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BRYOPHYTE FLORA OF ZENTRAL'NO-LESNOJ BIOSPHERE NATURE RESERVE (EUROPEAN RUSSIA, TVER PROVINCE)

БРИОФЛОРА ЦЕНТРАЛЬНО-ЛЕСНОГО БИОСФЕРНОГО ЗАПОВЕДНИКА (ЕВРОПЕЙСКАЯ РОССИЯ, ТВЕРСКАЯ ОБЛАСТЬ)

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Abstract

Zentral'no-Lesnoj Biosphere Nature Reserve is situated in the Russian plain, in the southern part of Valdaj Hills, 56°26'-56°36'N – 32°42'-33°05'E, 240–300 m alt.; its territory is 230 sq. km. 150 species of mosses and 45 hepatics have been found in the reserve (not including doubtful literature records). An annotated list and dicussion on general bryophyte complexes of reserve are given. A collection of V. Medvedskaya-Romanenko, made in 1938 allows evaluation of changes in bryoflora since that time. The main changes: (1) epixylic hepatic flora has become poorer,and some rare species (*Bazzania tricrenata,Diplophyllum taxifolium)* are probably disappeared; (2) *Hamatocaulis vernicosus,* a moss of minerotrophic bogs, has not been recollected; (3) southern epiphytic mosses have probably become rarer *(Anomodon viticulosus, Hypnum vaucheri* haven't been found); *Leucodon sciuroides* and *Anomodon longifolius* were found on only one trunk each. *Pylaisiella selwynii* can be considered to have recently become established in the flora of this area.

Резюме

Центрально-Лесной биосферный заповедник расположен на Русской равнине, у южных отрогов Валдайской возвышенности,56°26'-56°36'с.ш.– 32°42'-33°05'в.д.,240–300 м над ур. м.; его территория составляет 230 кв. км. В заповеднике выявлено 150 видов мхов и 45 печеночников (не включая сомнительные литературные данные). Приводится аннотированный список видов и очерк основных моховых комплексов заповедника. Коллекция В. Медведской-Романенко, собранная в 1938 г., позволяет оценить изменения во флоре, происшедшие с того времени. Основными из них можно считать следующие: (1) стала беднее флора эпиксильных печеночников, некоторые из которых, очевидно, исчезли (*Bazzania tricrenata, Diplophyllum taxifolium)*; (2) *Hamatocaulis vernicosus,* типичный представитель минеротрофных болот, исчез; (3) также реже стали эпифиты с более южным распространением *(Anomodon viticulosus* и *Hypnum vaucheri* не были найдены, а *Leucodon sciuroides* и *Anomodon longifolius* были найдены только на одном дереве каждый). *Pylaisiella selwynii,* по-видимому, недавно проникла в данный район.

INTRODUCTION

Zentral'no-Lesnoj (Central Forest) Biosphere Nature Reserve is situated in the Russian plain, in the southern part of Valdaj Hills with altitudes 240–300 m, at 56°26'-56°36'N – 32°42'-33°05'E. The biome is considered as southern taiga. Mean annual temperature is +3.8°C,annual precipitation – 707 mm,varying from 560 to 960 mm (see also Fig. 1). Average frost-free period is 114 days (from 80 to 230 days), snow-cover period – 148 days (from 122 to 176), snow depth – 18 cm (from 9 to 28 cm) on the open places and 56 cm (from 31 to 78 cm) in the forest. Hydrothermic coefficient (precipitation : evaporation) is 1.8 (in summer 0.5-0.9), which accounts for the predominance of spruce taiga in the vegetation.

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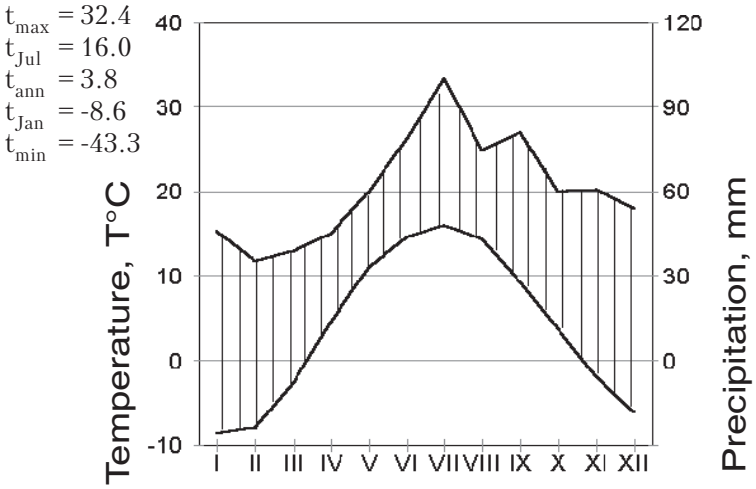

Fig. 1. Climatic diagramm of the Zentral'no-Lesnoj Nature Reserve.

The territory of the Nature Reserve is a plain watershed which includes sources of numerous streams and creeks without developed valleys. The main of them are Mezha Creek of the Baltic Sea Basin and Zhukopa Creek and Tyud'ma Creek of the Volga River Basin. All of them are only few meters wide and have very shallow slopes, without eroded precipitous banks. The bed rock is formed by the Upper Devonian limestones, which are covered by Quaternary deposits of (2)10-20(50) m thick hiding nearly all the ancient relief. These deposits are composed mostly by moraine clay and loam, with scattered granitic boulders, with the upper layer of fine loessy loam and at places of sand.

The Nature Reserve was organized in 1932, but in 1951-60 it was closed and its forests were partly cut. In 1960 it was resurrected with the area of 210 sq. km (including areas of two small disappeared villages), and in 1995 20 sq. km were added. The present territory of the reserve however excludes some areas which belonged to the reserve before its shutdown in 1951. Some roadsides and abandoned fields at or in close proximity to the edge of reserve were also included in our study.

Now 95% of the territory of reserve are covered by forests, 4% – by bogs, about 1% – by abandoned fields and abandoned hay-meadows and roadsides. 47% of the forests are dominated by *Picea abies*[1]; 41% – by secondary forests of *Betula pendula, B. pubescens, Alnus incana* and *Populus tremula*, representing various stages of natural and anthropogenic successions of spruce forests; 10% – by boggy and swampy pine forests; 1% – by swampy *Alnus glutinosa* stands.

Spruce forests are represented by three classes – (1) *Vaccinio-Piceetea* Br.-Bl. 1939, boreal forests with several associations dominated by *Oxalis acetosella, Majanthemum bifolium, Vaccinium myrtyllus, Dryopteris* and *Athyrium* ferns, *Pleurozium schreberi, Hylocomium splendens, Sphagnum girgensohnii*, etc.; (2) *Querco-Fagetea* Br.-Bl. 1931, spruce forests with *Tilia cordata, Acer platanoides, Ulmus laevis, Corylus avellana* and constant presence of nemoral herbs (*Galium odoratum, Asarum europaeum, Aegopodium podagraria, Milium effusum*); and (3) *Alnetea glutinosae* Br.-Bl. et Tx. 1943, including rich-soil swampy vegetation.

BRYOPHYTE VEGETATION

The considerable part of all spruce forests (45%) is represented by *Eu-Piceetum sphagnetosum*, the typical boreal spruce forests with *Sphagnum* dominating in the lower layer. These communities are found in an equilibrium status of paludification and terresterization processes. The composition of *Sphagna* depends on the level of paludification. The most common is meso-oligotrophic series, with *Sphagnum girgensohnii* as a dominant species mixed with *S. russowii, S. capillifolium* and *S. wulfianum.* In these communities *Pleurozium schreberii* and *Hylocomium splendens* are found on hummocks and strongly decomposed remains of trees and stumps. In more paludified forests Hypnales are almost eliminated by the rapid expansion of

[1] – The nomeclature of vascular plants is according to Czerepanov (1995)

S. angustifolium, S. magellanicum and *S. flexuosum*, while species of *Sphagnum* sect. *Acutifolia* are shifted to drier places (hummocks, etc.). In the mesotrophic and eutrophic paludified forests the flat places and depressions have rather poor moss cover (not more than 15 %), of *Calliergon cordifolium, Calliergonella cuspidata, Brachythecium rivulare, etc.*; on hummocks are *S. squarrosum, S.palustris* and *S. teres.*

In spruce forests of nemoral structure and with rather well-developed herbaceous layer bryophytes are confined mostly to the strongly decomposed wood. In such habitats *Brachythecium oedipodium,Rhytidiadelphus squarrosus* var. *calvescens*, *R. triquetrus, Cirriphyllum piliferum,Plagiomnium ellipticum,Plagiochila porelloides, Pleurozium schreberi, Hylocomium splendens, Climacium dendroides, Rhodobryum roseum* are the most common; in more wet places – *Brachythecium rivulare* and *Calliergon cordifolium*, which are especially abundant along wet trails (with *Plagiomnium ellipticum,P. medium, Rhytidiadelphus squarrosus*).

