

**Rare species of plants and fungi in the “Koigorodskiy”
National Park (Komi Republic, Russia)**

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The importance of the “Koigorodskiy” National Park (Komi Republic) for conservation of protected plants and fungi key habitats is demonstrated for the first time. By now, we registered here 367 occurrences of 32 rare species of plants and fungi, included in the Red Data Book of the Komi Republic. Among them, 11 taxons of plants (7 species of vascular plants and 4 species of bryophytes), and 21 taxons of fungi (9 species of fungi, 11 species of lichens and 1 species of lichenicolous fungi) were found. Three species of vascular plants and nine taxons of lichens require monitoring of their nature populations and are included in the Appendix 1 to the Red Data Book of the Komi Republic. Our results confirm the priority of the Koigorodskiy National Park for conservation of biological diversity in the ecotone zone between the middle and southern taiga, and for protection of rare plants and fungi key habitats.

Keywords: biodiversity, bryophytes, fungi, key habitats, lichens, nature protected areas, vascular plants.

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**Редкие виды растений и грибов
национального парка «Койгородский»
(Республика Коми, Россия)**

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Впервые продемонстрирована значимость национального парка «Койгородский» (Республика Коми) для сохранения ключевых местообитаний охраняемых растений и грибов. В национальном парке зарегистрированы 367 находок 32 видов охраняемых растений и грибов, занесённых в Красную книгу Республики Коми. Среди них 11 таксонов растений (7 видов сосудистых растений и 4 – бриофитов) и 21 таксон грибов (9 видов настоящих грибов, 12 – лишайников и 1 вид лишенизированных грибов). Найдены 3 вида сосудистых растений и 9 таксонов лишайников, нуждающихся в постоянном контроле численности в природе и включённых в приложение 1 к региональной Красной книге. Три

представителя царства грибы (*Sarcosoma globosum*, *Lobaria pulmonaria*, *Tuckneraria laureri*) охраняются на федеральном уровне. Выявлены популяции *Dendroscosticta wrightii*, *Usnea longissima*, *Neckera pennata* – видов, которые в ряде стран Европы в результате усиления антропогенного пресса на экосистемы стали малочисленными.

Ключевые слова: биологическое разнообразие, грибы, ключевые местообитания, лишайники, мохообразные, особо охраняемые природные территории, сосудистые растения.

Recently, the problem of studying and preserving biological diversity becomes crucial due to the global ecological crisis. In the second half of the XX century, people realized the growing trend of a steadily increasing intensity of the biological resources use, which causes the threat of an ecosystem biological diversity decrease. The need to preserve the diversity of life at various levels of its organization from genetic to landscape was claimed by the resolutions of the UN Conference on Sustainable Development, Rio de Janeiro, 1992 (<https://www.un.org/ru/conferences/environment/rio1992>).

The creation of Nature Protected Areas (NPA) networks is considered to be the most effective way to preserve natural ecosystems [1]. Since the late 1950s, systematic research has been conducted in the Komi Republic on the formation of a NPA system. The Republic has one of the most extensive networks of protected areas in the North-West of Russia, including four federal objects, and 228 regional reserves and nature monuments [2]. The total area of the NPAs is about 5.47 mln ha (13.1% of the total Komi Republic area). The local system of NPAs is of great value for the conservation of habitats of rare species listed in the “Red Data Book of the Komi Republic” [3] and the “Red Data Book of the Russian Federation” [4, 5].

The Koigorodskiy National Park with an area of 56700 ha was created in 2019 at the south-west of the Komi Republic. It is located in the ecotone area between middle and southern taiga [2] and protects a large array of undisturbed natural boreal forests [6]. Pristine forest ecosystems have high diversity of fungi, lichens, invertebrates, and birds [7, 8]. So, such areas are the key habitats for populations of rare species. Therefore, for the Koigorodskiy National Park, we expected many findings of rare species, including protected taxons, which have the northern boundaries of their areas in the region.

