

MOSES OF THE BELAYA RIVER BASIN (NORTHERN TIMAN,
NENETS AUTONOMOUS DISTRICT)

МХИ БАССЕЙНА РЕКИ БЕЛОЙ (СЕВЕРНЫЙ ТИМАН,
НЕНЕЦКИЙ АВТОНОМНЫЙ ОКРУГ)

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Abstract

Moss flora of the Belaya River basin, Northern Timan, Arkhangelsk Region (67° 18'–67° 23' N, 49° 05'–49° 23' E) includes data on 226 species and subspecies of mosses from 101 genera and 35 families with a brief geo-botanic description. We found bryophyte species new for the tundra areas of the European North such as *Didymodon fallax*, *Lescuraea secunda*, *Plagiothecium curvifolium*, *Pohlia vexans*, *Tetradontium repandum*, *Tetraplodon pallidus*, and *Timmia bavarica*. The taxonomic structure of mosses is the same as that for tundra areas of the European North. The most numerous moss families are the Dicranaceae (22 species), Amblystegiaceae (18), Sphagnaceae (16), and Mielichhoferiaceae (16). Boreal (85), arctic-alpine (60), hypo-arctic-mountain (29) and mountain (29) species are most numerous there.

Резюме

Приведены сведения о распространении 226 видов и подвидов из 101 рода и 35 семейств листостебельных мхов в бассейне р. Белая (Малоземельская тундра, Северный Тиман). Наиболее многочисленными семействами являются Dicranaceae (22 вида), Amblystegiaceae (18), Sphagnaceae и Mielichhoferiaceae (по 16). Таксономическая структура мхов характерна для тундровых областей европейского Севера. Ядро флоры листостебельных мхов составляют арктогорный (60 вид), бореальный (85), гипоарктогорный (29) и горный (29) элементы. Обнаружены виды, не отмеченные ранее для европейских тундр Севера: *Didymodon fallax*, *Lescuraea secunda*, *Plagiothecium curvifolium*, *Pohlia vexans*, *Tetradontium repandum*, *Tetraplodon pallidus*, *Timmia bavarica*. Среди указанных видов мхов *Tetradontium repandum* включен в Красную книгу Российской Федерации (Trutnev, 2008).

KEYWORDS: mosses, the Belaya River, Northern Timan, Malozemelskaya Tundra, Nenets Autonomous District

INTRODUCTION

The study area covers the Belaya River basin (67°18'–67°23'N, 49°05'–49°23'E) which originates in the Northern Timan Range (Fig. 1). The Belaya River, being 115 km long, is the largest tributary of the Indiga River which flows into the Barents Sea. Width of the river is 15–40 m, with depth of 0.5–2.5 m, with pebbly, stone, and sandy bed. Elevations of the study area range from 96 to 264 m above sea level. In the middle course of the river, a unique nature monument called Big Gates Canyon is situated; it belongs to the nature protected areas of the Nenets Autonomous District (Matveyeva, 2006). Formed of basalt of the Upper Devonian Age, it stretches for three kilometers in rocky fracture forming a variety of canyons 40 meters high and even higher. Below basalt rock, the canyon is formed of sandstones with 'stone architecture' forms and white quartz sand between them. Geomorphologically, the Northern Timan Range belongs to the Kanin-Ti-

man Region of the Russian Platform. The northern part of the Timan Range is included into southern tundra areas of the East-European Subprovince of the European-West Siberian Tundra Province (Aleksandrova, 1989). Vegetation is dominated by shrubs (*Salix lapponum*, *S. phylicifolia*, *S. lanata*, *S. recurvigemis*) and dwarf-shrub moss tundra (names of vascular plants are given according to Cherepanov, 1995). On river banks, open woods of birch (*Betula tortuosa*), birch and spruce or spruce (*Picea obovata*) are represented. Depressions are occupied by sedge-*Sphagnum* transitional mires.

The present study is based on the specimens collected by M. V. Dulin and identified by Zheleznova and Shubina. The collection includes 3000 samples stored in the Herbarium of the Institute of Biology, Komi Science Center, Ural Branch, Russian Academy of Sciences, Syktyvkar (SYKO).

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Fig. 1. Main collection sites of the Belaya River basin. The study area map was prepared using OpenStreetMap project data (<http://wiki.openstreetmap.org>).

