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Article *in* Journal of Bryology · October 2018

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To cite this article: N. G. Hodgetts & A. Vanderpoorten (2018) *Isothecium myosuroides* var. *brachythecioides* (Dixon) Braithw. reinstated as a species, *I. interludens* Stirt., Journal of Bryology, 40:4, 316-323, DOI: 10.1080/03736687.2018.1514176

To link to this article: https://doi.org/10.1080/03736687.2018.1514176

Isothecium myosuroides var. *brachythecioides* (Dixon) Braithw. reinstated as a species, *I. interludens* Stirt.

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The taxon currently known as *Isothecium myosuroides* var. *brachythecioides* (Dixon) Braithw. is reinstated as a species, *I. interludens* Stirt., the name originally assigned by Stirton when it was first described. The morphological characters separating *I. myosuroides s.s.* and *I. interludens* are summarised. The sporophytes of *I. interludens*, described here for the first time, differ in shape, and pattern of exothecial cells from those of *I. myosuroides*. A molecular analysis based on variation of the ITS region shows that *I. holtii* Kindb. and *I. alopecuroides* (Lam. *ex* Dubois) Isov. are not monophyletic, calling for a re-assessment of these species, whereas the monophyly of the other species, including *I. interludens*, cannot be rejected. The analysis failed, however, to yield molecular synapomorphies for *I. interludens* and other species within *I. myosuroides s.l.*, which we interpret as the incomplete sorting of alleles among recently evolved species. *Isothecium interludens* is a European endemic with a hyperoceanic temperate distribution. Its nested position within a clade including the two Macaronesian endemics *I. prolixum* (Mitt.) M.Stech and *I. montanum* Draper, Hedenäs, M.Stech, T.Lopes & Sim-Sim is suggestive of a Macaronesian origin, in line with the idea that the European Atlantic fringe flora assembled during the course of the last interglacial from Macaronesian ancestors. *Isothecium* therefore offers a model of prime importance for the study of ongoing speciation in mosses.

Key words: Endemic speciation, *Isothecium interludens*, *Isothecium myosuroides*, ITS, Molecular analysis, Morphology, Oceanic, Scotland

Introduction

James Stirton was the first to recognise what we now call *Isothecium myosuroides* Brid. var. *brachythecioides* (Dixon) Braithw. as a taxon in its own right. He described it as a new species, *Isothecium interludens* Stirt., in 1900 (Stirton, 1900), stating,

> … I published, in 1865, a description of the moss under the name *Isothecium intermedium*, which I now change to *I. interludens*, owing to the former name having been previously given to a *Hypnum*, even though the moss referred to is now classified under the genus *Bryum*.

We have not been able to trace the 1865 publication, so we regard the paper by Stirton (1900) as the first legitimate description of this taxon. Although a type specimen is not cited, the paper continues,

> I may mention that the moss was found by the late Mr. A. M'Kinlay and myself on almost all our western mountains of any considerable elevation, as Ben Ledi, Ben Voirlich (by Loch Lomond), etc.; also on Ben Lawers.

The same taxon was described again by Dixon (1902) as *Eurhynchium myosuroides* var. *brachythecioides* Dixon, citing specimens from The Quiraing (Skye), Ben Klibreck (Sutherland), Lough Swilly (Co. Donegal) and near Connor Hill (Co. Kerry). It is clear that Dixon was not, at the time, aware of the earlier description by Stirton, because later (Dixon, 1923), he referred to *Isothecium interludens* thus:

> This is my *Eurhynchium myosuroides* var. *brachythecioides*. Stirton has indeed identified a specimen of that var., which I sent him, with this species. Had I known of the identity at the time, I should have adopted his name for the variety.

He also referred to the specimen collected from Ben Ledi by A. McKinlay in 1864. This specimen, in the herbarium of Glasgow Art Gallery and Museum (GLAM) (with a duplicate at BM), is faintly labelled '*Isothecium interludens* Stirton', with an additional label in Dixon's handwriting stuck onto the packet: '*Isothecium interludens* Stirton = *Eurhynchium myosuroides* var. *brachythecioides* Dixon'. Dixon retained

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DOI 10.1080/03736687.2018.1514176

Published online 12 October 2018
Journal of Bryology 2018 VOL. 40 NO. 4

this plant as a variety of *Eurhynchium myosuroides* in the *Student's handbook* (Dixon, 1924), and this has been followed by all later authors (e.g. Smith, 1978; Smith, 2004), albeit under the genus *Isothecium*, which was originally introduced by Bridel (1827). We now propose the reinstatement of *I. interludens* as a species on morphological grounds, backed up by molecular evidence.

