

EPIPHYTIC LICHENS ON LARCH AT THE TIMBERLINE OF THE POLAR URALS

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Abstract

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The structure of the lichen groups of *Larix sibirica* Ledeb. was investigated in 1999-2001 in subgoltsy larch open woodland of the Eastern macroslope of Polar Urals. The composition of the lichen groups, frequency and cover of species, dominant species were determined.

Keywords: epiphytic lichens, species frequency, species participation, species frequency of dominance, subgoltsy belt, Polar Urals.

INTRODUCTION

The timberline is interesting to us due to extreme environmental conditions. The action of limitative climatic factors displays clear in the open woodland of the timberline and phytocenotic influence is minimal. Due to changes in global climate, it becomes necessary to conduct epiphytic lichen research in these areas to find out the

adaptation mechanisms and any dynamic tendencies connected to the climactic fluctuations.

The aim of our investigation is description of epiphytic lichen synusia structure at the tree line.

MATERIALS AND METHODS

The samples were collected in 1999-2001 in open larch woodland of the Eastern macroslope of Polar Urals at subgoltsy belt of mountains contiguous to Sob River, at 150-250 m above sea level.

The subgoltsy belt of Polar Urals is well represented. It borders all the high mountaintops on appropriate levels (URAL I PRIURALIE, 1968). The timberline in Sob River basin is mainly represented by pure larch open woodland that arise to the 200-370 m altitude. The nature of the timberline in Sob River basin is not exposed by significant human influence. Burnt areas and massive insect invasions are absent (SHIYATOV, 1965). Timberline dynamics at Polar Urals are most influenced by climatic factors (SHIYATOV, 1986).

Epiphytes were studied on Siberian larches (*Larix sibirica* Ledeb.), as it is the predominant species of the subgoltsy forests of the Ural range (GORCHAKOVSKI, 1965; GORCHAKOVSKI & SHIYATOV, 1985).

The research was conducted on sample plots of 100 cm² size located at the base of the tree, about 1,3 meters up from the ground on the side with the most pronounced epiphytic cover. 15-20 larch trees were selected from 15 sample areas, each area 50x50 m size. All phorophytes were upright, trunk diameter being at 10-15 cm.

To characterize lichen cover, following criteria were used:

1. diversity: general number of species found on all larches (including species which were found outside of sample plots) and the mean of total species number on both the sample plot and sample area, composition of the lichen groups;
2. structure of the lichen groups, including the frequency of each species, species frequency of dominance (the percent of sample plots with species dominance), projective cover (both common and for every species) on tree base and at the height of 1,3 m, including the species participation in epiphytic cover (the percentage of common cover).

All lichen names and their authors are given at ANDREEV et. al.(1996).

RESULTS

Species diversity

During our research we found 77 species of lichens on *Larix sibirica*, belonging to 17 families and 40 genera, which is more than 70% of all epiphytic lichen species of the Polar Urals (ANDREEV et. al., 1996; RIABKOVA, 1998).

15 species were recorded outside of sample plots: *Caloplaca holocarpa* (Ach.) A. E. Wade, *Bryoria chalybeiformis* (L.) Brodo & D. Hawksw., *Catillaria chalybeia* (Borrer) A. Massal., *Cetraria nigricans* Nyl., *Cladonia arbuscula* (Wallr.) Hale & W. L. Culb., *Cladonia coccifera* (L.) Willd., *Cladonia gracilis* (L.) Willd., *Hypocenomyce scalaris* (Ach.) M. Choisy, *Microphiale diluta* A. Z., *Pertusaria panyrga* (Ach.) A. Massal., *Sphaerophorus globosus* (Huds.) Vain., *Sticta wrightii* Tuck. – on tree base, *Collema furfuraceum* (Arnold) Du Rietz – at the height of 1,3 m, only on branches – *Caloplaca cerina* (Hedw.) Th. Fr., *Melanelia septentrionalis* (Lynge) Essl.

59 were found on sample plots (Tab. 1). 19-36 species were found per sampling area, 24 species average. The sample plots contained about 3-15 species at the tree base, with 7 species average, and 0-11 species at the height of 1,3 m, averaging 4 species.

95% of all lichen species were found on tree base, while only 39% of species were located at the height of 1,3 m. Number of species of crustose (38%) and fruticose (34%) lichens prevailed at the basal level, crustose (43%) and foliose (36%) species were predominant at the 1,3 m height.

Frequency

Lichens were found on all tree bases, while only 90% of the trees bore lichens at the height of 1,3 m. Frequency of foliose lichens (100%) was higher at the bases, crustose (80%) – at the 1,3 m height (Tab. 1).