Information about bryophyte flora of the Kanin-Pecherskii Region of the European North is very scarce (Afonina & Cernyadjeva, 1995; Afonina *et al.*, 2008; Zheleznova, 2010). Some data on bryophytes (51 species) was also published by Andreev (1931) and Dedov (1931, 2006) who studied vegetation of reindeer pastures in the Malozemelskaya Tundra and the Northern Timan. The records of *Hamatocaulis vernicosus* (Andreev, 1931), *Palustriella decipiens* (Dedov, 1931, 2006) and *Calliergon megalophyllum* and *Rhizomnium magnifolium* (Afonina *et al.*, 2008) based only on the literature data are included in the list.

RESULTS

Moss flora of the Belaya River basin includes data on 226 taxa (221 species and 5 subspecies) belonging to 101 genera and 35 families (Table 1). Species names are given according to Ignatov, Afonina, Ignatova *et al.* (2006). For each species, the occurrence in any of nine types of habitats is indicated. Eight species are newly recorded for the tundra areas of the European North, *i.e.*, *Didymodon fallax*, *Lescuraea secunda*, *Plagiothecium curvifolium*, *Pohlia vexans*, *Tetradontium repandum*, *Tetraplodon pallidus*, *Schistidium dupretii*, and *Timmia bavarica*. *Tetradontium repandum* is included in the Red Data Book of the Russian Federation (Trutnev, 2008).

The taxonomic structure of mosses is the same as that for tundra areas of the European North. Families with the largest number of species include Dicranaceae (22 species), Amblystegiaceae (18), Sphagnaceae (16), Mielichhoferiaceae (16), Polytrichaceae (14), Rhabdoweisiaceae (13), Mni-

aceae (13), and Grimmiaceae (12). The largest genera are *Dicranum* (16), *Sphagnum* (16), and *Pohlia* (16).

The heterogeneity of relief, soil and environmental conditions affects the habitat variety of bryophytes. Species number varies in different habitats, being the highest on rocks (117).

Moss flora of the Belaya River basin is largely represented by boreal species (84) which makes more than 30% of the total species number; boreal species also constitute both upland and lowland coenoses. Among them, the most typical and active are *Hylocomium splendens*, *Pleurozium schreberi*, *Pohlia nutans*, *Polytrichum juniperinum*, *Sanionia uncinata*, *Dicranum fuscescens*, *D. majus*, *D. scoparium*, *Polytrichum strictum*, *Sphagnum girgensohnii*, *S. russowii*, and *Straminergon stramineum*.

Moss flora is mostly formed by northern species which are spatially associated with the Arctic, northern taiga, and mountains of southward latitudes. The most numerous are the Arctic-alpine species (60); they usually occupy open habitats such as tundras, rock outcrops, slopes at the river banks (*e.g.*, *Dicranum elongatum*, *Polytrichastrum alpinum*, *Polytrichum hyperboreum*). Northern species with the other types of area are less numerous: Mountain (28) Arctic (5) and Hypoarctic (8).

Southern (nemoral) species (7) are very rare and grow on tree bark or decaying wood in floodplain willow forests, tundra and meadow communities. Cosmopolitan species are represented by *Ceratodon purpureus* and *Leprobryum pyriforme*. Xeric species *Syntrichia ruralis* was found on rocky ground and in tundra.

Table 1. Mosses of the Belaya River basin (Northern Timan). Note. Habitat types: 1 – tundra communities; 2 – rock outcrops; 3 – meadows; 4 – swamps (mires); 5 – shrub stands; 6 – slopes at river banks, 7 – weakly matted soil; 8 – forests; 9 – stream beds; 10 organic substrates.

