

## BRYOPHYTE DIVERSITY IN THE BELARUS CONIFEROUS FORESTS ХАРАКТЕРИСТИКА БРИОКОМПОНЕНТА ХВОЙНЫХ ЛЕСОВ БЕЛАРУСИ

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Abstract

In the article complex characteristics of bryophytes in forest types are presented with accentuation on their typological features in forests of pine and spruce formations in a comparative perspective. For describing the ecological structure of bryocomponent of Belarus coniferous forests, the relation of bryophytes to humidity and trophic characteristics of habitats is analyzed. Rare species and species under conservation are marked. The list of species typical for certain types of forest is presented.

Резюме

В статье дана разносторонняя характеристика мохообразных по типам леса с выделением их типологических особенностей в отношении лесов сосновой и еловой формаций в сравнительном аспекте. Для выяснения экологической структуры бриокомпонента хвойных лесов Беларуси рассмотрено отношение мохообразных к влажности и трофности местообитаний, выделены редкие и охраняемые виды. Приведены характерные для определенных типов леса виды бриофитов.

KEYWORDS: bryophytes, coniferous forests, pine forests, spruce forests, biodiversity, biomorphs, ecomorphs

### INTRODUCTION

The territory of Belarus is situated mainly in the broad-leaved-coniferous forest subzone. Forests cover about 35% of the country territory (Yurkevich et al., 1971, 1979, 1984), with the coniferous types composing 59.6% of the of forests vegetation (Yurkevich et al., 1971, 1979, 1984). The latter are represented by two main types: azonal *Pinus sylvestris* and zonal *Picea abies* forests. In Belarus, spruce occurs near the southern limit of its continuous distribution in this longitudinal sector.

Being widespread in Belarus, these forests provide a good model for the comparison of bryophyte distribution in parallel series of spruce and pine forest types, which has been never conducted before in the country.

### MATERIALS AND METHODS

Coniferous communities were studied (769 plots) in the territory of in all provinces of Belarus, in 53 administrative districts (Table 1). Our own bryophyte collections (>5000 samples) are kept in MSK-B, LE, KW, LWKS, GRSU. Materials from the previous publications (Rykovsky et al., 1980, 2010, 2012) were also used. The nomenclature of mosses follows Ignatov, Afonina, Ignatova et al. (2006), liverworts and hornworts names are given according to Potemkin & Sofronova (2009). Species ecology in respect to humidity and substrate nutrient richness are given according to Rykovsky & Maslovsky (2004, 2009). Geobotanical classification of

coniferous forest types of Belarus by Yurkevich et al. (1971, 1979, 1980, 1984) is used, and edaphotope classification by Pogrebnyak (1955) is followed.

### RESULTS

The bryophyte flora of coniferous forests of Belarus includes 255 species, which is 57.3% of bryoflora of the republic. There are 207 species in pine forests and 208 in spruce forests.

Dry forest types, e.g. *Picea abies* forest with *Vaccinium vitis-idea* and lichen types of *Pinus sylvestris* forest are poor in bryophytes, including 11 and 22 species respectively, while bryophytes of mesic forests are more diverse. The relatively meso-oligotrophic forest types of pleuroziosum, pteridiosum, caricosum and caricoso-sphagnosum were found to have more species in pine forest (67-91 species) than in the same forest types in spruce forest (42-69). At the same time, more wet and eutrophic types of oxalidosum, myrtillosum and fontinale-herbosum are more diverse in spruce forest (134-137 species) than in pine forest types of the same condition (65-119 species).

**Conifer forests.** The species common for all types of conifer forests in Belarus include epigeious *Dicranum polysetum*, *Hylocomium splendens*, *Polytrichum juniperinum*, *Pleurozium schreberi*, epixylic *Dicranum montanum*, *Tetraphis pellucida* and species of wide ecology *Ptilidium pulcherrimum*, *Dicranum scoparium*, *Pohlia nutans*.

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Table 1. – Number of relevées in forest type series. Abbreviations: Coniferous forests: Cl cladinosum; Ca callunosum; Va vaccinosum; Pl pleuroziosum; Pt pteridiosum; Ox oxalidosum; Ae aegopodiosum; Ur urticosum; F filicosum; My myrtillosum; FH fontinale-herbosum; Po polytrichosum; Le ledosum; C caricosum; CS caricoso-sphagnosum; S sphagnosum. Edaphotopes are given according to Pogrebnyak (1955).

