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Discovery of the rare liverwort *Haplomitrium hookeri* in Belgium: relictualism or long-distance dispersal?

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Abstract – *Haplomitrium hookeri*, a rare liverwort in Europe, is reported as new to Belgium. This discovery fills a distribution gap between northern Holland (Friesen islands) and the French Alps in the previously known suboceanic distribution of the species in Europe. The Belgian collection solely consists in a few male plants. *Haplomitrium hookeri* occurs within a patch of *Calliergonella lindbergii* with other pioneer species on the upper shoreline of a dried pond. The latter had not been dried-out since 1960, suggesting that the existence of *H. hookeri* is not relictual but rather results from recent long-distance dispersal. The nearest Dutch localities are distant of about 400 km. The importance of dried ponds for the conservation of rare species is emphasized and a plea for the regular drying-out of this habitat is made.

***Haplomitrium hookeri* / Belgium / dried ponds / conservation / rare liverworts / long-distance dispersal**

Résumé – *Haplomitrium hookeri*, une hépatique rare en Europe, a été trouvée nouvelle pour la Belgique. Cette découverte complète partiellement le caractère fragmentaire de la répartition de cette espèce entre le nord des Pays-Bas et les Alpes françaises. Seules des plantes mâles ont été trouvées en Belgique. *Haplomitrium hookeri* a été découvert dans une colonie de *Calliergonella lindbergii* avec d'autres espèces pionnières sur la partie supérieure d'un étang en assec. Ce dernier n'avait plus été asséché depuis 1960. En conséquence, la présence d'*H. hookeri* en Belgique n'est très vraisemblablement pas relictuelle mais liée à un événement récent de dispersion à longue distance. Les localités les plus voisines sont situées à quelque 400 km aux Pays-Bas. L'importance des étangs en assec pour la conservation des espèces rares est soulignée et l'assèchement périodique de ce biotope est préconisé.

***Haplomitrium hookeri* / Belgique / étang en assec / conservation / hépatiques rares / dispersion à longue distance**

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INTRODUCTION

A bryological inventory of a reservoir that had been dried-up to facilitate the fixation of the dam in the Ardennes range (Belgium) resulted in the discovery of *Haplomitrium hookeri* (Sm.) Nees. This constitutes the first evidence of the presence of the liverwort in Belgium. Indeed, a previous mention (Vanden Berghen, 1979) was rejected due to the absence of any voucher specimen (De Zuttere & Schumacker, 1984; Schumacker *et al.,* 1985).

In this note, we expand further on this discovery for two main reasons. First, *H. hookeri* is, throughout most of its distribution range, a very scarce species. Second, *H. hookeri* occurs in Belgium on the edge of a pond that had not been dried-out since 1960, suggesting that the presence of the species results from recent long-distance dispersal rather than relictualism. After providing an illustration of the Belgian material and describing its ecology, we discuss its origin and conservation status, and plea for an appropriate management of its habitat.

THE NEW LOCALITY

Belgium, province of Liège, Butgenbach, southern border of the reservoir, IFBL/G8.47.11, UTM/LA 0309, altitude: 540 m, 06.09.2004 (priv. herb., *Sotiaux 31.406*), on bare soil at the upper flood limit with *Pseudephemerum nitidum* (Hedw.) Loeske (dominant), *Fossombronia wondraczekii* (Corda) Dum., *Ditrichum cylindricum* (Hedw.) Grout, *Pohlia camptotrachela* (Renauld & Cardot) Broth., *P. wahlenbergii* (F. Weber & D. Mohr) A.L. Andrews, *Archidium alternifolium* (Dicks ex Hedw.) Mitt., *Ephemerum serratum* (Hedw.) Hampe, *Bryum pallens* Sw., *Calliergonella lindbergii* (Mitt.) Hedenäs, and *Climacium dendroides* F. Weber & D. Mohr (nomenclature of Sotiaux & Vanderpoorten, 2001).

The Belgian material includes only male plants. Its morphology (Fig. 1) fits with previous descriptions of *H. hookeri*, the only of the seven other species of the genus that is present in Europe (Bartholomew-Began, 1991).

DISTRIBUTION AND FREQUENCY

Haplomitrium hookeri exhibits a strongly disjunct distribution pattern. Its occurrence has been reported in North America, from Colorado to British Columbia in the West and from New Hampshire to Maine in the East, western Greenland, Iceland and Spitzbergen, Europe, Nepal, India, China and Japan (Stech & Frey, 2004). In Europe, *H. hookeri* is a northern suboceanic species that occurs in 21 countries (Tab. 1). The discovery of the species in Belgium fills a distribution gap between northern Holland (Friesen islands) and the French Alps.