Commonly occurring under upturned roots of windfall trees *Atrichum flavisetum, Dicranella heteromalla, Ceratodon purpureus, Polytrichastrum spp., Schistostega pennata*.

The epiphytic bryoflora on trunks of *Picea* and *Betula* is rather poor and composed of a few acidophilous species – *Dicranum scoparium, Orthodicranum montanum, Hypnum pallescens,Sanionia uncinata*,etc.). Epiphytes of aspen are more numerous; especially abundant are *Neckera pennata* (at 1-10 and more meters above ground) and *Homalia trichomanoides* (at 0 to 1 m); also very common are *Orthotrichum speciosum, Pylaisiella polyantha, Serpoleskea subtilis* and *Radula complanata; O. obtusifolium, Ulota crispa* and *Pylaisiella selwynii* are not so common, but in most places of the reserve with aspen stands they could be found. *Isothecium alopecuroides, Anomodon longifolius* and *Leucodon sciuroides* were found only once. In the lower 1-1.5 m of aspen trunk are common *Brachythecium reflexum, B. salebrosum, Plagiomnium cuspidatum, Sanionia uncinata, Hypnum pallescens*, etc., and also some species, which typically grow on the forest floor: *Climacium dendroides, Rhytidiadelphus triquetrus, Eurhynchium pulchellum, E. angustirete, Mnium stellare, Thuidium philibertii.*

Broad-leaved trees, especially *Acer platanoides* and *Ulmus scabra* are similar to *Populus tremula* in epiphyte composition,but somewhat poorer, probably because these trees are much rarer in the reserve.

On fallen logs at earlier stages of decay *Sanionia uncinata* and *Callicladium haldanianum* are especially abundant; later – *Plagiothecium laetum, Tetraphis pellucida, Chiloscyphus profundus, Ptilidium pulcherrimum, Calypogeia spp.* and also species which occur on litter (*Brachythecium oedipodium*,etc.).

In the large concentric oligotrophic raised bogs many species of *Sphagna* occur: (1) on hummocks in the younger parts of hummock-hollow complexes – *S. angustifolium* and *S. magellnicum*; (2) on hummocks in the older parts of these complexes and on northern slopes – *S. fuscum,* and rarely *S. rubellum;* (3) in wet hollows of the upper part of the slope – *S. fallax;* (4) in relatively drained hollows in the middle of slope is characteristic *S. balticum*, and in more wet hollows – *S.majus, S. cuspidatum* and *Cladopodiella fluitans;* the two latter species also prefer unforested hummock-hollow complexes; (5) in the lower part of slopes in hollows with high water level and pools with mesotrophic conditions there are common *S. cuspidatum* and *S. jensenii.*

Interesting is the very rare occurrence of Ambly stegiacean pleurocarps in bogs: *Calliergon stramineum, Drepanocaldus aduncus, Warnstorfia exannulata, and W. fluitans* have been found in a very few places.

There are very few springy fens with scattered black alder, but they are very interesting, since only there have been found *Tomentypnum nitens* and *Helodium blandowii*.

As usual in Central Russia, open places such as bare soil along roads and abandoned fields are rather rich in bryophytes (*Anthoceros agrestis, Pohlia annotina*-group, *Atrichum tenellum, Barbula spp., Dicranella spp., Trematodon ambiguus, Pottia truncata, Philonotis fontana, Scapania curta, S. irrigua,* etc.).

On granitic boulders *Brachythecium populeum, Schistidium apocarpum, Racomitrium heterostichum, Grimmia muehlenbeckii* are especially common, more rare are *Hedwigia ciliata, Grimmia ovalis, Racomitrium microcarpon*; on shaded rocks in forests mosses are usually not so interesting, here occur such widespread

species as *Sanionia uncinata, Hypnum pallescens, Dicranum scoparium,* etc.

In streams *Fontinalis antipyretica* and *Scapania undulata* are very common, and along banks *Conocephalum conicum* is also common.

HISTORY OF STUDIES

In 1938 the bryophytes of the reserve were studied by V. F. Medvedskaya-Romanenko. Some species of hepatics from her collections were reported by T. T. Trofimov (1948), who referred to her manuscript. Unfortunately these studies found no further developement and the manuscript of Medvedskaya-Romanenko also disappeared in time of the Second World War. Fortunately in 1996 her collection was found in the herbarium of the Zentral'no-Czernozemnyj Nature Reserve in Kursk. There is no explanation how this collection came there. Now it is deposited in the Herbarium of the Moscow University (MW). Specimens from this collection are of great interest, since they allow the confirmation of records of some very rare species in the flora of Central Russia. Specimens of hepatics from this collection were revised by Potemkin, of mosses – by Ignatov. The collection contains mostly one specimen of each species. Labels are headed by Komarov Botanical Institute (LE), and judging from the very low percent of incorrect identifications, Medvedskaya-Romanenko was extensively consulted in this institution, but no direct evidences of this have been found.

In the 1970s studies concerned mostly hepatics: in 1970-72 extensive collections were made by M. P. Akhminova and in 1976 by A. L. Zhukova. In their publications (Akhminova, Zhukova, 1976; Zhukova, 1978) 46 species were reported, including 5 species reported by Trofimov (1948). Collections of Akhminova and Zhukova are in Komarov Botanical Institute (LE), but in fact only selected specimens were deposited in the main collection of this herbarium, so for some species we were unable to find any voucher specimens. Some of these species were found in other localities in neighboring regions and can be assumed as rare species, not found by us due to their rarity: *Cephalozia loitlesbergeri, Cephaloziella rubella, Chiloscyphus minor, Fossombronia wondrachekii, Tritomaria exsectiformis.*

However some other species have never been found near the Zentral'no-Lesnoj Reserve, and in view of the absence of voucher specimens, can be considered as doubtful: *Calypogeia trichomanis, Chiloscyphus latifolius, C. cuspidatus, Scapania uliginosa,* etc. These species are commented upon in a special chapter after the main list.

Akhminova also collected moss specimens, which are presented in the Herbarium of Komarov Botanical Institute.

In the 1985 M. S. Botch and E. O. Kuzmina studied *Sphagna* in the reserve. Their collection is deposited in the herbarium of Zentral'no-Lesnoj Reserve and were used for the present study. In the late 1980s and 90s numerous specimens were collected in the course of geobotanical studies by Minayeva and Kurayeva (collections in the herbarium of the reserve and in MW), Ignatov (collections in MW).

CHANGES IN THE BRYOPHYTE FLORA IN 60 YEARS

Some species of mosses are absent in the collection of Medvedskaya-Romanenko, but they certainly grew in the reserve at that time (*Brachythecium rivulare, Bryum argenteum, Plagiomnium ellipticum,* etc.). Though this collection is rather complete, these species were occasionally not included in it. Some weedy species may have recently appeared (*Atrichum tenellum, Barbula unguiculata, Eurhynchium hians, Campylium chrysophyllum, Dicranella schreberiana, Didymodon fallax, Physcomitrium pyriforme, Pohlia andalusica, P. annotina, P. bulbifera),* but we have insufficient information about this.

Pylaisiella selwynii probably also appeared in the reserve rather recently – it is quite probably that this species expanded its distribution in XX centure due to the increasing of aspen stands in South and Middle taiga of Central Russia.

More interesting are the species absent from recent studies but present in collections of Medvedskaya-Romanenko and/or collections of Akhminova & Zhukova. Several groups can be recognized:

1. Epixylic hepatics. We failed to find two species found only by Medvedskaya-Romanenko – *Bazzania tricrenata, Diplophyllum taxifolium,* and several species reported by Akhminova and Zhukova – *Anastrophyllum hellerianus, Cephalozia connivens, Lophozia ascendens, Tritomaria exsectiformis*. We have no explanation of their apparent absence during the recent studies. There are many places with rather

rich hepatic flora (especially in swampy alder forests). The fact that old-cut conifer forests differ from virgin conifer forests primarily by the declining of epixylic hepatics has also been reported from different parts of the world (cf. Norris, 1990).