Forest type series																								
PINETUM													PICEETUM											
Cl	Ca	Va	Pl	Pt	Ox	My	FH	Po	Le	C	CS	S	Va	Pl	Pt	Ox	Ae	Ur	F	My	FH	Po	C	CS
Edaphotops																								
A <sub>0-1</sub>	A <sub>1-2</sub>	A <sub>2</sub>	A <sub>2</sub> B <sub>2</sub>	B <sub>2</sub>	C <sub>2</sub>	A <sub>3</sub> B <sub>3</sub>	B <sub>4(5)</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>5</sub>	A <sub>5</sub>	A <sub>5</sub>	B <sub>2</sub>	B <sub>2(3)</sub>	C <sub>2</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	C <sub>4</sub>	C <sub>3</sub>	C <sub>4(5)</sub>	B <sub>4</sub>	B <sub>5</sub>	B <sub>5</sub>
Number of relevées																								
9	15	13	75	38	30	56	16	25	33	22	29	28	6	42	17	100	22	13	39	82	18	17	15	9

Seven species occur in most forest types except only the most poor types of piceetum vaccinosum, pinetum cladinosum and sphagnosum; among them are species of the wide ecology *Brachythecium salebrosum*, *Hypnum curpessiforme*, *Plagiomnium cuspidatum*, *Pylaisia polyantha*, *Sanionia uncinata*, *Sciuro-hypnum oedipodium*, epigeious *Ptilium crista-castrensis*, *Rhytidiadelphus triquetrus*, epiphytic *Orthotrichum speciosum*.

The following widespread species do not occur only in the most dry types of piceetum vaccinosum, pinetum cladinosum and callunosum: epigeious *Leucobryum glaucum*, *Marchantia polymorpha*, *Climacium dendroides*, *Polytrichastrum formosum*, epixylic *Chiloscyphus profundus*, *Dicranum flagellare*, *Herzogiella seligeri*, *Plagiothecium laetum*, *Stereodon pallescens*, and epiphytic *Radula complanata*.

There are species common for the certain ecological groups. In drier forest types, i.e. cladinosum, callunosum, vaccinosum, pleuroziosum, pteridiosum, the following species are characteristic: *Abietinella abietina*, *Bryum argenteum*, *Buxbaumia aphylla*, *Polytrichum piliferum*, *Syntrichia ruralis*.

Spectra of spruce and pine forest species in relation to humidity and nutrition are shown in Figs 1 & 2.

**Pinetum forests.** There are groups of species, characteristic for certain groups of pinetum forest types. The central part of series (i.e. vaccinosum; pleuroziosum; pteridiosum; oxalidosum) is characterized by mesotrophic mesophytes *Callicladium haldanianum*, *Leptobryum pyriforme*, *Plagiothecium denticulatum*, *Polytrichastrum longisetum*; eutrophic mesohygrophytes *Thuidium assimile*, *T. recognitum*; eutrophic and mesotrophic hygro-

phytes *Aulacomnium palustre*, *Brachythecium rivulare*, *Calliergonella cuspidata*, *Chiloscyphus polyanthos*, *Lepidotictyum riparium*.

Common species for forest types with periodically dired soil (from pinetum cladinosum to pteridiosum) include xeromesophytes *Abietinella abietina*, *Brachythecium albicans*, *Bryoerythrophyllum recurvirostrum*, *Bryum argenteum*, *Niphotrichum canescens*, *Hedwigia ciliata* (the inhabitants of dry meadows and light woods) and *Paraleucobryum longifolium*.

Ecological range of a relatively humid pinetum forests, from oxalidosum to polytrichosum, a derived type from dark coniferous forests, is characterized by mesotrophic and eumesotrophic hygrophytes, e.g. *Cephalozia lunulifolia*, *Chiloscyphus pallescens*, *Geocalyx graevelens*, *Plagiomnium ellipticum*.

In the forest types more wet than pinetum myrtillosum, there are hygrophyte species, including oligomesotrophic *Odontoschisma denudatum*, *Sphagnum fallax*, *S. russowii*, mesotrophic *Chiloscyphus minor*, *Sphagnum centrale*, *S. fimbriatum*, *S. girgensohnii* and mesoeutrophic *Pellia endiviifolia*, *Drepanocladus aduncus*, *Fissidens adianthoides*, *Sphagnum squarrosum*.

