Lichen flora of the Obzhorovsk site of the Astrakhan Nature Reserve

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Abstract: The article cites results of the investigation into taxonomic biodiversity and substrate affinity of lichens inside the Obzhorovsky cluster (zone) of the Astrakhan Nature Reserve. We have compiled list of the 24 lichen species, 18 of them observed within the studied area for the first time. Identified lichen flora belongs to the two substrate-related ecological gropus: epiphytes and epilithes, epigeic lichens were not detected at all. Majority of species are crustaceous plagiotropic, fewer are leafy plagiotropic. Top family is Teloschistaceae Zahlbr. and Physciaceae Zahlbr.
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Introduction

There are four publications related to the Astrakhan Reserve lichens. The data on the area's species for the year of 2004 is incorporated into the review: «The Present-Day State of Biological Diversity Within Protected Areas». Issue 3. «Lichens and Byophytes» [1], where the list of 9 lichen species is provided. In the article by Insarov and Pchelkin [2] presented quantitative characteristics are epiphytic lichen flora of the study area. The article by Zakutnova lists 45 lichen species of the Astrakhan Reserve [3]. Unfortunately, this work does not report specific sample collection sites, collectors names or sample storage conditions. For the epiphytic lichens their phorophytes are not mentioned. Three species mentioned to be found on “rocks” cast doubt, as according to the Reserve employees there are no rock outcroppings in the area. It is also unclear what was meant by an “artificial substrate”. The epilitic lichen Lecanora muralis (in the paper – L. murales) was found on all studied substrates, which is an unlikely case. Such species as Aspicilia esculenta, A. fruticulosa, Diploshistes scruposus, Cetraria steppae, are found only in arid habitats, not present within confines of the Reserve territory. Some common species (Caloplaca lobulata, Lecanora piniperda) found, according to our data, chiefly on arboreal substrates are not mentioned in Zakutnova's paper. Thorough examination of the collected specimens is necessary in order to clarify information given in the paper; unfortunately present location of the specimens cannot be determined.

Purpose of research

The purpose of this research was to catalog lichen species from the Obzhorovsk site of the Astrakhan Nature Reserve in order to establish limits of their taxonomic biodiversity, perform biomorphological analysis and study their affinity towards certain substrates.

Astrakhan Nature Reserve is located in the lower part of the Volga Delta and divided into the three main areas: the Damchikskaya zone in the western delta (300.5 square kilometers, of them 94.3 sq. km of water area), the Trekhizbinsky cluster in the delta proper (94.6 sq. km, 2.32 sq. km water area), and the Obzhorovsky cluster situated in the eastern part of the delta (284.07 sq. km, 25.5 sq. km water area). Their boundaries pass through the Kamyzyaksky, the Ikryanisky and the Volodarsky districts of the Astrakhasky Oblast. The total area of the Astrakhan Nature Reserve is 670.17 sq. km, of them 122.12 sq. km are covered by water. The area of the buffer zone is 310 square kilometers. All three Reserve zones are situated in the lower Delta and the shallow waters of the Caspian Sea shelf [4]. The lower delta is characterized by the strongly fragmented channel network, alternating watercourse mergers and branches actively redistributing drainage. Reserve's climate is strongly influenced by the Central Asian Anticyclone - sunshine duration reaches 2400 hours per year, total solar irradiance - 118 kcal/cm^2. Cumulative air temperatures above 10 C add up to 3500-3600 C, warm season duration is over 250 days. Mean annual precipitation is 180-200 mm, mostly as summer showers. Cumulative annual evaporation is 1177 mm; all of this denotes arid climate: dry air and soil with frequent droughts. The dampening effect of the Caspian Sea is evident from the average diurnal temperatures being 1-2° C lower, nocturnal temperatures 1 - 2° C higher, relative air humidity 10-14% higher than for the rest of the delta. Due to this the frostless season lasts 15-30 days longer. The

vegetation cover of the Astrakhan Reserve is subdivided into the three zones according to their location within the delta. The upper part with significant anabranches and islands is covered with grasses and sedges, woody plants are mainly represented by the white willow (Salix alba) along the banks. Small lakes with grasslands, reeds, willowbrush are the typical landscape of the delta proper. The lower delta is marshy with dense reed and willowbrush cover [5].

