

# Contribution to the bryophyte flora of Donau-Auen National Park (Austria)

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**Abstract:** A representative collection of bryophytes from various types of habitats typical for the National-Park Donau-Auen, Austria was made between March and July 2007. Within the collection 63 mosses and 6 liverworts were identified. *Bryum archangelicum*, *Syntrichia calcicola* and *Kindbergia praelonga* were found for the first time outside of the main area of their Austrian distribution. Eight Austrian red-listed bryophytes were recorded in the investigated area. This study was the first recent bryological investigation on this important, protected riverine area of Central Europe.

**Keywords:** wetlands, riparian forests, Danube, Central Europe

**Kokkuvõte:** Donau-Aueni Rahvusparki (Austria) brüofüüdid

2007. aasta märtsist juulini koguti Donau-Auen'i Rahvusparki (Austria) erinevatest kasvukohatüüpidest andmeid samblaflora kohta. Kolleksioonist määrati 63 lehtsambla ja 6 helviksambla taksonit. *Bryum archangelicum*, *Syntrichia calcicola* ja *Kindbergia praelonga* leiti siin esmakordselt väljaspool Austria põhilevala, registreeriti ka kaheksa Austria punase nimekirja samblaliiki. See on esimene kaasaegne brüoloogiline uurimus sellel tähtsal Kesk-Euroopa Donau-äärsel kaitsealal.

## INTRODUCTION

The investigation of the bryoflora of Austria has a long outstanding tradition and respectable species richness. It counts 1019 species in total, of which 259 and 760 are hepatics and mosses, respectively (Grims et al., 1999; Saukel & Köckinger, 1999). The Austrian bryoflora is among the richest in Europe due to its high ecosystems' diversity. This is also true for the counties of Lower Austria and Vienna where the National Park Donau Auen is situated.

Most of the historic data (Poetsch, 1856, 1859; Juratzka, 1882; Höfer, 1887; Höhnel, 1891; Heeg, 1892) from these two counties do not cover the area of the National Park. Most of these old data refer to spots in the north-eastern part of the park, sites which nowadays have been destructed or affected by city construction or by flood regulation of the river Danube. The main part of the National Park has never been investigated bryologically. Recent bryological data derive mainly from studies which did not focus on bryophytes (Kuyper et al., 1978; Janauer & Pall, 1998). In consequence, they listed only few bryophyte species.

Therefore, this study presents a first contribution to the bryoflora of the National Park

Donau-Auen. A thorough investigation of the area is still going on by H. Zechmeister.

## MATERIAL AND METHODS

### Study area

The Donau-Auen National Park is located in north-eastern Austria, on the both sides of Danube river and it is a green area between the conurbations of Vienna (Austria, Province of Vienna and Lower Austria) and Bratislava (Slovakia) (Mattes, 1997). The Park area covers a narrow strip of lowland forests and meadows, 2–5 km wide and around 40 km long, in the altitude from 110 to 170 meters a.s.l. The Donau-Auen National Park was founded in 1996. The area of the park is 9,300 ha owned by Austrian Federal Forests (Directorate of Inland Waterways). About 60% of this area is forests, approx. 25% is covered by water. The river Danube forms part of the National Park over a range of 36 km. In some parts its waters flood the riverine land and thereby cause the natural rhythm of changes on the riparian wetland. These ecosystems are very dynamic. The variation of water levels

show the extreme range of conditions to which riparian wetlands are subjected. These varying conditions lead to a diversity of micro-habitats. Major habitats are the River Danube, canals and former tributaries of the Danube, pools and sloughs, gravel banks on islands and river-banks, forests, heaths and meadows. Obviously, this great range of habitats is the basis for an outstanding diversity of species. There are more than 700 species of vascular plants, more than 30 mammal and 100 breeding bird species, 8 reptilian and 13 amphibian species, more than 50 different species of fish and an abundance of terrestrial and aquatic invertebrates (National-Park Donauauen GmbH, 2008).

The Danube Floodplains National Park protects one of the largest natural riparian wetland in Central Europe, which is still to a high degree natural and also offers home and refuge to many endangered plants and animals. Further along the Danube river there are protected areas also in Hungary (Szigetköz) and Slovakia (Csallóköz = Žitny ostrov).

## Methods

During the period between March and July 2007, a representative collection of bryophytes was collected by the first author. The transect method was used to cover as many different types of habitats as possible in the region of Danube Floodplains National Park. The samples were taken from different substrates such as calcareous or non-calcareous soil, tree barks, decaying wood, exposed and shaded rocks and flooded substrates.

