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Bryophyte collection BEOU – a neglected national research treasure

Original Article

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Abstract:

Considering recent progress of bryology in Serbia digitisation of bryophyte collection within BEOU (Bryo BEOU) was initiated. It is the most important and the largest collection of the bryophytes in the country, and represent a significant basis for all further research and analysis of bryophyte flora of Serbia. This collection also keeps relevant material from neighbouring countries that are considered poorly investigated (e.g. N. Macedonia, Albania, Bosnia and Herzegovina). Here an overview of the specimens kept in the collection, data-based up to 2019, is given. However, work on the organisation and systematisation of this growing collection is ongoing.

Key words:

bryophytes, herbarium, collection, digitisation, Serbia

Apstract:

Kolekcija briofita BEOU - zanemareno nacionalno istraživačko blago

Sa razvojem briologije u Srbiji, koja je decenijama bila zapostavljena, započeta je digitalizacija kolekcije briofita u okviru BEOU Herbarijuma (Bryo BEOU). Ova kolekcija je najznačajnija i najveća kolekcija briofita u zemlji, i predstavlja važnu osnovu za sva buduća istraživanja i analize flore briofita u Srbiji. Zbirka sadrži i značajan materijal iz drugih zemalja koje se smatraju slabo ili nedovoljno briološki istraženim (npr. Severna Makedonija, Albanija, Bosna i Hercegovina). U radu je dat trenutni pregled briološke zbirke, sa presekom digitalizacije do 2019. godine. Rad na organizaciji i sistematizaciji ove kolekcije je i dalje u toku.

Ključne reči:

briofite, herbarijum, zbirka, digitalizacija, Srbija

The value of herbarium collections

Herbaria document the world's flora and provide a record of botanical diversity. Historically, the primary importance of herbarium specimens was related to the questions of taxonomy, which includes identification, nomenclature, and classification of taxa (e. g. Janković et al., 2014; Niketić, 2014; Di Pietro et al., 2017). Beyond this, herbarium collections have become crucial for a wide array of studies. Primarily, they ensure a continuous record of species distributions (Buzurović et al., 2013), and even its predictions (Loiselle et al., 2008; Wollan et al., 2008; Feeley & Silman, 2011). Hence, historical plant collections are of great value for studying changes in time of flora and vegetation due to the global climate change or degradation of habitats. Herbarium collections can also be used to monitor the spread of invasive taxa (Delisle et al., 2003; Crawford & Hoagland, 2009; Jenačković et al., 2015), population trends and traits of rare and endangered taxa (Christenson, 1994), and to identify priority sites for conservation. Historical herbarium specimens are also an important source of information for the conservation of rare or even extinct taxa (Kricsfalusy & Trevisan, 2014), but also for (phylo)genetic and evolutionary studies. The collections represent an important educational resource for researchers and students.

Herbarium BEOU

One of the most important and largest herbarium collections in Southeastern Europe is located at the Institute of Botany and Botanical garden "Jevremovac" of the Faculty of Biology, University of Belgrade. It was founded almost 160 years ago, in 1860, when the famous Serbian botanist Josif Pančić gave his collection of pressed plants to the Great School, cur-

Fig. 1. Labelled and digitised moss specimen in the bryophyte collection BEOU

rent University of Belgrade (Vukojičić et al., 2011). At that time, the collection numbered 20.000 specimens of 6.000 different species that he was gathering during his field trips, but also as an exchange with the European herbaria such as Germany, France, Italy, Spain and Russia. Pančić's collection (Herbarium Pancicianum) is of exceptional scientific, historical and cultural value and importance.

In addition to Pančić, many other Serbian botanists of the 19th and 20th centuries have contributed to the enrichment of the Herbarium, such as S. Petrović, P. Jurišić, Đ. Ilić, Đ. Ničić, S. Pelivanović, N. Košanin, T. Soška, L. Adamović, V. Blečić, I. Rudski, P. Černjavski, B. Tatić, M.M. Janković, J. Blaženčić and many others. Over the past 30 years, researchers of the recent generations (V. Stevanović, D. Lakušić, S. Jovanović, G. Tomović, S. Vukojičić, and others) have contributed significantly to the Herbarium collection, with over 60.000 herbarium specimens collected mostly from the Balkan Peninsula.