Smith (1978; Smith, 2004) claimed that *I. interludens* (as *I. myosuroides* var. *brachythecioides*) is linked to the type (i.e. *I. myosuroides* var. *myosuroides*) 'by intermediates, as for example on the Shetland Islands' (Smith, 2004). None of the specimens examined, including those from the Shetland Islands, could genuinely be described as intermediate. While there were some that at first sight seemed as if they might be intermediate, closer examination always made it possible to assign the specimens to one or other of the two taxa on the basis of branching pattern and leaf morphology. Mark Hill, co-author of an unpublished report on Shetland bryophytes, comments, '… I think the Shetland report of intergrades should be discounted' (M. O. Hill, pers. comm., 2016). In western Scotland, the two taxa frequently occur in close proximity, and are easily separable in the field.

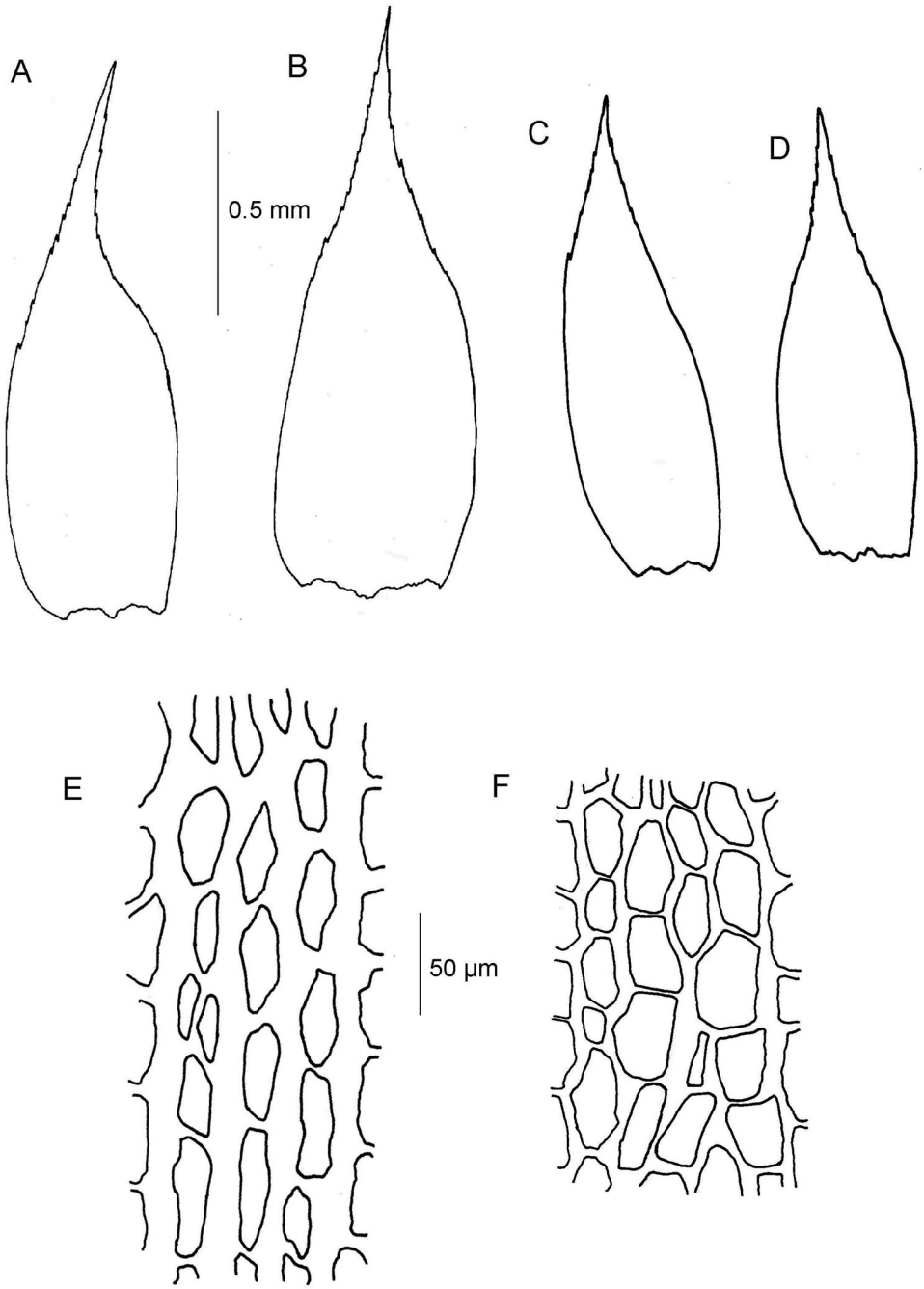

Figure 1 (A, B) Branch leaves of *I. interludens* (from Hodgetts 9099). (C, D) Branch leaves of *I. myosuroides* (from Hodgetts 6532). (E) Exothecial cells of *I. interludens* (from Hodgetts 6780). (F) Exothecial cells of *I. myosuroides* (from Hodgetts 6532).

Morphology

The main vegetative differences between *I. interludens* and *I. myosuroides s.s.* are well known and described in the literature (Dixon, 1924; Smith, 1978; Smith, 2004, etc). Essentially, *I. myosuroides* has a subdendroid habit and erecto-patent leaves, whereas *I. interludens* is not subdendroid, but irregularly branched (like a *Brachythecium*), with imbricate leaves. It also tends to be a larger plant. Dixon (1902) suggested that

> The nerve in the stem leaves in the var. *brachythecioides* is often very faint or short and double, as in the var. *tenuinerve* (Kindb.) Braithw.

We were unable to find any consistent difference between the stem leaf nerves of *I. myosuroides* and *I. interludens*. In both taxa, it was found to vary from distinct (and even rather thick at the base) to very indistinct or virtually absent. Dixon (1924) also states that

> ….. the most striking feature (of *I. interludens*) is the form of the branch leaves which do not taper gradually to a rather wide point as in the other forms, but are somewhat abruptly fine-pointed like those of the stem.

