryum arcticum* (R. Br.) Bruch et Schimp., *Bryum knowltonii* Barnes, *Bryum warneum* (Röhl.) Blandow ex Brid., *Ceratodon conicus* (Hampe) Lindb., *Cinclidium stygium* Sw., *Cnestrum schisti* (F. Weber et D. Mohr) I. Hagen, *Cynodontium fallax* Limpr., *Cyrtomnium hymenophylloides* (Huebener) T. J. Kop., *Dichodontium flavescens* (Dicks.) Lindb., *Grimmia decipiens* (Schultz) Lindb., *Hypnum cupressiforme* var. *resupinatum* (Taylor) Schimp., *Mnium blyttii* Bruch et Schimp., *Pelekium minutulum* (Hedw.) Touw (*Cyrto-hypnum minutulum* (Hedw.) W. R. Buck et H. A. Crum), *Pohlia sphagnicola* (Bruch et Schimp.) Broth., *Racomitrium ericoides* (Brid.) Brid. and *Syntrichia sinensis* (Müll. Hal.) Ochyra. were included in previous checklists (Kučera & Váňa 2003, 2005) among the taxa for which the historically reported occurrence is regarded as possible but not supported by a correctly identified herbarium specimen. *Microlejeunea ulicina*, *Scapania apiculata*, *Entosthodon pulchellus*, *Orthotrichum tenellum*, *Paraleucobryum sauteri* and *Rhynchostegium megapolitanum* have since been recorded in the Czech Republic (see above). In addition to the preceding species the following taxa are now regarded to be of uncertain occurrence:

Moerckia hibernica (Hook.) Gottsche – as discussed in annotation, we did not find this species among the specimens labelled with this name, after the understanding of this taxon changed following the study by Crandall-Stotler & Stotler (2007). An historical or even recent occurrence of *M. hibernica* is nevertheless possible.

Tortula muralis subsp. *obtusifolia* (Schwägr.) Culm. – its taxonomic status was clarified by Košnar & Kolář (2009) and Košnar et al. (2012). Although the historical occurrence on base-rich sandstones near Kralupy nad Vltavou, reported by Velenovský (1897), is probable, there are no specimens of this species in Czech herbaria. The specimens from the Český kras karst region belong to *T. muralis* var. *aestiva*.

(iii) Newly excluded taxa

Aschisma carniolicum (F. Weber et D. Mohr) Lindb. – reported from nearby Prague by Opiz (1852). Matouschek (1908) published the results of a revision of Opiz's specimens in PR, however the specimen of *A. carniolicum* was not found. We agree with Matouschek's judgment on the probable misidentification of this species based on the distribution pattern of this Mediterranean species.

Tayloria froelichiana (Hedw.) Mitt. ex Broth. – this species was also reported by Opiz (1852) without a particular locality. Matouschek (1906) did not find the original specimen and probably therefore excluded it as subsequently he did not mention this species again. Based on the distribution pattern of this species its occurrence in the Czech Republic is indeed highly improbable.

For information on 42 earlier excluded taxa see Kučera & Váňa (2003).

Annotations:

1 *Aneura maxima* was recently discovered in southern Bohemia by Kučera (2004) and reported at other localities since.

2 Buczkowska et al. (2012) recently published a paper, in which two genetically distinct taxa are recognized within *C. sphagnicola*. While the type corresponds to the haploid taxon and has a markedly northern distribution pattern in Poland (the specimens from outside Poland have not been studied), the diploid (allopolyploid)

taxon, which is called *C. sphagnicola* f. *paludosa* (Warnst.) R. M. Schust. by these authors, which very probably occurs in the Czech Republic, only doubtfully corresponds to Warnstorf's type, and hence its name is uncertain. There is a similar situation with morphologically cryptic or nearly cryptic taxa *Calypogeia muelleriana* (Buczkowska & Bączkiewicz 2011) and *C. fissa* (Buczkowska 2004).

3 The broad concept of *Chiloscyphus* has been advocated in recent molecular studies (He-Nygrén & Piippo 2003, Hentschel et al. 2006a, b), although the subgenus *Lophocolea* is still one of the resonably supported clades, closely related to subg. *Chiloscyphus*. Molecular data also seem to support the specific status of *C. pallescens* (cf. Hentschel et al. 2006b) and *C. cuspidatus* (cf. Hentschel et al. 2007), although the difference in their sexuality probably cannot serve as the sole differentiating character; this was noted by Damsholt (2010), who reported annual variation in sex expression with antheridia and perianths present at different times of the year, and Vogelpoel (1982), who manipulated the sex expression frequency, abundance and vitality of the gametangia by varying day length and light intensity). The application of names within *C. coadunatus* s.l. follows Váňa & Engel (2012), who found the type of *C. coadunatus* to be probably dioicous (containing only female plants), while the type of *Jungermannia bidentata* L. was found to be monoicous (Vogelpoel 1977), contrary to the treatment of Damsholt (2002).

4 *Conocephalum salebrosum* is a newly distinguished taxon (Szweykowski et al. 2005) that occurs widely in the Czech Republic.

5 The identity of *L. guttulata* and *L. longiflora* was recently doubted or rejected by several authors, including the monographer of the genus, V. Bakalin (Bakalin 2001, 2011), hence our acceptance of *L. guttulata* in place of the plant we earlier named *L. longiflora*. Hygric forms of *L. ventricosa* (and possibly also of other closely related taxa including *L. ventricosa* var. *silvicola* and *L. guttulata*) were identified with the types of *L. ventricosa* var. *uliginosa* Breidl. ex Schiffn. (Damsholt 2002) or of *Jungermannia longiflora* Nees. Bakalin (2011), who lists *L. ventricosa* var. *longiflora* (Nees) Macoun does not mention var. *uliginosa* at all). A wide ranging study using molecular markers is needed to resolve this problem.

