

## A PRELIMINARY STUDY OF BRYOPHYTES IN THE PINKA GORGE

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**Abstract:** The River Pinka originates in eastern Austria and reaches the territory of Hungary at first near Felsőcsatár. The river cuts through the Nagyvilágos Hill forming a gorge. This unique landscape is home to special flora and fauna. The floristic and vegetation studies conducted in the area have mainly focused on vascular plants, while the bryophyte flora has not been thoroughly investigated so far. The main aim of this study was to explore the bryophyte diversity and distribution patterns in the Hungarian part of the Pinka Gorge. During the field study, altogether 94 bryophyte species were found in the gorge. The 77 Bryophyta and 17 Marchantiophyta species belong to 57 genera of 34 families.

**Key words:** bryoflora, diversity, Felsőcsatár, Pinka Gorge

### INTRODUCTION

The River Pinka originates from the Wechsel Mountains in eastern Austria about 38 km far from Hungary. The river reaches the territory of Hungary at first near Felsőcsatár, and then it flows southeastward along the border crossing it altogether seven times before discharging into the river Raab near Körmend. The river cuts through the Nagyvilágos Hill forming a gorge between Pinkaóvár (Burg) and Felsőcsatár (Fig. 1). The main rock type of the Nagyvilágos Hill is greenschist with several foliated and massive serpentinites, gabbros and related talc deposits (KUBOVICS 1983, KORPÁS *et al.* 1999). The soil is basically acidic (KIRÁLY *et al.* 1999).

This unique landscape is home to special flora and fauna (KERESZTURINÉ 2000). Floristical and vegetation studies have been carried out in the area since the 19th century (e.g. BORBÁS 1887, 1897). KIRÁLY *et al.* (1999) made a review of the literature on botanical studies conducted in this region and created a vegetation map for the Nagyvilágos Hill. The floristical studies have mainly focused on vascular plants, while the bryophyte flora has not been thoroughly investigated so far either in the Pinka Gorge or on the Nagyvilágos Hill. The locations of the few moss species mentioned by BORBÁS (1887) and BOROS (1927) from this border region were

poorly described, and most probably they belong to Austria. HAZSLINSZKY (1885) reported three moss species from Pinkafő (based on specimens collected by Borbás), which can be also found outside present-day Hungary. Gáyer, Latzel, and Piers also collected moss species from this area, but the locations of most specimens are uncertain or can be identified again as Austrian territories (*cf.* BOROS 1927, LATZEL 1930). KIRÁLY *et al.* (1999) provided reliable information about plants found on Nagyvilágos Hill, but they mentioned only eight moss species (they were identified by Péter Szövényi). Since bryophyte flora of the Pinka Gorge is less known and it is