This does seem to be substantially correct. While there is considerable variation within both taxa, the branch leaves of *I. myosuroides* are usually well differentiated from the secondary stem leaves, being small and lanceolate to ovate, and gradually tapering to the apex. The branch leaves of *I. interludens* are much less well differentiated from the secondary stem leaves, being large, wide, ovate and more or less abruptly narrowed to the long fine apex (Figure 1).

Sporophytes are rare in *I. interludens* but have been found on a number of occasions, contrary to the statement in Smith (2004) that they are unknown. All the specimens with sporophytes in E and in the private herbaria of NGH and Gordon Rothero have been examined and, while there are no very well-defined sporophytic characters to add to the vegetative differences, there do seem to be slight 'soft' differences between the capsules of *I. interludens* and *I. myosuroides*. In his description, Dixon (1902) states,

> The few capsules present on the Quiraing plant and in the Irish specimens resemble those of the var. *rivulare* Holt, being short, ovate, of a deep chestnut-brown, and thick-walled.

There certainly seems to be a tendency for the capsules in *I. interludens* to be larger, but proportionately shorter, than those of *I. myosuroides*, and the pattern of the exothecial cells is also somewhat different. The capsules of *I. myosuroides* are about 1–1.6 mm long (after the lid has dropped off), and about 3–6 times longer than wide, while the capsules of *I. interludens* are about 1.3–1.9 mm long but only about 2.5–4 times longer than wide. The exothecial cells of *I.*

Table 1 Summary of morphological characters separating *Isothecium myosuroides* from *I. interludens*.

Character	*I. myosuroides*	*I. interludens*
Size	Medium	Robust
Habit	Subdendroid; secondary stems ± erect, short	Irregularly branched; secondary stems procumbent, long
Leaf orientation when moist	Erecto-patent	Imbricate
Branch leaves	Small, lanceolate-ovate, gradually tapering to apex	Large, ovate, ± abruptly narrowed to long fine apex
Capsule	Small but relatively long and thin, *ca* 1–1.6 mm long. *ca* 3–6 times longer than wide	Large but relatively short and wide, *ca* 1.3–1.9 mm long, *ca* 2.5–4 times longer than wide
Average exothecial cell length:width ratio	≤ 3:1	≥ 3:1
Exothecial cell longitudinal walls	Pale brown, not forming well-defined lines	Dark brown, forming well-defined lines

