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ALGAE, POLYPORALES FUNGI AND INSECTS – XYLOPHAGES OF THE SMOLNY ISLAND NATUAL RESERVE (KHANTY-MANSI AUTONOMOUS OKRUG, RUSSIA)

Скоробогатова О.Н., Кучумов М.С., Вечер П.С.

ВОДОРОСЛИ, АФИЛОФОРОВЫЕ ГРИБЫ И НАСЕКОМЫЕ-КСИЛОФАГИ ПРИРОДНОГО ПАМЯТНИКА «ОСТРОВ СМОЛЬНЫЙ» (ХАНТЫ-МАНСИЙСКИЙ АВТОНОМНЫЙ ОКРУГ, РОССИЯ)

Abstract. Smolny Island is a specially protected natural area of regional importance aimed to preserve a unique natural ecosystem of typical floodplain landscapes of the latitudinal section of the Ob River. The purpose of this research is to obtain primary data on the species composition and state of algological, polyporale communities and insects-xylophages of the Smolny Island natural reserve. The standard algological, mycological and entomological research methods were used. The original studies results for several components of the ecosystem are presented for the first time. The composition, structure, occurrence of freshwater algae, forest, polyporale communities and forest insects pests were investigated. The freshwater algocenoses of the island have a typical regional composition, in summer there is a tendency to cenosis characteristic of the region's swamps (diatom-euglena viridis type) in autumn there's diatom, with low occurrence of species. An increased saprobity of the studied waters was detected. In total, 12 insects – xylophages species of the *Agaricomycetes* class were found in forest communities (coniferous, floodplain, small-leaved cenosis), with the richest species community in the test plot of small-leaved forest and the least variety in the coniferous one. No great risk for the development of a mass insects-xylophages area in the test plots was revealed, but the constant monitoring of the forest stock of the Smolny Island natural reserve is necessary to prevent the development of invasions and preserve the biodiversity of the island. The research results can be recommended as special diagnostic methods for tracking the diversity and condition of island communities.

Keywords: island, algocenosis, phytophages, timber beetle, insects-xylophage.

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Аннотация. Остров Смольный – особо охраняемая природная территория регионального значения с целью сохранения уникальной природной экосистемы типичных пойменных ландшафтов широтного участка реки Обь. Цель настоящих исследований: получение первичных данных о видовом составе и состоянии альгологических, аффилофоровых сообществ и насекомых-ксилофагах памятника природы «Остров Смольный». Применены стандартные методы исследований, принятые в альгологии, микологии и энтомологии. Впервые приведены результаты оригинальных исследований нескольких компонентов экосистемы. Выявлен состав, структура, встречаемость пресноводных водорослей, лесных, аффилофоровых сообществ и насекомых – вредителей леса. Пресноводный альгоценоз острова имеет типичный для региона состав, летом наблюдается склонность к ценозу, характерному для болот региона (диатомово-эвгленово-зеленый тип, осенью – диатомовый, низкая встречаемость видов). Выявлена повышенная сапробность изученных вод. Всего в лесных сообществах (хвойный, пойменный, мелколиственный ценоз) найдено 12 видов грибов класса *Agaricomycetes*, с наиболее богатым видовым сообществом на экспериментальном участке мелколиственного леса и наименьшим разнообразием – хвойного. Большого риска для развития массового очага насекомых-ксилофагов на экспериментальных участках не выявлено, но для недопущения развития инвазий и сохранения биоразнообразия острова необходим постоянный мониторинг за древостоем ПП Острова Смольный. Результаты исследований могут быть рекомендованы в качестве диагностических специальных методов при отслеживании разнообразия и состояния островных сообществ

Ключевые слова: остров, альгоценоз, фитофаги, короед, ксилофаги, насекомые-ксилофаги.

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Introduction. Rich composition of taxa is not typical for islands in general. The extent of island ecosystems varies greatly depending on the age and origin, area, distance to the mainland, and the ecological diversity of nature [5].

The Smolny Island natural reserve of regional significance is located in the Nizhnevartovsk region of the Khanty-Mansiysk Autonomous Okrug – Ugra, two kilometers south-west of the city of Megion, on the left bank of the Ob River (fig.).