6 First proven occurrence of *Microlejeunea ulicina* in the Czech Republic was only recently reported (Kučera & Váňa 2011).

7 The distinctness of *Moerckia flotoviana* from *M. hibernica* is discussed and advocated by Crandall-Stotler & Stotler (2007). The two names were commonly misapplied, which was also the case in the earlier identifications in the Czech Republic. The recent and historical collections of material that have been revised belong to *M. flotoviana*, which seems to be generally much commoner than *M. hibernica,* but not all historical collections have been revised.

8 Hugonnot (2010) recently argued for the synonymy of *R. ciliata*, *R. trichocarpa* M. Howe and *R. canescens* Steph., whereas Jovet-Ast (1986) and Schumacker & Váňa (2005) advocate the distinctness of *R. trichocarpa* (syn. *R. canescens*), the latter treatment even synonymized the latter with an older name *R. crinita* Taylor, based on an Australian type.

9 *Scapania apiculata* was listed as of uncertain occurrence in the previous version. Since then it has been twice recorded in the Moravskoslezské Beskydy Mts.

10 Köckinger & Kučera (2011) showed that two of the *Barbula* sect. *Convolutae* Bruch & Schimp. species (*B. convoluta* and *B. commutata*) are phylogenetically very distant from the generitype of *Barbula*, *B. unguiculata*. Hence, their recognition within an earlier recognized genus, *Streblotrichum* P. Beauv. (generitype *S. convolutum*) is appropriate. *Barbula crocea* was also assigned to *Streblotrichum* by older authors including Pilous & Duda (1960) but it has closer genetic affinities with *Hydrogonium* (Müll. Hal.) A. Jaeger (Kučera et al. in prep.).

11 Phylogenetic affinities of this taxon, which is included in the European checklist (Hill et al. 2006) and our previous checklists as *Rhynchostegiella tenuicaulis*, is controversial. While Ignatov & Huttunen (2002) doubt its inclusion in *Brachytheciaceae*, Nebel & Philippi (2001) provide strong arguments that it is only a habitat form of *Brachythecium tommasinii*. Unfortunately, the recent molecular-phylogenetic studies of *Brachytheciaceae* (Huttunen & Ignatov 2004) and *Rhynchostegiella* (Aigoin et al. 2009) do not include this puzzling taxon. We obtained ITS sequences for one specimen of the typical *Brachythecium tommasinii* (JQ814782) that was growing on shaded limestone rocks in the Czech Republic and for one *Rhynchostegiella tenuicaulis* (JQ814783) growing on the bark of *Fagus* at the only Czech locality for this species. These sequences indeed are nearly identical and allow the evaluation as closely related taxa within one genus. For future reference, we prefer to retain the varietal status of the disputed taxon within *B. tommasinii*. The type of *Eurhynchium vaucheri var. fagineum* was studied by Nebel et al. (l.c.) and these authors confirm Limpricht's earlier opinion that it is identical to the type of *Eurhynchium germanicum* Grebe. With respect to the identity of the types of *Eurhynchium germanicum* and *Hypnum tenuicaule* Spruce from the French Pyrenees we refer to the treatment of Karttunen (1990).

12 Ochyra & Bednarek-Ochyra (2011) recently provided arguments for replacing the name *Bryum pallescens* Schleich. ex Schwägr. with the older name *B. boreale* (F. Weber et D. Mohr) Funck.

13 *Bryum gemmiferum* was first reported from the Czech Republic by Soldán & Kučera (2004) but further records continue to be added.

14 Holyoak & Hedenäs (2006) demonstrate the morphological intergradation between *Bryum pseudotriquetrum* var. *pseudotriquetrum* and var. *neodamense* and non-monophyly of the latter taxon.

15 Based on an unpublished revision of JK's collections by O. M. Afonina, the Czech collections of '*Campylidium sommerfeltii*' probably represent a different taxon, closely related to *Hypnum pallescens*. '*C. sommerfeltii*' has been distinguished in the Czech Republic only in recent decades, previous authors confused or merged this taxon with *C. calcareum* and the North American *C. hispidulum*. A revision of this complex is badly needed.

16 *Didymodon umbrosus* was shown to deserve specific status by Jiménez et al. (2005).

17 *Didymodon validus* was recognized as a variety of *D. rigidulus* in our previous checklist and not at all listed by Hill et al. (2006). Later though, Jiménez (2006) and Ochyra et al. (2011) recognized the taxon at the specific level.

18 The taxonomy of *Encalypta rhaptocarpa* agg. is very unsatisfactory. There is not a good match between the development of peristome and other characters of this species mentioned by Horton (1983), Nyholm (1998) and Mogensen (2001), and our application of the name is thus very tentative.

19 Hradílek (2008) clarified the situation with *Entosthodon pulchellus* that was confused with *E. muhlenbergii* in the Czech Republic. Both historical herbarium records and recent collections were cited.

20 We consider that *Fissidens bambergeri* is a good, although only rarely accepted species that cannot be lumped with *F. viridulus*. The distinctness of two Czech and several other central-European populations has been observed for years, although no molecular methods have yet been applied to resolve the genetic background and of course the application of the pattern to existing types may prove problematic.

21 We have applied the name *Fissidens limbatus* only to plants that narrowly correspond to the original description by Sullivant. In this concept, *F. limbatus* is an extremely rare and endangered species in the Czech Republic and should be evaluated similarly to *F. bambergeri*. An eventual broadening of the concept to include *F. crispus* Mont., as understood by Hill et al. (2006), would create problems in delimiting *F. pusillus*, however without an understanding of the underlying genetic pattern the problem cannot be resolved.