2. *Anomodon viticulosus* [not found] and *Leucodon sciuroides* [found only once] – these species occur in Central Russia in old broad-leaved forests and also on trunks of *Populus tremula*. Important to mention, that both *Anomodon* and *Leucodon* abruptly decreased in the neighboring Moscow Province during the twentieth century (Ignatov & Ignatova, 1990). The decreasing of these species is likely a result of extensive clear-cuttings in 1950s. Some other species clearly belong to this group, *Isothecium alopecuroides, Anomodon longifolius*, and probably also *Metzgeria furcata*. They were not found by Medvedskaya-Romanenko and found in recent years, but on only a single trunk each.

Hypnum vaucheri probably also belongs to this group – this species is extremely rare in Central Russia: in the taiga zone of lowland it is the only locality.

3. *Hamatocaulis vernicosus* occurs in Central Russia on wet meadows and in minerotrophic bogs - habitats becoming much rarer in recent time in Central Russia (cf. Ignatov, Ignatova, 1990). Probably it grew with *Tomentypnum*, but now the latter species occurs in very small quantity in alder fen.

Bryophyte flora

The species, which identifications have not been confirmed by the authors, are marked by "—" before their names. For rare species the number of quadrate (qu.) where they were found is indicated. Abbreviations: MR – collection of Medvedskaya-Romanenko (1938, MW); AZ1976 – Akhminova & Zhukova, 1976; Z1978 – Zhukova, 1978 (LE); A1983 – Akhminova, 1983; BK1985 - *Sphagnum* collections of Botch and Kuzmina (herbarium of the reserve); 1990s – collections of Ignatov (MW), Kuraeva (MW) and Minaeva (MW), identified mostly by Ignatov & Ignatova (mosses excl. *Sphagnum*), Minaeva (*Sphagnum*) and Potemkin (hepatics).

Hepaticae

Anastrophyllum hellerianum (Nees ex Lindenb.) Schust. – Z1978: on decaying logs and soil in spruce and pine forests.

A. minutum (Schreb.) Schust. – MR1938: on rotten log.

Aneura pinguis (L.) Dum. – Z1978: in *Alnus glutinosa* forest, on soil; 1990s: on decaying wood in swampy alder stand, rare.

Anthoceros agrestis Paton (*A. punctatus* auct.) – AZ1976; Z1978; 1990s: on soil in abandoned field ("Stulovskoye").

Barbilophozia attenuata (Mírt.) Loeske – MR1938: spruce forest with *Sphagnum*, associated with *Orthodicranum montanum*; AZ1976: spruce forest with *Sphagnum* and *Vaccinium myrtillus*, on strongly rotten log.

B. barbata (Schmid. ex Schreb.) Loeske – MR1938: rotten log.

Bazzania tricrenata (Wahlenb.) Lindb. – MR1938: on rotten log, 5.VIII.1938 (with *Anastrophyllum minutum*).

B. trilobata (L.) S. Gray – AZ1976: Z1978: in mesic and boggy spruce forests on soil, rotten logs and trunk bases; 1990s: spruce forest with *Sphagnum* and *Vaccinium myrtillus*, base of *Betula* trunk.

Blasia pusilla L. – MR1938: banks of creeks and streams; AZ1976 & Z1978: on bare soil near roads, peat, in dry ponds, swampy and mesic forests; 1990s: common along wet forest roads, on soil.

Blepharostoma trichophyllum (L.) Dum. – MR1938: on rotten log; AZ1976 & Z1978; 1990s: widespread in almost all types of forests on rotten logs and sometimes at base of trunks.

Calypogeia integristipula Steph.– MR1938 (as *C. neesiana*): on rotten log of spruce and among *Sphagna* with *Cephalozia lunulifolia*; Z1978 (as *C. neesiana*?): boggy spruce and pine forests, on soil; 1990s: common in alder and spruce forests and edges of bogs, on rotten wood of stumps and logs, on soil under upturned roots and tree-base hummocks (in alder swamps).

C. muelleriana (Schiffn.) K. Muell. – MR1938, on rotten logs; AZ1976 & Z1978 (as *C. trichomanis* p.p.); 1990s: in all types of spruce forests, alder swamps and in boggy pine forest on rotten logs and soil under upturned roots.

C. suecica (H. Arnell & J. Perrs.) K. Muell. – Z1978 (as *C. trichomanis p.p.*); 1990s: on strongly rotten logs (qu. 74, 79).

Cephalozia bicuspidata (L.) Dum. – MR1938: on rotten log; 1990s: not rare in *Sphagnum* bogs and alder swamps, on peat under upturned roots and on rotten wood.

C. connivens (Dicks.) Lindb. – AZ1976: on rotten logs in rather mesic spruce forests with *Lophozia ascendens, L. incisa, Nowellia, Blepharostoma*; Z1978: in wet and mesic spruce forests and in boggy pine forest on rotten logs.

–*C. loitlesbergeri* Schiffn. – Z1978: on soil in *Al-*

nus glutinosa forest. The occurrence of this species in the reserve is very likely.

C. lunulifolia (Dum.) Dum. (incl. *C. affinis* Lindb. ex Steph.) – MR1938: among *Sphagna* with *Calypogeia integristipula*; AZ1976: moist and mesic spruce forests, on rotten logs; Z1978: in all types of spruce forests and in boggy pine and *Alnus glutinosa* forests on rotten logs; 1990s: in mesic and boggy spruce and mixed forests, rather rare. Differentiation of *C. affinis* from *C. lunulifolia* is based primarily on their sex distribution (autoicous vs. dioicous). When plants are sterile, their correct identification is impossible because of virtually no reliable distinctions exist (cf. Schuster 1974), so *C. affinis* is included here into synonymy of *C. lunulifolia*.

C. pleniceps (Aust.) Lindb. – Z1978 (as *C. affinis* p.p. & *C. connivens* p.p.) and 1990s: spruce forest near small stream, on rotten wood (qu. 72).

–*Cephaloziella rubella* (Nees) Warnst. – Z1978: on soil in spruce forest with *Vaccinium myrtyllus*. The occurrence of this species in the reserve is very likely.

–*Chiloscyphus minor* (Nees) Engel et Schust. – Z1978: on rotten wood in mixed spruce forest and on wood bridge. The occurrence of this species in the reserve is very likely.

Ch. polyanthos (L.) Corda (incl. *Ch. pallescens* (Ehrh.) Dum. & *Ch. fragilis* (A.Roth) Schiffn.) – MR1938: on bark of *Alnus glutinosa* and on soil along stream; AZ1976: wet meadows, dry creek beds, rotten wood; Z1978: also in swampy alder and spruce forests; 1990s: rather common in wet spruce and alder forests, along streams and creeks, on soil, in deep to moderate shade. Extensive overlapping of variability ranges of northern species of *Chiloscyphus* s.str. and absence of reliable qualitative criteria for their differentiation persuade us to follow I. Jarvinen (1983) and distinguish the only species, *Ch. polyanthos.*

Ch. profundus (Nees) Engel et Schust. (= *Lophocolea heterophylla* (Schrad.) Dum.) – MR1938: rotten log near stream; AZ: 1976; Z1978 (also as *Lophocolea bidentata*); 1990s: very common on rotten logs in forests, rare on litter. Investigation of numerous specimens attributed by Zhukova (1978) to *Lophocolea bidentata* showed that they represent xylicolous and/or sciophylous phases of the exceedingly polymorphous *Ch. profundus*.

Cladopodiella fluitans (Nees) Buch – MR1938: in spruce forest with *Sphagna* (27.IX.1938); 1990s: in hollows of Staroselsky Mokh and Katin Mokh bogs.

Conocephalum conicum (L.) Und. – MR1938: creek banks; AZ1976 & Z1978: in dry bed of Mezha Creek; 1990s: on banks of creek, dry stream bed and in springy alder bog.

Diplophyllum taxifolium (Wahlenb.) Dum. – MR1938: on rotten log, 5.VIII.1938.

–*Fossombronia wondraczekii* (Corda) Dum ex Lindb. – AZ1976 & Z1978: along edge of arable field and near trail across meadow. The occurrence of this species in the reserve is very likely.

Frullania dilatata (L.) Dum. – MR1938: *Picea* + *Vaccinium myrtyllus* forest, on *Sorbus* trunk; AZ1976 (as *Frullania sp.*) & Z1978: on trunk of *Populus tremula* in spruce forest; 1990s: mesic spruce forest, on maple trunk, in single locality (qu. 93).