Then, along with the humidity increase, since pinetum fontinale-herbosum type, more and more hygrophytes occur; they include common mesoeutrophic and eutrophic species of wet forests and wetlands hygromesophytes and mesohygrophytes (*Cephalozia pleneiceps*, *Scapania irrigua*, *Riccardia latifrons*, *R. palmata*, *Dicranum bonjeanii*, *Mnium hornum*), hygrophytes (*Rhizomnium punctatum*, *Pseudobryum cinclidioides*), hydrohydrophytes (*Cratoneuron filicinum*, *Sphagnum riparium*) and hydro-

<sup>1</sup> – Of coniferous forest types of Belarus, the dominant species of ground cover are: cladinosum – *Cladonia silvatica*, *C. rangeferina*, *C. fimbriata*, etc.; callunosum – *Calluna vulgaris*, *Thymus serpyllum*, *Festuca ovina*, etc.; vaccinosum – *Vaccinium vitis-idaea*, *Arctostaphylos uva-ursi*, *Calamagrostis epigeios*, etc.; pleuroziosum – *Pleurozium schreberi*, *Dicranum polysetum*, *Hylocomium splendens*, *Vaccinium vitis-idaea*, *Vaccinium myrtillus*, etc.; pteridiosum – *Pteridium aquilinum*, *Melampyrum nemorosum*, *Pyrola rotundifolia*, etc.; oxalidosum – *Oxalis acetosella*, *Vaccinium myrtillus*, *Majanthemum bifolium*, *Luzula pilosa*, etc.; aegopodiosum – *Aegopodium podagraria*, *Asperula odorata*, *Rubus saxatilis*, etc.; urticosum – *Urtica dioica*, *Filipendula ulmaria*, *Impatiens noli-tangere*, *Circaea lutetiana*, etc.; filicosum – *Dryopteris filix-mas*, *Dryopteris spinulosa*, *Athyrium filix-femina*, *Aegopodium podagraria*, *Carex pilosa*, etc.; myrtillosum – *Vaccinium myrtillus*, *Pleuroziumschreberi*, *Vaccinium vitis-idaea*, *Molinia coerulea*, etc.; fontinale-herbosum – *Filipendula ulmaria*, *Thelypteris palustris*, *Epilobium palustre*, etc.; polytrichosum – *Polytrichum commune*, *Vaccinium myrtillus*, *Ledum palustre*, *Sphagnum capillifolium*, *S. palustre*, etc.; ledosum – *Ledum palustre*, *Vaccinium uliginosum*, *Polytrichum commune*, *Sphagnum magellanicum*, *S. angustifolium*, etc.; caricosum – *Carex acutiformis*, *C. vesicaria*, *C. rostrata*, *Menyanthes trifoliata*, *Calla palustris*, *Sphagnum centrale*, *S. teres*, *S. fallax*, etc.; caricoso-sphagnosum – *Carex rostrata*, *C. lasiocarpa*, *Sphagnum angustifolium*, *S. magellanicum*, *S. palustre*, *Andromeda polifolia*, etc.; sphagnosum – *Sphagnum magellanicum*, *S. angustifolium*, *S. fuscum*, *Eriophorum vaginatum*, *Chamaedaphne calyculata*, *Oxycoccus palustris*, etc.

Table 2. The bryophytes specific to coniferous forest types in Belarus. Abbreviations: PINETUM: Cl *cladinosum*; Ca *callunosum*; Va *vaccinosum*; Pl *pleuroziosum*; Pt *pteridiosum*; Ox *oxalidosum*; My *myrtillosum*; FH *fontinale-herbosum*; Po *polytrichosum*; Le *ledosum*; C *caricosum*; CS *caricoso-sphagnosum*; S *sphagnosum*; PICEETUM: Va *vaccinosum*; Pl *pleuroziosum*; Pt *pteridiosum*; Ox *oxalidosum*; Ae *aegopodiosum*; Ur *urticosum*; F *filicosum*; My *myrtillosum*; FH *fontinale-herbosum*; Po *polytrichosum*; C *caricosum*; CS *caricoso-sphagnosum*; + – species occurs in this forest type; # – species occasionally present, found 1-3 times; [ ] the range were species is registered or expected.