The vegetation of the Astrakhan Reserve is represented by the four major types: shrubs, forests, meadow and aquatic. All shrubs are deciduous, represented by almond willow (Salix triandra L.), salt cedar (Tamarix ramosissima Ledb.), and desert false indigo (Amorfa fruticosa L.). The trees are chiefly of floodplain hardwood types such as white willow (willow groves with grasslands and sedges, blackberry fields). Along with contiguous forestlands forming terraces along riverbanks, shrublands appear as willow trees decay and die off. This is typical for the upstream (upper) part of the Reserve. The meadow vegetation forms meadows of the three main kinds: wetlands, proper and steppe meadows [5].

Seven plant species of the Astrakhan Reserve are indexed in the Red Data Book of the Askrtakhan Region: gibbous duckweed (Lemna gibba L.), great spearwort (Ranunculus lingua L.), Inula caspica F.K.Blum ex Ledeb., Indian lotus (Nelumbo nucifera Gaert.), water caltrop (Trapa natans L.), Egyptian Water-clover (Marsiliea aegyptiaca Willd.), and the waterwheel plant (Aldrovanda vesiculosa L.). The last four species are entered into the Red Data Book of the Russian Federation [5].

Lichen phorophytes within the Reserve boundaries are not quite diverse, the white willow (Salix alba L.) being the most coomon. Green ash (Fraxinus pennsylvanica Marsh.), European white elm (Ulmus laevis Pall.), white mulberry (Morus alba L.) are less frequent. Tamarisk (salt cedar) and desert false indigo did not house any lichens.

Materials and methods

Lichens of the Obzhorovsky cluster were collected from all inhabited substrates, such as epithelial tissues of woody plants, bare sapwood, treated wood, slate, concrete, cement mortar, steel, fiberglass. Geographic coordinates of the collection sites were determined by GPS satelline navigation (WGS-84 reference system).

The total of 130 samples were collected and identified in the lab of the PPU botannical division using widely accepted methods of lichen identification [6]. Identified species were catalogued and stored in the PPU botannical division herbarium. Cartographic information was visualized using SASPlanet software.

Results and discussion

During the indoor identification phase we identified 24 lichen species belonging to 12 genera and 4 families, their annotated list is shown below. Species are alphabetized, taxonomic ranks assigned according to "The Catalog of the Russian Lichen Flora" [7]. Taxonomic structure of the list corresponds to CABI Bioscience Databases [8]. Abbreviations of authors' names are given by P.M. Kirk, A.E. Ansell [9]. Substrates are mentioned for every specie, for species encountered once the location of the collection site is given as well. To assess the frequency of occurrence we applied the following criteria: "single find" - specie is detected in one sample; "rare" - specie is found in the 3 - 4 samples; "common" - specie is found in 5 - 10 samples; "very common" - in more than 10 samples. Species mentioned in the Zakutnova's paper are marked with an asterisk (*).

1. Arthrosporum populorum A. Massal. - In all the surveyed plots. Common. On the trunks of white willow, ash, poplar.
2. *Anaptichia ciliaris (L.) Kцrb. - Single find on the right bank of the Obzhorov channel 400 m below the cordon #1, on the trunk of white willow.
3. Caloplaca cf. cerinelloides (Erichsen) Poelt - Single find, on the island by the mouth of the Kutum channel, near the "Barka" cordon, on the trunk of white willow.
4. Caloplaca lobulata (Flцrke) Hellb. - In all the surveyed plots. Very common on all phorophytes, on bare and treated wood.
5. Caloplaca cerina (Ehrh. ex Hedw.) Th. Fr. - Single find on the right bank of the Obzhorov channel 400 m below the cordon #1, on the mulberry tree branches.
6. Caloplaca cerinella (Nyl.) Flagey - Single find on the right bank of the Obzhorov channel 400 m below the cordon #1, on the ash tree trunk.
7. Caloplaca cirrochroa (Ach.) Th. Fr. - Rare, cordon #3, left bank of the Ovchinnikov channel, on slate.
8. *Caloplaca holocarpa (Hoffm. ex Ach.) A.E. Wade - Single find, cordon #3, left bank of the Ovchinnikov channel, on the power line concrete pole.
9. Caloplaca decipiens (Arnold) Blomb. & Forssell - Rare, cordon #1, on concrete, cordon #3, left bank of the Ovchinnikov channel, on fiberglass.
10. Caloplaca flavorubescens (Huds.) J.R. Laundon – Rare, cordon #1 of the Obzhorovsky cluster, on concrete and decaying wood.
11. Caloplaca saxicola (Hoffm.) Nordin - Single find, cordon #3, left bank of the Ovchinnikov channel, on the power line concrete pole.
12. Candelariella aurella (Hoffm.) Zahlbr. - Single find, cordon #3, left bank of the Ovchinnikov channel, on a fiberglass boat.