Jamesoniella autumnalis (DC.) Steph. – MR1938: on bark of aspen log and on decorticated logs; AZ1976: mesic spruce forests, on rotten log, and also on sandy soil; 1990s: mixed spruce forests, at bases of aspen trunks, sporadically.

Jungermannia caespiticia Lindenb. – 1990s: in abandoned fields and cuvettes, on soil. It is quite probable that AZ1976 & Z1978 have reported this species as *Plectocolea obovata.* This species is superficially very similar to *J. caespiticia* and *P. obovata* was reported from the same habitats where *J. caespiticia* grows now. No specimens identified as *P. obovata* were found in LE.

Kurzia pauciflora (Dicks.) Grolle – MR1938: Staroselsky Mokh, with *Sphagnum balticum* in *Carex-Sphagnum* community.

Lepidozia reptans (L.) Dum. – MR1938: rotten logs; AZ1976 & Z1978: common in all types of forests; 1990s: common on rotten logs in forests and occasionally on bark of alive trees.

Liochlaena lanceolata Nees (= *Jungermannia leiantha* Grolle) – Z1978: *Alnus glutinosa* forest, on rotten log; 1990s: on rotten wood in only one alder swamp, but rather abundant there (qu. 97).

Lophozia ascendens (Warnst.) Schust. – AZ1976: mesic spruce forests, on rotten logs.

L. bicrenata (Hoffm.) Dum. – 1990s: in abandoned field, on soil.

L. incisa (Schrad.) Dum. – MR1938: on rotten log; AZ1976: wet and mesic spruce forests, on rotten logs.

L. longidens (Lindb.) Macoun – AZ1976: mesic spruce forests, on rotten logs; 1990s: birch forest near stream, on old log, rather rare.

L. ventricosa (Dicks.) Dum. – MR1938; AZ1976: mesic spruce forest, on rotten log; 1990s: rare, on rotten wood in alder swamp (qu. 97).

Marchantia polymorpha L. s. l. – MR1938: near Mezha Creek among *Carex vesicaria*; AZ1976 (also as *M. aquatica*): in wet and secondary places and in dry bed of Mezha Creek; 1990s: common on disturbed places (roads, clear-cuttings), also in springy mire on bare peat, along creeks, meadows.

Metzgeria furcata (L.) Dum. - 1990s: mixed forest, on trunk of aspen, one collection (qu. 92).

Mylia anomala (L.) Dum. – MR1938: on *Sphagna* at bases of spruce trees; 1990s: hummocks in oligotrophic bogs.

Nowellia curvifolia (Dicks.) Mitt. – MR1938: decorticated rotten logs; AZ1976: mesic spruce forests, on rotten logs; 1990s: on rotten wood in flood plain forest of small Mezha tributary; in mesic spruce forests.

Pellia endiviifolia (Dicks.) Dum. - 1990s: alder swamps and wet sides of meadows, on soil, sporadic.

–*P. epiphylla* (L.) Corda – AZ1976: dry creek bed, dry log with alluvium, bare soil under upturned roots of trees in spruce forest; Z1978: on soil and rotten logs in forests, creek banks and abandoned fields.

P. neesiana (Gott.) Limpr. – MR1938: banks of creeks and streams in forest; AZ1976: in spruce forests on bare soil and on disturbed places; 1990s: common in creek beds and bare soil in different types of forests.

Plagiochila asplenioides (L.) Dum. s.l. (incl. *P. porelloides* (Torrey ex Nees) Lindenb., *P. major* (Nees) S. Arnell) – MR1938: on moist soil, on rotten logs in spruce forests and near Mezha Creek; AZ1976 & Z1978: widespread in different types of forests; 1990s: common in spruce forests and fern + *Filipendula ulmaria* meadows, on soil, litter and decaying wood.

Ptilidium pulcherrimum (G. Web.) Vaino – MR1938: on bark of fallen trunks; AZ1976 & Z1978: common everywhere in the reserve on trunks and rotten logs; 1990s: very common on trunks and rotten logs in forests, occasionally also on granite boulders in meadows.

Radula complanata (L.) Dum. – MR1938: on bark of leafy trees; AZ1976 & Z1978; 1990s: common on aspen (rarer on *Ulmus, Acer, Tilia*) trunks in various types of forests, mostly dominated by spruce.

Riccardia latifrons (Lindb.) Lindb. – MR1938: on rotten logs (as *R. multifida* and *R. sinuata*); AZ1976: mesic spruce forest, on soil with *Blasia* and *Calypogeia muelleriana*; 1990s: rotten log, rare (qu. 79).

R. palmata (Hedw.) Carruth. – MR1938: on rotten logs.

Riccia fluitans L. – 1990s: flood plain of Tudovka River, old river bed: on clayish bar and in water.

R. glauca L. – 1990s: abandoned field ("Stulovskoye"), on soil.

–*R. sorocarpa* Bish. – Z1978: abandoned field, on soil.

Scapania apiculata Spruce – MR1938: on rotten decorticated logs (2 collections); 1990s: on rotten log in mixed forests (glade between quadrates 74 and 89).

S. curta (Mart.) Dum. – AZ1976: on *Trifolium* field; Z1978: abandoned fields; 1990s: in abandoned field, on forest edge, in cuvettes, on soil.

S. irrigua (Nees) Nees – Z1978: in mixed spruce forest on soil and rotten logs; 1990s: wet meadows and cuvettes, on soil.

S. undulata (L.) Dum. – MR1938, somewhat rotten tree branches at banks of Mezha Creek; AZ1976 & Z1978; 1990s: in dry creek beds, on soil, gravel and rotten logs, common in Mezha Creek Basin.

Trichocolea tomentella (Ehrh.) Dum. – 1990s: swampy *Alnus glutinosa* forest, on wet peat among hummocks, very rare (qu. 55).

–*Tritomaria exsectiformis* (Breidl.) Schiffn. ex Loeske – AZ1976 & Z1978: mesic spruce forest, on rotten log.

MOSSES

Abietinella abietina (Hedw.) B.S.G. – MR1938: wet depressions near a creek; 1990s: dry edge of *Betula* forest (98 qu.).

Amblystegium serpens (Hedw.) B.S.G. – MR1938: rotten log, on trunk; 1990s: on trunks of *Ulmus, Populus, Betula*, dry fallen logs, on granite boulders – relatively rare species, almost absent in boreal forests.

A. varium (Hedw.) Lindb. – 1990s: grows in the similar habitats and sometimes with the previous species, but occurs rarer. Found in swampy black-alder and spruce forests and in wet meadow.

Anomodon longifolius (Brid.) Hartm. – 1990s: the only collection in lower part of aspen trunk (h – 0.3-0.7 m) in old aspen stand in 89 qu.

A. viticulosus (Hedw.) Hook. et Tayl. – MR1938: on maple trunk with *Leucodon*.

Atrichum flavisetum Mitt. – MR1938: under upturned roots; 1990s: under upturned roots in all types of forests.

A. tenellum (Roehl.) B. S. G. – 1990s: on bare soil in abandoned fields, wet meadows, cuvettes, vertical banks of rut of forest-road; relatively rare.

A. undulatum (Hedw.) P. Beauv. – MR1938: on soil; 1990s: on bare soil (often of old dig-outs of moles) and sometimes also on rotten logs in spruce and alder forests, at forest edges and along trails. Sometimes grows on soil under upturned roots of trees in secondary forests, but in this habitat much rarer than *A. flavisetum*.

Aulacomnium palustre (Hedw.) Schwaegr. – MR1938: complex spruce forest; on meadow near Fedorovskoye; 1990s: widespread in *Sphagnum* bogs, in wet spruce forests (especially in *Sphagnum* and *Vaccinium myrtyllus* types), along wet roads and cuvettes, in wet meadows; common.

Barbula convoluta Hedw. – 1990s: rare on soil near banks of roads and bridges (with calcareous or concrete material nearby).

B. unguiculata Hedw. – 1990s: rare on soil in abandoned field and soil banks of roads.

Brachythecium albicans (Hedw.) B.S.G. – 1990s: relatively dry forest edges, on soil and granitic boulders.

B. mildeanum (Schimp.) Schimp. ex Milde – MR1938: on rotten log; 1990s: on wet soil in meadows and abandoned fields.

B. oedipodium (Mitt.) Jaeg. – MR1938: *Picea* +*Oxalis* forest; 1990s: very common in different types of spruce forests, on soil, rotten logs and trunk bases.