Frequency of different lichen species varied greatly (from 0,2 to 62%) on all sample plots (Tab. 1). 9 species were the most widespread (5 foliose, 3 crustose and 1 fruticose): *Melanelia olivacea* (L.) Essl., *Parmeliopsis ambigua* (Wulfen) Nyl., *P. hyperopta* (Ach.) Arnold, *Tuckermannopsis sepincola* (Ehrh.) Hale, *Vulpicida pinastri* (Scop.) J.-E. Mattsson & M. J. Lai, *Amandinea punctata* (Hoffm.) Coppins & Scheid., *Biatora helvola* Hellb., *Lecanora hagenii* (Ach.) Ach., *Bryoria simplicior* (Vain.) Brodo & D. Hawksw. All these species are mesophytic.

3 species: *Parmeliopsis hyperopta*, *Vulpicida pinastri* and *Biatora helvola* were discovered on 95% of trunks.

Table 1

Species frequency and species participation in epiphytic cover

14 species (with frequency of 0,2-0,3%) were found only once. These species made one fifth of discovered species, 12 species of them were found at the tree bases.

Cover

Common lichen cover on tree base is 10-70%, with 34% average. Foliose (49% average of the overall cover) and crustose (46%) lichens predominant.

The typical species for basal part of the trees: *Vulpicida pinastri*, *Biatora helvola*, *Parmeliopsis ambigua*, *Tuckermannopsis sepicola*. *Biatora helvola* has the highest percent of cover – 35% average (the species frequency of dominance is 50%), *Parmeliopsis hyperopta* – 23% (the species frequency of dominance is 22%). *Parmeliopsis ambigua* had more rare dominance (8%).

Although many different species of fruticose lichens were observed on tree bases, their portion (4%) in epiphytic cover was not high (Tab. 1).

Common lichen cover at the height of 1,3 m is 0-57 %, with 15 % average. Foliose lichens predominant (63% of the overall cover).

The typical species for 1,3 m height: *Melanelia olivacea*, *Lecanora hagenii*, *Amandinea punctata*, *Biatora helvola*, *Bryoria simplicior*, *Melanelia olivacea* has the highest percent of dominance – 50% average (the species frequency of dominance is 43%). *Lecanora hagenii* participation is 21% (percent of dominance – 23%). *Biatora helvola* dominance is more rare in lichen cover (14%).

The main cover of lichens on all tree trunks is on the northeastern exposition.

Distribution along the trunk

The lower part of the trunks is inhabited by the butt species of mosses and lichens. The following lichen species, common for the soil, are found here: *Cetraria*

isladica (L.) Ach., *Flavocetraria cucullata* (Bellardi) Kärnefelt & Thell, *F. nivalis* (L.) Kärnefelt & Thell, *Cetrariella delisei* (Schaer.) Kärnefelt & Thell, *Alectoria ochroleuca* (Hoffm.) A. Massal., *Asahinea chrysantha* (Tuck.) C. F. Culb. & W. L. Culb., *Cetraria nigricans*, *Cladina arbuscula*, *Sphaerophorus globosus*. Also *Arctoparmelia incurva* (Pers.) Hale, *Parmelia saxatilis* (L.) Ach. and *Melanelia stygia* (L.) Essl. were found, more common for stony substrates of Polar Urals.

Parmeliopsis hyperopta, *P. ambigua* and *Vulpicida pinastri* go up the trunk to the height of 30 cm on average. *Tuckermannopsis sepincola* reaches 40 cm and *Biatora helvola* – to 1,2 m of the trunk on average. *Lecanora pullicaris* (Pers.) Ach., *Ochrolechia frigida* (Sw.) Lynge, *Mycoblastus* spp., were also common for basal parts of the trees and in moist habitats – *Lepraria* spp. as well.

Melanelia olivacea is most abundant on trunks within the bounds of the crown of the tree, it usually starts at the average of 1,6 m, and goes up to 7,5 m. This lichen goes up higher and is more abundant on old trees with thin crowns.

Lichen species also growing high up the tree trunks were *Evernia mesomorpha* Nyl., *Bryoria simplicior*, *Hypogymnia physodes* (L.) Nyl., *Parmelia sulcata* Taylor, *Lecanora hagenii*, *Amandinea punctata* and rarely *Vulpicida pinastri*.

Larch branches contained more or less the same lichen species that were found on trunks at the same height.