Figure 2 ***Isothecium interludens*** **Stirt.**

Figure 3 ***Isothecium myosuroides*** **(Dixon) Braithw.**

myosuroides are *ca* 12.5–25 µm wide and 15–38(–58) µm long, with an average length to width ratio of ≤ 3:1, and with moderately thick, pale brown longitudinal walls that usually do not form well-defined longitudinal lines. The exothecial cells of *I. interludens* are *ca* 15–25 µm wide and 30–55 µm long, with an average length to width ratio of ≥ 3:1, and very thick, dark brown longitudinal walls that tend to form well-defined longitudinal lines (Figure 1). The morphological characters separating the two taxa are summarised in Table 1, and the general appearance is shown in Figures 2 and 3.

Molecular Methods and Results

We tested the taxonomic identity of *I. interludens* using molecular methods. To determine whether phenotypic identity matches genetic identity rather than geographic origin, we sampled two well-characterized phenotypes of *I. interludens* and of *I. myosuroides s.s.* from western Scotland and sequenced their Internal Transcribed Spacers (ITS). We focused on ITS sequences here because Draper *et al*. (2007) found no variation at the cpDNA regions *trn*G and *trn*L-F in accessions of different species within the complex, namely *I. myosuroides*, *I. interludens*, *I. holtii* Kindb. and *I. stoloniferum* Brid., indicating that this marker, as opposed to ITS (Hedenäs, 2016), does not display the level of variation required for the present study. We compared the sequences obtained with previously published sequences of four accessions of *I. interludens* and 15 accessions of *I. myosuroides* from the entire range of the species (Appendix 1). We used sequences of all the other species of *Isothecium* available in GenBank as outgroups (Appendix 1). The dataset was analysed by Maximum Likelihood, with a GTR substitution model as selected by the AIC criterion of JModeltest (Darriba *et al*., 2012), and implemented by SeaView 4.6.3 (Gouy *et al*., 2010). A non-parametric bootstrap analysis with 100 replicates was performed to assess branch support. In the most likely tree resulting from this analysis (Figure 4), the six accessions of *I. interludens* were included in two weakly supported clades (bootstrap proportions of 60%), whose relationship was unresolved within a

