

An overview of the Bulgarian bryophyte flora: past, present and future

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In honour of the 75th anniversary of Dr SLAVCHO PETROV

Abstract. This overview presents briefly the main periods of bryological studies in Bulgaria, the current knowledge of species diversity and the extent of investigation of its various parts, as well as the priority points for further research into the bryophytes.

Key words: Bulgarian bryoflora, threatened bryophytes

Introduction

The year 2002 marked a century since the first list of bryophytes in Bulgaria was published by the Czech botanist Velenovský (1902). In the years to come both Bulgarian and foreign botanists had contributed to the knowledge of species diversity and distribution of bryophytes in Bulgaria. That knowledge was summarized in about 65 scientific papers. Bryology in Bulgaria has progressed considerably slower than the other fields of botany. The main reason was the general lack of specialists with interest in bryophytes. Consequently, the importance of bryophytes as elements of the Bulgarian flora and vegetation has been strongly underestimated.

The present overview is aimed at connecting the past, present and future of bryology in Bulgaria. We have focused on the already available information and have attempted to outline the prospects and challenges for future investigations of the bryophytes in Bulgaria.

Background

Velenovský (1902) listed 97 bryophyte species and several varieties occurring on the territory of Bulgaria.

Soon afterwards his list was supplemented by Kovachev (1903, 1905) and Petkoff (1908). The works of Prof. N. Arnaudoff outlined a distinctive period in the development of Bulgarian bryology. He contributed substantially to the knowledge of liverwort flora of Bulgaria and the bryophyte diversity of Mt Vitosha (Arnaudoff 1909, 1911a, b, 1914). The paper of another Czech botanist, Podpéra (1911), is of special interest for that period, who reported 300 taxa, of which 140 were new for Bulgaria.

The 1950s and 1960s outlined a new stage in the development of Bulgarian bryology marked by the scientific researches of Dr Slavcho Petrov. He investigated various parts of the country and added a substantial amount of new chorological data about many species. He also discovered new species for the Bulgarian bryophyte flora. Some mountainous areas, such as the Pirin, Slavyanka, and Belasitsa mountains (Petrov 1955a, b, 1956a, 1962a, b, 1963, 1964, 1966, 1970), were targeted for more thorough floristic investigations. He also investigated the vegetation of *Sphagnum* dominated mires in Mt Vitosha and the Western Rhodopes (Petrov 1956b, 1958). This was the period when the Bulgarian bryological herbarium collection kept at the Institute of Botany with the Bulgarian Academy of Sciences (SOM) was substantially enlarged. S. Petrov deposited some

7000 bryophyte herbarium specimens in SOM (out of the total 8200). During that period and up to the mid-1970s, several foreign bryologists had contributed data on the chorology of bryophytes of Bulgaria (Váňa & Duda 1965; Mickiewicz & al. 1966; Meyer & Grolle 1968; Šmarda 1970; Váňa 1974; Meinunger 1975). That stage of bryological investigations was completed by the publication of the first bryophyte flora of Bulgaria (Petrov 1975) where 670 species were treated.

After a decade devoid of bryological investigations, the work on Bulgarian bryophytes was resumed. Some of the publications contained additional chorological data on the bryophyte flora (Petrov 1986; Ganeva 1992, 1995c, 1996; Petrov & Ganeva 1996a; Natcheva 2003). Bryological investigations took up a new turn in the 1990s: the ecological aspect and evaluation of the role of bryophytes in forest phytocoenoses and their indicator value for estimation of air and water pollution (Ganeva 1994, 1995a, b, 1996; Yurukova & al. 1996; Yurukova & Ganeva 1997; Ganeva 1998; Roussakova & Ganeva 2001).

Current knowledge of the species diversity and extent of investigation of various parts of Bulgaria

Up to date, 705 species of bryophytes have been reported to occur on the territory of Bulgaria. Of these, there are two species of hornworts, 173 of liverworts (Ganeva & Natcheva 2003) and 530 of mosses (Natcheva & Ganeva in press). In respect to species diversity, Bulgaria ranks third among the Balkan countries, after Romania with 907 species and Slovenia with 767 species (Sabovljević & al. 2001), Turkey is not considered here, since there is no account of the number of species occurring only in its European/Balkan part).

This considerable species diversity on a Balkan scale is extremely unevenly distributed on the territory of Bulgaria (Table 1). It is primarily concentrated in the higher mountains: Rila (382 species), Pirin (362), Vitosha (313), Western (292) and Central (258) Balkan Range, Central (257) and Western (241) Rhodopes. Two are the reasons for such unevenness in the species distribution. In the first place, there is considerably higher habitat diversity in the mountains. It results from a wide range of combinations of microclimate conditions, substrate and vegetation types, and the lower anthropogenic impact as compared with the lowlands. The high habitat diversity supports high-

er species diversity of both bryophytes and vascular plants. The second reason for the uneven distribution of species partly results from the first one: the fact that mountainous areas have attracted much stronger the attention of local and foreign botanists than the lowlands. The areas with highest number of species are the ones that have been visited more often and from which the largest number of records exists (Table 1).