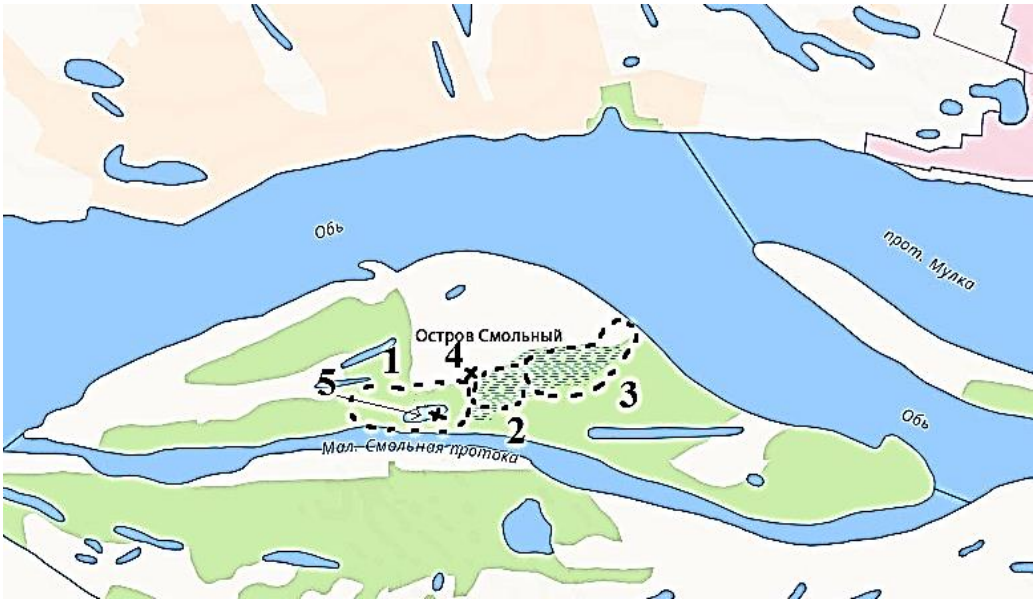

Fig. Schematic map and location of the study areas (https://www.kosmosnimki.ru):
1. Coniferous forest; 2. Floodplain forest; 3. Parvifoliate forest; 4. Swamp; 5. Oxbow

According to the soil-geographical zoning, the described territory is located in the West Siberian taiga forest region (61°0'17"N 76°0'57"E) and is attributed to the middle taiga subzone [11; 29]. The boundaries of the natural reserve coincide with the coastline of Smolny Island [26]. The island is wedge-shaped, 6.5 km long and 1.3 km wide, and its total area is 486 ha. The island was granted with the status of specially protected natural reserve in 2013. The purpose is to preserve a unique natural ecosystem of typical floodplain landscapes of the latitudinal section of the Ob River. The relief of the island is flat, the water elevation marks in low-water season range from 31.3 to 38.5 m, the highest one is in the central part of the island. The terrace cusp height is about 2.5 m [10; 26].

There are 11 small lakes on the island, with the water surface area from 0.1 to 0.5 hectares, most of which dry up in the summer-autumn period. Smolny Island is washed by the Mulka channel from the

north and by the Malaya Smolnaya channel from the south, which is 6.5 km long, 100-150 m wide, shallow. When the channel dries up, oxbows appear. A significant part of the island is flooded during the spring flood and the water goes away by the end of summer. Half of the annual supply (50%) is snow, rainwater is 20-35%, ground-swamp – up to 15-25% of the annual runoff.

The flora and fauna of the Smolny Island NR consists of a complex of floodplain meadow, forest and coastal water communities and is similar to the typical vegetation of the middle taiga subzone of the forest zone of the West Siberian Plain [19; 26].

According to the original data, the parvifoliate forest includes birch *Betula pubescens* L. (*Betulaceae*) with a population density of 65-70%. The underbrush contains species of the genus willow: *Salix alba* L., *S. caprea* L. (*Salicaceae*), mountain ash *Sorbus sibirica* L. (*Rosaceae*) and bird cherry *Padus avium* Mill. (*Rosaceae*). The average height of the forest-forming stock does not exceed 3.0-4.0 m, the average diameter is 14.0 cm. The shrub layer is represented by wild rose and siberian violet-willow. The herbous layer is composed mainly of gramineous plants with a projective cover of 7-10%, the moss layer was not found.