Herbarium of the University of Belgrade today numbers more than 180.000 specimens of vascular plants, bryophytes (Bryo/BEOU) and algae. It is included in the global directory of registered herbaria (*Index Herbariorum*), under the herbarium code BEOU.

Bryophyte collections BEOU

Bryology in Serbia started in the middle of the 19th century. During the so-called early period of exploration (Pantović & Sabovljević, 2017), many Serbian botanists and teachers - from Pančić, Katić, Jurišić, Simić and Soška, to Košanin, Rudski, Černjavski and Grebenščikov - in addition to the vascular flora also collected bryophytes. Bryophyte material collected by the first researchers is kept at the Natural History Museum in Belgrade (Pavletić, 1955), which is also included in the Index Herbariorum under code BEO. Material from this collection is from localities from all over former Yugoslavia and the Balkan Peninsula. Although historically important, this collection was forgotten and remained neglected with unnamed specimens for a long time. According to the catalogue, it numbers over 800 specimens.

A far greater collection of bryophytes has been kept at the BEOU Herbarium, which has been intensively increasing over the last twenty years. It is estimated to have over 18.000 specimens (Vukojičić at al., 2011), of which 8.000 are identified and data-based, and about 10.000 undetermined specimens. The collection was established in the 1990s, within the two Chairs of the Institute of Botany. At the Department of Plant Ecology and Phytogeography, Professor Vladimir Stevanović and his associates collected bryophytes while exploring the flora and vegetation of the Durmitor Mountain in Montenegro. Then Svetlana Grdović enriched the collection with bryophytes from Belgrade and its surroundings (e. g. Grdović, 2005; Grdović & Stevanović, 2006;). From 2000 until today, Professor Marko Sabovljević had the highest importance for the enrichment of the herbarium collection. Together with his foreign and local coworkers (Beata Papp, Erszebet Szurdoki and Jovana Pantović), or by himself, he has collected an impressive number of herbarium specimens of mosses and liverworts from Serbia and Balkan countries (e. g.

Fig. 2. Stored boxes of bryophyte collection in the BEOU Herbarium

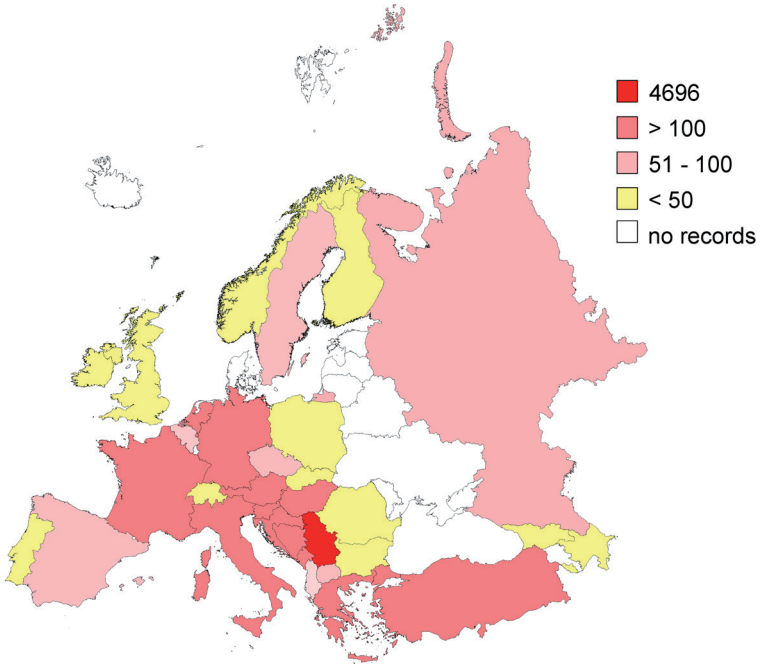

Fig. 2. Map indicating the number of specimens in Bryo BEOU collected from different European countries

