

Baseline study of the lichen flora of the minor caucasus, Azerbaijan

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Abstract

Upon summarizing all the lichenological data including our data it was established that the lichen flora of the Minor Caucasus numbers 696 species of lichens pertaining to 159 genera and 55 families. From them 16 families, 45 genera and 7 species: *Bacidina chlorotricula* (Nyl.) Vezda & Poelt, *Candelariella plumbea* Poelt & Vezda, *Chrysotrix flavovirens* Tønsberg, *Chaenotheca furfuracea* (R.) Tibell, *Hypotrachyna revoluta* (Flörke) Hale, *Enchylium ligerinum* (Hy) Otálora, Jørgensen et Wedin, *Lecidea confluens* (Weber) Ach., are new for lichen flora of Azerbaijan. This article supplements information on the taxonomic composition of the lichen flora of the studied region. Taxonomical analysis of lichen flora was conducted at the level of families and genera. Also bio-morphological and ecological analysis was conducted. It is noted that generally taxonomical richness of the lichen flora of the Minor Caucasus reflects diversity of natural climatic conditions and geographical location of the region.

Keywords: diversity, lichens, new species, taxonomical analysis

Introduction

The Minor Caucasus represents a huge mountainous structure situated in 3 republics of Transcaucasia – Azerbaijan, Armenia, Georgia. Within Azerbaijan the Minor Caucasus is a mountainous area within complex structure which overlays the southwestern and western part of Azerbaijan and comprises a series of ridges and meadows. The characteristic of relief of the Minor Caucasus is its vertical zonation. Within its slopes 5 vertical zones are marked: alpine, midland, piedmont, flat and lowland. Its highest peaks have the altitude of about 4000 m^[1].

The territory of the Minor Caucasus has rare and rich flora. In the lowland up to a height of 200 meters deserted, semiarid and wetland kinds of plants are developed; on plains at the foot of mountains at a height of 200 to 700, sometimes 1200 meters annual and perennial xerophytic plants and bushes are spread, and at 1200-1800 meters deciduous forests of *Quercus* L., *Fagus* L., *Carpinus* Decne, as well as *Acer* L., *Tilia* L., *Alnus* Mill., *Populus* L., *Salix* L., *Ulmus* L. and other trees are located.

Study and preservation of biological diversity is one of key challenging issues of the present day. In order to address those issues floristic research has to be conducted on certain territories which is regarded as a foremost and inevitable stage of activities to be implemented. Lichenological studies have been carried out for more than a century's period which was earlier described by Sh. O. Barkhalov in his monograph^[2] and covered years from 1844 to 1970. The monograph which included 465 species represented a comprehensive summary on lichens of the Minor Caucasus. In years to follow study of lichen flora of this region was continued, a series of publications^[3, 4, 5, 6, 7, 8] devoted to different aspects of lichenological researches: biodiversity, ecology, rare and disappearing species was issued. Data on new rare species of lichens of this large region were accumulated which allowed to increase indices known earlier by 231 species. In the result of conducted work, we made an up-to-date inventory of herbarium specimens of lichens collected in the

territory of the Minor Caucasus. Inventory making was done in conjunction with the modern nomenclatural revisions and with consideration of literary data. At the present time Specimens of lichens are stored in the lichen bryological herbarium of the Institute of Botany of Azerbaijan National Academy of Sciences (BAK).

The purpose of our work was identification of the taxonomical composition of the lichen flora of the Minor Caucasus based on generalization of all the in hand available materials.

Material and Methods

Specimens of original collections gathered in the territory of the Minor Caucasus in various years (1981-1990, 1993-2020) and literary sources^[2, 5, 6, 7, 8] were used as the basis of this article. Collection, herborization and establishment of lichens were carried out under generally accepted lichenological methodology^[9]. Traditional methods of taxonomical, bio-morphological and ecological analyses were used in the work. The taxonomical analysis of the lichen flora was carried out based on the taxonomic classification of the section *Ascomycota*^[10, 11, 12, 13, 14].