22 We are not convinced of the value of infraspecific taxa within *Fontinalis antipyretica*, distinguished pragmatically by Hill et al. (2006). Shaw & Allen (2000) show that the subsp. *gracilis* (Lindb.) Kindb. is paraphyletic and a similar pattern can be expected for other infraspecific taxa. Nevertheless, both the subsp. *gracilis* and subsp. *kindbergii* (Renauld et Cardot) Cardot are reported in the Czech Republic but the underlying genetic differences have never been studied.

23 *Grimmia dissimulata* was newly reported for this country by Kučera (in Ellis et al. 2010).

24 We agree with the authors of the European checklist that the radical treatment of Vanderpoorten (2004), which merged all European species of *Hygroamblystegium* with *H. varium*, needs to be supported by a more extensive study. In a later study Vanderpoorten & Hedenäs (2009) admit *H. humile* is a variety of *H. varium* but maintain the full synonymy of *H. fluviatile* and *H. tenax* with *H. varium*, particularly with respect to the situation in North America.

25 *Hypnum cupressiforme* var. *julaceum* Brid., listed in our previous checklists, is not recognized by Hill et al. (2006). As we could only doubtfully identify some of our plants as of this variety, we have not included it in this list.

26 *Hypnum cupressiforme* var. *heseleri* was recently detected at one locality in southern Moravia (Košnar & Kučera in prep.).

27 Conflicting evidence was presented by Vanderpoorten et al. (2003) and Frahm (2005) about distiguishing *Leucobryum albidum* (Brid. ex P. Beauv.) Lindb. (which is an older name) from *L. juniperoideum*. Therefore, we pragmatically retain the more narrowly defined concept of both taxa until a more convincing conclusion is reached.

28 *Eurhynchium pumilum* was transferred to a newly established monotypic genus *Microeurhynchium* by Aigoin et al. (2009).

29 Goffinet et al. (2004) and Sawicki et al. (2010) argue for accepting the genus *Nyholmiella* as distinct from *Orthotrichum*. Accepting this probably well-defined lineage however renders the rest of *Orthotrichum* paraphyletic, which will necessitate the recognition of further genera within *Orthotrichum* s.l. in the future.

30 Taxonomy of *Hygrohypnum* s.l. partially settled after Oliván et al. (2007) and Ignatov et al. (2007) reached similar conclusions based on different datasets. The only serious conflict is over *Hygrohypnum duriusculum*, which was resolved within *Hygrohypnella* (sequenced specimen from Caucasus) by Ignatov et al., but within *Ochyraea* (sequenced specimen from Norway) by Oliván et al. Our plants seem to match the concept of Oliván et al., which is supported by the nrITS sequence of one Czech specimen (JQ814784). Nevertheless, we

still have problems differentiating *O. mollis* from the closely related *O. duriuscula*, and therefore cannot at present decide on the possible level of threat to *O. mollis*, although it is probable that the latter is very rare, if it occurs at all, in the Czech Republic.

31 *Orthotrichum affine* var. *bohemicum* was recently described (Plášek et al. 2011) based on material from 3 localities in the Czech Republic.

32 *Orthotrichum moravicum* was described from a single locality in Moravia (Plášek et al. 2009) and no other occurrence has been reported.

33 *Orthotrichum pulchellum* was first reported in the Czech Republic in NW Bohemia by Plášek & Marková (2007) and Plášek & Marková in Blockeel et al. (2008) and seems to be spreading.

34 *Orthotrichum tenellum* was listed among the taxa with unproven occurrence in the Czech Republic in previous versions of the checklist. Recently, this species was found in Northern Bohemia (Plášek & Marková 2011, Plášek & Marková in Ellis et al. 2012).

35 *Paraleucobryum sauteri* was listed previously as another taxon of uncertain occurrence in the Czech Republic. During a revision of selected species from the herbarium of the Museum of Upper Austria (LI), JK found one correctly identified specimen of *P. sauteri*, collected by Cypers in 1877 in the valley of Bílé Labe in Krkonoše Mts.

36 *Pohlia tundrae* was first reported from the Czech Republic by Müller (2004) and is still known only from a single locality.

37 We do not recognize the varieties of *Pohlia wahlenbergii* but should they be distinguished they all occur in the Czech Republic and only var. *glacialis* (Brid.) E. F. Warb. has a limited distribution and could qualify for inclusion on the Red List, probably in category LR-nt (D).

38 Bell & Hyvönen (2010) show that species of *Polytrichastrum* sect. *Aporotheca* (*P. formosum*, *P. longisetum* and *P. pallidisetum*) form with *Polytrichum* s.str a well-supported clade.

39 *Polytrichum uliginosum*, re-established by Schriebl (1991), has only recently been shown to be reproductively isolated from *P. commune* (van der Velde & Bijlsma 2004). Nevertheless, there is little information on its distribution in the Czech Republic and elsewhere.

40 Ros & Werner (2007) re-define the genus *Pottiopsis* based on molecular and morphological data and confirm our earlier suspicion (Kučera & Váňa 2003) that *Trichostomum caespitosum* and *T. pallidisetum* are very closely related, as they regard them as synonymous.

41 Vanderpoorten & Hedenäs (2009) describe new genera, *Pseudoamblystegium* and *Pseudocampylium,* to accommodate the phylogenetically isolated species earlier recognized by us as *Serpoleskea subtilis* and *Amblysteium radicale*, respectively.

42 *Rhynchostegium megapolitanum* was listed among uncertain occurrences in the previous version, but has since been recorded several times (see e.g. Kučera et al. 2006).

43 *Rhytidiadelphus loreus, R. squarrosus* and *R. subpinnatus* are tranferred to a newly established genus *Rhytidiastrum* Ignatov et Ignatova in their treatment of pleurocarpous mosses for the Moss flora of the central part of European Russia (Ignatov & Ignatova 2004). This concept needs to be tested using molecular methods.