13. Diplotomma alboatrum (Hoffm.) Flot. s. lat. - In all the surveyed plots., common, on the trunks of ash, apple, mulberry, white willow.

14. Hyperphyscia adglutinata (Flцrke)H. Mayrhofer & Poelt - Rare, cordon №1, Obzhorovsky cluster, on the right bank of the Obzhorov channel , on the trunks of ash, elm, white willow.

15. Lecania fuscella (Schaer.) A. Massal. - In all the surveyed plots., common, on the trunks of ash, apple, mulberry, white willow, poplar, elm.

16. Lecanora dispersa (Pers.) Sommerf. - In all cordons. Common. On concrete, cement mortar, slate.

17. Lecanora piniperda Kцrb. nom. illegit. - In all the surveyed plots.. Very common. On all phorophytes, bare and treated wood, fiberglass.

18. Phaeophyscia insignis (Mereschk.) Moberg – Rare, Obzhorovsky cluster, on the trunks of mulberry trees, white willow.

19. *Phaeophyscia nigricans (Flцrke) Moberg - In all the surveyed plots. Very common. On all phorophytes, bare and treated wood, fiberglass.

20. *Phaeophyscia orbicularis (Neck.) Moberg - Cordon #3, left bank of the Ovchinnikov channel. Rare. On the trunks of ash and apple trees.

21. Physcia aipolia (Ehrh. ex Humb.) Fьrnr. - Single find on the right bank of the Obzhorov channel 450 m below the cordon #1, on the trunk of the mulberry tree.

22. *Physcia tenella (Scop) DC. - In all the surveyed plots, common, on the trunks of ash, mulberry, white willow, poplar.

23. Rinodina pyrina (Ach.) Arnold - In all the surveyed plots. Very common. On all phorophytes, bare and treated wood, fiberglass.

24. *Xanthoria parietina (L.) Th. Fr. - In all the surveyed plots. Very common. On all studied phorophites.

Conclusions

Leading in the number of species is a family Teloschistaceae Zahlbr. (10 species). Its dominance is a hallmark of the arid climate [10]. The family Physciaceae Zahlbr. includes nine species of lichens, fewer belong to the family Lecanoraceae Fee emend. Hafellner - 4 species. The family Bacidiaceae Walt. Watson is represented by only one specie - Arthrosporum populorum.

Biodiversity of the Obzhorovsky cluster lichens is not very wide - majority of species are crustaceous plagiotropic (19 species), fewer are leafy plagiotropic (7 species). Bushy branched form is represented by one specie only - Anaptichia ciliaris.

In the course of field work we have found lichens on the following substrates: epithelial tissues of woody plants (13 species), bare and treated wood (4 species), mineral antropogenic substrates: concrete, cement mortar, slate (5 species). As a curious fact, we have found 5 species of lichens on fiberglass boats operating in the Obzhorovsky cluster, of them: Rinodina pyrina, Phaeophyscia nigricans, Lecanora piniperda, Candelariella aurella, Caloplaca decipiens. Judging by the species diversity, fiberglass holds an intermediate position between the arboreal and mineral substrates.

Identified lichen flora belongs to the two substrate-related ecological gropus: epiphytes (19 species), epilithes (5 species), epigeic lichens were not detected at all.

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