B. populeum (Hedw.) B. S. G. – 1990s: on granitic boulders in both open and shaded places; occasionally at tree bases.

B. reflexum (Starke) B. S. G. – MR1938: in many types of forests on litter and on trunk bases; 1990s: very common in spruce and alder forests on litter, fallen logs, trunk bases.

B. rivulare B.S.G. – 1990s: widespread in wet forests, meadows, near springs, along trails and roads, on soil, peat and on fallen log covered by alluvium.

B. roteanum De Not. – 1990s: on aspen trunks in mixed forests. Collected in few places, but probably has wider distribution.

B. rutabulum (Hedw.) B. S. G. – MR1938: wet clear-cutting, at bases of stumps; 1990s: rare in spruce and alder forests, on moist soil and rotten logs, rather rare.

B. salebrosum (Web. et Mohr) B.S.G. – MR1938: on soil in mesic spruce forest, on clear-cutting; 1990s: very common on rotten logs and trunk bases in spruce forests and occasionally also on soil in mesic meadows and forests and on boulders.

B. starkei (Brid.) B.S.G. – 1990s: on decaying wood and litter in spruce forests and ferns+*Filipendula* meadows.

B. velutinum (Hedw.) B.S.G. – 1990s: in spruce forests on rotten logs, litter and soil, sometimes in ferns+*Filipendula* meadows and at base of aspens.

Bryum algovicum Sendtn. ex C. Muell. – 1990s: abandoned field ("Stulovskoye"), on soil.

B. argenteum Hedw. – 1990s: along roads and on granitic boulders, relatively rare.

B. caespiticium Hedw. – MR1938: forest plantation; 1990s: on rather dry meadows and secondary places.

B. pallens Sw. – 1990s: wet soil in secondary places.

B. pallescens Schleich. ex Schwaegr. – 1990s: one collection from cuvette.

B. pseudotriquetrum (Hedw.) Gaertn. et al. – MR1938: banks of Mezha Creek, meadow near Fedorovskoye (with *B. weigelii*); 1990s: swampy spruce and alder forests, springy mires, wet places in flood valleys and in secondary places (roads, cuvettes); scattered.

B. subelegans Kindb. – 1990s: rare, on trunks of aspen (qu. 92).

B. uliginosum (Brid.) B.S.G. – 1990s: abandoned field, on soil.

B. weigelii Spreng. – MR1938: meadow near Fedorovskoye (with *B. pseudotriquetrum*).

Callicladium haldanianum (Grev.) Crum – MR1938: rotten logs; 1990s: relatively common in mesic mixed spruce forests, on fallen logs and bases of *Populus, Betula, Salix*; more rare in boggy oligotrophic forests.

Calliergon cordifolium (Hedw.) Kindb. – MR1938: spruce+alder forest with *Filipendula*; 1990s: alder, spruce and pine swamps and wet meadows, common throughout the reserve.

C. giganteum (Schimp.) Kindb. – MR1938: spruce+alder forest with *Filipendula*; 1990s: in flood valley of small creeks, in wet bogging meadows, occasionally in alder swamps; relatively rare.

C. stramineum (Brid.) Kindb. – 1990s: among *Sphagnum* and on peat under upturned roots of fallen pines in big peat bogs and sometimes on soil in wet spruce forests and old clear-cuttings.

Calliergonella cuspidata (Hedw.) Loeske – MR1938: opening in the forest and along streams, also meadow near Fedorovskoye; 1990s: in springy mires, alder swamps, wet meadows and abandoned field, along trails in forests; very common.

C. lindbergii (Hedw.) Hedenaes – 1990s: in rather open forests, edges of forest, meadows; on soil, occasionally on boulders and bases of trunks, sporadically.

Campylium chrysophyllum (Brid.) J. Lange – 1990s: found only once on soil in abandoned field ("Stulovskoye").

C. sommerfeltii (Myr.) J.Lange – 1990s: in forests on rotten wood and sometimes on soil nearby, also on soil on slopes to the bed of a small temporary creek and soil under upturned roots of fallen trees.

C. stellatum (Hedw.) C.Jens. – 1990s: on alder swamp in Kvashenka Creek and in wet cuvettes of road; only two localities.

Ceratodon purpureus (Hedw.) Brid. – MR1938: open places; 1990s: very common on dry soil in wind-fall areas, also in forests under upturned roots, on soil and boulders in meadow, in abandoned fields, along roads and other disturbed places.

Cirriphyllum piliferum (Hedw.) Grout – MR1938: wet types of vegetation; 1990s: very common throughout reserve in spruce and alder forests and in ferns+*Filipendula* meadows, on soil, litter, and old decaying logs.

Climacium dendroides (Hedw.) Web. et Mohr – MR1938: *Picea+Alnus incana+Filipendula+Calliergon cordifolium*; 1990s: common in wet spruce and alder forests and in meadows, occasionally in mesic forests; on soil, boulders, rotten logs, bases of trunks (especially on aspen).

Cratoneuron filicinum (Hedw.) Spruce – MR1938: on calcareous rocks near springs; 1990s: one locality: in springs at bank of Zhukopa Creek.

Dichelyma falcatum (Hedw.) Myr. – MR1938: In Mezha Creek, on fallen logs.

Dicranella cerviculata (Hedw.) Schimp. – 1990s: in *Sphagnum* bogs and swampy spruce forests, under upturned roots; rare.

D. heteromalla (Hedw.) Schimp. – MR1938: at *Betula* bases and under upturns in forest, on plots near laboratory; 1990s: occurs on most soil blocks under upturned roots of fallen trees, in all types of forests.

D. rufescens (Dicks.) Schimp. – 1990s: one collection in cuvette.

D. schreberiana (Hedw.) Hilp. – 1990s: Fedorovskoye, on soil in cuvette and in disturbed places at forest edge.

D. subulata (Hedw.) Schimp. – 1990s: [has not been not found in the reserve, but collected in wet cuvette of a road near Vysokoye, 12 km from Fedorovskoye, so it is expected in reserve soon]. This locality is the first in Tver Province and neighboring regions.

D. varia (Hedw.) Schimp. – 1990s: in abandoned fields and cuvettes, on bare loamy soil.

Dicranum bonjeanii De Not. – MR1938: meadow near Fedorovskoye; [1990s: has not been found in the reserve, but collected in wet cuvette of a road near Vysokoye, 12 km from Fedorovskoye].

D. fragilifolium Lindb. – 1990s: the only locality in swampy spruce forest, on rotten log (92 qu.).

D. fuscescens Turn. – MR1938: on rotten logs, stumps, tree bases in spruce forests; 1990s: in different types of boreal spruce forests, typically at bases of *Betula* trunks, and sometimes rotten logs; sporadically.

D. polysetum Sw. – MR1938: in forest; 1990s: sporadically on soil, hummocks, stumps and rotten logs in spruce and swampy alder forests, typically in small quantity.

D. scoparium Hedw. – MR1938: *Picea+Oxalis* forest, on soil; 1990s: very common in all types of forests on rotten logs, trunks of both leafy and conifer trees, on soil and granitic boulders.

Didymodon fallax (Hedw.) Zander – 1990s: in abandoned fields, strongly trampled places in meadows, cuvettes of roads; on soil.

Ditrichum cylindricum (Hedw.) Grout – MR1938: open place in forest plantation; 1990s: sporadically in abandoned fields, along roads, under upturned roots of trees in windfalls, on bare soil.

D. pusillum (Hedw.) Hampe – 1990s: in abandoned fields, disturbed edges of forests and cuvettes of roads, on soil banks, sporadically.

Drepanocladus aduncus (Hedw.) Warnst. – 1990s: in flood valleys of small creeks and streams in the reserve, rather rare; more common in buffer zone of the reserve in wet meadows and disturbed places.

Eurhynchium angustirete (Broth.) T. Kop. – MR1938: at bases of aspen; 1990s: mesic spruce forest, along trails, mixed stands in flood valleys; on litter, sporadically and occasionally on bases of aspens.

E. hians (Hedw.) Sande Lac. – 1990s: few localities: in mesic *Alnus incana* forest, on boulder; along a road at border of forest and grazed meadow; meadows in flood valley of Zhukopa Creek.

E. pulchellum (Hedw.) Jenn. – MR1938: *Picea +Oxalis* forest, on rotten fallen branch; 1990s: mesic spruce forests, on aspen trunks; rather rare.