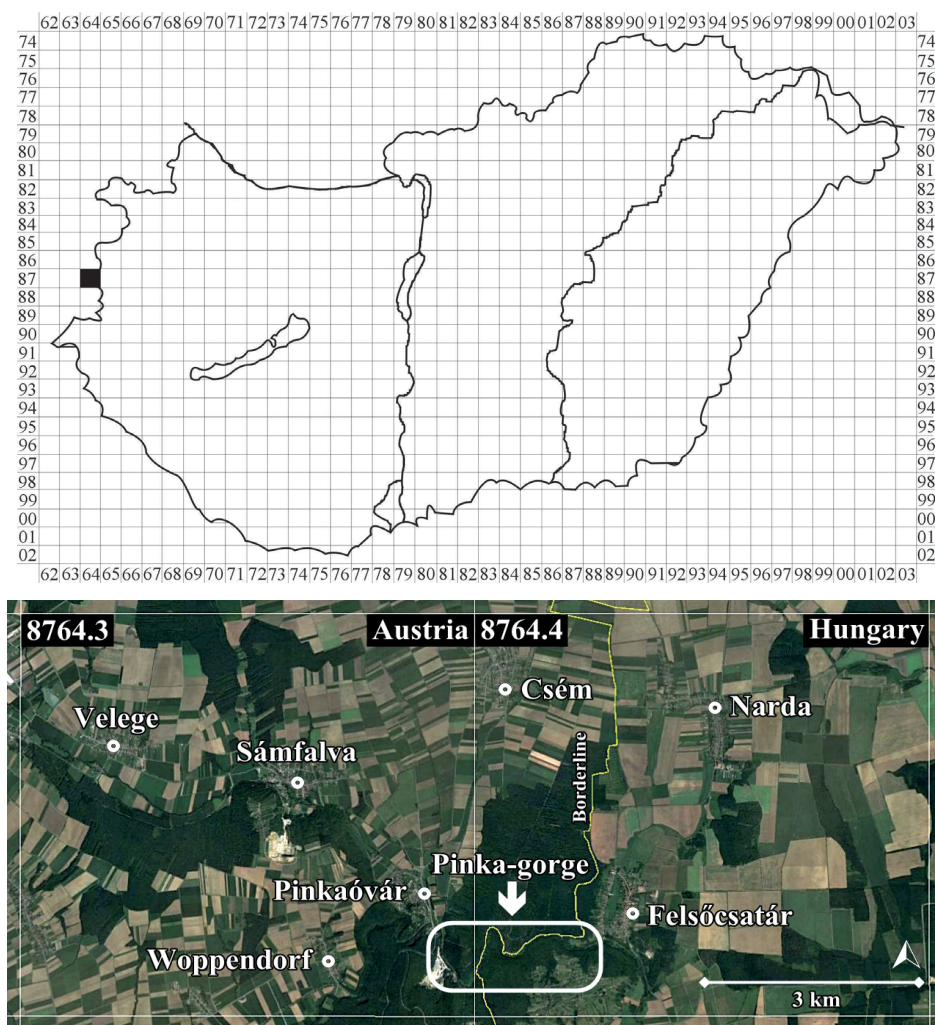


Fig. 1. Geographical location of the Pinka Gorge according to the grid of the Central European Mapping System (NIKLFELD 1971).

not possible to determine the exact locations of the specimens which were collected earlier in the region, the main aim of this study was to explore the bryophyte diversity and distribution patterns in the Hungarian part of the Pinka Gorge.

## MATERIAL AND METHODS

The bryophyte diversity was studied in the gorge in April, July, and August of 2016 and in March and April of 2017, between 47.208928° N, 16.439169° E and 47.207272° N, 16.423364° E [8764.4]. The examined area was *ca* 1500 m long and maximum 60 m wide along the right side of the river. It was divided into three equal long parts marked with letter A, B, and C from east to west (Fig. 2).

Part 'A' is a disturbed, open sunny habitat at the beginning of the gorge dominated by some invasive species, such as *Solidago gigantea*, *Impatiens glandulifera*, and *Robinia pseudoacacia*. Part 'B' is a shady forest area with several standing and fallen deadwood, dominated by *Carpinus betulus*, *Alnus glutinosa*, and *Cerasus vulgaris*. Part 'C' is also a shady forest area, which can be characterised by less deadwood and many rock outcrops. The geographical coordinates were determined using a Garmin eTrex-30 GPS. The moss species were identified according to BOROS (1953), ORBÁN and VAJDA (1983), SMITH (2004), and ERZBERGER (unpublished). Collected specimens were studied using both stereomicroscope Olympus SZ51 at 10–40× magnification and optical microscope at 60–400× magnification. Specimens are deposited in the author's herbarium in Szombathely. The nomenclature of the bryophyte taxa follows PAPP *et al.* (2010). The classification of mosses (Bryophyta) follows GOFFINET and SHAW (2009), while the classification of liverworts (Marchantiophyta) follows SÖDERSTRÖM *et al.* (2016). The species in each family are arranged in alphabetical



Fig. 2. The examined area in the Pinka Gorge divided into three equal long parts marked with letter A, B, and C.

order. Species names are followed by the ‘letter’ of the study sites (A, B, or C) in which they were found, and by the substrate on which they were grown. In the case of vascular plants the nomenclature follows KIRÁLY (2009).

## RESULTS

During the field study, 94 bryophyte species were found in the Pinka Gorge. The 77 Bryophyta and 17 Marchantiophyta species belong to 57 genera of 34 families. Altogether 168 specimens were collected from the examined area.

### Bryophyta

#### Polytrichaceae

*Atrichum undulatum* (Hedw.) P. Beauv. – A, B, C – soil.

*Pogonatum aloides* (Hedw.) P. Beauv. – A, B, C – soil.

*Polytrichum formosum* Hedw. – A, B, C – soil.

#### Encalyptaceae

*Encalypta streptocarpa* Hedw. – B, C – rock.

#### Funariaceae

*Funaria hygrometrica* Hedw. – A – soil.

#### Grimmiaceae

*Grimmia pulvinata* (Hedw.) Sm. – C – concrete dike.

*Schistidium apocarpum* (Hedw.) Bruch et Schimp. – B, C – concrete dike and rock.

#### Fissidentaceae

*Fissidens bryoides* Hedw. – A, B, C – soil.

*Fissidens dubius* P. Beauv. – B, C – soil and rock.

*Fissidens exilis* Hedw. – C – soil.

*Fissidens taxifolius* Hedw. – A, B, C – soil.

#### Ditrichaceae

*Ceratodon purpureus* (Hedw.) Brid. – A, B, C – soil, stones, and rock.

*Pleuroidium subulatum* (Hedw.) Rabenh. – A – soil.