Species	PINETUM													PICEETUM												
	Cl	Ca	Va	Pl	Pt	Ox	My	FH	Po	Le	Ca	CS	Sp	Va	Pl	Pt	Ox	Ae	Ur	FM	My	FH	Po	Ca	CS	
<i>Dicranum polysetum</i>	[+ + + + + + + + +]	#	#	#	#	#	#	#	#	#	#	#	#	[+ + + + + + + + +]	#	#	#	#	#	#	#	#	#	#	#	#
<i>Pleurozium schreberi</i>	[+ + + + + + + + +]	#	#	#	#	#	#	#	#	#	#	#	#	[+ + + + + + + + +]	#	#	#	#	#	#	#	#	#	#	#	#
<i>Buxbaumia aphylla</i>	[+ + + +]																									
<i>Dicranum spurium</i>	[+ + + +]					#																				
<i>Polytrichum juniperinum</i>	[+ + + + +]					#	#	#	#	#				#	#	#	#	#	#	#	#	#	#	#	#	#
<i>Syntrichia ruralis</i>	[+ + + + +]					#																				
<i>Abietinella abietina</i>	[+ + +]	#	#											#												
<i>Brachythecium albicans</i>	[+ + +]	#	#																							
<i>Dicranum scoparium</i>	[+ + +]	#	#	#	#	#	#	#	#	#	#	#	#	[+]	#	#	#	#	#	#	#	#	#	#	#	#
<i>Polytrichum piliferum</i>	[+ +]	#	#																							
<i>Niphotrichum canescens</i>	[+]		[+]														#				#	#				
<i>Sphagnum capillifolium</i>		#	[+ + + + +]											[+]												
<i>Chiloscyphus profundus</i>			[+ + + + +]											[+ + + + +]												
<i>Herzogiella seligeri</i>			[+ + + + +]											[+ + + + +]												
<i>Hylocomium splendens</i>	#	#	#	[+ + + + +]									#	#	[+ + + + +]											
<i>Plagiothecium laetum</i>				[+ + + + +]										[+ + + + +]												
<i>Stereodon pallescens</i>		#		[+ + + + +]										[+ + + + +]												
<i>Brachytheciastrum velutinum</i>	#			[+ + + + +]										[+ + + + +]												
<i>Callicladium haldanianum</i>				[+ + + + +]										[+]												
<i>Nowellia curvifolia</i>				[+ + + + +]										[+]												
<i>Atrichum undulatum</i>	#			[+ + + + +]										[+ + + + +]												
<i>Brachythecium rutabulum</i>	#			[+ + + + +]										[+ + + + +]												
<i>Bryum caespiticium</i>				[+ + + + +]										[+ + + + +]												
<i>Plagiomnium cuspidatum</i>				[+ + + + +]				#						[+ + + + +]									#	#	#	#
<i>Polytrichastrum formosum</i>				[+ + + + +]				#						[+ + + + +]									#	#	#	#
<i>Sciuro-hypnum oedipodium</i>	#	#		[+ + + + +]				#						[+ + + + +]									#	#	#	#
<i>Amblystegium serpens</i>				[+ + + + +]										[+ + + + +]												
<i>Brachythecium salebrosum</i>	#	#		[+ + + + +]				#	#	#	#	#	#	[+ + + + +]									#	#	#	#
<i>Eurhynchium angustirete</i>		#		[+ + + + +]										[+ + + + +]												
<i>Hygroamblystegium varium</i>				[+ + + + +]										[+ + + + +]												
<i>Campylopus flexuosus</i>				[+]										[+]												
<i>Ptilidium ciliare</i>				[+]										[+]												
<i>Calliergon giganteum</i>						[+ + + + +]								#												
<i>Lepidozia reptans</i>						[+ + + + +]								#												
<i>Cephalozia lunulifolia</i>						[+ + + + +]								#												
<i>Chiloscyphus pallescens</i>						[+ + + + +]								#												
<i>Chiloscyphus polyanthos</i>				#		[+ + + + +]								#												
<i>Geocalyx graveolens</i>						[+ + + + +]								#												
<i>Plagiochila porelloides</i>						[+ + + + +]								[+ + + + +]												
<i>Rhytidiadelphus triquetrus</i>	#	#	#	#		[+ + + + +]								#	#	#										
<i>Thuidium assimile</i>				#		[+ + + + +]								#												
<i>Thuidium delicatulum</i>				#		[+ + + + +]								#												
<i>Thuidium recognitum</i>				#		[+ + + + +]								#												
<i>Thuidium tamariscinum</i>						[+ + + + +]								#												
<i>Cephaloziella divaricata</i>	#	#				[+ + + + +]								#												
<i>Calliergonella cuspidata</i>				#		[+ + + + +]								#												
<i>Climacium dendroides</i>				#	#	[+ + + + +]								#	[+ + + + +]											
<i>Brachythecium rivulare</i>				#	#	[+ + + + +]								#	[+ + + + +]											
<i>Plagiomnium ellipticum</i>						[+ + + + +]								#	[+ + + + +]											
<i>Dicranum flagellare</i>	#			#	#	[+ + + + +]		#	#					#	[+ + + + +]								#	#	#	#
<i>Mnium stellare</i>				#		[+ + + + +]								#	[+ + + + +]											
<i>Plagiomnium affine</i>	#		#	#		[+ + + + +]		#						#	[+ + + + +]								#	#	#	#
<i>Plagiomnium elatum</i>				#		[+ + + + +]		#	#					#	[+ + + + +]								#	#	#	#
<i>Plagiothecium denticulatum</i>				#	#	[+ + + + +]		#	#					#	[+ + + + +]								#	#	#	#
<i>Ptilium crista-castrensis</i>	#	#	#	#		[+ + + + +]		#	#	#				#	[+ + + + +]							#	#	#	#	#
<i>Rhodobryum roseum</i>						[+ + + + +]		#						#	[+ + + + +]								#	#	#	#
<i>Plagiothecium cavifolium</i>						[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Plagiothecium nemorale</i>						[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Kindbergia praelonga</i>						[+ + + + +]	#							#	[+ + + + +]								#	#	#	#
<i>Plagiothecium latebricola</i>						[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Aulacomnium palustre</i>	#	#	#	#	#	[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Calliergon cordifolium</i>						[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Chiloscyphus minor</i>						[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Polytrichastrum longisetum</i>				#		[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Polytrichum commune</i>	#	#	#	#	#	[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Sphagnum fallax</i>						[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Sphagnum magellanicum</i>				#		[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Sphagnum palustre</i>						[+ + + + +]								#	[+ + + + +]								#	#	#	#
<i>Sphagnum russowii</i>						[+ + + + +]								#	[+ + + + +]								#	#	#	#