Sabovljević & Cvetić, 2003; Papp & Sabovljević, 2010; Sabovljević et al., 2010), but also from other European countries (e. g. Papp & Sabovljević, 2009; Papp et al., 2016). At the same time in the 1990s, at the Department of Plant Morphology and Systematics, Professor Milan Veljić has started his collection of bryophytes, which is now part of the Bryo BEOU. He collected material from various sites in Serbia (e. g. Veljić et al., 2001, 2008). Part of this Bryo BEOU collection is valuable material from nature reserves and protected areas in Serbia, collected and published afterwards by Mića Popović in the middle of the last century (Popović, 1966).

The modern period of the Bryo BEOU collection

Considering recent progress of bryology in Serbia a comprehensive data summarisation on the distribution of bryophytes in Serbia was necessary to be able to critically assess certain taxa and to update the country list of the species. For that purpose, Bryo database was established (Pantović & Sabovljević, 2017), and besides aggregation of literature data, digitisation of bryophyte herbarium specimens within BEOU was initiated.

8084 specimens have been digitised so far, but a large part of the collection has not been identified nor digitised yet. All original data on taxa, locality, collector, date, locality, habitat and ecology and identifier, were entered into excel spreadsheet. Specimens have been identified to at least genus level, although the majority was identified to a species or lower level. Specimens are kept in paper envelops, labelled (**Fig. 1**) and stored in card boxes (**Fig. 2**) in controlled conditions.

The collection of bryophytes at the BEOU Herbarium is of great scientific and cultural value today. Bryophyte specimens originate from 6 different continents: Europe, Asia, Africa, North America, Australia and Antarctica, from 46 different countries. However, the majority of the specimens are from Europe (**Fig. 3**). The largest number was collected on the territory of Serbia, altogether 4696 bryophyte specimens, followed by Montenegro 544, Slovenia 327, Bosnia and Herzegovina 295, Italy 241 and so on (**Fig 4**). However, these numbers refer only to identified specimens.

Until the 1990s mosses were sporadically collected, hence only 613 records in the Bryo BEOU collection were collected before 1990. From 1990 onwards, bryophyte flora has been intensively studied and all other records originate from this so-called modern period (Pantović & Sabovljević, 2017) of exploration. By years (**Fig. 5**), largest number of