## Dicranaceae

- Dicranella heteromalla* (Hedw.) Schimp. – B, C – soil.  
*Dicranella schreberiana* (Hedw.) Hilf. ex H. A. Crum et L. E. Anderson – B – soil.  
*Dicranum montanum* Hedw. – B – decaying wood  
*Dicranum scoparium* Hedw. – C – soil and rock, about 50 m far from the river.

## Pottiaceae

- Barbula convoluta* Hedw. – A, B – soil.  
*Barbula unguiculata* Hedw. – A, B, C – soil.  
*Syntrichia ruralis* (Hedw.) F. Weber et D. Mohr – C – concrete dike.  
*Tortula muralis* Hedw. – C – concrete dike and rock.  
*Weissia* sp. – C – rock (without capsules).

## Bryaceae

- Bryum argenteum* Hedw. – A, C – concrete dike and rock.  
*Bryum bicolor* Dicks. – B, C – soil and stones along the river.  
*Bryum capillare* Hedw. – A, B, C – soil and rock.  
*Bryum moravicum* Podp. – B, C – soil and rock.  
*Bryum pallens* Sw. ex anon. – C – soil along the river.  
*Pohlia lutescens* (Limpr.) H. Lindb. – B – soil and rock.  
*Pohlia nutans* (Hedw.) Lindb. – A, B, C – soil.

## Mniaceae

- Mnium marginatum* (Dicks.) P. Beauv. – B, C – soil and stones along the river.  
*Mnium stellare* Hedw. – A, B – soil.  
*Plagiomnium cuspidatum* (Hedw.) T. J. Kop. – B, C – soil.  
*Plagiomnium undulatum* (Hedw.) T. J. Kop. – A, B, C – soil.  
*Rhizomnium punctatum* (Hedw.) T. J. Kop. – B, C – soil and stones along the river.

## Bartramiaceae

- Bartramia pomiformis* Hedw. – B, C – rock.

## Orthotrichaceae

- Orthotrichum lyellii* Hook. et Taylor – B – bark of *Sambucus nigra*.



*Orthotrichum pallens* Bruch ex Brid. – A, B – bark of *Fagus sylvatica* and *Carpinus betulus*.

*Orthotrichum patens* Bruch ex Brid. – A, B – bark of *Carpinus betulus*.

*Orthotrichum speciosum* Nees – A, B, C – bark of *Sambucus nigra* and *Alnus glutinosa*.

*Orthotrichum striatum* Hedw. – A – bark of *Carpinus betulus*.

*Ulotia crispa* (Hedw.) Brid. – B – bark of *Carpinus betulus* and *Alnus glutinosa*.

#### Amblystegiaceae

*Amblystegium serpens* (Hedw.) Schimp. – A, B, C – soil and deadwood.

*Amblystegium tenax* (Hedw.) C. E. O. Jensen – C – stones in the river.

*Amblystegium varium* (Hedw.) Lindb. – C – soil along the river.

*Cratoneuron filicinum* (Hedw.) Spruce – C – soil and stones in the river.

#### Leskeaceae

*Leskea polycarpa* Ehrh. ex Hedw. – A – bark of *Robinia pseudoacacia* and *Sambucus nigra*.

#### Thuidiaceae

*Thuidium philibertii* Limpr. – C – soil.

#### Brachytheciaceae

*Brachythecium glareosum* (Spruce) Schimp. – A – soil.

*Brachythecium populeum* (Hedw.) Schimp. – B – rock.

*Brachythecium rivulare* Schimp. – C – soil and rocks along the river.

*Brachythecium rutabulum* (Hedw.) Schimp. – A, B, C – soil.

*Brachythecium velutinum* (Hedw.) Schimp. – A, B, C – soil, deadwood, and rock.

*Eurhynchium angustirete* (Broth.) T. J. Kop. – B, C – soil and trunk base of *Carpinus betulus*.

*Eurhynchium hians* (Hedw.) Sande Lac. – A, B, C – soil, stones, and rock.

*Eurhynchium schleicheri* (R. Hedw.) Milde – B – soil and rock.

*Eurhynchium striatum* (Hedw.) Schimp. – C – soil, stones, and rock.

*Isoetecium alopecuroides* (Dubois) Isov. – A, B, C – soil, rock, and bark of several trees.

*Platyhypnidium riparioides* (Hedw.) Dixon – C – stones in the river.

## Hypnaceae

*Hypnum cupressiforme* Hedw. – A, B, C – soil, stones, rock, and trunk base and bark of several trees.

*Homalothecium sericeum* (Hedw.) Schimp. – A, B – bark of several trees and rock.

*Pylaisia polyantha* (Hedw.) Schimp. – A, B – bark of several trees.

## Pterigynandraceae

*Pterigynandrum filiforme* Hedw. – A, B – stones, rock, and bark of several trees.

## Hylocomiaceae

*Ctenidium molluscum* (Hedw.) Mitt. – B, C – soil and rock.