Species	Habitat types									
	1	2	3	4	5	6	7	8	9	10
<i>Abietinella abietina</i>	+	+					+	+		
<i>Amblystegium serpens</i>			+		+			+		
<i>Amphidium lapponicum</i>				+						
<i>Aplodon wormskjoldii</i>	+	+								+
<i>Arctoa fulvella</i>		+								
<i>Aulacomnium palustre</i>		+		+	+	+	+			
<i>Aulacomnium turgidum</i>	+	+		+	+					
<i>Bartramia ithyphylla</i>	+	+	+		+			+	+	
<i>Brachythecium albicans</i>		+								
<i>Brachythecium cirrosum</i>	+									
<i>Brachythecium rivulare</i>						+			+	
<i>Brachythecium salebrosum</i>		+			+			+		
<i>Brachythecium turgidum</i>		+		+						
<i>Bryoerythrophyllum recurvirostrum</i>	+	+	+			+	+	+		
<i>Bryum sp.</i>	+	+	+		+	+	+	+	+	
<i>Bryum pseudotriquetrum</i>				+				+		
<i>Bryum weigelii</i>						+				
<i>Bucklandiella microcarpa</i>		+					+			
<i>Bucklandiella sudetica</i>	+	+								
<i>Buxbaumia aphylla</i>		+								
<i>Calliergon cordifolium</i>			+	+	+	+	+	+	+	
<i>Calliergon giganteum</i>			+	+	+	+				
<i>Calliergon megalophyllum</i>				+						
<i>Calliergon richardsonii</i>			+							
<i>Calliergonella lindbergii</i>		+	+	+	+	+	+	+	+	
<i>Campyliadelphus chrysophyllus</i>	+	+		+			+			
<i>Campylidium calcareum</i>							+			
<i>Campylidium sommerfeltii</i>					+					
<i>Campylium protensum</i>			+			+				
<i>Campylium stellatum</i>		+					+			
<i>Catoscopium nigratum</i>							+			
<i>Ceratodon purpureus</i>	+	+	+				+	+		
<i>Cirriphyllum piliferum</i>		+						+		
<i>Climacium dendroides</i>			+	+	+	+	+	+		
<i>Cnestrum schisti</i>	+	+								
<i>Codriophorus aquaticus</i>		+								
<i>Conostomum tetragonum</i>	+	+	+			+	+			
<i>Cratoneuron filicinum</i>									+	
<i>Cynodontium strumiferum</i>	+	+				+				
<i>Cynodontium tenellum</i>	+	+						+		
<i>Cyrtomnium hymenophylloides</i>		+								
<i>Dichelyma falcatum</i>			+							
<i>Dichodontium pellucidum</i>			+					+	+	
<i>Dicranella cerviculata</i>		+	+	+		+	+			
<i>Dicranella crispa</i>		+								
<i>Dicranella grevilleana</i>	+					+				
<i>Dicranella schreberiana</i>						+				
<i>Dicranella subulata</i>	+	+	+			+				
<i>Dicranella varia</i>			+			+				
<i>Dicranum acutifolium</i>	+			+	+	+				
<i>Dicranum angustum</i>	+	+	+	+	+	+				
<i>Dicranum bonjeanii</i>	+	+			+	+		+		
<i>Dicranum brevifolium.</i>	+						+			
<i>Dicranum elongatum</i>	+	+		+	+	+	+			
<i>Dicranum flexicaule</i>	+	+		+	+	+	+	+		
<i>Dicranum fragilifolium</i>	+			+						
<i>Dicranum fuscescens</i>	+	+			+			+		
<i>Dicranum groenlandicum</i>	+			+	+					
<i>Dicranum majus</i>	+	+	+	+	+	+	+	+		
<i>Dicranum montanum</i>	+	+		+	+		+	+		
<i>Dicranum muehlenbeckii</i>	+	+						+		