Although *Haplomitrium hookeri* has been recorded in a number of European countries, it is included within the list of rare species in the Red Data Book of European Bryophytes (Schumacker & Martiny, 1995). The species is indeed exceedingly scarce across most of its distribution range and is therefore included within the red-list of most of the countries where it occurs (Tab. 1). Although it is true that parts of its rarity may come from the fact that the species

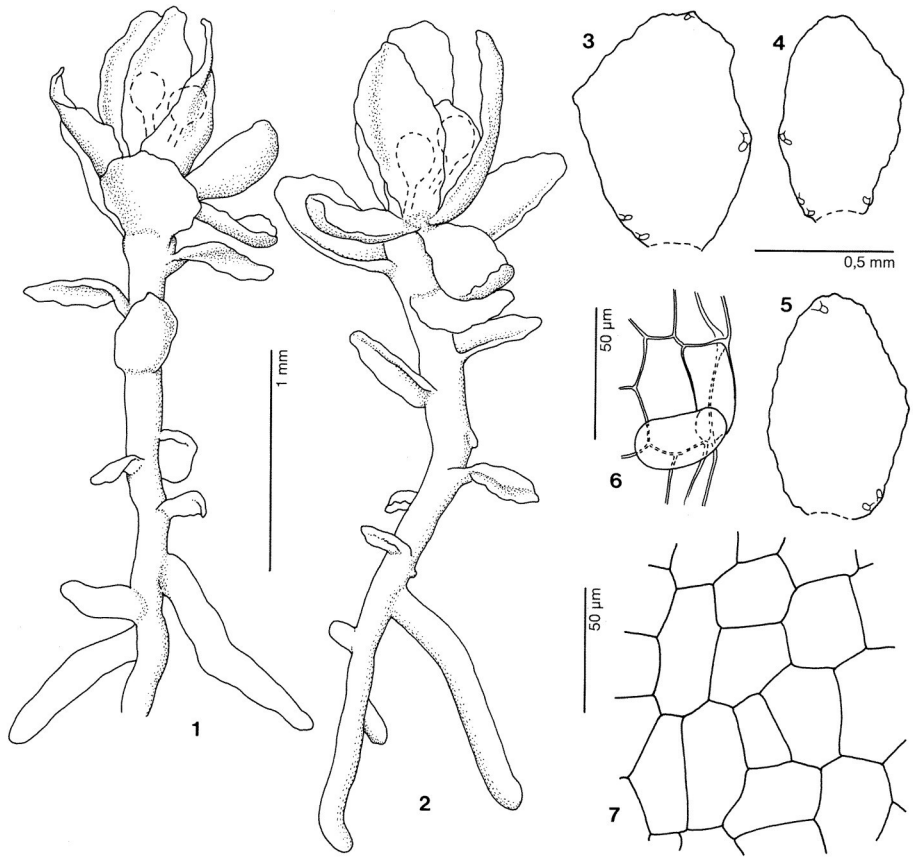

Fig. 1. *Haplomitrium hookeri* in Belgium. **1, 2 :** male shoots ; **3, 4, 5, 6 :** leaves ; **6 :** border with mucilage papilla ; **7 :** mid-leaf cells. All from *Sotiaux 31.406* (priv. herb. A. Sotiaux).

is fairly hard to find, especially when it grows in association with taller bryophytes such as *Calliergonella* or when it grows in open habitats, where it often displays an even smaller size (Paton, 1999), it thus makes no doubt that *H. hookeri* is a relevant species in terms of conservation. Even in Britain, where the species is most abundant (Hill *et al.*, 1991; Paton, 1999) and can be locally frequent in such areas as the Cairngorns (4), it is overall 'nationally scarce'. *Haplomitrium hookeri* is therefore included within the 'Guidelines for the Selection of Biological Heritage Sites' in the context of Britain's responsibility to conserve populations of threatened species in Europe (5).

ECOLOGY, DISPERSION AND CONSERVATION

Haplomitrium hookeri is a pioneer species in a range of bare, moist or wet, sandy, peaty or gravelly soil, often in areas of high light intensity, from near sea-level to alpine levels. In its low altitude European localities, the species is

Table 1. Review of the conservation status of *Haplomitrium hookeri* across its distribution range.