44 Ignatov & Milyutina (2007) argued for separating *Sciuro-hypnum oedipodium* from *S. curtum*. European records of *S. oedipodium* refer generally to *S. curtum*. *S. oedipodium* s.str. is primarily a western North American taxon with one known disjuct occurrence in the Caucasus, however our material needs to be completely revised.

45 *Sphagnum inundatum* is a problematical taxon both with respect to its morphological definition and genetic background, which is connected with a complicated polyploid and hybridogenous microspeciation pattern (for a summary, see Shaw et al. 2012). While the North American plants that have '*S. inundatum*-morphology'are considered synonymous with either *S. lescurii* Sull., when haploid or with *S. missouricum* Warnst. & Card., when diploid, this pattern cannot be transferred to the situation in Europe, which has not yet been adequately studied, although the type of *S. inundatum* originates from Europe. The European plants of, *S. inundatum*-morphology'studied are allopolyploids derived from *S. subsecundum* (female parent) and haploid *S. auriculatum* (male parent) (Shaw et al. 2008).

46 *Streblotrichum commutatum* was earlier not distinguished in the Czech Republic but both historical and recent collections were found during a partial revision of our herbaria and a focused field survey (Kučera unpubl.). Nevertheless, this species seems to be relatively rare and the morphological delimitation from *S. convolutum* is not always straightforward, although the molecular differentiation is considerable (Köckinger & Kučera 2011, Kučera et al. in prep.).

47 *Syntrichia fragilis* was recently first discovered at a single locality in central Bohemia (Müller & Kučera in Blockeel et al. 2006).

48 *Tortella densa* (Lorentz et Molendo) Crundw. & Nyholm, which we accept at the specific level, was listed among the excluded species in the last version of the checklist.

49 The genus *Pleurochaete* Lindb. is nested within *Tortella* (Grundmann et al. 2006).

50 Among the varieties that are traditionaly recognized within *Desmatodon latifolius*, var. *muticus* (Brid.) Brid.) seems to represent a distinct taxon, as mixed stands of clearly separable plants matching both varieties were observed in the Czech Republic (Mt Kotel) and in the Alps. However, we refrain at the moment from combining it within *Tortula hoppeana*, before the problem is addressed using molecular methods.

51 Košnar & Kolář (2009) and Košnar et al. (2012) present arguments for accepting *Tortula lingulata* at the specific level, although this taxon is phylogenetically nested within *T. muralis* s.l. and its acceptance renders *T. muralis* paraphyletic in the strictly cladistic view.

52 *Tortula schimperi* represents a taxon that earlier was mostly recognized as a variety of *T. subulata*. According to Cano et al. (2005), it deserves specific status. There is very little known about its distribution in the Czech Republic, but recently two very small populations were recorded at two localities.

53 While Hill et al. (2006) do not recognize var. *angustifolium* as distinct from *Trichostomum crispulum*, central-European authors (Grims 1999, Müller 2004) usually prefer to distinguish it as a distinct variety or even species. The revision of material in Czech herbaria (Kučera unpublished) at first did not reveal a taxon clearly separable from *T. crispulum* but recently JK realized that there might be a distinguishable taxon matching this variety present in the Czech flora. This problem needs to be addressed in a taxonomic study.

Discussion

Changes in the checklist, and comparison with neighbouring countries and Europe

The total number of accepted and evaluated taxa is 15 more than in the 2003 version. However, of these there are only 12 newly reported taxa for the Czech Republic, while 5 species appeared in the list in the result of a taxonomic reconsideration, and 8 previously listed under uncertain or taxonomically doubtful taxa have since been confirmed as occurring in the Czech Republic. On the other hand, 6 earlier recognized taxa are no longer included, 4 have been moved to the 'taxonomically doubtful' and one to the 'uncertain occurrence' category. From the user's perspective, there has unfortunately been a considerable number of name changes (136 taxa affected, i.e. 15.1%), caused by shifts into different genera (97 taxa), taxonomic rank changes (16 taxa), or changes in (infra)specific epithets for mostly nomenclatural reasons (15 taxa). We corrected the author citation in 31 cases, although mostly only to conform to our 'strategy' of citing pre-Hedwigian moss names to that of Hill et al. (2006). The number of genera increased from the 59 for liverworts and 175 for mosses, recognized in the 2003 version, to 76 and 194, respectively, as a consequence of different generic concepts, mostly based on recent molecular phylogenetic treatments.

The bryoflora of the Czech Republic (78, 867 km^2) comprises roughly half of the European liverworts (423 species listed by Grolle & Long 2000) and mosses (1239 species accepted by Hill et al. 2006). The comparison of numbers with those in neighbouring countries is hampered by the fact that they are either significantly different in area, mostly larger (Germany, Poland), or contain a significantly larger or smaller diversity of ecosystems. For example, the bryoflora of the state of Carinthia in Austria (9536 km^2) exceeds that of the Czech Republic by some 30 species, having 893 species and 48 additional infraspecific taxa (Köckinger et al. 2008), while only 651 species of mosses are listed for the much larger (312,685 km^2) but generally much less diverse Poland (Ochyra et al. 2003). Similarly, the area of Hungary (93,030 km^2) is similar to that of the Czech Republic but the bryophyte flora of Hungary is only three quarters (659 bryophyte species plus 3 subspecies – 2 hornwort, 146 liverwort and 511 moss species according to Papp et al. 2010) of that of the Czech Republic, possibly because the smaller diversity of ecosystems and historically lower intensity of research on bryophytes in the former.