*Pleurozium schreberi* (Brid.) Mitt. – C – soil.

*Hylocomium splendens* (Hedw.) Schimp. – C – soil and rock.

*Rhytidiadelphus triquetrus* (Hedw.) Warnst. – B, C – soil and rock.

## Plagiotheciaceae

*Herzogiella seligeri* (Brid.) Z. Iwats. – A, B – decaying wood

*Plagiothecium cavifolium* (Brid.) Z. Iwats. – A, B, C – soil.

*Plagiothecium nemorale* (Mitt.) A. Jaeger – A, B, C – trunk base of *Fagus sylvatica*.

*Pseudotaxiphyllum elegans* (Brid.) Z. Iwats. – B, C – rock.

## Pylaisiadelphaceae

*Platygyrium repens* (Brid.) Schimp. – A, B, C – bark of several trees.

## Neckeraceae

*Homalia besseri* Lobarz. – C – rock.

*Homalia trichomanoides* (Hedw.) Brid. – B, C – trunk base of *Carpinus betulus*.

*Neckera complanata* (Hedw.) Huebener – C – rock.

## Anomodontaceae

*Anomodon attenuatus* (Hedw.) Huebener – A, B, C – rock and trunk base of *Carpinus betulus* and *Fagus sylvatica*.

*Anomodon longifolius* (Brid.) Hartm. – C – rock.

*Anomodon viticulosus* (Hedw.) Hook. et Taylor – B, C – rock.

### **Marchantiophyta**

#### **Anastrophyllaceae**

*Barbilophozia barbata* (Schreb.) Loeske – C – soil and rock.

#### **Lophocoleaceae**

*Chiloscyphus pallescens* (Hoffm.) Dumort. – B, C – soil along the river.

*Chiloscyphus polyanthos* (L.) Corda – B, C – stone.

*Lophocolea bidentata* (L.) Dumort. – B – soil and decaying wood.

*Lophocolea heterophylla* (Schrad.) Dumort. – A, B, C – soil and decaying wood.

*Lophocolea minor* Nees – B – rock.

#### **Plagiochilaceae**

*Plagiochila asplenoides* (L.) Dumort. – B, C – soil and rock.

*Plagiochila porelloides* (Nees) Lindenb. – A, B, C – soil and rock.

#### **Frullaniaceae**

*Frullania dilatata* (L.) Dumort. – B, C – bark of several trees.

#### **Lejeuneaceae**

*Lejeunea cavifolia* (Ehrh.) Lindb. – C – rock.

#### **Porellaceae**

*Porella platyphylla* (L.) Pfeiff. – C – rock and bark of several trees.

#### **Radulaceae**

*Radula complanata* (L.) Dumort. – B, C – bark of several trees.

#### **Metzgeriaceae**

*Metzgeria conjugata* Lindb. – A, B, C – rock, trunk base and bark of several trees.

*Metzgeria furcata* (L.) Dumort. – A, B, C – rock, trunk base and bark of several trees.



## Pelliaceae

*Pellia endiviifolia* (Dicks.) Dumort. – B, C – soil along the river

## Conocephalaceae

*Conocephalum conicum* (L.) Dumort. – B, C – soil.

## Marchantiaceae

*Marchantia polymorpha* L. – C – soil along the river.

## DISCUSSION

The results of this preliminary study suggest that the bryophyte diversity is quite high in the Pinka Gorge. The main reason for that can be the several different habitat types that can be found in this area. *Orthotrichum patens*, *Chiloscyphus pallescens*, and *Bryum pallens* have been indicated as vulnerable species in the red list of Hungarian bryophytes (PAPP *et al.* 2010), which also emphasizes the importance of further research in this highly valuable Natura 2000 territory.

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**Összefoglaló:** A Pinka folyó a kelet-ausztriai Wechsel-hegységben ered, körülbelül 38 km-re Magyarországtól. Felsőcsatár közelében éri el először az országhatárt, ahol a Nagyharsány-hegyet átszelve sajátos szurdokvölgyet alakít ki. A terület állat és növényvilága rendkívül gazdag. Azonban a Pinka-szurdokra és a Nagyharsány-hegyre kiterjedő florisztikai vizsgálatok ezidáig főleg az edényes növényeket érintették, míg a terület mohafldrája hiányosan ismert. A szurdok mohafldrájának a feltérképezése 2016 tavaszán kezdődött, s a mai napig tart. E tanulmányban az eddig kimutatott fajok és azok elterjedési mintázatai kerülnek bemutatásra. A vizsgálatok során 94 mohafajt sikerült azonosítani a Pinka-szurdok átvizsgált, közel 1,5 km-es szakaszán. A 77 lombosmoha és 17 májmosmoha faj 34 növénycsalád 57 nemzetségéhez tartozott.

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