The bryophyte specimens were identified at the Faculty of Life Sciences, Vienna University and Faculty of Biology, University of Belgrade and deposited in the WU, BEOU and the first authors' private herbaria.

Nomenclature for mosses follows Hill et al. (2006) and Sabovljević et al. (2008) and for liverworts Sabovljević & Natcheva (2006).

The investigated sites are shown in Fig. 1

## RESULTS

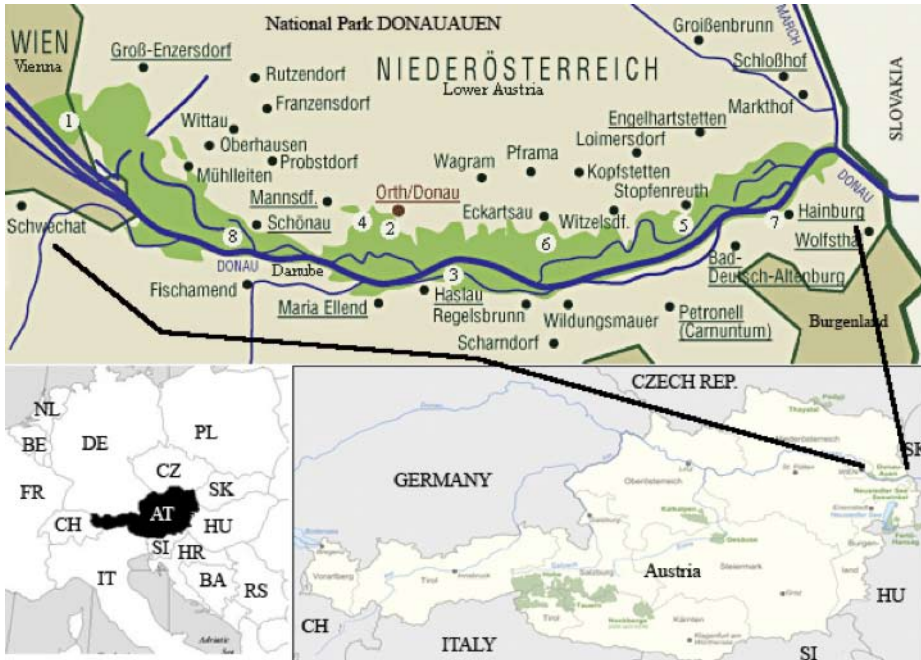
A total number of 69 taxa were found, 63 mosses and 6 liverworts. *Bryum archangelicum*, *Syntrichia calcicola* and *Kindbergia praelonga* were found for the first time outside their main area of distribution which is the Alpine area.

Eight species are listed in the Red Data List of bryophytes of Austria (Grims and Köckinger, 1999; numbers in brackets represent localities on Fig.1): *Bryum algovicum* (5), *Bryum archangelicum* (3), *Didymodon acutus* (1), *Didymodon vinealis* (1), *Drepanocladus aduncus* (4,5), *Fissidens adianthoides* (2), *Syntrichia calcicola* (5) and *Syntrichia latifolia* (5).

## List of bryophytes of Donau-Auen National Park

**Mosses (Bryopsida).** Numbers in brackets point to localities (Fig. 1).

- ABIETINELLA ABIETINA (Hedw.) M.Fleisch. – on soil in dry grasslands (1, 8)  
 AMBLYSTEGIUM SERPENS (Hedw.) Schimp. – decaying wood or tree bark in flooded forest (2, 3, 4, 5)  
 AMBLYSTEGIUM VARIUM (Hedw.) Mönk. – on tree bark, flooded forest (2, 5, 8)  
 ANOMODON ATTENUATUS (Hedw.) Huebener – on tree bark, flooded forest (4, 5)  
 ANOMODON VITICULOSUS (Hedw.) Hook. & Tayl. – on the bark of *Quercus* (2, 4)  
 BARBULA UNGUICULATA Hedw. – on soil (1), on soil, forest edge (3)  
 BRACHYTHECIASTRUM VELUTINUM (Hedw.) Ignatov & Huttunen – on stump and sandy soil, flooded forest (4, 7)  
 BRACHYTHECIUM ERYTHORRHIZON Schimp. – on stump, forest (4)  
 BRACHYTHECIUM GLAREOSUM (Bruch ex Spruce) Schimp. – on stump, forest (5)  
 BRACHYTHECIUM SALEBROSUM (Hoffm. ex F.Weber & D.Mohr) Schimp. – on soil and decaying wood (2, 4)  
 BRACHYTHECIUM RUTABULUM (Hedw.) Schimp. – on decaying wood, forest (2, 4)  
 BRYUM ALGOVICUM Sendtn. ex Müll.Hal – on soil, meadow (5)  
 BRYUM ARCHANGELICUM Bruch. & Schimp. – on rock, Danube channel bank (3)  
 BRYUM ARGENTEUM Hedw. – on soil, open area (3)  
 BRYUM CAPILLARE Hedw. – on the stump, forest edge, on soil (1)  
 BRYUM DICHOTOMUM Hedw. – on flooded rock, Danube channel bank (3)  
 BRYUM MORAVICUM Podp. – on wet soil, Danube channel bank (2)  
 CALLIERGONELLA CUSPIDATA (Hedw.) Loeske – on wet soil, forest (5)