	1	2	3	4	5	6	7	8	9	10
<i>Dicranum polysetum</i>								+		
<i>Dicranum scoparium</i>	+	+		+	+			+		
<i>Dicranum spadiceum</i>	+	+	+	+	+	+	+	+		
<i>Dicranum undulatum</i>	+				+					
<i>Didymodon fallax</i>						+				
<i>Distichium capillaceum</i>	+	+	+			+	+	+		
<i>Distichium inclinatum</i>		+					+			
<i>Ditrichum flexicaule</i>	+	+		+			+			
<i>Ditrichum heteromallum</i>	+	+					+			
<i>Ditrichum pusillum</i>	+				+					
<i>Drepanium recurvatum</i>		+					+			
<i>Drepanocladus aduncus</i>			+	+		+	+			
<i>Drepanocladus polygamus</i>			+							
<i>Drepanocladus sendtneri</i>				+						
<i>Encalypta alpina</i>		+								
<i>Encalypta rhaptocarpa</i>		+								
<i>Encalypta spathulata</i>		+								
<i>Encalypta streptocarpa</i>		+								
<i>Fissidens bryoides</i>			+			+				
<i>Fontinalis antipyretica</i>						+			+	
<i>Fontinalis antipyretica</i> var. <i>gracilis</i>									+	
<i>Fontinalis hypnoides</i>						+				
<i>Grimmia longirostris</i>		+								
<i>Hamatocaulis vernicosus</i>	+									
<i>Helodium blandowii</i>				+	+					
<i>Heterocladium dimorphum</i>	+									
<i>Hygroamblystegium varium</i>						+	+			
<i>Hygrohypnella ochracea</i>		+	+		+	+			+	
<i>Hygrohypnum luridum</i>						+				
<i>Hylocomiastrum pyrenaicum</i>					+		+	+		
<i>Hylocomium splendens</i>	+	+	+	+	+	+	+	+		
<i>Hymenoloma crispulum</i>	+	+	+			+		+	+	
<i>Isopterygiopsis pulchella</i>	+	+						+		
<i>Kiaeria blyttii</i>	+	+	+				+		+	
<i>Kiaeria falcata</i>	+	+	+							
<i>Kiaeria glacialis</i>	+	+	+	+			+			
<i>Kiaeria starkei</i>	+	+	+				+		+	
<i>Leptobryum pyriforme</i>	+		+		+	+				
<i>Leptodictyum riparium</i>			+		+			+	+	
<i>Lescuraea saxicola</i>								+		
<i>Lescuraea secunda</i>								+		
<i>Meesia uliginosa</i>		+	+				+			
<i>Mnium blyttii</i>		+	+		+			+		
<i>Mnium lycopodioides</i>					+	+		+		
<i>Mnium marginatum</i>			+							
<i>Mnium spinosum</i>	+				+			+		
<i>Mnium stellare</i>					+	+		+		
<i>Mnium thomsonii</i>					+			+		
<i>Myrinia pulvinata</i>								+		
<i>Myurella julacea</i>	+	+								
<i>Niphotrichum canescens</i>	+	+	+		+					
<i>Oligotrichum hercynicum</i>		+	+			+	+		+	
<i>Oncophorus virens</i>			+							
<i>Oncophorus wahlenbergii</i>				+	+					
<i>Orthothecium strictum</i>		+					+			
<i>Paludella squarrosa</i>			+	+	+	+				
<i>Palustriella decipiens</i>	+			+						
<i>Philonotis capillaris</i>			+							
<i>Philonotis caespitosa</i>		+	+	+		+	+		+	
<i>Philonotis fontana</i>	+		+	+		+			+	
<i>Philonotis seriata</i>						+			+	
<i>Philonotis tomentella</i>	+		+	+	+	+			+	
<i>Plagiomnium curvatulum</i>			+	+	+	+		+		
<i>Plagiomnium ellipticum</i>			+	+	+	+		+		
<i>Plagiothecium curvifolium</i>				+	+			+		
<i>Plagiothecium denticulatum</i>		+	+		+			+		