The floodplain forest consists of a stock of black poplar *Populus nigra L.* (*Salicaceae*), aspen *Populus tremula* L. (*Salicaceae*), and birch *Betula pubescens* (*Betulaceae*). The average stock height is 8.3 m and the average diameter is 43.0 cm. In the undergrowth, there is Siberian mountain ash, Siberian pine, and a high density of wild rose *Rosa cinnamomea* L. (*Rosaceae*) was found with a population density of the latter of 45-50%. The herbous layer consists of river horsetail *Equisetum fluviatile* L. (*Equisetaceae*), meadowsweet *Filipendula* L. (*Rosaceae*), gramineae and sedges, with a projective cover above 85%.

The coniferous forest consists mainly of Scots pine with small inclusions of Siberian pine, in the undergrowth there are occasional specimens of birch and willow. The average height of the stock is 6.4 m, the average diameter is 24.0 cm. The trunks of mature trees have traces of burnt bark due to the ground fire in the past. There is an active undergrowth of Scots pine; the rates of seedlings on the site are high. The grass layer is very heterogeneous and is divided into sectors. Such sectors include plots with foxberry *Vaccinium vitis-idaea* L. (*Ericaceae*), with the projective cover up to 90%; in this area, the species is found everywhere. The plots with the common wintergreen (*Pyrola rotuntifolia* L., *Ericaceae*), the arctic starflower *Trientalis europaea* L. (*Primulaceae*), and the wood sorrel *Oxalis* (*Oxalidaceae*), with a total projective cover of 65%, are located in waves, closer to the center of this ecosystem. Also, areas with river horsetail and gramineae with the projective cover up to 45% were found in the northern part of this biome. The moss cover is absent.

The work carried out is relevant and timely, because algae, aphilophoric fungi and insects-xylophages in the specially protected natural territory “Natural Reserve Island Smolny” (OOPT Ostrov Smolny NR) have not been studied, although they are very important for understanding the condition and processes occurring in the island ecosystem. Island ecosystems are extremely fragile, while at the same time they have enormous scientific, educational and cultural significance.

Experimentation. The aim of this work is to obtain primary data on the species composition and condition of algological, aphilophoric communities and insects-xylophages of the specially protected area of the Smolny Island natural reserve.

Field work and collection of material were carried out in the summer-autumn period of 2018-2021 [28]. Algae (phytoplankton, accumulations) were sampled in hollows, mats, upper layers of open water of the raised swamp and oxbow. Diatoms have been identified on permanent specimens prepared by cold

burning and placed in Canada balsam for clinical diagnosis [20]. Species diagnostics was carried out using Nikon ECLIPSE E200 and OLYMPUS SX4 microscopes, cross-checking in domestic and foreign guides. Synonyms for all identified algae are combined with data from the worldwide electronic database Algae Base [32]. The water temperature and active reaction were measured using a portable pH meter (Oakton Eco Testr Ph 2 Waterproof Rocket pH Tester) simultaneously with the collection of freshwater algae. The chemical composition of water was analyzed in the laboratory of Nizhnevartovsk State University. The frequency of occurrence was carried out according to the Starmach scale: 1 – occasional (1-6 cells in a specimen); 2 – low (7-16); 3 – significant (17-20); 4 – much (31-50); 5 – plenty (over 50 cells in a specimen) [4]. The ecological confinement and saprobity of the species are given from large summaries [4; 18; 20; 34].

The geobotanical description was carried out by the itinerary method, the determination of the population density and projective cover was determined by field sketching [25].The study of forest communities, tinder fungi and forest pests was based on three main communities, where the experimental plots were laid: parvifoliate, floodplain, and coniferous. The species diversity was determined in relation to the collection sites; the research of tinder fungi was carried out in the summer-autumn period of 2018-2021 (July-September). The collection of samples of xylofagous fungi was carried out using the route method, without a quantitative analysis of the community according to the methods of A.S. Bondartseva [1]. The identification of tinder fungi was carried out by morphological characteristics using domestic [1; 2; 24] and foreign guides [31; 33].