At the time the national park was founded, information about its biological diversity was fragmentary. There are still no data on the flora and vegetation diversity. In the literature, one can find only information about the diversity of vascular plants and lichens in the adjacent territories of the southern regions of the Komi

Republic. In 2021, specialists of the IB Komi SC UrB RAS began systematic studies of flora, lichen- and mycobiota on the territory of Koigorodskiy National Park. The main goal of the research was to identify the habitats of protected taxons listed in the “Red Data Book of the Komi Republic” [3] and the “Red Data Book of the Russian Federation” [4]. The article is devoted to the characteristics of habitats and populations of rare species.

Materials and methods

The Koigorodskiy National Park is located in the eastern part of East-European Plain (Figure) on the watershed of the largest European rivers – the Volga (Caspian Sea basin) and the Northern Dvina (White Sea basin). Its southern border coincides with the administrative boundary between the Komi Republic and the Kirov region. In the Kirov region, the Tulashor cluster site (area 17,815 ha) of the Nurgush State Nature Zapovednik adjoins the boundaries of the National Park.

Tectonically, the Koigorodskiy National Park is confined to the Russian Platform overlain by deposits of the Jurassic and Cretaceous periods [9]. Deposits of the Quaternary period are fluvio-glacial pebbles and sands. The most of the territory is a part of the Northern Uvaly – an elevated denudation-accumulative gently hilly plain, dissected by the sources of rivers. The elevation ranges from 200 to 220 (240) m [9]. The climate is intracontinental, temperate [9]. The winter is cold and long with a short frost-free period. The summer is cool and short. The precipitation is reduced (700–850 mm/year) and falls mainly in the warm season. The amount of annual precipitation exceeds the annual land evaporation (500–530 mm/year). This contributes to the formation of a dense hydrographic network. The national park watercourses belong to the basins of the Suran, Mytets, Fedorovka and Letka rivers. Rivers have a mixed feeding with a predominance of snow one, and the waters are hydrocarbonate-calcium with a salinity of 250 mg/dm³.

According to botanical-geographical zoning, the study area is in the Kama-Pechora-West