Red List

The relatively great increase in studies on the bryophyte flora over the last ca 20–30 years, together with active monitoring of the bryophytes listed in Annex II of the EC Directive 92/43 and some additional smaller-scale national monitoring projects supported particularly by the Czech Agency for Nature and Landscape Protection (AOPK ČR) enabled us to reconsider the threat status for most of our taxa. This led to changes in the status of 308 bryophyte taxa, i.e. 34.5% of the bryoflora in the 2003 version of the list. As the shifts in the evaluation commonly included both upward and downward reconsiderations of individual taxa, the changes in percentages for individual categories are perhaps less apparent than expected based on the above mentioned rate of change. We particularly addressed the Data Deficient taxa, which resulted in the shift of 102 taxa in total (11.4%) to other categories (including 6 excluded or not evaluated taxa). Of them, 14 were moved from the Vanished to the Regionally Extinct Category but the rest are now either listed among threatened taxa (57) or Lower Risk and Least Concern taxa (25). The high number of recent floristic surveys is best illustrated by the rediscovery of 28 Vanished and even one 'Regionally Extinct' species. New data on earlier non-Data Deficient taxa accounted mostly for a decrease in the threat evaluation, which is the case for 79 taxa (8.8%) in total, but on the other hand, for 41 taxa (4.6%) the threat evaluation was increased.

It is more difficult to compare the percentages in the various threat categories in different countries than to compare checklists. Although the criteria used in different countries to evaluate species for inclusion on the Red List are largely identical (IUCN criteria used in most European countries for which there are Red Lists, although neighbouring Austria and Germany use their own criteria), the baseline data for the different regions vary greatly in both quantity and quality, and even the application of the criteria is very far from being comparable. For example, the authors of the Hungarian Red List (Papp et al. 2010), who use the same criteria as used in the Czech Republic, including the LC-att and DD-va subcategories, use the Data Deficient (21.1%) and Lower Risk (17.3%) categories more frequently, while the authors of the Swiss Red List (Schnyder et al. 2004) treat 259 species (24.4.% of their bryoflora and 62% of their Red-Listed species) as Vulnerable based on criterion D2, i.e. their rarity in terms of very few locations or area of occupancy. Despite the various approaches, the numbers of threatened versus non-threatened species in central-European countries are very similar and substantially higher than in, e.g., the United Kingdom or Sweden (see Table 1).

Analysis of the Czech bryoflora

As reported above, there are 863 accepted species with 5 additional subspecies and 23 varieties, in the modern taxonomic sense, in the Czech bryoflora, i.e. taxa for which there is some genetic background and evolutionary history and which are not just based on phenotypic plasticity. Nine additional species, currently regarded as taxonomically doubtful, might in the future be added to the list if taxonomic studies provide the justification for this and/or the morphological characters that can be used for their identification, and 17 additional taxa if their historical (or eventually recent) occurrence is verified. The composition of the Czech flora can be analysed in several ways as outlined below.

Table 1. – Comparison of the Red Lists of selected countries. Percentages of taxa in particular categories are shown.

Categories	Czech Republic (this study)	Slovakia (Kubinská et al. 2001)	Hungary (Papp et al. 2010)	Switzerland (Schnyder et al. 2004	UK (Hodgetts 2011)	Sweden (www[1])
RE	4.5%	2.9%	0.5%	1.4%	2.4%	1.6%
CR	7.8%	10.5%	3.0%	5.6%	1.5%	0.7%
EN	9.9%	11.4%	13.7%	5.4%	3.8%	3.7%
VU	10.4%	12.3%	9.6%	26.0%	8.2%	5.6%
Sum of Red-Listed extinct and threatened taxa	32.6%	37.1%	26.7%	38.4%	15.9%	11.6%
LR	7.4%	9.4%	17.3%	6.2%	7.4%	6.1%
DD	6.1%	8.1%	21.1%	9.0%	1.8%	4.1%
LC	53.8%	45.4%	34.9%	46.4%	74.9%	78.3%
Sum of evaluated taxa	892	909	659	1083	1056[2]	1072[3]

[1] http://www.artfakta.se/GetSpecies.aspx, accessed on March 20, 2012.
[2] Sum of evaluated taxa inferred from Hill et al. (2008)
[3] Sum of evaluated taxa inferred from Hallingbäck et al. (2006).

Speciation-related problems

Because the structure of bryophytes is simple and some morphological and anatomical characters that can be used to identify them are confined to the ephemeral sporophytic stage, bryologists have always found it difficult to identify species. Only recently, with the advent of molecular techniques, have bryophyte taxonomists realized the extent of two important phenomena, which make it difficult to delimit species. The first is cryptic speciation, which is the molecular divergence and evolution of separate lineages, sometimes showing the characteristics of good biological species, but differing little if at all morphologically. The second is the role of hybridization in the formation of taxa, which is mostly accompanied by polyploidization.

Cryptic speciation is documented, e.g. in the liverwort genera *Pellia*, *Aneura* and *Calypogeia* (Buczkowska 2004, Buczkowska & Bączkiewicz 2011, Wachowiak et al. 2007) and moss genera *Hamatocaulis* and *Rhynchostegium* (Hedenäs & Eldenäs 2007, Hutsemékers et al. 2012), and it is assumed or has been already documented that the formally undescribed sibling species reported in these papers do occur in the Czech Republic, representing moreover probably only the "tip of an iceberg". Morphological characters that can be used for naming the earlier not recognized cryptic lineages have in some cases been successfully identified (e.g., *Conocephalum salebrosum*, see annot. 4 above) and this process is likely to continue in the future.

Moss hybrids have rarely been identified and formally described in the past and have generally been omitted from checklists, including the European list of Hill et al. (2006). The Polish catalogue (Ochyra et al. 2003) represents a rare exception, listing the putatively hybridogeneous taxa *Funaria* ×*hybrida* R. Ruthe ex Limpr. and *Physcomitrella* ×*hampei* Limpr., which are also likely to occur in the Czech Republic. Recent studies have shown that there are allopolyploid hybrids, commonly of polytopic origin, not only in taxa that have traditionally been regarded as difficult (*Porella* ×*baueri*, removed from the main list, see under Not Evaluated – taxonomically doubtful taxa) but also in taxa that have the characteristics of typical species, with clear morphological characters, ecology and pattern of

distribution (*Plagiomnium medium*, *Polytrichum longisetum*, *Sphagnum auriculatum*, *S. majus*, *S. papillosum* and others). The situation needs to be clarified e.g. in the *Metzgeria conjugata/simplex* and *Riccia ciliifera/gougetiana* complexes, which are no longer included in the main list, and also in *Sphagnum inundatum*, in which the equivocal morphological delimitation is obviously related to its complex speciation pattern (Shaw et al. 2008, 2012).