During the route study, we collected imagoes, larvae and pupae of xylophages, and the damaged bark on infected coniferous trees. Photos and videos of some insects and damaged trees were made. When collecting insects, killing bottles with diethyl ether were used [9]. Subsequently, the collected species were preserved in vials using formidron [7]. Xylophagous insects were identified using guides and atlases [14]. The assessment of the forest species condition in the experimental plots was carried out according to the method of A.V. Pobedinsky [17]. The experimental plots were 25x25 m in size. Accounting of undergrowth and seedlings was carried out on plots of 10x10 m perpendicular to the long side of the plot. The renewal was accounted in two groups: the occurrence of undergrowth and seedlings. Occurrence is understood as the percentage of the number of counting sites where undergrowth occurred to the total number of sites. Activity of species in relation to confinement to tree species.

Discussing the results. Algae. According to the classification of swamps given in the works of I.V. Filippova and E.D. Lapshina [30] wetlands of the Smolny Island natural reserve are oligotropic-raised, of the pine-dwarf shrub-sphagnum type (riam). Water temperature and water pH activity during sampling in the oxbow were in the range of 22.8-10.0°C and 5.7, respectively. In the waters of the raised swamp, the temperature in July was 21°C, pH - 5.9 (tabl. 1).

The chemical analysis of water in the oxbow was made in October. According to the results, the water is with weak acidity (pH 6.1), electrical conductivity – 72.98 μS/sm, chromaticity is very high – 210 mg/dm^3, content of phosphate ions in the sample – 0.082 mg/dm^3, content of sulfate ions – 12.43 mg/dm^3, content of ammonium ions – 0.15 mg/dm^3, content of nitrate ions is 0.43 mg/dm^3, content of nitrite ions – 0.013 mg/dm^3, content of chloride ions is 7.8 mg/dm^3, the value of the total hardness is – 0.62 mg-eq/dm^3, content of calcium ions is 9.62 mg/dm^3, content of CO^{2-} ions is 0.0v mg/dm^3, content of HCO-ions is 24.4 mg/dm^3.

Table 1

Characteristics of the sampling conditions at the locations of the SmolnyIsland NR

Name	Location	Sampling period	Water temperature, °C	pH, units
Lake Oxbow	N61°00’274” / E076°00’394”	VII-X / 2021.	22.8 -10	5.7
Swamp	N61°00’349” / E076°00’549”	VI - X / 2021.	21	5.9-6.1

As a result of the field material processing, the complete systematic list of algae found in the swamp community and in the oxbow in natural conditions, includes 94 species and intraspecific taxa belonging to 5 divisions, 8 classes, 20 orders, 30 families and 44 genera (tabl. 2).

Table 2

Taxonomic structure of freshwater algae groups on the studied sites of the Smolny Island NR

Taxon	Total number	Algae divisions				
		Ochrophyta	*Bacillariophyta*	*Euglenophyta*	*Chlorophyta*	*Charophyta*
Classes	8	2	2	1	2	1
Orders	20	2	14	1	2	1
Families	30	2	18	2	6	2
Genera	44	4	23	4	11	2

With the same number of Divisions, the number of other taxa of different levels (Classes, Orders, Families and Genera) and their species composition diversities are higher in the oxbow, when compared with the swamp. In general, the most taxonomically diverse are Diatoms, with a significant contribution from the taxa of Euglena algae. Euglenae even prevail in species diversity of the swamp algal community (tabl. 2, 3).

Table 3

Species composition of freshwater algae in the studied areas of the Smolny Island NR

Type	Number of species and intraspecific taxa, %		
	Total	Oxbow	Swamp
Ochrophyta	9 / 9.6	9/ 13.0	2 / 4.2
Bacillariophyta	40 / 42.6	33 / 47.8	20 / 42.6
Euglenophyta	28 / 29.8	13 / 18.9	21 / 44.7
Chlorophyta	13 / 13.8	12 / 17.4	1 / 2.1
Charophyta	4 / 4.2	2 / 2.9	3 / 6.4
Total	94 / 100	69 / 100	47 / 100

Other Divisions are less significant. Note that only the species *Sorastrum spinulosum* Nägeli (*Hydrodictyaceae*) was found among green algae in the swamp community, with a single frequency of occurrence, which is absent in the oxbow. The family *Hydrodictyaceae* in the swamps of the Khanty-Mansi Autonomous Okrug – Yugra is a rare one, although some of its species prevail in rivers [21].

In the general list of the family spectrum, half of the species composition is concentrated in the first five Families, with the largest share being Euglena algae – 29.4%, followed by Diatoms – 12.6%, Ochrophytic algae – 8.4% of the total composition identified (tabl. 4).

