A supplement to the checklist of the liverwort flora of Bulgaria

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Abstract. Here, we summarize the most recent advances in the knowledge on diversity of the hepatic flora in Bulgaria. After publication of the latest checklist, nine new liverwort species have been discovered. Thus, the total number of liverworts in Bulgaria is 200. Further information on the distribution of 31 species is also provided.

Key words: bryophytes, Bulgaria, checklist, hepatics, liverworts, new species

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Introduction

The latest checklist of hepatics in Bulgaria was published in 2022 (Gospodinov & Natcheva 2022). It included 191 species and two subspecies. Within just two years, a number of new species to the bryophyte flora of Bulgaria have been found (Ellis & al. 2015, 2021, 2023, 2024; Natcheva & Ganeva 2022; Natcheva 2024), as well as a number of new localities of some poorly known species. Most of these findings were of ephemeral species in seasonally wet habitats or, else, poorly known regions that have been the focus of research in recent years. The aim of this study has been to summarize the new knowledge on the hepatic flora of Bulgaria.

Material and methods

In order to summarize the latest data on the bryophyte diversity and its distribution, we searched: 1) the relevant literature published after 2022, and 2) the bryological collection at SOM for specimens collected after 2022. The data presentation format adopted in

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Table 1. Supplement to the checklist of liverworts of Bulgaria by 2024.

Taxon	Distribution by floristic regions																										Source
	B	Bsc		D	M	NeB	P	Fb	R	Rh			Sg		Sf	Sl	Sp			Sv	Sz	Thc	Tl	V	Wfm	Zn	
		n	s							w	c	e	w	e			w	c	e								
Aneura pinguis (L.) Dumort.							●	■	●	●■	●■		●■				●■	●■						●■	●	●	SOM
Cephaloziella hampeana (Nees) Schiffn.									●									■						●			SOM
Cephaloziella rubella (Nees) Warnst.									■	■								■						○			SOM
Conocephalum salebrosum Szweykowski, Buczkowska & Odrzykoski						●■		●■	■		■						■	●■			●■						Natcheva & Ganeva 2022, SOM
Corsinia coriandrina (Spreng.) Lindb.												●■								●■	●□						Natcheva 2024, SOM
Fossombronia angulosa (Dicks.) Raddi											■	●■									●■						Natcheva 2024, SOM
Fossombronia caespitiformis (Raddi) De Not. ex Rabenh	●■																●			■							SOM
Fossombronia pusilla (L.) Nees	■							■				■							●■	■	●				●■		SOM
Jungermannia pumila With.									●								●	●■						○			Natcheva & Ganeva 2022, SOM
Kurzia pauciflora (Dicks.) Grolle*																		■									SOM
Mannia androgyna (L.) A. Evans							●					■								■							SOM
Mannia fragrans (Balbis) Frye & L. Clark									●	●	●■					●■	●	■		●							SOM
Mesoptychia badensis (Gottsche ex Rabenh.) L. Söderstr. & Váňa											●							●■									Natcheva & Ganeva 2022, SOM
Mesoptychia bantriensis (Hook.) L. Söderstr. & Váňa									●									●						○	■		SOM

Taxon	Distribution by floristic regions																									Source
	B	Bsc		D	M	NeB	P	Fb	R	Rh			Sg		Sf	Sl	Sp			Sv	Sz	Thc	Tl	V	Wfm	Zn	
		n	s							w	c	e	w	e			w	c	e								
Nowellia curvifolia (Dicks.) Mitt.									●■	●■	●				■		○	●■						○	●■		SOM
Oxymitra incrassata (Brot.) Sérgio & Sim-Sim											■	■				■				●■		●■	●				Natcheva 2024, SOM
Riccardia incurvata Lindb.																	●■	■						●			Natcheva 2024, SOM
Riccia beyrichiana Hampe							●■					■												■			SOM
Riccia bifurca Hoffm.*															■												SOM
Riccia canaliculata Hoffm.*										●■						●■											Ellis & al. 2022, SOM
Riccia cavernosa Hoffm.				■								■				■							■		●■	■	SOM
Riccia ciliata Hoffm.	●						●■				●■	●■				●■				●■		■	●	■	●		SOM
Riccia ciliifera Link ex Lindenb.							●		●			■			■	●				●■			●				SOM
Riccia crozalsii Levier*												●■								●■							Ellis & al. 2024, SOM
Riccia crystallina L. emend. Raddi								●■							○					●				■	■		Ellis & al. 2021, SOM
Riccia fluitans L.				■				■		□													■			■	SOM
Riccia frostii Austin				■								■				■				■					●■	■	SOM
Riccia gougetiana Durieu & Mont.	●■						●					■			■					●■		■		■			SOM
Riccia huebeneriana Lindenb.*																				●■							Ellis & al. 2023, SOM
Riccia macrocarpa Levier*												■															SOM
Riccia nigrella DC.									●			■				●■				●■		●■					Natcheva 2024, SOM
Riccia papillosa Moris												■				●■				■		■		■			SOM
Riccia perennis Steph.*												■															SOM