Native status, invasive and spreading species

Of the taxa that are known to occur in the Czech Republic the majority are native, with new records of bryophytes being published nearly every year, depending on the level of bryofloristic activity and application of latest taxonomic treatments, which recognize new taxa. With respect to non-native (exotic) taxa, bryophytes differ from vascular plants mainly in the fact that such species are hardly ever deliberately introduced and the recording of such accidental introductions is poor (Essl & Lambdon 2009). Most of the unintentional introductions are ephemeral escapes of tropical and subtropical species from greenhouses that are usually not included on lists of non-native plants of individual regions and are also not included in this list, which is in accordance with the practice adopted by Pyšek et al. (2002). Bryophytes may not only commonly be cryptogenic in the sense of Carlton (1996), i.e. not clearly native or exotic (alien), because of the way species that enter the Czech Republic from a neighbouring region and spread are evaluated. They are categorized as non-native if they arrived from an area in which they are also non-native but native if they are native in the area from which they spread (Pyšek et al. 2004). However, in bryophytes this differentiation may be less straightforward or even arbitrary, because native status in the area of origin may be disputed (cf. the status of *Didymodon umbrosus* in the British Isles, Smith 2006) and moreover the character of the spontaneous spreading/invasion of individual bryophyte species hardly differs between putatively 'native in the neighbouring/next-to-neighbouring area' and non-native taxa. Hence we have summarized the available information for known cases of non-native and recently spreading species and explain the particular circumstances in each case. For the definition of the terms see Pyšek et al. (2004).

Non-native species

Lunularia cruciata – probably a casual alien, widespread in the Mediterranean area and western Europe, which regularly occurs in botanical gardens and parks and sometimes it is reported for extended periods of time in natural biotopes in the Czech Republic (Prokopské údolí valley in Prague), probably dependent on the repeated adventive supply of diaspores.

Campylopus introflexus – invasive, introduced to the British Isles from Southern Hemisphere, first recorded in the Czech Republic in 1988 (Novotný 1990) and currently spreading rapidly (Mikulášková 2006). *Campylopus introflexus* is probably the only Czech non-native species that depends on human activity for its spread (exploited peatlands or other easily colonizable substrates).

Orthodontium lineare – invasive non-native species, first recorded in the Czech Republic in 1964 (Futschig & Kurková 1977), rapidly spreading throughout the country (Soldán 1996) in natural habitats.

Didymodon umbrosus – probably a naturalized non-invasive species, first recorded in 1997 (Kučera 1999). Not yet reported from any other than its initial locality near Prague, revisited by JK in 1998 and 2000.

Native species that are extending their ranges and cryptogenic species

Campylopus flexuosus – probably a native species, which was regarded as very rare by older authors (e.g. Velenovský 1897), is nowadays widely distributed in sandstone regions and dry pine woods throughout the country and seems to be spreading.

Campylopus pyriformis – was first reported from the Czech Republic in the 2003 checklist, although the revision of herbarium material showed that it was collected earlier (one from 1899 and another from 1968). It is currently widely scattered in south-western and the southern part of the country and is perhaps still spreading.

Bryoerythrophyllum ferruginascens – first reported from this country by Pilous (1993), based on the adventive occurrence in an abandoned limestone pit. Since then, the species seems to be spreading in similar habitats and along the roads and interestingly, the revision of unidentified herbarium material of *Pottiaceae*, revealed earlier collections, among others the probably native occurrence on rocks in the Hrubý Jeseník Mts.

Dicranum tauricum – according to the bryoflora of Czechoslovakia (Pilous & Duda 1960), this species was reported to occur only 'rarely in eastern Slovakia'. First Czech reports started to appear in early 1990s (Anonymous 1993). Franklová (1997) summarized the known distribution, based on an old herbarium record from 1927, two records from 1977–1978 and an increasing number of records since 1989.

Dicranoweisia cirrata – known from the Czech Republic since the time of the early bryological studies but recorded only extremely sporadically between the first record in 1884 and early 1980s (Plášek 2001). Since then, the species has spread widely, particularly as an epiphyte.

Orthotrichum pulchellum – apparently native in western Europe and otherwise occurring only in western North America but now a cryptogenic species spreading in many countries of western to central Europe. Its rapid expansion after apparently completely vanishing in Germany started in early 1990s (Frahm 2002), together with other (sub)oceanic taxa (*Ulota phyllantha*, *Zygodon conoideus*, *Dendrocryphaea lamyana*, *Orthotrichum consimile*, *Metzgeria temperata*), of which the latter three have already been recorded in neighbouring Saxony and Bavaria (Müller 2004, Meinunger & Schröder 2007). The rate of spread of *O. pulchellum* is moderate and no adverse effect on native epiphytes has been observed.

Orthotrichum rogeri – regarded as native, historically known from a single locality in northern Moravia near Šumperk. Spreading at a moderate rate from Saxony since 2008 (Kučera 2009b) in a way comparable to that of *Orthotrichum pulchellum.* The source of recolonization lies obviously outside the Czech Republic.