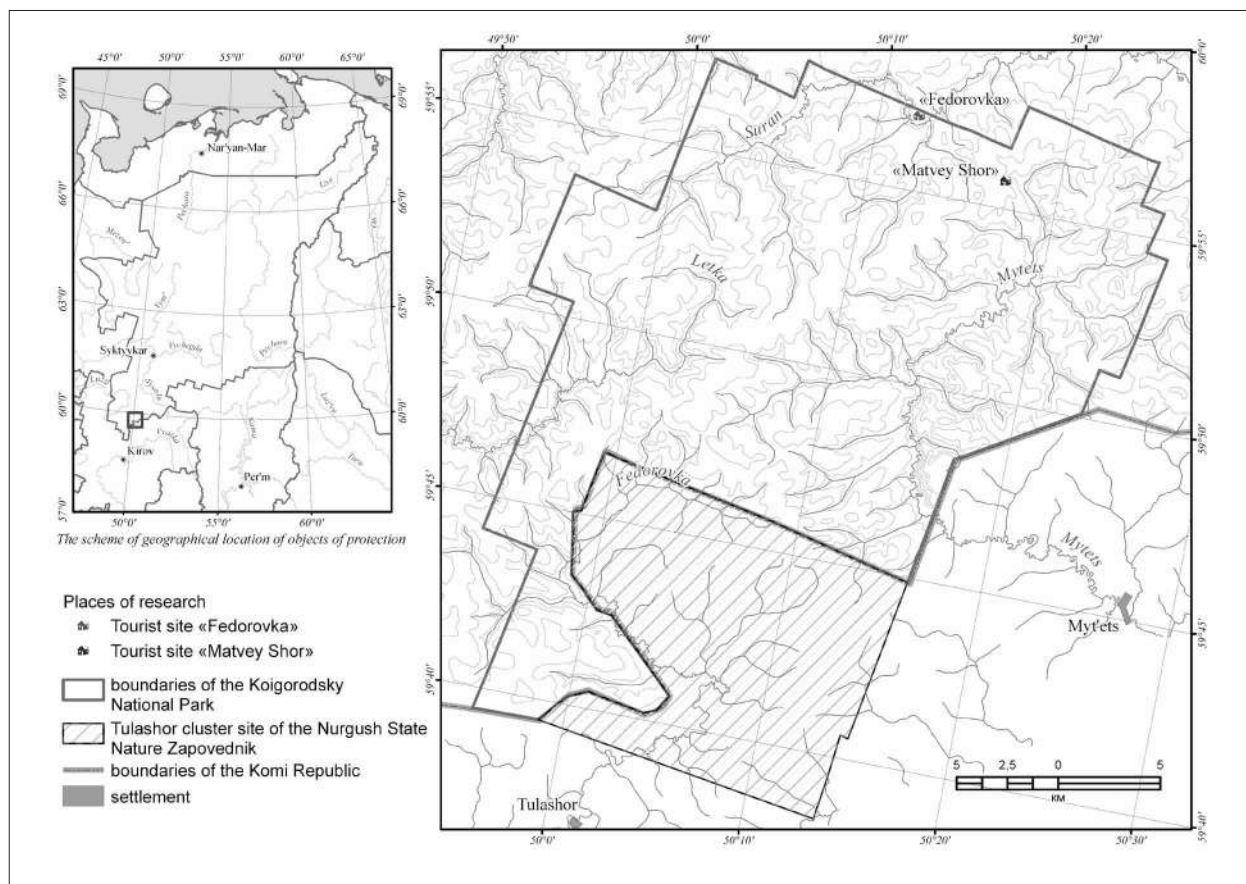


Fig. Places of research

Ural subprovince of the East-European Plain taiga province of the Eurasian boreal area [10]. Forest is a dominant type of vegetation [6] and covers about 98% of the territory. Mixed aspen and birch stands are common at the watersheds and cover 42 and 24% of the afforested area. Coniferous forests are mainly presented by spruce stands formed by *Picea obovata* Ledeb., often with co-dominant *Abies sibirica* Ledeb., *Betula pubescens* Ehrh. and *Populus tremula* L. Spruce forests cover 32% of the afforested area.

Tree stands are old and have medium density (0.7). An average yield class of the stands is II.5, ranged from III.4 in spruce stands to I.7 in aspen stands. Scots pine (*Pinus sylvestris* L.) stands are rare and cover about 2% of the afforested area. There are large arrays of wind fallen stands on the territory of the National Park. Bogs are common in the wet depressions, meadows and willows – in the river valleys. These types of vegetation have a small area.

Podzolic soils are formed on loamy bedrocks under green moss spruce forests. Ferruginous podzols are developed on drained sandy bedrocks under lichen and green moss pine forest. Under the canopy of spruce and aspen forests of her-

baceous type sod-podzolic soils are developed, in river valleys – alluvial sod and alluvial sod-gley soils. In areas of watershed with stagnant moisture under the canopy of dark coniferous forests dog-podzolic and peat-podzolic-gley soils are dominate [9].

The inventory of the biological diversity of plants and fungi was carried out in June–September 2021 in the northern part of the Koigorodskiy National Park (the vicinity of the “Fedorovka” and “Matvey Shor” tourist sites). The samples of plants, fungi and lichens were collected by route method according to the standard approach [11] in all types of plant communities found at the study sites. The length of radial routes was up to 3–4 km. Vascular plants floras were studied using standard local flora approaches [12, 13]. To identify the diversity of mosses, fungi and lichens, various substrates were examined: trunks and branches of living and dead trees, stumps, decks, soil, etc. The processing and determination of the collections was carried out in laboratory conditions using the comparative morphological, anatomical and morphological methods generally accepted in biology. Species names of vascular plants are

given according the *Plants of the World Online* source (<https://powo.science.kew.org/>). The size and names of moss families, genera and species are given according to the list of bryophytes from Europe, Macaronesia and Cyprus [14]. The nomenclature, volume of taxa, taxonomic position of lichens and associated fungi are indicated from the MycoBank Database (<http://www.mycobank.org>). The taxonomy and nomenclature of fungi taxa are given in accordance with the recommendations of the Index Fungorum resource (www.indexfungorum.org).