**Fig. 1.** Map of Donau-Auen National Park and its location in Austria. The following sites were investigated: 1. Lobau, 2. Orth an der Donau, 3. Haslau an der Donau, 4. Mannsdorf, 5. Stopfenreuth, 6. Eckartsau, 7. Hainburg, and 8. Schönau.

Abbreviations: AT – Austria, BA – Bosnia-Herzegovina, BE – Belgium, CH – Switzerland, CZ – Czech Republic, DE – Germany, FR – France, HR – Croatia, HU – Hungary, IT – Italy, NL – the Netherlands, PL – Poland, RS – Serbia, SI – Slovenia, SK – Slovakia.

*CERATODON PURPUREUS* (Hedw.) Brid. – on decaying wood, forest edge (5)  
*CINCLIDOTUS FONTINALOIDES* (Hedw.) P.Beav. – on flooded rocks, Danube channel bank (8)  
*CINCLIDOTUS RIPARIUS* (Host ex Brid.) Arn. – on flooded rocks, Danube river bank (2, 5)  
*DICRANUM TAURICUM* Sapjegin – on decaying wood, forest edge (6)  
*DIDYMODON ACUTUS* (Brid.) K.Saito – on soil, in grassland (1)  
*DIDYMODON VINEALIS* (Brid.) R.H.Zander – on soil, in grassland (1)  
*DREPANOCADUS ADUNCUS* (Hedw.) Warnst. – on flooded wood and rocks, Danube channels (4, 5)  
*ENCALYPTA STREPTOCARPA* Hedw. – on sandy soil, Danube river bank (7)  
*EURHYNCHIASTRUM PULCHELLUM* (Hedw.) Ignatov & Huttunen – on soil, forest road (2)  
*FISSIDENS ADIANTHOIDES* Hedw. – on flooded forest soil (2)

*FISSIDENS TAXIFOLIUS* Hedw. – on flooded forest soil (4)  
*FONTINALIS ANTIPIRETTICA* Hedw. – on submerged rocks, Danube channel (5)  
*FUNARIA HYGROMETRICA* Hedw. – on wet soil, Danube channel bank (2, 4)  
*GRIMMIA ORBICULARIS* Bruch ex Wilson – on concrete, in dyke system (2)  
*HOMALIA TRICHOMANOIDES* (Hedw.) Brid. – on the bark of *Acer*, flooded forest (2, 4)  
*HOMALOTHECIUM PHILIPPEANUM* (Spruce) Schimp. – on soil, meadow (2, 4, 5)  
*HOMALOTHECIUM SERICEUM* (Hedw.) Schimp. – on soil, meadow (2, 4)  
*HYLOCOMIUM SPLENDENS* (Hedw.) Schimp. – on soil, forest edge (1)  
*HYPNUM CUPRESSIFORME* Hedw. – on the bark of *Quercus*, forest (2, 4)  
*HYPNUM CUPRESSIFORME* Hedw. var. *CUPRESSIFORME* – on decaying wood, forest (2)