Uncertain cases

Zygodon dentatus, *Orthotrichum patens*, *Metzgeria violacea*, *Orthotrichum tenellum* and *Microlejeunea ulicina* and many other epiphytes might belong among taxa that have started to spread in this country, although in the case of the latter two species there is only a single recent record, and their eventual spread is only inferred from the situation in neighbouring regions of Germany (Seifert 2009). The spread of epiphytes following the improvement in air quality in recent decades occurred in all central-European countries. It is interesting that the restored habitat is not simply being reclaimed by earlier occurring epiphytes but rather earlier unknown or extremely rarely occurring species emerge, often using migratory routes different from the historical ones (the above mentioned *Orthotrichum rogeri, Zygodon viridissimus*). The cases of recently spreading terrestrial bryophytes are less clearly documented but *Endogemma caespiticia* is an example; whether the terrestrial species of *Bryum* and *Pohlia* with rhizoidal and axillary gemmae are spreading, is not known, as they were recognized only in the last three decades.

Phytogeographic considerations

Phytogeographic aspects of the bryophytes occurring in the Czech Republic have never been studied in a comprehensive way and this task goes far beyond the scope of this article. The main problem is the incomplete knowledge of the world-wide distribution of those bryophytes occurring in Europe, and also the generally broad distribution pattern of most European bryophytes, which is very difficult to simplify and abstract in a way that could be easily used in regional bryophytogeographic analyses. Dierßen (2001) tried to summarize the available phytogeographic information on European bryophytes, based largely on earlier works by Düll, but his evaluation is difficult to apply for the above mentioned reasons and in many cases his evaluation is very different from our experience, hence we have refrained from presenting a general phytogeographic analysis of the Czech bryoflora and a comparison with that of neighbouring countries.

The geographic position of the Czech Republic in central Europe, which is influenced both by oceanic and continental climatic conditions but at the same time is protected from

their more extreme effects, latitudinally belongs to the middle of the temperate zone and altitudinally mostly occupies the lower and middle altitudes, barely touching the lower alpine zone in the highest mountain ranges. The presence of individual species and their distribution has historically been determined by climate changes, particularly numerous and severe during the Pleistocene, although significant climate changes have occurred throughout the Holocene, local geology and geomorphology (influencing the microclimatic condition), human activity and the dispersal and establishment abilities. Logically, the Czech bryoflora contains the majority of the broadly distributed, temperate, or boreo-montane elements.

With respect to the gradients of oceanity and continentality, the Czech bryoflora has several dozens of suboceanic elements, which more or less reach their eastern-European limit of distribution in the Czech Republic or at last markedly decrease in abundance further east – *Anastrepta orcadensis*, *Cephalozia macrostachya*, *Kurzia* spp., *Microlejeunea ulicina*, *Nardia compressa*, *Odontoschisma sphagni* and *Scapania compacta* may be named among the liverworts and *Campylopus* and *Dicranodontium* species, *Kindbergia praelonga*, *Fissidens rufulus*, *Hookeria lucens*, *Hypnum imponens*, *Isothecium myosuroides*, *Mnium hornum*, *Plagiothecium undulatum*, *Rhabdoweisia crenulata*, *Thamnobryum alopecurum* and *Zygodon dentatus* among the mosses, to name just a few examples. The more pronouncedly oceanic species commonly do not occur in the Czech Republic, although recorded in Germany or Austria, sometimes even close to their border with the Czech Republic (e.g. *Metzgeria temperata*, *Solenostoma paroicum*, *Frullania microphylla*, *Leptodontium flexifolium*, *Syntrichia pagorum*, *Racomitrium obtusum*, *Zygodon conoideus*, *Pterogonium gracile*, *Isothecium holtii* and *Hygrohypnum eugyrium*). Interestingly, while there are several suboceanic bryophytes among them, which are now regarded extinct or vanished from Czech Republic (*Gymnomitrion obtusum*, *Pallavicinia lyellii*, *Neckera pumila*, *Ptychomitrium polyphyllum*, *Sphagnum austinii*, *Ulota drummondii*), another group of suboceanic taxa is now spreading eastwards, particularly but not solely, the epiphytes (*Orthotrichum pulchellum*, *Microlejeunea ulicina*, *Campylopus introflexus*, *C. pyriformis*). Subcontinental elements in the Czech flora are much rarer and mostly can be attributed to the Pannonian migration route (*Hilpertia velenovskyi*, *Syntrichia caninervis*) but there are also rare examples of eastern boreal elements (*Callicladium haldanianum* and also the common *Eurhynchium angustirete*, which is increasingly rare west of the Czech border). *Tortula lingulata* is another example of a taxon with a very limited (subendemic) distribution centred in the eastern Baltic region.

The Czech Republic is also the region, where several circumboreal species reach their southern limit of distribution and a few southern taxa are at their northern limit. Well-known examples of circumarctic or circumboreal taxa at their southern limit in the Czech Republic are *Sphagnum lindbergii*, *Discelium nudum* and the vanished *Dichelyma falcatum* and *Sphagnum jensenii* (known from Poland just a few dozen metres from our boundary) can be added to these examples if we do not limit our considerations to political boundaries. Southern species generally do not reach their northern limit in the Czech Republic but mostly extend to the warm, subcontinental regions of Germany via the Pannonian route (*Didymodon acutus*, *D. cordatus*, *Hilpertia velenovskyi*) or have reached the oceanically influenced regions in north-western Europe in the case of the species spreading from the southwest. A rare and remarkable example of a subcontinental south-eastern element is the probably extinct *Syntrichia caninervis,* with one historical locality

in southern Moravia, and the only known example of the extant Illyric-Insubric element is *Frullania inflata*, known from several close by locations in southern Moravia. Two primarily Alpine species that occur in the Czech Republic are *Plagiothecium neckeroideum*, occurring only in the Šumava Mts (Bohemian Forest) and *Streblotrichum enderesii*, known from one historical locality in the Krkonoše (Giant) Mts.