Results and discussion

The regional Red Data Book contains 532 taxa, including 150 species of fungi and lichens, 314 species of plants and 68 species of invertebrates and animals. The distribution of species listed in the third edition of the “Red Data Book of the Komi Republic” [3] by categories of rarity status is shown in the Table.

Analysis of the plants and fungi rare species representation within the regional NPA network showed that 86% of rare species are presented in the NPAs. At the same time, 13 species of fungi (including 5 lichen species) and 54 taxons of plants (5 species of algae, 12 bryophytes, and 37 vascular plants) are not protected in NPAs. The main reason is that the regional NPA network does not includes all types of landscapes of the Komi Republic [2]. The establishment of the Koigorodsky National Park in 2019 filled one of the gaps in the regional NPA network and ensured the preservation of the moraine plain landscapes with a silty mantle loams of the ecotone area between the middle and southern taiga subzones.

We found 32 populations of protected plants and fungi, including 11 taxa of plants (7 vascular

and 4 bryophytes) and 21 taxa of fungi (9 fungi and 12 lichens). The dataset on rare species with 367 occurrences was published in GBIF (<https://www.gbif.org/dataset/d2fa65c0-4e89-4763-af31-29bf09183a5d>). Information about rare species listed in the Red Data Book of the Komi Republic is contained in 43 more data sets also published in GBIF. The largest of them was prepared by specialists of the IB Komi SC UrB RAS and contains records of 8893 occurrences of 470 species [15]. Comparison with other GBIF data showed that our information significantly complete the knowledge on protected rare species in the Komi Republic.

All the protected vascular plant species has a category of rarity status 3: *Cinna latifolia* (Trevir. ex Göpp.) Griseb., *Dryopteris filix-mas* (L.) Schott, *Anemonoides ranunculoides* (L.) Holub, *Ranunculus ficaria* L., *Thalictrum aquilegifolium* L., *Tilia cordata* Mill., *Viola selkirkii* Purs ex Goldie. Moreover, we found three species included in the Annex 1 to the Red Data Book of the Komi Republic: *Platanthera bifolia* (L.) Rich., *Dactylorhiza maculata* (L.) Soó, and *Viola mirabilis* L. The most interesting findings are *Thalictrum aquilegifolium*, *Anemonoides ranunculoides*, and *Ranunculus ficaria* (Ranunculaceae). *Thalictrum aquilegifolium* was previously known only from two sites in the southern part of the Komi Republic. There are no new herbarium specimens of this species in the SYKO during the last 50 years and there are no the species findings at other regional NPAs. Moreover, the previously collected samples were vegetative individuals. Our findings confirm the emergence of this species in the Komi Republic. Its population establishes the Suran floodplain, between herbaceous meadow and the edge of mixed forest. We found about 300 individuals growing along the river bank. *Thalictrum aquilegifolium*

Table

Distribution by category of rarity status of species of fungi and plants, included in the “Red Data Book of the Komi Republic” [3]

Group of organisms	Category of rarity status						Total
	0	1	2	3	4	5	
Kingdom Fungi							150
Fungi	0	0	1	55	9	0	65
Lichens	2	17	12	48	6	0	85
Kingdom Plants							314
Algae	0	0	0	10	0	0	10
Bryophytes	0	0	12	52	7	0	71
Vascular plants	0	16	43	144	30	0	233

Note. The categories of species rarity status are given according to the system adopted in the “Red Data Book of the Russian Federation” [4].

is included in the “Red Data Book of the Kirov region” [16], and was recorded from the Tulashor cluster, Nurgush State Nature Reserve.

Anemonoides ranunculoides and *Ranunculus ficaria* were also found in the Suran floodplain grass-sedge communities, where the species grown in the silted open hollows. The populations are large and consist of more than 500 individuals, growing along the river course. There are the northern borders of the species ranges in the Komi Republic, and their occurrences are rare. Earlier, the species were protected only in the Pechoro-Ilychsky State Nature Reserve. Population of *Cinna latifolia* (Poaceae) was found in the riverine spruce forest in the wet hollow. The population is small – about 30 individuals. This species is sporadically distributed in the Komi Republic and protected in the Pechoro-Ilychsky State Nature Reserve and three landscape regional reserves. On the Vychegda Plain, *Cinna latifolia* is protected only in the Koigorodskiy National Park.