According to the published data it is known that *Euglenidae* in water bodies also play an important role, being at the top of the list in Khanty-Mansi Autonomous Okrug – Yugra [15; 22; 35; 36].

The Family includes 5 species, of which *Navicula radiosa* Kützing (*Naviculineae*) and *Navicula viridula* (Kützing) Ehrenberg (*Naviculineae*) were found in both sites. Four species were found in the Families *Selenastraceae* and *Scenedesmaceae*, and all representatives of *Scenedesmaceae* were found in

the oxbow, which is obvious as this group is attributed to rheophiles [16; 23]. Small-species Families are represented by 20 taxa: 15 Families of them with one species, 3 Families (*Tabellariaceae, Achnanthaceae, Eunotiaceae*) with two species, 2 Families (*Aulacoseiraceae, Closteriaceae*) with three species.

Table 4

Distribution of species across leading Families and Genera of freshwater algae on the studied sites of the Smolny Island NR

Family	Number of species	Percentage	Genus	Number of species	Percentage
Euglenidae	16	16.8	*Trachelomonas*	12	12.6
Phacidae	12	12.6	*Lepocinclis*	7	7.4
Dinobryaceae	8	8.4	*Dinobryon*	6	6,3
Pinnulariaceae	6	6,3	*Pinnularia*	6	6,3
Bacillariaceae	6	6,3	*Nitzschia*	6	6,3
Total	48	50.4	Total	37	38.9

The top five genera include 38.9% of all identified species of algae. Of these, the most packed are two Genera of Euglena – *Trachelomonas* (*Euglenidae*) and *Lepocinclis* (*Phacidae*), one Genus of ochrophytic (*Dinobryon*), and 2 diatoms. 24 one-species Genera were found, 5 two-species (*Ulnaria, Achnanthes, Planothidium, Eunotia, Desmodesmus*), with 3 three-species (*Aulacoseira, Navicula, Closterium*), the composition of the remaining Genera varies from 4 to 6 types.

Out of 94 identified species and intraspecific taxa of the total composition, 69 or 72.6% of species were found in the oxbow, 47 or 49.4% – in the swamp. The common species found both in the oxbow and in the swamp include 21 taxa with a rank below a genus. There are only five species of algae that constantly develop from late July to mid-October, of which four are diatom species: *Stauroneis anceps* Ehrenberg (*Stauroneidaceae*), *Nitzschia palea* (Kützing) W. Smith, *N. holsatica* Hustedt, *N. obtusa* W. Smith (*Bacillariaceae*) and one of Euglenae – *Trachelomonas volvocina* (Ehrenberg) Ehrenberg (*Euglenidae*). The period of phytoplankton vegetation development of the *Trachelomonas volvocina* (*Bacillariaceae*) species in the Vakh River begins in June and ends in November [15; 34].

The July algocenose in the oxbow, under conditions favorable for development, is represented by a complex of 5 groups: *Ochrophytic* – 6 species, *Diatoms* – 18 species, *Euglenids* – 13 species, *Green* – 10 species and harophytes – 2 species: *Closterium pronum* Brébisson (*Closteriaceae*) and *Staurastrum proboscideum* (Brébisson) W. Archer (*Desmidiaceae*). Due to a water temperature decrease as a leading factor for the development of algae, most of the species disappear from the October cenosis, small-celled diatoms prevail. As a result, mid-October algocenoses are represented by 31 species: Ochrophytic – 3: *Dinobryon pediforme* (Lemmermann) Steinecke (*Dinobryaceae*), *Dinobryon suecicum* Lemmermann (*Dinobryaceae*), *Pseudokephyrion ellipsoideum* (Pascher) Conrad (*Dinobryaceae*), diatoms – 27, Euglenae – 1: *Trachelomonas volvocina* (Ehrenberg) Ehrenberg (*Euglenidae*); Green – 2 (*Ankistrodesmus fusiformis* Corda (*Selenastraceae*); *Monoraphidium griffithii* (Berkeley) Komárková-Legnerová (*Selenastraceae*) and Harophytes – 1: *Staurastrum proboscideum* (Brébisson) W. Archer (*Desmidiaceae*).