There are very few examples of convincingly stenoendemic bryophyte species in Europe, because the ability of bryophytes to disperse is considerable and the rate of speciation accompanied by observable morphological changes is relatively low. Therefore, despite the fact that many originally believed endemic species are described for Europe, they have later either been synonymized with earlier described, broadly distributed taxa, or have been recorded from other localities in Europe or beyond. Several dozens of broadly distributed species were originally described from the Czech Republic, including e.g. *Racomitrium sudeticum* described from Krkonoše Mts and *Fossombronia wondraczekii* and *Hilpertia velenovskyi*, from localities in what is now Prague. *Bryum moravicum*, described by Podpěra as a southern-Moravian endemic from one locality near Řeznovice, was recently shown to be the oldest name for a widely distributed species, which has been known under several different names (Kučera & Holyoak 2005). Three taxa were described recently from the Czech Republic: *Platyhypnidium grolleanum* Ochyra, which probably represents only a rheophytic modification of *Rhynchostegium riparioides*, and two *Orthotrichum* taxa – *O. moravicum* and *O. affine* var. *bohemicum*. It is likely that further localities of the latter two taxa will be reported from adjacent countries in the near future, as the latter taxon has been recorded in the USA (Plášek in Ellis et al. 2012). An interesting example of a relatively stenoendemic species that was described from the Czech Republic and not so far recorded elsewhere than in central Europe, is *Anthoceros neesii*. Although it occurs in the common, broadly distributed biotope of stubble fields in submontane regions on non-calcareous substrates, it seems to be surprisingly rare and was long regarded as having vanished from our bryoflora, until its rediscovery in 2010 (Koval & Zmrhalová 2010).

With respect to relic taxa, the reasons for their scarcity and the problems with their identification are the same as for the regional endemics. It can be assumed that species of severely fragmented fen biotopes, which are entirely dependent on non-specific vegetative propagation, can be considered to be relics from the Ice Age. These species are generally under strong threat (*Drepanocladus sendtneri*, *D. trifarius*, *Helodium blandowii*, *Meesia triquetra*, *Paludella squarrosa*, *Scorpidium scorpioides*) or have already become extinct (*Bryum longisetum*, *Drepanocladus lycopodioides*, *Meesia longiseta*). Glacial relics can also be identified among the arctic-alpine elements, although these are more often species that sporulate and hence it cannot be excluded that their populations were sometimes boosted by propagules from the Alps or other mountain ranges during the Holocene. Nevertheless, this group of species seems to be currently declining in abundance (*Anthelia juratzkana*, *Gymnomitrion corallioides*, *Lophozia wenzelii*, *Dicranum elongatum*, *Grimmia elatior*, *Kiaeria falcata*) or such species have apparently become extinct in the past few decades (*Gymnomitrion adustum*, *G. brevissimum*, *Arctoa fulvella*, *Grimmia unicolor*, *Ochyraea smithii*, *Pohlia obtusifolia*, *Polytrichastrum sexangulare*), as a consequence of successional changes connected with the warming of the climate in the recent century.

Earlier authors speculated about the possibility of pre-glacial relics. This seems to be particularly tempting in cases of bryophytes occurring in biotopes where the level of competition from vascular plants is very low and which are believed not to have grown by woods during the last climatic optima or were climatically stable with respect to specific geomorphological and geological conditions. Suza (1938) believed that *Oxymitra incrassata*, *Riccia ciliifera* and *R. ciliata*, which occur in the valleys of larger rivers in southern Moravia, might be Tertiary relics, Pospíšil (1962) suggests a similar scenario for the occurrence of *Frullania inflata* near Znojmo and later (Pospíšil 1968) for Pleistocene refugia for *Homalothecium lutescens*, *Entodon concinnus*, *Rhytidium rugosum* and *Abietinella abietina*. Similarly the occurrence of *Targionia hypophylla* at the ventaroles on Boreč hill was regarded as a relict population that goes back to the Tertiary (Pilous 1959). Nevertheless, sound evidence of the length of time these bryophytes have been present at these localities is missing.

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Souhrn

Předkládáme stručnou analýzu bryoflóry České republiky založenou na aktualizované verzi seznamu a červeného seznamu mechorostů České republiky. Do soupisu druhů byly zahrnuty veškeré nové nálezy a revize vztahující se k našemu území a taxonomická pojetí rodů, druhů i poddruhových taxonů byla přizpůsobena nejnovějším taxonomickým a fylogenetickým studiím. Hlavní seznam nyní obsahuje 863 druhy mechorostů (4 hlevíky, 207 játrovek a 652 mechů) s 5 dalšími poddruhy a 23 všeobecně uznávanými varietami; 9 dalších druhů je uvedeno jako taxonomicky problematických a nejistý či neprokázaný výskyt je dokumentován pro 17 dalších druhů. Zároveň jsme znovu kompletně přehodnotili podkladová data pro aplikaci IUCN 3.1 kritérií pro vytvoření revidovaného červeného seznamu mechorostů, který předkládáme zároveň se seznamem. Z 892 hodnocených taxonů bylo 46 % vyhodnoceno jako splňující některé z kritérií pro zařazení do červeného seznamu (40 taxonů v kategorii RE, 70 v CR, 88 v EN, 93 ve VU, 66 v LR-nt, 24 v DD-va a 30 v DD), 54 % bylo hodnocených jako neohrožených, z nich ovšem 120 zůstává v seznamu druhů vyžadujících pozornost (podkategorie LC-att). V analýze bryoflóry diskutujeme taxonomické problémy, které ovlivnily naše rozhodování v hodnocení oprávněnosti rozeznávání druhů i hodnocení kritérií potenciální ohroženosti, pokusili jsme se sestavit seznam nepůvodních, invazních a expanzních mechorostů ČR a rozebíráme specifické problémy mechorostů z hlediska původu a invazivnosti. Dotýkáme se také fytogeografických aspektů reliktnosti, okrajů areálu, endemismu a uvádíme významné elementy z hlediska kontinua kontinentality a oceanity.

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