phytes (*Philonotis fontana*, *Riccia fluitans*).

The most wet places starting from the pinetum caricosum type, typical inhabitants of fens occur: hygrophytes and hydrohydrophytes *Riccardia multifida*, *Hamatocaulis vernicosus*, *Sphagnum contortum*, *S. obtusum*, *S. platyphyllum*.

From pinetum polytrichosum and in more wet habitats, there are a larger diversity of epixylic species, including many liverworts.

Only in the pinetum caricosum and caricoso-sphagnosum forest type, the hygrophytes of eutrophic swamps occur: *Aneura pinguis*, *Hamatocaulis vernicosus*, *Helandium blandowii*, *Sphagnum contortum*, *S. obtusum*, *S. platyphyllum*, *Tomentypnum nitens*, etc.

Pinetum forest types in wetlands and on the poor soils (ledosum and sphagnosum) are marked by the inhabitants of oligotrophic bogs, hygrophytes *Cephalozia conivens*, *Mylia anomala*, *Sphagnum balticum*, *S. flexuosum*, *S. fuscum*, *S. rubellum* etc.

Extreme pine forest types, both drier types, cladinosum and callunosum, and wetter ones, sphagnosum, include species which occur only in pine forest of these types.

**Piceetum forests.** There are species occurring in spruce forest throughout the spectrum of forest types, being absent only in piceetum vacciniosum; they include epigeous *Plagiochila porelloides*, *Calliergon cordifolium*, *Eurhynchium angustirete*, *Plagiomnium ellipticum*, *Polytrichastrum longisetum*, *Polytrichum commune*, *Rhizomnium punctatum*, *Sphagnus girgensohnii*, *S. palustre*, and epixylic *Chiloscyphus pallescens*, *Lepidozia reptans*, *Nowellia curvifolia*.