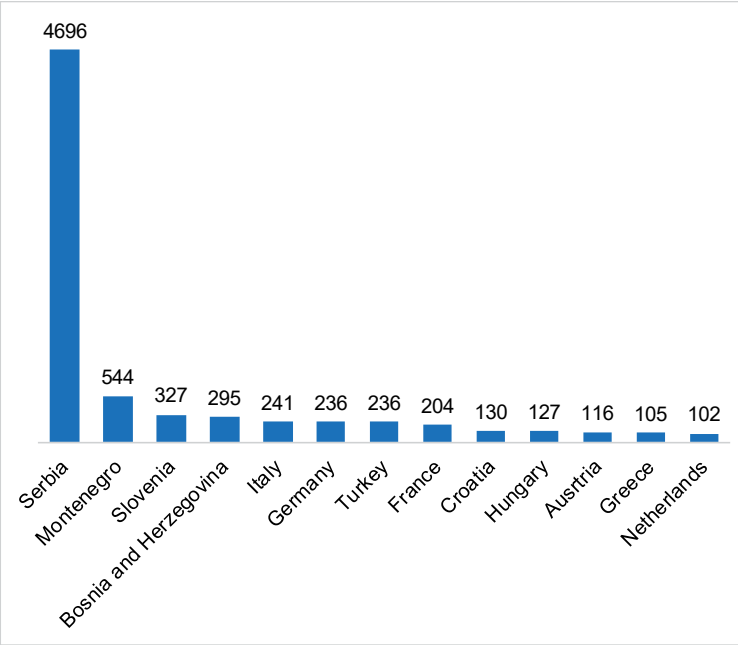

Fig. 4. Countries with more than 100 specimens in the bryophyte collection

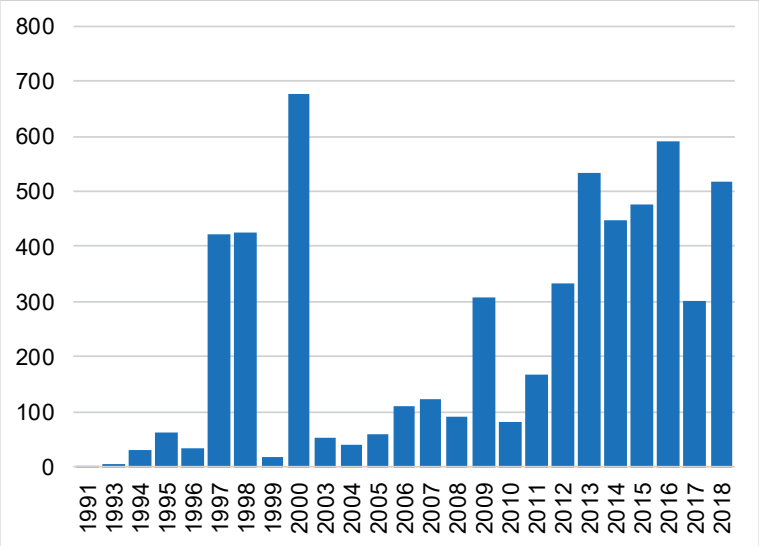

Fig. 5. Number of collected specimens per year collected only during the modern period of investigation (since 1990 onwards)

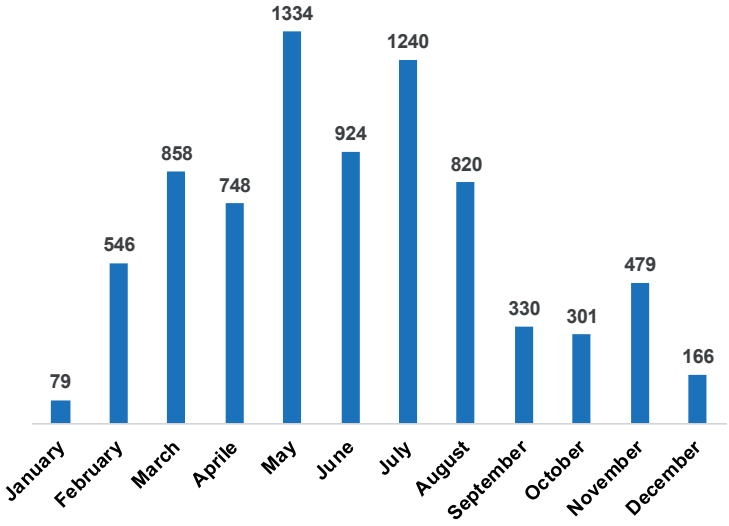

Fig. 6. Number of collected specimens per each calendar month

identified herbarium specimens was collected in 2000 and 2001 (951 and 676), followed by over 500 specimens in 2013, 2016 and 2018, and more than 400 specimens collected in 1997, 1998, 2002, 2014 and 2015. More than half (66%) of the specimens, a total of 5112, was collected by Marko Sabovljević and his coworkers.

Analysis of the period of collecting showed that the majority of the field trips were done in the spring and summer months (**Fig. 6**). Largest number of bryophyte specimens was collected in May (1334) and July (1240) while the least records were collected in January (79) and December (166).

All digitised bryophytes can be grouped into 797 different taxa and 294 genera.

Bryo BEOU collection and its digitised data represent an important basis for all further research and analysis of bryophyte flora of Serbia. This collection also keeps important material, although not yet completely identified and digitised, from neighbouring countries that are considered poorly investigated (e.g. Macedonia, Albania, Bosnia and Herzegovina). Work on the organisation and systematisation of this growing collection is ongoing.

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