Taxon	Distribution by floristic regions																										Source
	B	Bsc		D	M	NeB	P	Fb	R	Rh			Sg		Sf	Sl	Sp			Sv	Sz	Thc	Tl	V	Wfm	Zn	
		n	s							w	c	e	w	e			w	c	e								
Riccia rhenana Lorb. ex Müll. Frib.			■	●■				●■		■			■		■											●■	SOM
Riccia warnstorfii Limpr. ex Warnst.*												■															SOM
Ricciocarpos natans (L.) Corda				■		□		●■					■										■			●■	SOM
Scapania aspera Bernet & M. Bernet							●■				●■					●■		●■								■	SOM
Scapania uliginosa (Sw. ex Lindenb.) Dumort.*									●																		Ellis & al. 2015
Southbya nigrella (De Not.) Henriq.							●					■															SOM
Targionia hypophylla L.	●						●■					■				●■				■							SOM

Abbreviations: **B** – Mt Belasitsa; **Bsc** – Black Sea Coast; **D** – Danubian Plain; **Fb** – Forebalkan; **M** – Valley of River Mesta; **NeB** – Northeast Bulgaria; **P** – Pirin Mts; **R** – Rila Mts; **Rh** – Rhodopi Mts; **Sf** – Sofia Region; **Sg** – Mt Sredna Gora; **Sl** – Mt Slavyanka; **Sp** – Stara Planina Mts (the Balkan Range); **Sv** – Valley of River Struma; **Sz** – Mt Strandzha; **Thc** – Tundzha Hilly Country; **Tl** – Thracian Lowland; **V** – Mt Vitosha; **Wfm** – West Frontier Mts; **Zn** – Znepole Region; **w** – western; **c** – central; **e** – eastern; **n** – northern; **s** – southern. **Symbols**: * - new after 2022; ○ – observations based on literature before 1956; ● – observations based on literature after 1956; □ – report based on herbarium materials collected prior to 1956; ■ – report based on herbarium materials collected after 1956; **gray field** – report after 2022.

the latest checklist was used for quick comparison (Gospodinov & Natcheva 2022).

The nomenclature follows Hodgetts & Lockhart (2020).

Results and discussion

As a result of the present study, nine new species have been added to the liverwort flora of Bulgaria: *Kurzia pauciflora* (Dicks.) Grolle, *Riccia bifurca* Hoffm., *Riccia canaliculata* Hoffm., *Riccia crozalsii* Levier, *Riccia huebeneriana* Lindenb., *Riccia macrocarpa* Levier, *Riccia perennis* Steph., *Riccia warnstorfii* Limpr. ex Warnst., and *Scapania uliginosa* (Sw. ex Lindenb.) Dumort. (Table 1). Thus, by 2024 it consists of a total of 200 species and two subspecies.

Furthermore, new locations for 31 species from 15 floristic regions have been identified. Most of these findings are of ephemeral species in seasonally wet habitats or, else, poorly known regions that have been the focus of research in recent years. A striking example is the difference in the known distribution of the two ecologically similar species *Riccia cavernosa* Hoffm. and *R. frostii* Austin. These species have been found in Bulgaria for the first time in 2020 in three locations in the Znepole floristic region (Ellis & al. 2021). Targeted search in suitable habitats in late autumn and early winter of the following years has revealed that both species are common and usually abundant on the mud on shores of some reservoirs. They have been found in five more floristic regions in numerous locations. Another interesting example represent five new species of genus *Riccia* encountered in seasonally wet

microhabitats in sub-Mediterranean dry grasslands in the Eastern Rhodopi Mts. (*R. crozalsii*, *R. macrocarpa*, *R. perennis*, and *R. warnstorfii*), and on the seasonally inundated mud shore of a dam in the Mt Slavyanka floristic region (*R. huebeneriana*). These examples highlight the importance of thorough and careful investigation of all possible habitats across different seasons, and the significance of protection of habitats with variable and dynamic, often contrasting, conditions.

In conclusion, the hepatic flora of Bulgaria is among the most species-rich floras in South-Eastern Europe, and still new species are expected to be discovered.

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