From the lowland regions (Valley of Mesta River, Danubian Plain, Toundzha Hilly Country, Thracian Lowland) and most of the lower mountainous areas (the Forebalkan, Eastern Rhodopes, and Mt Sredna Gora), very few records are available and strikingly few species are known to occur. These regions have never been visited intentionally for the study of their bryophyte flora. Bryophytes from these regions were collected only incidentally, and in many cases their findings were not published, but existed only as herbarium specimens. The lower parts of the country are generally dryer and stronger affected by human activities. However, in the lowlands a number of interesting bryophytes were found, for example with Mediterranean trends in their distribution (Ganeva 1997) and more such species could be expected to emerge. Another argument is that the dryer regions are inhabited by many bryophyte species that presumably should be searched for "at the right time and in the right place", i.e. these are taxa that exist above ground for a relatively short periods of time, when there are favourable conditions for them, or very small species that in the dryer periods are difficult to notice and recognize. This means that an incidental collection is likely to pick up only the few most common and relatively large species and skip off many interesting and rare ones.

Strongly underestimated is probably the bryophyte diversity of the regions of Znepole and West Frontier Mts. Again, the main reasons are the very few visits by bryologists and the lack of systematic collections. These regions are characteristic with a strongly intersected relief, wide altitudinal range, and diverse bedrock and vegetation types. On this basis, one could expect higher bryophyte diversity after a thorough inventory.

Another trend is the high number of reports made prior to 1956 (Table 1), as compared to those made subsequently for the same floristic region. Of the relatively well known regions, for Northeast Bulgaria 64% of the reports are older than 47 years, for Rila this number is 44%, for the Western Balkan Range 35%, and for the Central Rhodopes 23.2%. On the species level the trend for these regions becomes more

Table 1. Summary of the number of reports and number of bryophyte species that occur in Bulgaria per floristic region. A report is considered any collection or publication of a species for a given locality within a region by a single author. Floristic regions are according Kozhuharov (1995)

Floristic region	Total number of reports	Reports before 1956	Reports after 1956	Total number of species	Liverworts (incl. hornworts)		Mosses	
					total number	not reported after 1956	total number	not reported after 1956
Black Sea Coast: <i>Northern</i>	31	9	22	25	1	0	24	5
<i>Southern</i>	38	11	27	36	5	2	31	6
Northeast Bulgaria	94	37	57	81	2	4	79	4
Danubian Plain	25	5	20	25	5	2	20	4
Forebalkan	20	2	18	20	3	1	17	0
Balkan Range: <i>Western</i>	519	137	382	292	61	1	231	3
<i>Central</i>	428	23	405	258	58	14	200	24
<i>Eastern</i>	110	5	105	100	24	5	76	4
Sofia region	67	52	15	66	8	0	58	0
Znepole region	52	7	45	49	2	1	47	5
Mt Vitosha	693	478	215	313	71	59	242	130
West Frontier Mts	49	10	39	43	14	5	29	0
Valley of Strouma River	59	8	51	52	17	4	35	0
Mt Belasitsa	172	1	171	137	37	1	100	0
Mt Slavyanka	89	2	87	71	15	1	56	1
Valley of Mesta River	14	3	11	4	2	0	2	32
Pirin Mts	684	17	667	362	92	1	270	1
Rila Mts	796	244	552	382	97	15	285	33
Mt Sredna Gora: <i>Western</i>	3	0	3	3	2	7	1	36
<i>Central</i>	24	1	23	24	5	1	19	0
<i>Eastern</i>	3	1	2	3	0	0	3	1
Rhodopi Mts: <i>Western</i>	335	31	304	241	52	0	189	0
<i>Central</i>	335	63	272	257	54	4	203	9
<i>Eastern</i>	22	0	22	22	4	0	18	15
Thracian Lowland	34	18	16	34	0	0	34	10
Toundzha Hilly Country	20	1	19	15	6	0	9	1
Mt Strandzha	128	14	114	123	29	3	94	14
Total for Bulgaria	4841	1180	3664	702	175	8	530	32

clear: 39% of the species known in Northeast Bulgaria have not been collected since 1956, as well as 13.9% in Strandzha, 13% in the Western Balkan Range, and 12.5% in Rila. Even more striking is the situation in the Sofia and Vitosha regions, where 65.1% and 60.4% of the species have not been collected since 1956.

The already described general pattern of distribution of the bryophytes in Bulgaria is similar in the two major groups: liverworts (incl. hornworts) and mosses (Table 1).

Red-listed bryophytes and conservation of the Bulgarian bryophyte flora

Bryophyte conservation became an important aspect in conservation biology only during the last 10–12 years. In 1990a Standing Committee for Endangered

Bryophytes was founded with the International Association of Bryologists. At the First International Conference on endangered bryophytes (September 1990, Uppsala), the need and possibilities for joining the efforts of European bryologists in bryophyte conservation were discussed. Soon afterwards, the IUCN Bryophyte Specialist Group was formed. In 1995 the first edition of the *Red Data Book of European Bryophytes* (ECCB 1995) came out and provided lists of the threatened bryophytes in Europe. Twenty-four of the red listed species in Europe occur on the territory of Bulgaria.