Fern *Dryopteris filix-mas* (Dryopteridaceae) was recorded in the mixed forest of herbaceous type. The population is small – about 50 individuals. In the Komi Republic, the species rarely grows in the forests of the Northern and Subpolar Urals, on a plain – in the southern part of the middle taiga in the old growth mixed forests of herbaceous type. Many of the species’ habitats are out of the limits of NPA. A single plant of *Tilia cordata* (Tiliaceae) of bushy form and 3 m height was found in the floodplain mixed forest at a slope to the stream Matvey Shor. In the Komi Republic this species is on the northern boundary of its range. Its populations are growing in the basins of the rivers Sysola, Luza, Letka, and Kobra. The populations are small. The species is under protection in one botanical reserve and two nature monuments.

Numerous populations of *Viola selkirkii* (Violaceae) were found in the old growth mixed forests of herb-green moss type. This species prefers south-west of the Komi Republic and sometimes grow in Suburals. *Viola selkirkii* is well provided with territorial protection in the regional NPAs. In addition to the Koigorodskiy National Park, it is under protection in the Pechoro-Ilychsky State Nature Reserve and six local reserves. All rare species of vascular plants, found in the national park, belong to southern latitudinal elements (nemoral-boreal and nemoral) and may be suggested as relics of the Holocene climatic optimum.

Two species are in the “Red Data Book of the Kirov Region” [16]: *Corallorhiza trifida* Chatel.

and *Neottia cordata* (L.) Rich. Single plants of *Corallorhiza trifida* were noted at the fen. *Neottia cordata* was recorded from mixed and spruce forests of the green moss type. Analysis of the data on the flora of the Tulashor cluster, Nurgush State Nature Reserve [17, 18] revealed that it contains 12 species of the «Red Data Book of the Komi Republic» [3]: *Carex pseudocyperus* L., *Chimaphila umbellata* (L.) W.P.C. Barton, *Dactylorhiza traunsteineri* (Saut. ex Rchb.) Soó, *Dryopteris cristata* (L.) A. Gray, *Epipogium aphyllum* Sw., *Iris sibirica* L., *Monotropa hypopitys* L., *Polygala comosa* Schkuhr, *Potentilla erecta* (L.) Raeusch., *Thelypteris palustris* Schott, *Viola collina* Besser, and *Viscaria vulgaris* Röhl. They will probably be found on the territory of the Koigorodskiy National Park during further research. Most of these taxons are not under protection in the NPAs of the Komi Republic.

Neckera pennata Hedw. and *Schistostega pennata* (Hedw.) F. Weber et D. Mohr., rare moss species included in the “Red Data Book of the Komi Republic” [3] with a status 3, are mainly concentrated in the old-growth forests and floodplain habitats of the Koigorodskiy National Park. Rarity of *Neckera pennata* and *Schistostega pennata* in the Komi Republic is mainly due to natural reasons. These species have narrow ecological range and is near the northern border of their area. *Neckera pennata* is rare in many European countries [19] and 52 regions of Russia. This species is typical for the zone of broad-leaved and coniferous-broad-leaved forests, where its populations had significantly decreased since the middle of the 20th century. In the Komi Republic, *Neckera pennata* grows mainly in the ecotopes with high air humidity, usually old-growth aspen forests. In most cases, the moss is confined to the bark of old aspen trees, climbing 3–4 m on trunks.

The species can be of interest as an indicator of aspen forests that have not been disturbed by felling or fires for a sufficiently long time. 166 species occurrences are known in the Komi Republic, of which more than a half (52%) was found in the southern part of the region in the southern and middle taiga. In the Koigorodskiy National Park, we registered 12 habitats of *Neckera pennata*. The species is protected in the Pechoro-Ilychsky State Nature Reserve, and five regional reserves. *Neckera pennata* is included in the “Red Data Book of Kirov Region” [16], and found in the Tulashor cluster, Nurgush State Nature Reserve [18].