Results and Discussion

Studies in the Minor Caucasus were started by the author in 1981 in Zangilan and then in Gubatli, Lachin and Kalbadjar regions together with colleagues from the mycology laboratory, Institute of Botany of Azerbaijan National Academy of Sciences. South-west regions of this large area were studied and described in papers^[4, 15]. Studies continued till 1984. From 1986 till 1990 studies of lichens of the Minor Caucasus were carried out by the author on the territory of Nagorno-Karabakh in Agdere, Khankendi, Shusha and Khodjavend regions. Results of those studies are summarized in paper^[3]. Later, in 2003 study of lichens in this region was restored in Gadabay region and in 2006 in

Dashkasan region. New and interesting species were identified which allowed to increase the diversity of lichens of the Minor Caucasus by 170 species.

Certain contribution to the study of the Minor Caucasus were made by E.A. Novruzov who identified 181 epiphyte lichens for Garayaz reserve, D.Sh. Ganbarov 124 species for Nakhchivan Autonomous Republic, T.Y. Pashayev 138 species for the same territory, A.A. Bayramova identified 119 species for north-east regions^[4].

So, number of lichens in the lichen flora of the Minor Caucasus increased during the elapsed time by 231 species

where of 7 species: *Bacidina chlorotica* (Nyl.) Vezda & Poelt, *Candelariella plumbea* Poelt & Vezda, *Chrysotrix flavovirens* Tønsberg, *Chaenotheca furfuracea* (R.) Tibell, *Hypotrachyna revoluta* (Flörke) Hale, *Enchylium ligerinum* (Hy) Otálora, Jørgensen et Wedin, *Lecidea confluens* (Weber) Ach, proved to be new for Azerbaijan.

As it was previously mentioned the species in the lichen flora of the Minor Caucasus belong to 18 orders, where 8 orders are considered as leading (by number of species). 80% species, 74% genera and 67% families are concentrated in them (Table 1).

Table 1: Leading orders in lichen flora of the Minor Caucasus

Place in spectrum	Orders	Number of species	Number of genera	Number of family
1	<i>Lecanorales</i> Nannf.	223	50	11
2	<i>Peltigerales</i> Walt. Watson	54	17	7
3	<i>Caliciales</i> Bessey	51	13	3
4	<i>Pertusariales</i> M. Choisy ex D. Hawksw. & O. E. Erikss.	43	7	4
5	<i>Teloschistales</i> D. Hawksw. & O. E. Erikss.	37	14	1
6	<i>Verrucariales</i> Mattick ex D. Hawksw. & O. E. Erikss.	33	9	1
7	<i>Acarosporales</i> Reeb, Lutzoni & Cl. Roux	23	5	1
8	<i>Arthoniales</i> Henssen ex D. Hawksw. & O. E. Erikss.	23	4	9

The analysis of spectrum of families of lichen flora shows that 15 families.

Are leading which account for 81% of the species composition of flora (Table 2).