	2	3	5	6	8	9
<i>Plagiothecium laetum</i>						+
<i>Platydictya jungermannioides</i>						+
<i>Pleurozium schreberi</i>	+	+	+	+	+	+
<i>Pogonatum dentatum</i>	+	+				
<i>Pogonatum urnigerum</i>				+		+
<i>Pohlia</i> sp.	+	+		+	+	+
<i>Pohlia andrewsii</i>		+				
<i>Pohlia atropurpurea</i>				+		
<i>Pohlia bulbifera</i>		+	+		+	
<i>Pohlia cruda</i>	+	+		+	+	+
<i>Pohlia crudoides</i>		+				
<i>Pohlia drummondii</i>		+			+	
<i>Pohlia elongata</i> var. <i>greenii</i>						+
<i>Pohlia filum</i>		+		+	+	
<i>Pohlia lescuriana</i>					+	
<i>Pohlia ludwigii</i>		+			+	
<i>Pohlia nutans</i>	+	+	+	+	+	+
<i>Pohlia nutans</i> subsp. <i>schimperi</i>	+	+	+		+	
<i>Pohlia obtusifolia</i>	+		+	+		
<i>Pohlia proligera</i>				+	+	
<i>Pohlia vexans</i>				+		
<i>Pohlia wahlenbergii</i>		+		+	+	+
<i>Polytrichastrum alpinum</i>	+	+		+	+	
<i>Polytrichastrum alpinum</i> var. <i>fragile</i>		+				
<i>Polytrichastrum longisetum</i>				+	+	
<i>Polytrichastrum sexangulare</i>	+	+			+	
<i>Polytrichum commune</i>	+	+	+	+	+	+
<i>Polytrichum hyperboreum</i>	+	+				
<i>Polytrichum jensenii</i>		+	+		+	
<i>Polytrichum juniperinum</i>	+	+	+	+	+	+
<i>Polytrichum piliferum</i>	+	+	+		+	
<i>Polytrichum strictum</i>	+	+	+		+	
<i>Polytrichum swartzii</i>		+	+	+		
<i>Pseudobryum cinclidioides</i>		+	+	+		
<i>Pseudoleskeella nervosa</i>				+		
<i>Pseudoleskeella tectorum</i>		+			+	
<i>Ptilium crista-castrensis</i>					+	
<i>Pylaisia polyantha</i>					+	
<i>Racomitrium lanuginosum</i>	+	+			+	
<i>Rhizomnium magnifolium</i>				+		
<i>Rhizomnium pseudopunctatum</i>		+	+	+	+	+
<i>Rhizomnium punctatum</i>				+	+	
<i>Rhodobryum roseum</i>					+	
<i>Rhytiadelphus squarrosus</i>				+		
<i>Rhytiadelphus subpinnatus</i>					+	
<i>Rhytiadelphus triquetrus</i>	+	+		+	+	
<i>Rhytidium rugosum</i>	+	+			+	
<i>Sanionia uncinata</i>	+	+	+	+	+	
<i>Schistidium agassizii</i>						+
<i>Schistidium apocarpum</i>	+	+			+	+
<i>Schistidium dupretii</i>		+				
<i>Schistidium papillosum</i>	+	+				
<i>Schistidium platyphyllum</i>					+	+
<i>Schistidium rivulare</i>		+		+		
<i>Sciuro-hypnum oedipodium</i>				+		
<i>Sciurohypnum ornellanum</i>					+	
<i>Sciuro-hypnum reflexum</i>		+		+	+	
<i>Sciuro-hypnum starkei</i>	+		+	+	+	
<i>Scorpidium cossonii</i>			+			
<i>Scorpidium revolvens</i>				+		
<i>Serpoleskea subtilis</i>					+	
<i>Sphagnum angustifolium</i>	+		+		+	
<i>Sphagnum balticum</i>			+	+		
<i>Sphagnum capillifolium</i>	+		+	+	+	
<i>Sphagnum centrale</i>				+		

<i>Sphagnum compactum</i>	+	2	3	+	5	6	+	8	9	
<i>Sphagnum cuspidatum</i>				+	+	+			+	
<i>Sphagnum fimbriatum</i>			+	+	+	+	+			
<i>Sphagnum flexuosum</i>				+	+					
<i>Sphagnum fuscum</i>	+			+	+			+		
<i>Sphagnum girgensohnii</i>	+	+	+	+	+	+	+		+	
<i>Sphagnum lindbergii</i>				+	+	+				
<i>Sphagnum riparium</i>				+	+	+	+			
<i>Sphagnum russowii</i>	+	+	+	+	+	+	+		+	
<i>Sphagnum squarrosum</i>				+	+	+				
<i>Sphagnum teres</i>		+	+	+	+					
<i>Sphagnum warnstorffii</i>				+	+			+		
<i>Splachnum vasculosum</i>				+						
<i>Stereodon plicatulus</i>	+	+			+					
<i>Stereodon revolutus</i>		+								
<i>Stereodon vaucheri</i>		+								
<i>Straminergon stramineum</i>	+	+	+	+	+	+	+	+	+	
<i>Syntrichia ruralis</i>	+	+								
<i>Tetraphis pellucida</i>	+	+			+			+		
<i>Tetraplodon mnioides</i>	+	+	+	+		+			+	
<i>Tetraplodon pallidus</i>		+								
<i>Tetraplodon paradoxus</i>	+									
<i>Tetradontium repandum</i>	+									
<i>Timmia austriaca</i>	+				+	+	+			
<i>Timmia bavarica</i>		+						+		
<i>Tomentypnum nitens</i>			+	+	+	+	+			
<i>Tortella fragilis</i>		+								
<i>Tortella tortuosa</i>		+								
<i>Warnstorfia exannulata</i>		+	+	+	+	+	+	+	+	
<i>Warnstorfia fluitans</i>		+		+	+		+		+	
<i>Warnstorfia sarmentosa</i>						+				
<i>Warnstorfia tundrae</i>						+				
Total	88	117	77	71	85	86	68	76	32	5