Schistostega pennata was found in a wooded valley of stream on fine sand under the roots of

fallen tree. This small annual moss is adapted to grow in shaded habitats. In Russia, *Schistostega pennata* is sporadically found in the European part, Siberia and the Far East. The species is listed in the Red Data Books of 19 regions of Russia. There are 21 known occurrences of this species in the Komi Republic, including two in the Koigorodskiy National Park. The species was recorded in the northern, middle and southern taiga, as well as in the Northern Urals. Until recently, *Schistostega pennata* was protected only in the Pechoro-Ilychskiy State Nature Reserve.

New habitats of liverworts *Lophozia ascendens* (Warnst.) R.M. Schust. and *Scapania apiculata* Spruce were found in the National Park. The species are included in the “Red Data Book of the Komi republic” [3] with status 3. *Lophozia ascendens* was found in old windfall site in spruce-birch forest of hair-cap moss-sphagnum type, and in mixed spruce-aspen forest of dwarf shrub-bilberry-green moss association. The species inhabits rotting wood. The species is found sporadically in the taiga zone of the Komi Republic. It is under protection in the NPAs of federal (Pechoro-Ilychskiy State Nature Reserve and Yugyd va National Park) and local (regional reserves) levels. *Scapania apiculata* was found in the same habitats as *Lophozia ascendens*, and in the reed-dwarf shrub-fern-green moss aspen forest. The species is found sporadically in the middle taiga of the Komi Republic (basins of the Luza, Sysola, and Vychegda rivers, and upper course of the Pechora river), and is under protection in the Pechoro-Ilychskiy State Nature Reserve and two local reserves.

In the Koigorodskiy National Park, we found 9 species of fungi included in the “Red Data Book of the Komi Republic” [3]: *Leucocortinarius bulbiger* (Alb. et Schwein.) Singer, *Microstoma protractum* (Fr.) Kanouse, *Onnia tomentosa* (Fr.) P. Karst., *Pluteus umbrosus* (Pers.) P. Kumm., *Rigidoporus crocatus* (Pat.) Ryvardeen, *Sarcosoma globosum* (Schmidel) Casp., *Thelephora palmata* (Scop.) Fr., *Trichoderma nybergianum* (T. Ulvinen & H.L. Chamb.) Jaklitsch & Voglmayr. It counts 14% from total number of fungi species protected in the region. *Onnia tomentosa* and *Thelephora palmata* have status 4, other species – status 3. One species, *Sarcosoma globosum*, is included in the “Red Data Book of Russian Federation” [4], with the status 2. All species were recorded earlier in the other federal NPAs of the Komi Republic: *Leucocortinarius bulbiger*, *Pluteus umbrosus*, and *Trichoderma nybergianum* in the Yugyd va National Park; *Leucocortinarius bulbiger*, *Onnia tomentosa*, *Phlebia coccineofulva*,

Rigidoporus crocatus, *Sarcosoma globosum*, and *Thelephora palmate* in the Pechoro-Ilychskiy State Nature Reserve; *Microstoma protractum* was found in the federal reserve Paraskiny lakes.

Onnia tomentosa and *Phlebia coccineofulva* prefer pristine and old-growth forests. Populations of *Leucocortinarius bulbiger* and *Pluteus umbrosus* are on the northern border of their ranges, and their emergence indicates the nemoral character of the microbiota. *Leucocortinarius bulbiger* was collected in the fern spruce forest. Fruiting bodies of *Pluteus umbrosus* established mainly the large fallen wood of aspen. In the northern part of the National Park, where old-growth aspen and mixed forests are widespread, optimal conditions are formed for this species. In the Komi Republic, there is an eastern border of the *Trichoderma nybergianum* range. In the Koigorodskiy National Park, the species was collected in the fern spruce forest. *Sarcosoma globosum* is found sporadically in the boreal zone of the Komi Republic. The species emergence indicates the intact state of forests in the Koigorodskiy National Park. Four rare species: *Leucocortinarius bulbiger*, *Microstoma protractum*, *Rigidoporus crocatus*, and *Trichoderma nybergianum*, are found in the Tulashor cluster, Nurgush State Nature Reserve [20].