Fissidens adianthoides Hedw. – MR1938: at base of the bank of Mezha Creek; 1990s: several localities (36, 38, 53, 97 qu.) in black-alder swamps (on peat of hummocks at tree bases) and in moist *Alnus incana* forest, on soil and boulders.

F. bryoides Hedw. – MR1938: at banks of Mezha Creek; 1990s: very rare on soil under upturned roots of trees in valley of Mezha and its tributaries.

Fontinalis antipyretica Hedw.– MR1938: in Mezha Creek; 1990s: on soil and roots of trees in Mezha, Zhukopa Creeks and their tributaries with permanent or temporary flowing (in latter case creek beds are narrow and with rather abrupt banks).

Funaria hygrometrica Hedw. – MR1938: clear cutting, old fire place, in forest plantation; 1990s: on bare soil on disturbed places, both artificial and windfalls; sporadically.

Grimmia muehlenbeckii Schimp. – 1990s: on granitic boulders in different parts of the reserve (both in meadows and not very dense forests); one of the most widespread acidophylous epilithic species.

G. ovalis (Hedw.) Lindb. – 1990s: in meadow near Fedorovskoye, on granitic boulder; the single collection.

Hamatocaulis vernicosus (Mitt.) Hedenäs – MR1938: *Picea+Alnus incana+Filipendula+Calliergon cordifolium.*

Hedwigia ciliata (Hedw.) Beauv. – MR1938: on boulders at edge of forest; 1990s: in meadow near Fedorovskoye, on granitic boulders.

Helodium blandowii (Web. et Mohr) Warnst. – MR1938: complex spruce forest; 1990s: in the single locality in *Alnus glutinosa* swamp (36 qu.), on open springy places, on hummock.

Herzogiella seligeri (Brid.) Iwats. – 1990s: moist spruce forest, rotten wood; in few localities.

Homalia trichomanoides (Hedw.) B.S.G. – MR1938: on bark of *Alnus glutinosa*; A1983: epiphytic in spruce forests; 1990s: on bases of trunks of *Populus tremula, Ulmus, Acer, Alnus*, and *Sorbus*; common in many types of forests.

Hylocomiastrum umbratum (Hedw.) Fleisch. – MR1938: spruce forest with *Oxalis* and *Majanthemum*, on rotten wood; 1990s: in mixed spruce forests, on litter and rotten logs and twigs and also along forest trails; sporadically.

Hylocomium splendens (Hedw.) B.S.G. – MR1938: rotten logs; 1990s: not rare in most types of forests, on litter, rotten logs, trunk bases.

Hypnum pallescens (Hedw.) Beauv. – MR1938: mesic spruce forest, rotten log; 1990s: in mixed forests, on bases of trunks, rather common; sometimes also on granitic boulders.

H. vaucheri Lesq. – MR1938: on rotten logs (with *Syntrichia ruralis*). Both species of this collection are rather xeric and usually epilithic, and grow on rotten logs only in dry and open places.

Isothecium alopecuroides (Dubois) Isov. – 1990s: mesic spruce forest, on trunk of *Populus tremula*, found only once (76 qu.).

Leptobryum pyriforme (Hedw.) Wils. – 1990s: in spruce forests under upturned roots of trees and in cuvette, on soil banks; sporadic.

Leptodictyum riparium (Hedw.) Warnst. – 1990s: in temporary flooded valleys of creeks and streams (92, 36 qu.).

Leskea polycarpa Hedw. – MR1938: on bark of trunks; 1990s: on willow trunk on the forest edge.

Leucodon sciuroides (Hedw.) Schwaegr. – MR1938: on maple with *Anomodon viticulosus*; 1990s: mesic spruce forest, on trunk of *Populus tremula*, found only once.

Mnium marginatum (Hedw.) With. – 1990s: one collection in dry stream bed, on soil bank (94 qu.).

M. stellare Hedw. – MR1938: at Mezha Creek bank; 1990s: several collections – in small creek valley, at base of *Ulmus*; in springy *Alnus* bog, on soil; in mesic and wet spruce forests at bases of aspen and alder trunks and under upturned roots.

Neckera pennata Hedw. – MR1938: on aspen bark, 74 qu.; A1983: epiphytic in different types of spruce forests, especially abundant in nemoral types; 1990s: common on aspen trees everywhere they are; also on *Ulmus* and *Acer*, and rare on *Sorbus* and *Alnus*; grows usually above 1 m, reaching tree crowns; sometimes occurs to 20 cm above the ground.

Oncophorus wahlenbergii Brid. – MR1938: at *Betula* bases; A1983: on rotten wood in different types of spruce forests.

Orthodicranum flagellare (Hedw.) Loeske – 1990s: rare, on rotten logs in wet forests, few localities.

O. montanum (Hedw.) Loeske – MR1938: *Betula* base; 1990s: very common in mixed and spruce forests, on rotten logs and trunk bases.

Orthotrichum anomalum Hedw. – 1990s: in meadow near Fedorovskoye, on granitic boulder.

O. obtusifolium Brid. – MR1938: on bark of *Alnus glutinosa* trunk; 1990s: in mixed forests, on aspen trunks; not rare, but not so common as *O. speciosum*.

O. speciosum Nees – MR1938: on tree bark; 1990s: on aspen trees everywhere they are, occasionally also on *Salix caprea, Acer, Ulmus, Tilia*; from 1 m above ground to crown.

Philonotis fontana (Hedw.) Brid. – 1990s: in abandoned fields and cuvettes, on wet soil.

Physcomitrium pyriforme (Hedw.) Hampe – 1990s: common along wet forest roads on soil banks and open peat in peaty meadows with *Filipendula*.

Plagiomnium affine (Bland.) T. Kop. – 1990s: scattered in mesic spruce and alder forests; on litter and old decaying logs.

P. cuspidatum (Hedw.) T. Kop. – MR1938: mesic spruce forest; 1990s: common in mesic spruce forests on soil near trunk bases and on bases of aspen and rotten logs; on aspens grows also in other types of forests; sporadic on soil in ferns +*Filipendula ulmaria* meadows, wet grazed meadows and cuvettes.

P. ellipticum (Brid.) T. Kop. – 1990s: very common in wet forests, meadows, swamps, secondary places (trails, roadsides, cuvettes); on soil, peat or litter, sometimes on trunk bases.

P. medium (Bruch et Schimp.) T. Kop. – MR1938: mesic spruce forest; 1990s: in different types of spruce and mixed forests and in *Filipendula*+ferns meadows, on soil, litter and rotten logs, sometimes among *Sphagna*.

P. rostratum (Schrad.) T. Kop. – MR1938: rotten logs; 1990s: rare, in ferns+*Filipendula* meadow, on rotten log and soil.

P. undulatum (Hedw.) T. Kop. – 1990s: two localities in 3 and 36 qu.: at the border of spruce forest and opening, and in spruce+*Alnus incana* forest.

Plagiothecium cavifolium (Brid.) Iwats. – MR1938: near Mezha Creek; 1990s: in flood valleys on soil banks to creek beds, under upturned roots and at bases of trees; occasionally in mesic spruce forests under upturned roots of trees.

P. curvifolium Schleich. ex Limpr. – 1990s: sporadically at bases of *Betula* and *Picea* in mesic forests.

P. denticulatum (Hedw.) B.S.G. – 1990s: very common in forests on soil, at trunk bases and on rotten logs.

P. laetum B.S.G. – MR1938: rotten log; 1990s: very common, especially on logs and trunks, though there are many records from soil.

P. latebricola B. S. G. – MR1938: rotten log of aspen; 1990s: few collections, in moist spruce and alder forests, especially close to streams; on strongly rotten logs.

Platygyrium repens (Brid.) B.S.G. – MR1938: near creek, on fallen trunks; 1990s: several collections on aspen trunks in mesic mixed forests.

Pleuridium subulatum (Hedw.) Rabenh. – 1990s: soil bank near a road in Fedorovskoye.

Pleurozium schreberi (Brid.) Mitt. – MR1938: in many types of vegetation; 1990s: very common in

all forests,in ferns+*Filipendula* meadows and on hummocks in *Sphagnum* bogs; grows on soil, peat, rotten logs and trunk bases.

Pogonatum urnigerum (Hedw.) Beauv. – 1990s: few collections in cuvettes and under upturned roots of trees in windfalls.