During the study period from July to October, 13 species constantly developed in the oxbow, more than 84% of which are Diatoms. The highest frequency of occurrence of the identified species in summer does not exceed 3 points and is observed in 4 species: *Dinobryon bavaricum* Imhof (*Dinobryaceae*); *Aulacoseira italica* (Ehrenberg) Simonsen (*Aulacoseiraceae*), *A. granulata* var. *angustissima* (O. Müller) Simonsen (Family *Aulacoseiraceae*) and small form *Trachelomonas volvocina* (Ehrenberg) Ehrenberg (*Euglenidae*), 2 points – *Monoraphidium griffithii* (Berkeley) Komárková-Legnerová (*Selenastraceae*), in other algae the occurrence is occasional and 1 point. In autumn, the occurrence of *Aulacoseira italica*

(Ehrenberg) Simonsen (*Aulacoseiraceae*), *Hippodonta luneburgensis* (Grunow) Lange-Bertalot, Metzeltin & A. Witkowski (*Diadesmidaceae*) and *Eunotia lunaris* (Ehrenberg) Grunov (*Eunotiaceae*) is 1 point, other species are found occasionally.

In the swamp area in October, there is a lack of water in the upper tiers; therefore, only the July algocenosis, represented by 47 species from 5 groups, is discussed. The swamp algae complex consists of Diatoms and *Euglena* algae by 87%. The highest frequency of occurrence was recorded for small-celled species of genera *Nitzschia* (*Bacillariaceae*) and *Planothidium* (*Achnanthidiaceae*), max. 3 points.

During assessment of the general botanical and geographical characteristics of the studied water bodies, a high proportion of planktonic algae species was revealed, which make up almost half of the total list of the identified algae species. Epiphytic algae form a small group – 8.5%, benthic – 12.8% (tabl. 5).

Table 5

Distribution of the found algae by ecological groups

Algae family	Number of species	Percentage	Algae family	Number of species	Percentage	Algae family	Number of species	Percentage
Occurrence at the dwell area			In relation to salinity			In relation to pH		
Planktonic	44	46.8	Oligohalobes including:	71	75.5	Acidophiles	7	7.4
Benthic	13	13.8	Halophobes	7	7.4	Indifferent	34	36.2
			Indifferent	58	61.7			
Foulers	8	8.5	Halophiles	6	6.4	Alcaliphiles	12	12.8
Unclarified	29	30.9	Unclarified	23	24.5	Unclarified	41	43.6

The percentage of algae with an unknown ecological confinement varies from 24.5% (in relation to salinity) to 43.6% (in relation to the pH value). The cosmopolitan species of algae comprise 59 (62.8% of the total composition), only 11.7% boreal and 3.2% holarctic *Aulacoseira distans* (Ehrenberg) Simonsenт (*Aulacoseiraceae*), *Planothidium ellipticum* (Cleve) M.B. Edlund (*Achnanthidiaceae*), *Eunotia parallela* Ehrenberg (*Eunotiaceae*). In terms of halobness, all algae with a clarified ecological confinement belong to oligohalobes, 75% of total identified. Among the oligohalobic species, halophobes, halophiles, and a large group of indifferent species (61.7%) are distinguished. A significant proportion of taxa belongs to species indifferent to pH (36.3%), 12.8% and 7.4% of algae are indicators or stenobionts: alkaliphiles and acidophiles, respectively

Of the 94 species found in the waters of Smolny Island, 64 species or 68.1% are indicators of varying degrees of organic content. The group of beta-mesosaprobes accounts for the largest share of 28.7%, the group of oligo-beta-mesosaprobes and beta-oligo-mesosaprobes is 14.9% (tabl. 6).

Table 6

Distribution of identified algae in relation to saprobity

Algae family	Number of species	Percentage	Algae family	Number of species	Percentage
x-o; o-x	3	3.2	β	27	28.7
o	6	6.4	β-α; α-β	6	6.4
o-β; β-o	14	14.9	α	8	8.5

Designations: x-o; o-x; – xeno-oligosaprobes; oligo-xenosaprobes o – oligosaprobes; o-β; β-o; – oligo-beta-mesosaprobes; beta-oligo-mesosaprobes

Indicators of water with low organic content (xeno-oligo, oligo-xeno-saprobes) are represented by: *Aulacoseira distans* (Ehrenberg) Simonsen (*Aulacoseiraceae*), *Pinnularia subcapitata* var. *paucistriata* (Grunow) Cleve (*Pinnulariaceae*), *Epithemia gibba* (Ehrenberg) Kützing (*Rhopalodiaceae*) with a frequency of occurrence ranging from occasional to low.