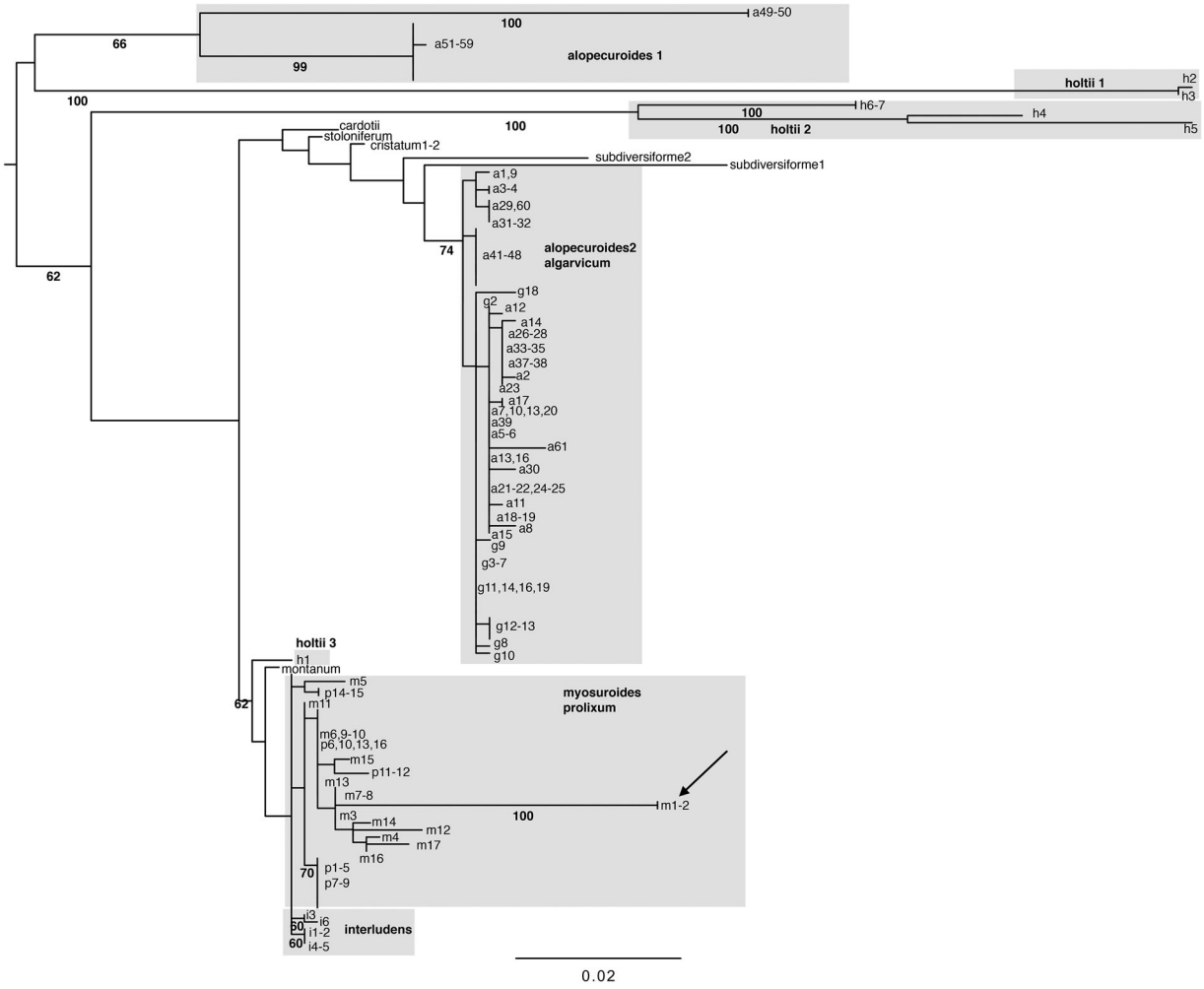

Figure 4 Most likely tree resulting from the analysis of ITS variation in the moss *genus Isothecium*. Arrow indicates the position of the sympatric Scottish accessions of *I. myosuroides* and *I. interludens*. Numbers below the branches are the bootstrap supports. See Appendix 1 for abbreviations.

larger clade, including polyphyletic accessions of *I. prolixum* (Mitt.) M.Stech, Sim-Sim, Tangney & D.Quandt and *I. myosuroides*.

Due to limited bootstrap support for individual branches, we tested morphological species concepts by successively constraining the accessions of each morphospecies to monophyly and contrasting the log-likelihood of each of these constrained trees with that of the unconstrained most-likely tree, using the Shimodaira-Hasegawa tests as implemented by RaxML (Stamakis, 2015). Constraining conspecific accessions of *I. alopecuroides* (Lam. *ex* Dubois) Isov. and *I. holtii* to monophyly led to a significant decrease of log-likelihood ($p < 0.001$), whereas the monophyly of *I. myosuroides*, *I. algarvicum* W.E.Nicholson & Dixon, *I. prolixum* and *I. interludens* could not be rejected. Draper *et al*. (2007) rejected the hypothesis of convergent evolution to explain the incongruence between molecularly and morphologically defined species because morphotypes are largely independent of the ecological settings. Draper *et al.* (2007) therefore proposed that the para- or polyphyletic relationships among conspecific accessions could result from hybridisation. Based on the results presented here, we suggest that the polyphyly of *I. alopecuroides* and *I. holtii* calls for a further taxonomic reassessment of these species. Within the *I. myosuroides s.l.* group, the lack of a clear pattern may result from the incomplete sorting of alleles among recently evolved species or the lack of resolution of the ITS locus, despite the fact that the latter has been identified as one of the most discriminant barcodes in mosses (Hofbauer *et. al*., 2016). In all cases – the absence of reproductive barriers, the incomplete sorting of alleles, or the lack of resolution of a highly variable locus – apparent conflict between molecules and morphology points to an ongoing speciation process.

In this phylogenetically complex picture, the molecular data alone provide only rather weak support for the recognition of *I. interludens* as a species. However, the molecular data are not in conflict, as they are in the case of *I. alopecuroides* and *I. holtii*, with a morphospecific concept of *I. interludens*. Furthermore, the two Scottish accessions of *I. interludens* were not resolved as part of the same clade as the two sympatric accessions of *I. myosuroides* (indicated with an arrow in Figure 4), providing evidence that the former do not represent a local variant of the latter.