Country	*Status*	*Reference*
Andorre	Known from a single locality	Chavoutier, 2004
Austria	Potentially threatened	Söderström *et al.*, 2002
China	Recently discovered in two localities	Higuchi *et al.*, 2000
Czech Republic	Critically endangered	Kucera & Vana, 2003
Denmark	–	Söderström *et al.*, 2002
Finland	Regionally extinct	Söderström *et al.*, 2002
France	6 localities in the Alps	Skrzypczak, 2004
Germany	Endangered	Söderström *et al.*, 2002
Iberian Peninsula	Endangered	Sergio *et al.*, 1994
Iceland & Faroe islands	–	Söderström *et al.*, 2002
India	Threatened	List of threatened species prepared for assessment and conservation (3)
Italy	Known from a single locality	Schumacker *et al.,* 1999
Japan	Critically endangered	Red list of threatened mosses and hepatics of Japan (2)
North America	Rare	Schofield, 2002
Norway	Declining, monitor species	Red List of threatened mosses in Norway (1)
Poland	Rare	Söderström *et al.*, 2002
Russia	–	Söderström *et al.*, 2002
Slovakia	Indeterminate status	Söderström *et al.*, 2002
Sweden	Vulnerable	Gärdenfors, 2000
Switzerland	Rare	Söderström *et al.*, 2002
The Netherlands	Highest rarity class (only known from the island of Schiermonnikoog, not recorded after 1984)	Landwehr, 1980 ; Siebel & Bijlsma, 2004 ; van Tooren & Bruin, 2004
Ukraine	Rare	Söderström *et al.*, 2002
UK & Ireland	–	Söderström *et al.*, 2002

mostly found in dune slacks, with *Jungermannia gracillima* Sm., *Aneura pinguis* (L.) Dum., *Fossombronia incvurva* Lindb., *Gymnocolea inflata* (Huds.) Dum., and *Pohlia camptotrachela* (Landwehr, 1980 ; Paton, 1999 ; Damsholt, 2002) and sandy or peaty soil on tracks, along water, often with, e.g., *Pellia neesiana* (Gott.) Limpr., *Cephalozia bicuspidata* (L.) Dum., *Riccardia incurvata* Lindb., *Philonotis fontana* (Hedw.) Brid. and *Dicranella palustris* (Dicks.) Crundw. & E.F. Warb. (Damsholt, 2002). A pioneer species, *H. hookeri* is also found on roadsides and other waste grounds (Paton, 1999 ; Mierzeńska, 2002). At higher elevation, *H. hookeri* has been mostly reported from detritus exposed on the margins of watercourses and lakes, melt water areas below late-lying snow patch (Paton, 1999; Schofield, 2002), as high as 4300m (Higuchi *et al.*, 2000), more rarely on humus in partially shaded subalpine (2500m) coniferous forest and meadows (Furuki & Inoue, 1984; Schumacker *et al.*, 1999; Higuchi *et al.*, 2000).

The bare, humid soil at the edge of a dried pond, where the species was most recently discovered in Belgium, thus falls within its ecological range. It is noteworthy that the pond had not been dried-out since 1960. Although bryophyte diaspores, and spores especially, are capable of long-term survival (During, 1997), spore germination after 45 years is very unlikely. Spore longevity, despite showing considerable inter-specific variation and also depending on conditions of storage,

indeed mostly ranges between a few months to a 1-2 decades (Longton & Schuster, 1983). Although a relictual presence of *Haplomitrium* in Belgium cannot be completely ruled-out, because exceptional spore longevities up to 55 years have been reported (Longton & Schuster, 1983), the massive colonization of the pond by bryophytes, only a few weeks after it has been emptied, most probably results from dispersal. If most of the species that have been recorded there on the mud are of fairly frequent occurrence in the area and exhibit high dispersal abilities due to the frequent production of spores (e.g., *Pseudephemerum nitidum, Fossombronia wondraczekii, Ephemerum serratum*) or bulbils (*Pohlia camptotrachela*), other, including *Haplomitrium,* are not known within the even fairly distant surroundings. In fact, the nearest population of *Haplomitrium* occurs on the Friesen Islands in The Netherlands, somewhat 400 km away. As opposed to the traditional view according to which bryophytes exhibit poor dispersal capacities (see Tan & Pòcs, 2000, for a review), this suggests that *H. hookeri* is capable of fairly long-distance dispersal, raising the question of its rarity given its apparently broad ecological range.

At the Belgian locality, the dry muds also host large colonies of *Riccia huebeneriana* Lindenb., another rare species of the Red Data Book of European Bryophytes. This stresses once more, together with other observations on bryophytes (e.g., Schumacker *et al.*, 1977; Sotiaux *et al.*, 1984; Duvigneaud *et al.*, 1986; Schumacker, 1996) but also other taxa (Williams *et al.*, 2004), that temporary water bodies are highly relevant in terms of conservation (Eitam *et al.*, 2004; Nicolet *et al.*, 2004). Temporary water bodies are, however, largely ignored in national monitoring and protection strategies (Williams *et al.*, 2004). In particular, and this is the case of the pond hosting *H. hookeri* in Belgium, constant flow levels over decades resulting from regulations by, e.g., hydroelectric weirs, may eventually result in the complete disappearance of the typical pioneer flora. We therefore urge for the implementation of management programmes according to which ponds would be dried-up at a regular time-scale to create a continuity in the existence of this habitat at the landscape scale.

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