Quite a lot of eutrophic algae, indicating an increase in the amount of nutrients in the environment and the development of oxidation-reduction processes, the threshold of an aerobic process of organic substances, the appearance of ammonia and carbon dioxide, a decrease in oxygen concentration, the transition of iron compounds into oxide and ferrous forms. The highest frequency of occurrence (2-3 points) was found among the following alpha-saprobionts: *Achnanthes lanceolata* var. *rostrata* Schulz (*Achnanthaceae*), *Planothidium ellipticum* (Cleve) M.B. Edlund (*Achnanthidiaceae*), *P. lanceolatum* f. *ventricosum* (Hustedt) Buktiyarova (*Pinnulariaceae*), *Nitzschia palea* (Kützing) W. Smith (*Bacillariaceae*), *N. acicularis* (Kützing) W. Smith (*Bacillariaceae*), and *Trachelomonas planctonica* Svirenko (*Euglenidae*).

Polyporaceae. Polyporate fungi are of great importance for the study of forest biocenoses. They are being studied over a century, but still there is no clear and unambiguous understanding of what kind of group of organisms they are. In a general sense, they include all fungi that develop on woody substrates, which are the initial agent for the destruction of wood residues, and practically the only one in the harsh climate of the Khanty-Mansi Autonomous Okrug – Yugra [6].

Xylobiont fungi are located at the very low end of the detrital food chain, and this group of organisms is also widely used as natural indicators in identifying old natural forests for the purpose of their protection. By the beginning of the 21st century, xylotrophic fungi of the boreal zone in the Urals and Siberia are still relatively poorly studied in comparison with other types of living organisms. In the Khanty-Mansi Autonomous Okrug – Yugra, this group of fungi is also studied fragmentarily [12; 17].

On the territory of all studied areas, during the survey by the route method, polyporaceae fungi were found mainly on the remains of dead trees, despite the consequences of a fire that occurred in 2012. In total, 12 species of Polyporaceae fungi were found belonging to 7 Genera, 3 Families, Class *Agaricomycetes* and Division *Basidiomycota* (tabl. 7).

In the parvifoliate forest area, 9 species of aphyllophoric macromycetes from 6 Genera, 3 Families of Class *Agaricomycetes* and Division *Basidiomycota* were found. The *Polyporaceae* Family is the most representative in this area and includes 6 species of polypore fungi. The richest Genus is *Daedaleopsis* from the *Fomitopsidaceae* family, which includes 3 species. The analysis of the species composition showed that the species *Fomes fomentarius* L. (*Polyporaceae*) and *Piptoporus betulinus* L. (*Fomitopsidaceae*) were found on all three sites.

Table 7

Distribution of polyporaceae fungi on the territory of communities of Smolny Island NR

Family	The number of species taxa/ percentage of the cenotic composition			
	Total	Parvifoliate forest	Floodplain forest	Coniferous forest
Fomitopsidaceae	5 / 41.7	2 / 22.2	4 / 57.1	2 / 40.0
Polyporaceae	6 / 50.0	6 / 66.7	3 / 42.9	3 / 60.0
Stereaceae	1 / 8.3	1 / 11.1	0 / 0	0 / 0
Total	12 /100	9 /100	7 /100	5 /100

Insects-Xilophages. The results of the assessment of the natural regeneration structure, growth and viability in the composition of forest-forming species of Smolny Island after forest fires are shown in Table 8.

Table 8

Composition of forest species (Smolny Island)

Site No.	Composition, pcs								
	Pi	undergrowth	seedlings	B	undergrowth	Po	W	SPi	undergrowth
Coniferous forest	29	23	80	3	-	-		-	-
Floodplain forest	-	-	-	30	18	6	23	12	5
Parvifoliate forest	-	-	-	36	20	-	20		-

Designations: Pi – Scots pine B – Birch Po – poplar W – willow SPi – Siberian pine "-" — not found

It was found that the number of seedlings and undergrowth of forest-forming species during the post-fire succession is determined by the intensity of the fire and the duration of the pyrogenic effect [3; 13]. At the same time, in the pine forests of Smolny Island renewal takes place without species replacement with high quantitative indicators. Birch and siberian pine have average seedling and undergrowth rates. The relationship between the fire and the xylophages' invasion of the forest stock was not revealed in the studied areas. The trees in the coniferous forest area, *Pinus sylvestris* (Family *Pinaceae*) in particular, are healthy and not invaded by pest.