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LITERATURE CITED

- [ALEKSANDROVA, V.D. & T.K. YURKOVSKAYA (eds.)] АЛЕКСАНДРОВА, В. Д., Т. К. ЮРКОВСКАЯ (ред.). 1989. Геоботаническое районирование Нечерноземья Европейской части РСФСР. – [Geobotanical regionalization of the Non-Black Earth Area of the European part of the RSFSR] *Л., Наука [Leningrad, Nauka]*, 64 pp.
- [AFONINA, O.M. & I.V. CERNYADJEVA] АФОНИНА О.М., И.В. ЧЕРНЯДЬЕВА. 1995. Мхи Российской Арктики: список видов и библиография. – [Mosses of the Russian Arctic: check-list and bibliography] *Arctoa* 5: 99–142.
- [AFONINA, O.M., O.V. LAVRINENKO, S.S. KHOLOD & I.A. LAVRINENKO] АФОНИНА О.М., О.В. ЛАВРИНЕНКО, С.С. ХОЛОД, И.А. ЛАВРИНЕНКО. 2008. Новые находки мхов в Ненецком Автономном округе. 2. – [New moss records Nenets Autonomous District. 2] *Arctoa* 17: 192–194.
- [ANDREEV, V.N.] АНДРЕЕВ В.Н. 1931. Растительность тундры Северного Канина. – [Vegetation of North Kanin tundra] *В кн.: Оленьи пастбища Северного края: исследования тундры, как пастбища. Архангельск, Сев. краев. акционер. о-во «Севкрайгосторг»* [In: *Olenji pastishcha Severnogo kraja: issledovaniya tundry, kak pastbishcha. Arkhangelsk, Severnoe kraevoe aktsioner-noe obshchestvo «Sevkraygostorg»*]: 5–85.
- [CHEREPANOV, S.K.] ЧЕРЕПАНОВ С.К. 1995. Сосудистые растения России и сопредельных государств (в пределах бывшего СССР). – [Vascular plants of Russia and adjacent countries within the former USSR] *СПб.: Мир и семья [Sankt-Petersburg: Mir i semja]*, 992 pp.
- [DEDOV, A.A.] ДЕДОВ А.А. 1931. Оленьи пастбища Тиманской тундры. – [Reindeer pastures of Timanskaya tundra] *В кн.: Оленьи пастбища Северного края: исследования тундры, как пастбища. Архангельск, Сев. краев. акционер. о-во «Севкрайгосторг»* [In: *Olenji pastishcha Severnogo kraja: issledovaniya tundry, kak pastbishcha. Arkhangelsk, Severnoe kraevoe aktsioner-noe obshchestvo «Sevkraygostorg»*]: 86–135.
- [DEDOV, A.A.] ДЕДОВ А.А. 2006. Растительность Малоземельской и Тиманской тундры. – [Vegetation of Malozemelskaya and Timanskaya tundra] *Сыктывкар, Коми НЦ УрО РАН [Syktyvkar, Komi Science Centre of Ural Branch of RAS]*: 160 pp.
- IGNATOV, M.S., O.M. AFONINA., E.A. IGNATOVA *et al.* 2006. Check-list of mosses of East Europe and North Asia. – *Arctoa* 15: 1–130.
- [MATVEEVA, N.V. (ed.)] МАТВЕЕВА Н.В. (ред.). 2006. Красная книга Ненецкого автономного округа. – [Red Data Book of Nenets Autonomous District] *Нарьян-Мар, ненецкий информационно-аналитический центр [Narjan-Mar, Nenets information-analytical center]*: 450 pp.
- [TRUTNEV, Yu.P. *et al.* (eds.)] ТРУТНЕВ Ю.П. и др. (ред.). 2008. Красная книга Российской Федерации (растения и грибы). – [Red Data Book of Russian Federation (plants and fungi)]. М., Товарищество научных изданий КМК [Moscow, KMK]: 855 pp.
- [ZHELEZNOVA, G.V.] ЖЕЛЕЗНОВА Г.В. 2010. Новые находки мхов в Ненецком Автономном округе. 3. – [New moss records Nenets Autonomous District. 3]. – *Arctoa* 19: 262.