Pohlia andalusica (Hoehnel) Broth. – 1990s: abandoned fields (Stulovskoye, Krasnoye) and disturbed places near Fedorovskoye, on soil.

P. annotina (Hedw.) Lindb. – 1990s: in abandoned field with the previous species and also along a road in forest, on bare soil.

P. bulbifera (Warnst.) Warnst. – 1990s: abandoned field ("Stulovskoye") at the border of reserve, on soil.

P. camptotrachela (Ren. et Card.) Broth. – 1990s: soil bank of pit in abandoned hay-meadow (Krasnoye).

P. cruda (Hedw.) Lindb. – MR1938: near a road.

P. lescuriana (Sull.) Grout – 1990s: on bare soil in spruce forest, 29 & 92 qu.

P. nutans (Hedw.) Lindb. – 1990s: very common in all forests at tree bases, on fallen logs, on soil, among *Sphagna*, etc.

P. proligera (Kindb. ex Breidl.) Lindb. et H. Arnell – 1990s: one collection in disturbed forest edge near Fedorovskoye.

P. wahlenbergii (Web. et Mohr) Andrews – 1990s: on soil in secondary places (trails, roadsides, cuvettes, temporary flooded depressions in open places, etc.); scattered throughout the reserve.

Polytrichastrum formosum (Hedw.) G. L. Sm. – 1990s: three localities, in very different habitats: under upturned roots in nemoral spruce forest (72 qu.), on peat in black-alder swamp (56 qu.); on soil in secondary stand (93 qu.).

P. longisetum (Brid.) G.L.Sm. – MR1938: (with no more data); 1990s: in different types of spruce forests, on soil (especially under upturned roots), occasionally on rotten logs; common throughout the reserve.

P. pallidisetum (Funck) G.L.Sm. – 1990s: in the same habitats as *P. longisetum* and also rather common in different types of forests.

Polytrichum commune Hedw. – MR1938: upturning roots, on wet places; 1990s: very common in boreal spruce forests at early stages of palludification and in mesotrophic *Sphagnum* bogs; in black-alder swamps as well as in nemoral broad-leaved+spruce forests grows under upturned roots of trees; occurs on soil, among *Sphagna*, occasionally on rotten logs.

P. juniperinum Hedw.– 1990s: common on soil in windfalls and disturbed secondary forests; occasionally under upturned roots and fallen logs.

P. piliferum Hedw. – MR1938: on upturning roots; 1990s: on granitic boulders in several localities.

P. strictum Brid. – MR1938: wet places in many types of vegetation; 1990s: constantly occurs on hummocks in *Sphagnum* bogs and boggy forests, sometimes also on rotten wood.

Pottia truncata (Hedw.) Fuernr. – 1990s: on bare soil along roads, in cuvette and abandoned field and meadow; sporadically.

Pseudobryum cinclidioides (Hueb.) T.Kop. – MR1938: spruce+alder forest with *Filipendula*, on soil; 1990s: in alder swamps and boggy spruce forests, sometimes along trails in boggy forests; on wet peat, not rare.

Ptilium crista-castrensis (Hedw.) De Not. – MR1938: on rotten logs in rather mesic spruce forest (74 qu.); 1990s: rather rare on big rotten logs in spruce forests.

Pylaisiella polyantha (Hedw.) Schimp. – MR1938: on bark of trunks; 1990s: in different types of mixed forests, on trunks (especially of aspen) and decorticated logs.

P. selwynii (Kindb.) Crum et al. – 1990s: in several places in mixed spruce forest, on trunks of *Populus tremula* at 2-7 m above ground. Most findings are at 4-7 m above ground (on fallen trunks).

Racomitrium heterostichum (Hedw.) Brid. – MR1938: granitic boulders at forest edge; 1990s: in meadows near Fedorovskoye and Krasnoye and in qu. 98, on granitic boulder.

R. microcarpon (Hedw.) Brid. – MR1938: granitic boulders at forest edge; 1990s: Krasnoye: on granitic boulder in forest.

Rhizomnium magnifolium (Horik.) T.Kop. – 1990s: in wet spruce forests near streams, on soil; rather rare (92 & 78 qu.).

R. pseudopunctatum (Bruch et Schimp.) T. Kop. – 1990s: in the same habitats as the previous species, and also in black-alder swamps and in springy bog with *Tomentypnum*; on hummocks, soil and trunk bases (36, 56, 78, 92, 96 qu.).

R. punctatum (Hedw.) T. Kop. – MR1938: on soil and rotten logs; 1990s: in wet forests on soil and rotten logs, common throughout the reserve.

Rhodobryum roseum (Hedw.) Limpr. – MR1938: on upturning roots of trees; 1990s: mesic spruce forests and ferns+*Filipendula* meadows; on litter, rotten logs, bases of aspen trees; sporadic.

Rhytidiadelphus squarrosus (Hedw.) Warnst. var. *calvescens* (Lindb.) Warnst. – MR1938: in mesic spruce forest; 1990s: in different types of spruce forests and meadows, on soil and litter.

– var. *squarrosus* – 1990s: in moist meadows and grassy communities along road; not always clearly differentiated from var. *calvescens*.

R. triquetrus (Hedw.) Warnst. – MR1938: rotten logs, 74 qu.; 1990s: very common in forests and forest edges, on soil, rotten logs, trunks of

aspen (to 1 m high above ground).

Sanionia uncinata (Hedw.) Loeske – MR1938: mesic spruce forest, on soil; 1990s: very common throughout the reserve on trunks and rotten logs, and also on soil in disturbed places in forest.

Schistidium apocarpum (Hedw.) B.S.G. – MR1938: forest edge, on granitic boulders; 1990s: on granitic boulders in meadows and not very dense forests.

Schistostega pennata (Hedw.) Web. et Mohr – MR1938: wet forests, on upturned roots; 1990s: common on loamy soil under upturned roots of fallen trees.

Serpoleskea subtilis (Hedw.) Warnst. – 1990s: rather common on aspen trunks whereever they are, occasionally also on *Alnus*, *Ulmus, Acer*.

Sphagnum angustifolium (Russ.) C. Jens. – BK1985; 1990s: widely distributed in the reserve. In the raised bogs it is found in the most oligotrophic and dry habitats in ridges with *S. magellanicum* and *S.fuscum* and in the oligotrophic and mesotrophic habitats in the edges of raised bogs, forming carpets with *S. flexuosum;* sometimes grows in the thickets of *Phragmites australis* or *Carex rostrata* in the edges of bogs and in places of minerotrophic percolation. In the oligotrophic paludified forests rapidly spreads independently on microrelief and displaces *S. girgensohnii+S. nemoreum+S. wulfianum+S. russowii*. In the mesotrophic and eutrophic forests occurs in hummocks and rotten trunks.

S. balticum (Russ.) Russ. ex C. Jens. – MR1938: Staroselsky Mokh; BK1985; 1990s: common in the raised bogs in hollows on middle part of slope, indicating some drainage; also occurs in the open mesotrophic *Sphagnum* and *Carex+Sphagnum* swamps; dominates in *Juncus+Carex* communities on slopes of karst-funnels in raised bog "Katin mokh".

S. capillifolium Hedw. – BK1985; 1990s: rather common in the slightly paludified spruce forests, more rare on the hummocks in mesotrophic forested mires and black alder fens. It occurs also in the pine forests at the edges of raised bogs.

S. centrale C. Jens. – MR1938: complex spruce forest; BK1985; 1990s: rather common on hummocks in the mesotrophic pine forests, more rare in black alder fens. Sometimes forms the carpets on the peat soils along the temporary streams.

S. cuspidatum Ehrh. ex Hoffm. – MR1938; BK1985; 1990s: widely distributed in all raised bogs, where it is found in the middle- and high water level hollows, on the edges of pools and lakes, sometimes along the streams.

S. fallax (Klinggr.) Klinggr. – MR1938: Staroselsky Mokh; BK1985; 1990s: widely distributed in the reserve; it is found in low- and middle water level hollows of upper or middle part of raised bogs' slopes; forms carpets in the open mesotrophic high water level open and forested bog communities; dominates in the depressions in paludified spruce and birch forests.

S. flexuosum Dozy et Molk. – BK1985; 1990s: the species is widely distributed in paludified oligotrophic and mesotrophic forests, where it grows in the flat habitats with middle water level; it is also a dominant species in the drained communities of Eriophoro-Pinetum on the edges of bogs; together with *S. angustifolium* and *S. riparium* forms the moss cover in the *Phragmites australis* and *Carex rostrata* thickets in the places with limited percolation.