CONCLUSIONS

Our research found 77 different species of lichens on *Larix sibirica* Ledeb. belonging to 17 families and 40 genera, which is more than 70% of all epiphytic lichens species of the Polar Urals. The sample plots contained 59 species of lichens total, with

24 species per the sampling area. 9 lichen species from *Parmeliopsis*, *Biatora*, *Vulpicida*, *Melanelia*, *Lecanora*, *Tuckermannopsis*, *Bryoria*, *Amandinea* genera were the most widespread. The tree trunks contained about 7 species at the tree base, and 4 species at the height of 1,3 m on average.

Crustose lichens prevailed on tree base (38%) by number of species. The common projective cover is 34% on average. Foliose lichens are predominant (49%). *Biatora helvola* and *Parmeliopsis hyperopta* have the highest percent of cover.

Crustose lichens also prevailed on 1,3 m height (43%) by number of species. The common projective cover is 15% on average. Foliose lichens are predominant (63%). *Melanelia olivacea* and *Lecanora hagenii* have the overall dominance.

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SUMMARY

77 different species of lichens were found on *Larix sibirica* Ledeb. in larch open woodland at subgoltsy belt of Polar Urals at 150-250 m above sea level. The sample areas (50x50 m) contained 24 species of lichens average and the sample plots (100 cm²) – 7 species average at the tree base and 4 species at the height of 1,3 m. Common projective cover is 34% on tree base on average and - 15% on 1,3 m height. Foliose lichens are predominant on tree base and on 1,3 m height.

Table 1

Species frequency and species participation in epiphytic cover

Species	R*	Species frequency, %:		Species participation, % from common cover:	
		tree base	1,3 m high	tree base	1,3 m high
Only at the height of 1,3 m:					
<i>Candelariella vitellina</i> (Hoffm.) Müll. Arg.	0,6	-	1,3	-	0,04
<i>Rinodina archaea</i> (Ach.) Arnold	0,3	-	0,6	-	0,02
<i>Biatora sphaeroides</i> (Dicks.) Körb.	0,3	-	0,5	-	0,02
Predominantly at the height of 1,3 m:					
<i>Melanelia olivacea</i> (L.) Essl.	44,3	22,0	66,5	1,18	50,38

<i>Lecanora hagenii</i> (Ach.) Ach.	36,6	23,6	49,9	2,58	20,85
<i>Amandinea punctata</i> (Hoffm.) Coppins & Scheid.	20,2	5,6	35,0	0,12	3,18
<i>Bryoria simplicior</i> (Vain) Brodo & D. Hawksw.	21,4	13,4	29,5	0,19	1,97
<i>Japewia tornoenensis</i> (Nyl) Tønsberg	16,4	16,2	16,4	0,67	1,93
<i>Lecanora</i> sp.	7,5	0,5	14,7	0,09	2,33
<i>Evernia mesomorpha</i> Nyl.	7,3	1,1	13,5	0,01	1,09
<i>Parmelia sulcata</i> Taylor	12,5	12,4	12,5	0,24	0,83
<i>Lecidella euphorea</i> (Flörke) Hertel	6,9	4,2	9,6	0,05	0,37
<i>Lecanora symmicta</i> (Ach.) Ach.	8,8	8,1	9,5	0,33	0,55
<i>Bryoria</i> spp.	2,4	1,2	3,6	0,08	0,13
<i>Hypogymnia bitteri</i> (Lyng) Ahti	0,6	0,5	0,7	0,04	0,01
<i>Bryoria fuscescens</i> (Gyeln.) Brodo & D. Hawksw.	0,7	0,6	0,6	0,01	0,04
Predominantly at the tree base:					
<i>Parmeliopsis hyperopta</i> (Ach.) Arnold	50,7	95,8	6,2	22,96	0,27
<i>Vulpicida pinastri</i> (Scop.) J.-E. Mattsson & M. J. Lai	55,8	92,4	18,4	8,20	0,93
<i>Biatora helvola</i> Hellb.	62,1	89,7	34,3	35,05	13,57
<i>Parmeliopsis ambigua</i> (Wulfen) Nyl.	50,9	86,6	14,8	10,85	0,75
<i>Tuckermannopsis sepincola</i> (Ehrh.) Hale	25,8	48,8	2,1	1,61	0,11
<i>Hypogymnia physodes</i> (L.) Nyl.	12,6	16,2	8,8	1,33	0,5
<i>Lecanora pulicaris</i> (Pers.) Ach.	4,7	7,6	1,8	0,17	0,07
<i>Flavocetraria cucullata</i> (Bellardi) Kärnefelt & Thell	3,1	5,5	0,5	0,09	0,02
<i>Alectoria sarmentosa</i> (Ach.) Ach.	1,2	1,3	1,1	0,02	0,03
Only at the tree base:					
<i>Lepraria</i> spp.	14,5	29,2	-	2,52	-
<i>Cladonia</i> spp.	9,9	19,4	-	0,79	-
<i>Lecidea nylanderii</i> (Anzi) Th. Fr.	8,4	16,7	-	3,50	-
<i>Mycoblastus</i> spp.	8,3	16,3	-	1,45	-
<i>Ochrolechia frigida</i> (Sw.) Lyng	7,1	14,1	-	0,52	-
<i>Cetraria isladica</i> (L.) Ach.	3,7	7,3	-	0,12	-
<i>Cladonia ecmocyna</i> Leight.	3,2	6,3	-	0,15	-
<i>Flavocetraria nivalis</i> (L.) Kärnefelt & Thell	2,8	5,4	-	0,13	-
<i>Ochrolechia</i> spp.	2,3	4,6	-	0,30	-
<i>Cladonia ochrochlora</i> Flörke	2,0	4,0	-	0,29	-
<i>C. pleurota</i> (Flörke) Schaer.	1,7	3,4	-	0,27	-
<i>C. cornuta</i> (L.) Hoffm.	1,5	2,9	-	0,11	-
<i>C. subulata</i> (L.) F. H. Wigg.	1,3	2,5	-	0,09	-
<i>C. coniocraea</i> (Flörke) Spreng.	0,9	1,8	-	0,22	-
<i>Cetraria laevigata</i> Rass.	0,9	1,7	-	0,03	-
<i>Arctoparmelia incurva</i> (Pers.) Hale	0,8	1,5	-	0,04	-
<i>Bacidia beckhausii</i> Körb.	0,7	1,4	-	0,03	-
<i>Varicellaria rhodocarpa</i> (Körb.) Th. Fr.	0,7	1,4	-	0,04	-
<i>Biatora meiocarpa</i> (Nyl.) Arnold	0,6	1,3	-	0,02	-
<i>Cladonia crispata</i> (Ach.) Flot.	0,6	1,3	-	0,11	-
<i>C. sulphurina</i> (Michx.) Fr.	0,6	1,3	-	0,03	-