- HYPNUM CUPRESSIFORME var. FILIFORME Brid. – on tree bark, forest (2)
- HYPNUM CUPRESSIFORME var. RESUPINATUM (Tayl.) Schimp. – on the bark of *Quercus*, forest (2)
- KINDBERGIA PRAELONGA (Hew.) Ochyra – on a stump (2)
- LEPTODICTYUM RIPARIUM (Hedw.) Warnst. – decaying branches on river banks (6)
- LESKEA POLYCARPA Hedw. – on the bark of *Populus*, flooded forest (3)
- MNIUM MARGINATUM (Dicks.) P.Beauv. – on soil, meadow (3)
- ORTHOTRICHUM ANOMALUM Hedw. – on rock, open area (3)
- ORTHOTRICHUM DIAPHANUM Schrad ex Brid. – on tree bark, forest edge (3)
- ORTHOTRICHUM sp. Hedw. – decaying wood, open area (5)
- PLAGIOMNIUM CUSPIDATUM (Hedw.) T.J.Kop. – on wet soil, forest edge (4)
- PLAGIOMNIUM UNDULATUM (Hedw.) T.J.Kop. – on wet soil, forest edge (5)
- PHYSCOMITRIUM PYRIFORME (Hedw.) Bruch & Schimp. – on wet soil, Danube channel bank (2, 4)
- POLYTRICHASTRUM FORMOSUM (Hedw.) G.L.Sm. – on soil under *Fagus* (3)
- PSEUDOSCLERPODIUM PURUM (Hedw.) M.Fleisch. – on soil, meadow (1, 2, 4, 7)
- RACOMITRIUM CANESCENS (Hedw.) Brid. – on soil, dry grassland (1)
- RHYTIDIADELPHUS TRIQUETRUS (Hedw.) Warnst. – on soil, forest edge (1)
- RHYTIDIUM RUGOSUM (Hedw.) Kindb. – on soil, forest edge (1)
- SYNTRICHIA CALCICOLA J.J.Amann – on soil, dry grassland (5)
- SYNTRICHIA LATIFOLIA (Bruch ex Hartm.) Huebener – on decaying wood, forest edge (5)
- SYNTRICHIA RURALIS (Hedw.) F.Weber & D.Mohr var. RURALIS – on soil, dry grassland (1)
- SYNTRICHIA RURALIS var. RURALIFORMIS (Besch.) Delogne – on roof (2)
- THUIDIUM DELICATULUM (Hedw.) Schimp. – on soil, dry grassland (1)
- TORTELLA TORTUOSA (Hedw.) Limpr. – on calcareous soil, dry grassland (1)
- TORTULA MURALIS Hedw. – on rocks, open area (3, 5)
- TRICHOSTOMUM CRISPULUM Bruch – on flooded rocks, Danube channel bank (3)

### Liverworts (Hepaticae)

- CONOCEPHALUM CONICUM (L.) Dumort. – on wet soil, Danube channel bank (3, 5)
- LOPHOCOLEA HETEROPHYLLA (Schrad.) Dumort. – on moss, wet soil, forest (3)
- PELLIA EPIPHYLLA (L.) Corda – on wet soil, Danube channel bank (5)
- PORELLA PLATYPHYLLA (L.) Pfeif. – on stump and tree bark, forest (2, 4)
- RADULA COMPLANATA (L.) Dumort. – on stump and tree bark, forest edge (1)
- RADULA LINDENBERGIANA Gottsche ex C. Hartm. – on stump, forest edge (1)

### DISCUSSION AND CONCLUSION

Bryophyte vegetation is known to react rapidly to varying environmental conditions. So, bryophytes are often used as good indicators. Many authors highlight the importance of bryophyte vegetation use in water pollution and water quality estimation or riparian ecosystem disturbance (Empain, 1973, 1978; Frahm, 1974; Peñuelas & Sabater, 1987; Vrhovšek et al., 1984, 1985; Mouvet et al., 1986; Elisa et al., 1992; Papp & Rajczyk, 1995, 1998a, 2009; Vanderpoorten, 1999; Vanderpoorten & Klein 1999; Vanderpoorten et al., 1999; Nimis et al., 2002; Samecka-Cymerman et al. 2002). Besides, it is documented that the flow regulation strongly affects bryophyte components of riparian river side ecosystems (Englund et al. 1997) so studies of river sides bryofloras form important base for further monitoring (Philippi, 1961, 1968; Vitt et al., 1986; Glime and Vitt, 1987; Muotka & Virtanen, 1995; Papp and Rajczyk, 1998b; Dragičević et al. 2008).

Papp & Rajczyk (2009) reported that there are extensive changes in aquatic-riparian vegetation in Hungarian Danube branch system protection area named Szigetköz, but such studies are still missing in neighboring Austrian (Donau-Auen) and Slovakian (Žitny ostrov) riparian parts.

This bryophyte flora report is the first such contribution for Donau-Auen in Austria, but further investigation is urgently needed.

### ACKNOWLEDGEMENT

The study was performed within a volunteer period of the first author. Thanks to C. Baumgartner (NP Donauauen) and the Donauauen

National Park GmbH for supporting this stay. We thank Beáta Papp and the editors for the valuable comments on the manuscript.

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