In the ecological range of forest types along increasing of moisture, up to piceetum myrtillosum (and less frequently to polytrichosum) eutrophic and mesotrophic species occur *Trichocolea tomentella*, *Amblystegium serpens*, *Anomodon longifolius*, *Atrichum undulatum*, *Brachythecium velutinum*, *Brachythecium rutabulum*, *Campylidium sommerfeltii*, *Cirriphyllum piliferum*, *Fissidens adianthoides*, *Funaria hygrometrica*, *Homomallium incurvatum*, *Plagiomnium affine*, *P. undulatum*, *Pylaisia polyantha*, *Rhodobryum roseum*, *Sanionia uncinata*, *Sciurohypnum oedipodium*. Starting from oxalidosum type, the following hygrophytes appear: liverworts *Blepharostoma trichophyllum*, *Cephalozia lunulifolia*, *Chiloscyphus polyanthus*, *Geocalyx graveolens*, *Plagiochila asplenioides* and mosses *Bryum capillare*, *B. moravicum*, *Calliergonella cuspidata*, *Sphagnum squarrosum*, *Thuidium assimile*.

Forest types of aegopodiosum, urticosum and filicosum are characterized mainly by eutrophic and to a lesser extent mesotrophic hygrophytes *Calypogeia muelleriana*, *C. neesiana*, *Cephalozia pleniceps*, *Geocalyx graveolens*, *Liochlaena lanceolata*, *Pellia epiphylla*, etc.

A number of hydrophytes and hydrohydrophytes were found only in the fontinale-herbosum type: *Riccia fluitans*, *Bryum pallens*, *Campylium protensum*, *Cratoneu-*

*ron filicinum*, *Philonotis fontana*, *Pohlia wahlenbergii*, *Sphagnum warnstorffii*. Three species, the inhabitants of eutrophic swamps, hygrophytes *Breidleria pratensis*, *Sphagnum cuspidatum*, *Tomentypnum nitens*, were found only in the caricosum and caricoso-sphagnosum types.

**Comparison of bryophyte species of pine and spruce forest.** As many as 90 species are differential between pinetum and piceetum forest in Belarus. 47 of them occur only in the *Picea* forests (7 liverworts, 40 mosses, including Andreaeopsida 1, Sphagnopsida 9, Bryopsida 30). Pine forest include 43 species which were not recorded in spruce forest, as they include 12 liverworts, 31 mosses, all of them belonging to Bryopsida.

Comparative analysis of differential bryophytes of pinetum and piceetum showed that species in pine forest are distributed fairly evenly in relation to moisture, while in spruce forest a relatively more species are mesophytes or hygromesophytes, xeromesophytes are few and mesoxerophytes are absent (Fig. 1).

The differential species in pine forest are distributed relatively uniformly in relation to trophic groups, whereas those species from piceetum are mostly indicators of the nutrient rich substrates, mesotrophic species occur less frequently and there are no indicators of depleted and the nutrients poor substrates (Fig. 2).

Species of spruce forest have in general a wider range in forest types as compared with the pine forests (Table 1).

In the pinetum the number of oligomesotrophic and oligotrophic species is maximum between three groups of trophomorphs (Fig. 2).

Epigeous and epixylic bryophytes more definitely correlate with the forest type in the Belarus coniferous forests, whereas obligate epiphytic and epilithic species poorly reflect the specificity of environmental conditions in this region.

Differential bryophyte species of spruce forests indicate its more favorable trophic and moisture conditions as compared with pine forests, reflecting a broader ecological range of pine-dominated forests which may occur in more extreme conditions.

*Picea abies* demands on more humid and fertile soils as compared with pine. Spruce grows in Belarus on fresh sandy loam and loamy soils, tolerates conditions of constant excessive moisture, poor sandy soils with high water tables, drained peaty-gley and peat soils with good aeration, but does not tolerate dry air, stagnant soil moisture, and sudden changes in soil moisture regime (Pogrebnyak, 1955, Yaroshenko, 1969, Yurkevich et al., 1971, 1979, Sukachev, 1972, Tikhomirov, 2005). These conditions are favorable for the growth of many species of bryophytes, including stenotopic ones. There are few true xerophytes and oligotrophic species in spruce forests.

Pine forests cover a fairly wide edaphic habitat: from sandy dunes to expanded bogs, including those with unstable microclimate (Pogrebnyak, 1955, Yaroshenko,

1969, Yurkevich et al., 1979, 1984, Sukachev, 1972, Tikhomirov, 2005). Thus, pine forest conditions favor a greater diversity of pioneer bryophytes, presence of species that tolerate extreme environmental conditions, but restricts the occurrence of stenotopic bryophytes.

Bryophytes of pine and spruce forests well correspond to these dominant tree species.

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