<i>Imshaugia aleurites</i> (Ach.) S. L. F. Meyer	0,6	1,3	-	0,05	-
<i>Cetrariella delisei</i> (Schaer.) Kärnefelt & Thell	0,6	1,2	-	0,02	-
<i>Cladonia phyllophora</i> Hoffm.	0,6	1,2	-	0,05	-
<i>C. polydactyla</i> (Flörke) Spreng.	0,6	1,1	-	0,04	-
<i>C. bellidiflora</i> (Ach.) Schaer.	0,5	1,0	-	0,06	-
<i>C. chlorophaea</i> aggr.	0,5	1,0	-	0,08	-
<i>Bryoria fremontii</i> (Tuck.) Brodo & D. Hawksw.	0,4	0,8	-	0,01	-
<i>Cladonia fimbriata</i> (L.) Fr.	0,3	0,6	-	0,01	-
<i>Parmelia saxatilis</i> (L.) Ach.	0,3	0,6	-	0,05	-
<i>Pertusaria dactylina</i> (Ach.) Nyl.	0,3	0,6	-	0,02	-
<i>Alectoria ochroleuca</i> (Hoffm.) A. Massal.	0,3	0,5	-	0,01	-
<i>Asahinea chrysantha</i> (Tuck.) C. F. Culb. & W. L. Culb.	0,3	0,5	-	0,01	-
<i>Cladonia carneola</i> (Fr.) Fr.	0,3	0,5	-	0,01	-
<i>C. deformis</i> (L.) Hoffm.	0,3	0,5	-	0,04	-
<i>C. pyxidata</i> (L.) Hoffm.	0,3	0,5	-	0,05	-
<i>Buellia schaeereri</i> De Not.	0,2	0,4	-	0,01	-
<i>Chaenotheca chrysocephala</i> (Ach.) Th. Fr.	0,2	0,4	-	0,01	-
<i>Cladonia cenotea</i> (Ach.) Schaer.	0,2	0,4	-	0,02	-
<i>Lecidella elaeochroma</i> (Ach.) M. Choisy	0,2	0,4	-	0,01	-
fruticose	48	57	38	4,3	3,7
foliose	86	100	72	49,4	62,5
crustose	89	99	80	46,3	33,8

* Species frequency on sample area on all sample plots, %