Conclusion

The reinstatement of *I. interludens* Stirt. as a species in its own right, as originally described by Stirton (1900), therefore seems to be entirely justified on the basis of both morphological and molecular evidence. The specimen collected from Ben Ledi by A. McKinlay in 1864 (GLAM) is proposed as the lectotype, with an isolectotype in BM. *Isothecium interludens* is a European endemic with a hyperoceanic temperate distribution encompassing strongly Atlantic areas of Great Britain, Ireland, Norway, the Faroe Islands, France and Spain (Draper *et al*., 2015; Hodgetts, 2015; T. Hallingbäck, pers. comm., 2017).

The nested position of *I. interludens* within a clade including the two Macaronesian endemics *I. prolixum* and *I. montanum* Draper, Hedenäs, M.Stech, T.Lopes & Sim-Sim is suggestive of a Macaronesian origin. This pattern fits well with the idea that the European Atlantic fringe flora assembled during the course of the last interglacial from Macaronesian ancestors (Patiño *et al*., 2015), followed in some cases by endemic speciation on the continent (Patiño & Vanderpoorten, 2015; Patiño *et al*., 2017). In this context, *Isothecium* offers a model of prime importance for the study of ongoing speciation in mosses.

Acknowledgements

We would like to thank Neil Bell (RBGE), David Harris (RBGE), Len Ellis (BM), Gordon Rothero and Keith Watson (GLAM) for specimens and useful advice.

Taxonomic Additions and Changes: *Isothecium interludens* Stirt. (*I. myosuroides* var. *brachythecioides* (Dixon) Braithw., *syn. nov.*).

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Appendix 1. Voucher information and GenBank Accession Numbers for *Isothecium* species. Newly produced sequences are in bold.

Taxon	Label	ITS	Voucher	Geographic origin
interludens	**i1**	**MH465612**	***Hodgetts 6780***	**Scotland**
interludens	**i2**	**MH465613**	***Hodgetts 9099***	**Scotland**
interludens	i3	DQ294925	E-00197979	Norway
interludens	i4	DQ294921		Ireland
interludens	i5	HQ380928	E-00266448	Scotland
interludens	i6	DQ294926	S-B97667	Scotland
myosuroides s.s.	**m1**	**MH465614**	***Hodgetts 6532***	**Scotland**
myosuroides s.s.	**m2**	**MH465615**	***Hodgetts 7016***	**Wales**
myosuroides s.s.	m3	HQ380927	E-00266447	England
myosuroides s.s.	m4	HQ380926	S-B9337	Madeira
myosuroides s.s.	m5	HQ380925	S-B42776	Azores
myosuroides s.s.	m6	HQ380924	TFC- Bry-15254/MUB-28588	Canary Islands
myosuroides s.s.	m7	HQ380923	TFC-Bry-15259/MUB-28586	Canary Islands
myosuroides s.s.	m8	HQ380922	TFC-Bry-15244/ MUB-28589	Canary Islands
myosuroides s.s.	m9	HQ380921	TFC-Bry-15235/MUB-28587	Canary Islands
myosuroides s.s.	m10	HQ380920	TFC-Bry-15238/MUB-28585	Canary Islands
myosuroides s.s.	m11	HQ380919	DUKE-0019487	Canada
myosuroides s.s.	m12	DQ294927	MAUAM-Bryo-4396	Morocco
myosuroides s.s.	m13	DQ294924	*Lara 210993* (MAUAM)	Canary Islands
myosuroides s.s.	m14	DQ294922	*Sérgio* 060604 (S)	Spain
myosuroides s.s.	**m15**		**MY3**	**Scotland**
myosuroides s.s.	m16	AY737479	*Vanderpoorten s.n.* (LG)	Belgium
myosuroides s.s.	m17	AM182054		Germany
montanum	montanum	HQ380942	*Stech* 1044/S-B9261	Madeira
alopecuroides	a1	DQ294916	*Vasák* 200780 (H)	Georgia
alopecuroides	a2	DQ294915	*Ignatov* 140991 (S)	Ukraine
alopecuroides	a3	DQ294914	*Zarnowiec and Klama* 121089 (S)	Poland
alopecuroides	a4	DQ294913	*Wójcicki* 090886 (S)	Poland
alopecuroides	a5	DQ294912	*Preußing and Iso2* Preußing 101102 (STU)	Germany
alopecuroides	a6	DQ294911	*Holz* 240196 (STU)	Germany
alopecuroides	a7	DQ294910	*Koperski* 300302 (STU)	Germany
alopecuroides	a8	DQ294909	*Nebel & Preußing* 131104 (STU)	Germany
alopecuroides	a9	DQ294908	*Nebel & Schoepe* Iso2 041095 (STU)	Germany
alopecuroides	a10	DQ294907	*Hakelier* 010495 (S)	Sweden
alopecuroides	a11	DQ294906	*Hedenäs* 050686 (S)	Sweden
alopecuroides	a12	DQ294905	*Hedenäs* 260504 (S)	Sweden
alopecuroides	a13	DQ294904	*Hedenäs* 210504 (S)	Sweden
alopecuroides	a14	DQ294903	*Fransson* 180788 (S)	Sweden
alopecuroides	a15	DQ294902	*Hedenäs* 160791 (S)	Sweden
alopecuroides	a16	DQ294901	*Hedenäs* 240504 (S)	Sweden
alopecuroides	a17	DQ294900	*Hedenäs* 070502 (S)	Sweden
alopecuroides	a18	DQ294899	*Hedenäs* 140789 (S)	Sweden
alopecuroides	a19	DQ294898	*Hedenäs* 221191 (S)	Sweden
alopecuroides	a20	DQ294897	*Hedenäs* 240704 (S)	Norway
alopecuroides	a21	DQ294896	*Hedenäs* 200704 (S)	Norway
alopecuroides	a22	DQ294895	*Hedenäs* 170704 (S)	Norway
alopecuroides	a23	DQ294894	*Hedenäs* 140704 (S)	Norway
alopecuroides	a24	DQ294893	*Hedenäs* 140704 (S)	Norway
alopecuroides	a25	DQ294892	*Hedenäs* 140704 (S)	Norway