Thanks to the joint efforts of bryologists worldwide, many bryophyte species were included in International Conventions and directives for biodiversity protection. Four species, *Buxbaumia viridis*, *Dicranum viride*, *Drepanocladus (Hamatocaulis) vernicosus*, and *Mannia triandra*, are included in Annex II of the Bulgarian

Biodiversity Protection Law (2002). The same species are listed in Annex I of Resolution VI (1998) of the Standing Committee of the Bern Convention and in Annex II of the Habitat Directive assigning priority conservation status to their habitats.

In 1998 a preliminary list of the threatened bryophytes of Bulgaria was published (Ganeva 1998). It included 201 species evaluated according to the threat categories applied in the *Red Data Book of European Bryophytes* (1995). During biodiversity estimation of the Central Balkan National Park and Rila National Park, and of the Rila Monastery Nature Park for the purposes of management planning of these protected areas, bryophyte flora was evaluated both with respect to species diversity and degree of rarity (Ganeva 1999a, b, 2003).

A thorough summary of all chorological information during work on the latest check lists of the bryophytes in Bulgaria (Ganeva & Natcheva 2003; Natcheva & Ganeva in press) revealed additionally 12 liverwort and 44 moss species deserving attention with respect to conservation. This makes altogether 257 species of conservation importance that constitute 36% of the species known to occur in Bulgaria.

Perspectives

The current overview highlights several points of priority for further investigation of the bryophytes in Bulgaria.

In the first place, this is the enhancement of our knowledge on bryophyte diversity on the territory of Bulgaria and about the details of distribution of species in relation to chorology and microhabitat preferences. Of special interest are the poorly known regions noted above and the species for which there is no recent chorological data.

On the basis of exhaustive chorological data it is possible to delimit sites with high bryophyte diversity: bryophyte hot spots on a national scale. They are of special interest as a reference for evaluation of the threatening factors and for conservation. Owing to their small size and frequently high demands of the micro-environmental conditions, many bryophytes are restricted to stable habitats. Conservation of most bryophytes and of plants in general strongly depends on the conservation of their natural environment. Along these lines efforts should be directed towards identification of major representative habitat types

with high species diversity. Indicator bryophyte species are a useful tool for identification of areas with conservation value. Along with this, indicator bryophytes are often threatened due to narrower range of their ecological tolerance.

It is necessary to focus on specific types of habitats. Two approaches can be adopted when choosing priority habitats to study. They can be chosen among the habitats of the least known bryoflora, or among vulnerable habitats with high species diversity. Such are the loess areas of the North Bulgaria, wet carst and limestone areas, serpentine areas, old-growth broad-leaf and coniferous forests with high air humidity and large amount of deadwood. On the other hand, special attention deserve the priority habitats listed in Annex I of the Habitats Directive by the EU Habitat Commission, such as mires in the middle and upper mountain belts, bryophytes of tufa-forming springs, alluvial plain forests, etc.

At species level, priority has been assigned to the species with conservation value. The chorology of many such species is poorly known and often their occurrence is based merely on a single record dating before 1950. When evaluated against the new IUCN categories, such species generally fall into the Data Deficient category. Furthermore, information is virtually lacking on the current condition of the populations of many threatened species which makes impossible the prediction of future development of these populations and impedes the undertaking of adequate measures for their conservation. A progress marked along these lines was the recently collected data on distribution of the rare species *Buxbaumia aphylla*, *Trichocolea tomentella* and *Porella pinnata*. Until recently, the first species was known only from a single locality in the subalpine zone of the Rila Mts (Petrov 1966), but it was found also in the Western Balkan Range to grow in the beech forest belt. In the same area the occurrence of *Trichocolea tomentella* was confirmed, which formed healthy mats along the mountain brooks (Natcheva & Ganeva unpubl.). *Porella pinnata* was known only from a single report (Petkoff 1908) but no herbarium material was available. Its occurrence in Bulgaria was considered doubtful by Düll & al. (1999). The locality in the Rila Mts reported by Petkoff (1908) was re-visited in 2003 and *Porella pinnata* was found growing abundantly in several places on water sprayed rocks (Natcheva, unpublished). *Coscinodon cribrosus* was found recently to occur in the Central and Western Balkan Range

(Ganeva 2002; Natcheva 2003) and these are the only definite occurrences of this species in Bulgaria.

The work on the *Development of Red Lists of the Higher Plants and Fungi* project launched by the Ministry of Environment and Waters of Bulgaria opens up an opportunity to include the bryophytes for the first time in the National Red Lists of Bulgaria. The threatened and rare species are evaluated according the new IUCN categories. Such information will be equally valuable on national and European level. Work on the second edition of the *Red Data Book of European Bryophytes* is currently in progress and it is of essential importance to obtain the latest data on the status of each threatened species from all countries of its occurrence.

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