As a result of lichenological studies in the Koigorodskiy National Park, new habitats of 12 species from the “Red Data Book of the Komi Republic” [3] were found: *Cetrelia olivetorum* (Nyl.) W.L. Culb. & C.F. Culb., *Coenogonium luteum* (Dicks.) Kalb & Lücking, *Dendricosticta wrightii* (Tuck.) B. Moncada & Lücking, *Heterodermia speciosa* (Wulfen) Trevis., *Usnea longissima* Ach. (= *Dolichousnea longissima* (Ach.) Articus) (status 1); *Cheiomycina flabelliformis* B. Sutton, *Cliostomum leprosum* (Räsänen) Holien & Tønsberg, *Lobaria pulmonaria* (L.) Hoffm., *Pertusaria hemisphaerica* (Florke) Erichsen (= *Varicellaria hemisphaerica* (Flörke) I. Schmitt & Lumbsch), *Sclerophora coniophaea* (Norman) J. Mattsson et Middelb. (= *S. pallida* (Pers.) Y.J. Yao & Spooner), *Tuckneraria laureri* (Kremp.) Randle & A. Thell (status 3); *Multi-clavula mucida* (Pers.) R.H. Petersen (status 4). *Lobaria pulmonaria*, and *Tuckneraria laureri* are included in the “Red Data Book of the Russian Federation” [4] with statuses 2 and 3. Nine species (*Chaenotheca gracillima* (Vain.) Tibell, *Cladonia parasitica* (Hoffm.) Hoffm., *Evernia divaricata* (L.) Ach., *Hypogymnia bitteri* (Lyngé) Ahti, *H. vittata* (Ach.) Parrique, *Physconia detersa* (Nyl.) Poelt, *Ramalina farinacea* (L.) Ach., *R. thrausta* (Ach.) Nyl., *Rostania occultata*

(Bagl.) Ot lora et al.) require care demanding and are included in the Appendix 1 to the “Red Data Book of the Komi Republic” [3].

Some of the rare species (*Cetrelia olivetorum*, *Coenogonium luteum*, *Cliostomum leprosum*, *Dendrioscicta wrightii*, *Heterodermia speciosa*, *Multiclavula mucida*, and *Tuckneraria laureri*) may be found only in the southern part of the republic, being at the northern border of ranges. *Coenogonium luteum*, *Dendrioscicta wrightii* and *Multiclavula mucida* are extremely rare species with a single occurrence. Many of the species, especially epiphytes of deciduous trees, *Cetrelia olivetorum*, *Coenogonium luteum*, *Dendrioscicta wrightii*, and *Heterodermia speciosa* are suggested to be nemoral relics of the Holocene climatic optimum [24]. Rare populations of *Cetrelia olivetorum*, *Coenogonium luteum*, and *Dendrioscicta wrightii* are under protection in the Pechoro-Ilychskiy State Nature Reserve and the “Uninskiy” reserve (Northern Urals foothills). On the Vychegda Plain, these species are more common. The creation of the Koigorodskiy National Park made it possible to protect some of the southernmost habitats of these species in the republic.

During the monitoring protected lichen populations in the southern part of the Komi Republic in 2016–2018, we found the loss of previously known habitats as a result of forest fellings. The greatest damage was made to populations of a very rare species *Dendrioscicta wrightii*. This species has a intermittent eurasian-north american range and is known from India, China, Japan, USA (Alaska), Canada (British Columbia) and Russia (Central Russia, Urals, Western and Southern Siberia, Far East). Despite the wide geographical distribution of the species, its populations are rapidly declining throughout the entire range due to deforestation, air pollution, construction and recreation. A few habitats of *Dendrioscicta wrightii* in the Europe are historical. In Germany, the taxon is considered extinct, herbarium specimens date back to the end of the 19th century [22]. Other European findings are in Russia. In Vologda region and Karelia the species is considered extinct [23, 24]. The last living European populations are found in the Kostroma region [25], Perm region [26] and Komi Republic [3]. In the Komi Republic, seven habitats of the species have been found in the southern regions (Priluzsky, Koigorodsky) and two occurrences are in the foothills of the Northern Urals. In the Koigorodskiy district, the only known population of the species is located on the territory of

the Koigorodskiy National Park (near the tourist site “Matvey Shor”). Lichen thalli emerged on trunks of large old trees of *Sorbus aucuparia* L. in the spruce fern forest.