Continued

Continued

Taxon	Label	ITS	Voucher	Geographic origin
alopecuroides	a26	DQ294891	*Tangney* 071003 (NMW)	France
alopecuroides	a27	DQ294890	*Hedenäs* 080904 (S)	Wales
alopecuroides	a28	DQ294889	*Holyoak* 020902 (NMW)	Ireland
alopecuroides	a29	DQ294888	*Hedenäs* 040804 (S)	Switzerland
alopecuroides	a30	DQ294887	*Hedenäs* 040804 (S)	Switzerland
alopecuroides	a31	DQ294886	*Tangney* 061003 (NMW)	France
alopecuroides	a32	DQ294885	*Tangney* 051003 (NMW)	France
alopecuroides	a33	DQ294884	*Cortés & Pokorny* 230603 (MAUAM)	Spain
alopecuroides	a34	DQ294883	*Pokorny et al.* 080303 (MAUAM)	Spain
alopecuroides	a35	DQ294882	*Lara* 020688 (MAUAM)	Spain
alopecuroides	a36	DQ294881	*Jorquera & Lara* 091189 (MAUAM)	Spain
alopecuroides	a37	DQ294880	*Garilleti & Lara* 011189 (MAUAM)	Spain
alopecuroides	a38	DQ294879	*Albertos et al.* 110694 (MAUAM)	Spain
alopecuroides	a39	DQ294878	*Guerra & Cano* 080694 (MUB)	Spain
alopecuroides	a40	DQ294877	*Cano et al.* 160397 (MAUAM)	Morocco
alopecuroides	a41	DQ294876	*Cano et al.* 160397 (MAUAM)	Morocco
alopecuroides	a42	DQ294875	*Draper* 130502 (MAUAM)	Morocco
alopecuroides	a43	DQ294874	*Draper & Medina* 110604 (MAUAM)	Morocco
alopecuroides	a44	DQ294873	*Draper & Medina* 110604 (MAUAM)	Morocco
alopecuroides	a45	DQ294872	*Draper* 130502 (MAUAM)	Morocco
alopecuroides	a46	DQ294871	*Cano et al.* 160397 (S)	Morocco
alopecuroides	a47	DQ294870	*Albertos et al.* 150697 (S)	Morocco
alopecuroides	a48	DQ294869	*Cano et al.* 160397 (MUB)	Morocco
alopecuroides	a49	DQ294863	*Cano et al.* 150397 (MAUAM)	Morocco
alopecuroides	a50	DQ294862	*Cano et al.* 160397 (MAUAM)	Morocco
alopecuroides	a51	DQ294861	*Tangney* 080904 (NMW)	Wales
alopecuroides	a52	DQ294860	*Edrzejko & Zarnowiec* 081090 (S)	Poland
alopecuroides	a53	DQ294859	*Hedenäs* 200704 (S)	Norway
alopecuroides	a54	DQ294858	*Tangney* August 01 (NMW)	England
alopecuroides	a55	DQ294857	*Tangney* 150400 (NMW)	England
alopecuroides	a56	DQ294856	*De Sloover* 160585 (S)	Belgium
alopecuroides	a57	DQ294855	*Hedenäs* 240504 (S)	Sweden
alopecuroides	a58	DQ294854	*Tangney* 081003 (NMW)	France
alopecuroides	a59	DQ294853	*Hedenäs* 230704 (S)	Norway
alopecuroides	a60	AF395636		
alopecuroides	a61	AJ937834		France
algarvicum	g1	HQ380915	S-B9356	Madeira