S. fuscum (Schimp.) Klinggr. – MR1938: Staroselsky Mokh; collected there also by Skvortsov in 1950s; BK1985; 1990s: common species in the northern slopes of raised bogs, where it is forming high hummocks and ridges together with *S. angustifolium* and *S. magellanicum.*

S. girgensohnii Russ. – MR1938: complex spruce forests; BK1985; 1990s: the main species in all the types of paludified spruce forests with peat depth usually not more then 30-35 cm; in black alder fens it grows on hummocks; in the drained forests it is not abundant but found regularly, in depressions (windfall-made, etc.) and other ±wet habitats.

S. jensenii H. Lindb. – BK1985; 1990s: found only in the raised bogs "Katin Mokh" and "Staroselskij Mokh" in very wet hollows and in the edges of pools.

S. lindbergii Schimp. ex Lindb. – MR1938: Staroselsky Mokh; in 1930s was collected by Trofimov in "Katin Mokh".

S. magellanicum Brid. – MR1938: BK1985; 1990s: species is widely distributed in all open bogs of the reserve, where it forms ridges and hummocks together with *S.angustifolium* and *Polytrichum strictum***.** It is also common on hummocks in the paludified spruce and pine forests with peat depth more than 35 cm.

S. majus (Russ.) C. Jens. – BK1985; 1990s: rather common in raised bogs in the oligotrophic hollows together with *Sphagnum cuspidatum*, but it occupies habitats with comparatively lower water level.

S. palustre L. – BK1985; 1990s: rather rare species found in mesotrophic forested mires with pine, birch and willow; in the black alder forests at the edges of raised bogs and along the temporary waterflows.

S. riparium Aongstr. – MR1938: Staroselsky Mokh; BK1985; 1990s: rather common species, which usually forms the pure carpets in habitats with high water level at the edges of raised bogs with birch and willow; also common along temporary waterflows in mesotrophic mires and in

the *Phragmities australis* and *Carex rostrata* thickets together with *S. angustifolium* and *S. flexuosum*.

S. rubellum Wils. – BK1985; 1990s: rather rare species, growing on ridges, hummocks and dry hollows in the bogs "Katin mokh", "Staroselskij Mokh" and "Gulnovskij Mokh".

S. russowii Warnst. – MR1938: BK1985; 1990s: common in flat habitats in the paludified spruce forests and more rare on hummocks in the paludified pine forests.

S. squarrosum Crome – MR1938: complex spruce forest; BK1985; 1990s: rather common in many kinds of wet eutrophic habitats: in small depressions in the rich spruce forests, in the herbaceous and willow carrs, in the black alder fens, etc.

S. quinquefarium (Lindb. ex Braithw.) Warnst. – 1990s: only once collected on the hummock at the base of pine tree in the rapidly growing forested peatbog (qu. 97).

S. teres (Schimp.) Aongstr. ex Hartm. – BK1985; 1990s: sporadically distributed in eutrophic and mesotrophic habitats with minerotrophic percolation, often on disturbed substrate.

S. warnstorfii Russ. – BK1985; 1990s: rather rare in eutrophic spring mires along the Zhukopa River and in the minerotrophic forested carrs.

S. wulfianum Girg. – BK1985; 1990s: common species on the slight eminencies of the microrelief in spruce forests in the early stages of paludification.

Splachnum ampullaceum Hedw. – MR1938: on dung at the bank of Mezha Creek.

Syntrichia ruralus (Hedw.) Brid. – MR1938: "on rotten logs" with *Hypnum vaucheri* (see note under that species).

Tetraphis pellucida Hedw. – MR1938: rotten log; 1990s: very common on rotten wood and wet peaty soil in all types of forest; occasionally grows on living trunks to 1.5 m above ground.

Thuidium delicatulum (Hedw.) B.S.G. – 1990s: one collection from Kvashenka Creek in 37 qu., on peat at base of black alder trunk.

T. philibertii Limpr. – MR1938: on fallen rotten logs; 1990s: *Alnus incana* mesic stand, on litter and in mixed forest, on base of aspen.

T. recognitum (Hedw.) Limpr. – 1990s: in spruce and alder forests, along trails and roads, in meadows, on soil.

Tomentypnum nitens (Hedw.) Loeske – 1990s: one locality in *Alnus glutinosa* bog with springs, on hummock in open springy place (36 qu.).

Trematodon ambiguus (Hedw.) Hornsch. – MR1938: on soil under upturned roots of spruce; 1990s: mixed spruce forests, on soil in disturbed places at forest edges; in few places, but grows usually in abundance.

Ulota crispa (Hedw.) Brid. – MR1938: on bark of trees; 1990s: in mixed forests on trunks of *Populus tremula* and sometimes also *Ulmus* and *Acer*; in many places, but much rarer than *Orthotrichum speciosum*.

Warnstorfia exannulata (B.S.G.) Loeske – 1990s: bogging places on road across *Sphagnum* bogs; pools in meadows.

W. fluitans (Hedw.) Loeske – 1990s: on soil in flood valleys; in hollows in Katin Mokh bog.

ERRONEOUS AND DOUBTFUL RECORDS

Calypogeia trichomanis (L.) Corda – AZ1976. All specimens found in LE belong to *C. muelleriana* and *C. suecica*.

Lophocolea bidentata (L.) Dum.) – AZ1976 & Z1978. All specimens found in LE belong to *Chiloscyphus profundus.*

L. cuspidata (Nees) Limpr. – Z1978. No specimens were found in LE. Probably this record was based on misidentified *Chiloscyphus profundus*.

Chiloscyphus fragilis (A.Roth) Schiffn. = *Ch. polyanthos* s.l. See comment under the latter species.

Ch. pallescens (Ehrh.) Dum. = *Ch. polyanthos* s.l. See comment under the latter species.

Lophozia wenzelii (Nees) Steph. – AZ1976 reported this species referring to data of Medvedskaya-Romanenko. However, in the available collection of Medvedskaya-Romanenko this species is absent.

Marchantia aquatica (Nees) Burgeff = *M. polymorpha* L. s.l. (cf. Bischler-Causse & Boisseler-Dubayle, 1991).

Plagiochila major Nees = *P. asplenioides*

Plagiochila porelloides (Nees) Lindenb. = *P. asplenioides* s.l.

Plectocolea obovata (Nees) Lindb. – AZ1976 & Z1978: see comments under *Jungermannia caespiticia*.

Riccardia chamaedryfolia (With.) Grolle – MR (as *R. sinuata* (Dicks.) Trev.): one specimens so named by Medvedskaya-Romanenko appeared to be *R. latifrons.*

Scapania uliginosa (Lindenb.) Dum. – Z1978: on soil and rotten wood of woody bridge. Doubtful record.

PHYTOGEOGRAPHIC NOTES

Most moss species of the flora of the reserve are widespread in boreal lowlands of Eastern Europe. The absence of limestone outcrops, rich heavy clays and big valleys and rather limited occurrence of open places result in a rather low species number. Some widespread species in this zone are extremely rare in the reserve (*Fissidens bryoides, Drepanocladus aduncus*, etc.). A considerable number of species occurs in the reserve only at its edges, along roads and in abandoned fields.

Several species with primarily western distribution occur in the reserve close to its eastern limit: *Ulota crispa, Isothecium alopecuroi-*

des, Nowellia curvifolia, Bazzania trilobata.

The north-eastern limit has here *Plagiomnium undulatum*, which is still common in Smolensk and the western part of Moscow Provinces, but very rare in Tver Province. The south-western limit has *Sphagnum lindbergii*, which is common in Siberia and has only few scattered localities in boreal zone of Western Europe.

Pylaisiella selwynii is distributed in Central Russia mostly in zone of Middle taiga (Kostroma and Vologda Provinces and Karelia). The locality in the reserve is the most south-western in Europe. A somewhat similar distribution has *Hylocomiastrum umbratum*, a rare moss in the Central European lowland.

Hypnum vaucheri is very rare in Eastern Europe: the nearest localities are on chalk outcrops in steppe zone in the Kursk Province (ca. 600 km to the SE) and in northern Karelia (ca. 900 km to theN).*Diplophyllum taxifolium,Bazzania tricrenata* and *Kurzia paucifolia* are very rare in Central Russia. Collections of these four species made by Medvedskaya-Romanenko are the only specimens of these species from the Central Russia.

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