In the old fern spruce forest, we found 10 of 12 protected lichen species of the national park. Several species grow only in this habitat: *Cliostomum leprosum*, *Coenogonium luteum*, *Sclerophora coniophaea*, *Usnea longissima*. Rare relic species *Cetrelia olivetorum* and *Dendrioscicta wrightii* form relatively large populations. It should be emphasized that indigenous spruce and fir-spruce forests with large trees of *Salix caprea* L. and *Sorbus aucuparia* in the lower canopy of the stand serve as a key biotope for nemoral relics, as *Cetrelia olivetorum*, *Dendrioscicta wrightii*, *Heterodermia speciosa* and some other species. Such stands are of small areas and occur along the streams at slopes and in the relief depressions. In the primary spruce forests on the trunks of *Salix caprea* and *Sorbus aucuparia*, the epiphytic community *Lobarion pulmonariae* Ochner is formed. It is known to be rich in rare species of lichens that can grow only in climax forests [27]. At single trees of *Sorbus aucuparia*, we registered 3–7 species of lichens considered as rare and requiring monitoring in the Komi Republic. More and more information is accumulating about the reduction of ranges and sometimes the complete disappearance of some lichens characteristic of the communities of *Lobarion pulmonariae* Ochner in a number of regions of Europe [28]. Thus, the preservation of the last arrays of the pristine forests is extremely important, and the organization of the Koigorodskiy National Park contributes to the solution of this problem.

Eight protected lichen species were found in the old aspen forests. *Pertusaria hemisphaerica* and *Multiclavula mucida* were registered only in aspen stands. *Pertusaria hemisphaerica* grows on the bark of large aspen trees, *Multiclavula mucida* – on decaying woods. Despite the fact that a significant number of rare species have been recorded in the aspen forests, their occurrence is not high, and their abundance is low. The only exception is *Lobarion pulmonariae*, which massively populates the trunks of aspen. This species is also found on the territory of the Tulashor cluster, Nurgush State Nature Reserve.

Conclusion

The results of a survey of the territory of the Koigorodskiy National Park, carried out by specialists from the IB Komi SC UrB RAS,

confirmed the assumption about the importance of the reserve for the conservation of biological diversity in the ecotone zone between the middle and southern taiga and, in particular, key habitats of rare plant and fungi (including lichens) species. General state of ecosystems in the Koigorodskiy National Park is closed to the natural.

The national park has 32 species of protected plants and fungi listed in the “Red Data Book of the Komi Republic” [5]. Among them, there are seven species of vascular plants, four bryophytes, nine fungi and 12 lichens. Three representatives of the fungi kingdom (*Sarcosoma globosum*, *Lobaria pulmonaria*, and *Tuckneraria laureri*) are protected at the federal level. In a number of European countries, *Dendrocosticta wrightii* disappeared and populations of *Usnea longissima* and *Lobaria pulmonaria* are degrading as a result of increased anthropogenic pressure on ecosystems. Thus, regional protection of these species is facilitated by the establishment of the Koigorodskiy National Park.

The high diversity of lichens and fungi is explained by the fact that an array of intact coniferous and deciduous forests is located within the boundaries of the national park. Among the protected vascular plants and lichens, there are many species that can be considered as relics of the climatic optimum of the Holocene. The adjoining territories of two federal NPAs (Koigorodskiy National Park and “Tulashor” cluster, Nurgush State Nature Reserve) provide the inter-regional protection of *Leucocortinarius bulbiger*, *Lobaria pulmonaria*, *Microstoma protractum*, *Neckera pennata*, *Rigidoporus crocatus*, and *Thaollictrum nileberg*, included in the Red Data Books of the Komi Republic and the Kirov Region. It is necessary to continue targeted botanical research on the territory. This will allow to obtain more data on the species and coenotic diversity of the flora of the reserve and to reveal new habitats of rare species of plants and fungi, as well as to formulate recommendations aimed at their more effective protection.

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