algarvicum	g2	HQ380914	S-B9354	Madeira
algarvicum	g3	HQ380913	S-B9351	Madeira
algarvicum	g4	HQ380912	S-B9340	Madeira
algarvicum	g5	HQ380911	S-B9343	Madeira
algarvicum	g6	HQ380909	TFC-Bry-17017/ MUB-28774	Canary Islands
algarvicum	g7	HQ380907	LG-1574	Canary Islands
algarvicum	g8	HQ380906	LG-PALM-1457	Canary Islands
algarvicum	g9	HQ380905	TFC- Bry-12165	Canary Islands
algarvicum	g10	HQ380904	TFC-Bry-15261/MUB-28578	Canary Islands
algarvicum	g11	HQ380903	MUB-28579	Canary Islands
algarvicum	g12	HQ380902	MUB-28583	Spain
algarvicum	g13	HQ380901	MUB-28582	Spain
algarvicum	g14	HQ380900	MUB-28581	Spain
algarvicum	g15	HQ380899	MUB-28580	Spain
algarvicum	g16	HQ380898		Spain
algarvicum	g17	HQ380897	MUB-28584	Spain
algarvicum	g18	DQ294868	S-B9347	Madeira
algarvicum	g19	DQ294867	S-B9341	Madeira
cardotii	cardotii	HQ380917	DUKE-0018250	Canada
cristatum	cristatum1	HQ380918	DUKE-0019425	USA
cristatum	cristatum2	DQ294919	S-B165251	Canada
holtii	h1	DQ294923	*Odland* 210996 (BG)	Norway
holtii	h2	DQ294865	*Long* 280788 (E)	Scotland
holtii	h3	DQ294864	*Long* 070488 (E)	Ireland
holtii	h4	AM182056		Germany
holtii	h5	AM182055		Germany
holtii	h6	AJ964884		Ireland
holtii	h7	AJ964883		Ireland
prolixum	p1	KM676288	*Lobo et al.* 256509 (LISU)	Madeira
prolixum	p2	KM676287	*Lobo et al.* 256511 (LISU)	Madeira
prolixum	p3	KM676286	*Lobo et al.* 256507 (LISU)	Madeira
prolixum	p4	KM676285	*Lobo et al.* 256506 (LISU)	Madeira
prolixum	p5	KM676284	*Fontinha et al.* 256505 (LISU)	Madeira
prolixum	p6	HQ380941	*Stech 04–306* (L)	Madeira

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Taxon	Label	ITS	Voucher	Geographic origin
prolixum	p7	HQ380940	*Stech 04–450* (L)	Madeira
prolixum	p8	HQ380939	*Stech 04–231* (L)	Madeira
prolixum	p9	HQ380938	*Stech 04–531* (L)	Madeira
prolixum	p10	HQ380937	*Stech 04–156* (L)	Madeira
prolixum	p11	EU477598	LISU-RG-011204/2	Azores
prolixum	p12	HQ380929	S- B42630	Azores
prolixum	p13	HQ380930	S-B42628	Azores
prolixum	p14	HQ380931	HQ380930	Azores
prolixum	p15	HQ380932	*Stech 08–466* (L)	Azores
prolixum	p16	HQ380933	*Stech 08–486* (L)	Azores
stoloniferum	stoloniferum	DQ294920	E-00197985	USA
subdiversiforme	subdiversiforme1	DQ294918	S-B117361	Japan
subdiversiforme	subdiversiforme2	DQ294917	*Redfearn et al.* 230888 (H)	China