The floodplain forest site, on the other hand, is exposed to xylophagous effects. The main damage by xylophages is observed on *Pinus sibirica* Du Tour (*Pinaceae*). The highest activity of the six-toothed bark beetle species *Ips sexdentatus* Börner (*Curculionidae*) was noted here, in a small locus of five trees. At the time of the monitoring (2021), the bark beetle left the infected trees, while no invasions were detected on a number of healthy trees growing nearby. In addition to the bark beetle, the Black Pine Barbel *Monochamus gallopovincialis* Olivier (*Cerambycidae*) was observed on Siberian pine. Same as in the case with the bark beetle, no invasion was found on healthy trees. Rust pine borer *Arhopalus rusticus* Linnaeus (*Cerambycidae*) has been encountered once. In the area of the floodplain forest there are some windfall trees which is a good place for the development of subsequent generations of insects-xylophages. On the stumps of downy birch *Betula pubescens* Ehrenberg (*Betulaceae*), there are birch sapwood borer *Scolytus ratzeburgi* Jansen (*Scolytidae*) tunnels.

In the area of parvifoliate forest, a single specimen of the Horntail family *Siricidae* xylophagewas found on a bird cherry *Padus avium* Mill. (*Rosaceae*). No other representatives of this family were found on the island. Thus, the activity of insects-xylophages in relation to tree species ranges from one to three (tabl. 9).

Table 9

The confinement of the identified insects - xylophages with tree species (Smolny Island)

Species	Bird cherry	Scots pine	Siberian pine	Birch
Ips sexdentatus Börner (*Scolytinae*)	-	-	+	-
Scolytus ratzeburgi Jansen (*Scolytidae*)	-	-	-	+
Arhopalus rusticus Linnaeus (*Cerambycidae)*	-	-	+	-
Monochamus gallopovincialis Olivier (Cerambycidae)	-	-	+	-
Siricidae Billberg sp.	+	-	-	-
Total	1	0	3	1

Designations: "+" – found; "-" – not found

Due to the special status of the territory and limited human activities, it is necessary to continue monitoring the condition of the forest stock to prevent the development of larger foci of xylophages and to preserve biodiversity.

Conclusions. The composition and condition of several cenoses of the Smolny Island NR were studied. The composition of algocenoses is represented by 94 species and intraspecific taxa of algae, the species diversity in the oxbow (69 species of algae) exceeds the one in the swamp – 47 species of algae. The oxbow algocenosis in the vicinity of Smolny Island NR is more a diatom-eugleno-green in summer, and diatom – in autumn. The frequency of occurrence of algae was generally occasional and mostly 1 point, the highest occurrence was 3 points. The swamp cenosis in summer is mostly diatom-euglena from occasional to 2 point frequency of occurrence.

In ecological and geographical terms, cosmopolitans, plankters (46.8%), indifferent to salts and pH (61.7% and 36.2%, respectively), prevail.The predominance of beta-meso-saprobes (28.7%) and the enrichment of the indicators qualitative composition with species indicating a high degree of pollution (alpha-beta-mesosaprobes, beta-alpha-mesosaprobes, alpha-saprobes) to 14.9% with a frequency of occurrence ranging from low to sufficient.

In three forest communities, over two years of research, 12 species of Polyporaceae fungi were found from 7 genera, 3 families, the class *Agaricomycetes* and the division *Basidiomycota*. On the parvifoliate forest site the richest species community of 9 aphyllophoric macromycete species was found, but only 7 species in the floodplain forest cenosis and 5 species in the coniferous one.

In total, 5 species of xylophages included in 3 families were identified in the experimental plots. There is no correlation between fire and xylophagous colonization of the forest stock. The most vulnerable species is Siberian pine, with the Six-toothed bark beetle *Ips sexdentatus* (*Scolytinae*) and the Black pine barbel *Monochamus gallopovincialis* (*Cerambycidae*) being the most active pests. Birch sapwood borer *Scolytus ratzeburgi* (*Scolytidae*) lives only on downy birch. Xylophages of the family Horntails (*Siricidae*) and Rust pine borer *Arhopalus rusticus* (*Cerambycidae*) were found singly.

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