Table 2: Spectrum of leading families and genera

Family spectrum			
Family	Number of genera	Number of species	% of total number of species
<i>Parmeliaceae</i> Zenker	27	76	13.0
<i>Lecanoraceae</i> Körb.	5	50	8.60
<i>Cladoniaceae</i> Zenker	1	43	7.40
<i>Physciaceae</i> Zahlbr.	6	40	6.88
<i>Ramalinaceae</i> C.Agardh	6	39	6.71
<i>Teloschistaceae</i> Zahlbr.	14	37	6.37
<i>Verrucariaceae</i> Zenker	9	33	5.68
<i>Lecideaceae</i> Chevall.	7	26	4.47
<i>Megasporaceae</i> Lumbsch	4	26	4.47
<i>Acarosporaceae</i> Zahlbr.	5	23	3.96
<i>Collemataceae</i> Zenker	7	23	3.96
<i>Peltigeraceae</i> Dumort	2	20	3.44
<i>Arthoniaceae</i> Rehb.	2	12	2.06
<i>Pertusariaceae</i> Körb.	1	12	2.06
<i>Umbilicariaceae</i> Körb.	1	12	2.06
<i>Total:</i>	97	472	81.2
Genus spectrum			
Genus	Number of species		% of total number of species
<i>Cladonia</i> P.Browne	43		7.40
<i>Lecanora</i> Ach. in Luyken	41		7.06
<i>Acarospora</i> A. Massal.	17		2.92
<i>Lecidea</i> Ach.	16		2.75
<i>Peltigera</i> Willd.	16		2.75
<i>Aspicilia</i> A. Massal.	15		2.58
<i>Caloplaca</i> Th. Fr.	15		2.58
<i>Physcia</i> (Schreb.) Michx.	14		2.41
<i>Pertusaria</i> DC.	12		2.06
<i>Umbilicaria</i> Hoffm.	12		2.06
<i>Arhonia</i> Ach.	11		1.89
<i>Lecania</i> A. Massal.	11		1.89
<i>Ramalina</i> Ach. in Luyken	11		1.89
<i>Usnea</i> Dill. ex Adans.	11		1.89
<i>Verrucaria</i> Schrad.	11		1.89
<i>Total:</i>	256		36.8

Families with few species with the number of species less than 11 are represented in the flora of the Minor Caucasus by 42 families (include only 117 species). Where 4 families number 6-10 species, 16 families 2-5 species and 17 families are represented by 1 species.

The analysis of generic spectrum shows that major diversity is concentrated in a small number of leading genera. Out of 159 genera 15 large genera contain 256 species or 37%. 144 genera contain less than 11 species, where of 67 genera (42%) have one species.

Examining the composition of large families it should be noted that as a whole the spectrum of leading families of the lichen flora of the Minor Caucasus is typical for lichen floras of the moderate zone of Holarctics, where the high level of biodiversity is characteristic primarily for families *Parmeliaceae*, *Lecanoraceae*, *Physciaceae*, *Ramalinaceae*, *Teloschistaceae*, *Cladoniaceae*.

High status in the flora of such families like *Parmeliaceae* which combine significant quantity of epiphytic lichens especially from genus *Bryoria*, *Parmelia*, *Usnea*, as well as *Cladoniaeae*, *Peltigeraceae*, characterizes its belonging to lichen floras of nemoral and boreal types of forest floras of Holarctics. Leading position of families *Lecanoraceae*, *Physciaceae*, *Teloschistaceae* in lichen flora of the Minor Caucasus emphasizes specific character of floras of the arid region. On the other side, high status of families *Verrucariaceae*, *Lecideaceae*, *Umbilicariaceae*, emphasizes mountainous character of the region. Heterogeneous character of the flora combining arid, nemoral-boreal and mountainous features is explained by diversity of natural and climatic conditions and geographic location of the region. As mentioned above the Minor Caucasus has relatively small height and is a mountainous territory with complex structure.

The analysis of lichens distribution by their biomorphic and ecological groups shows that the crustose lichens which include 420 species or 64% of the total number of lichens make up main volume of lichens in the studied lichen flora. Further come by the number of species foliose lichens numbering 118 species or 18%, then come fruticose lichens with 71 species or 15%. Among them epiphytic lichens are represented by the greater number of species-269 species (39%) and epilithic - 257 species (37%). Epigey lichens were found to be 154 species (22%), epibiophytes -11 species (2.58%), epiphyll-5 species (0.72%). Dominance of crustose lichens is connected with that they are most adapted to various environmental conditions.

Distribution of lichens over botanic and geographic regions of the Minor Caucasus has shown that out of 696 species 373 species (63% of the total number of species) grow in the Talish, 347 species (50%) – Nakhchivan Autonomous Republic, 212 species (30%) – Nagorno-Karabakh, 309 species (44%) – north-east part and 212 species (30%) in south-west part of Minor Caucasus.

With regard to taxonomical diversity out of 5 above mentioned regions the large share belongs to the unique region of Talish. Species which are specific for this subtropical area have been noted here. As such, a competitive analysis of distribution of lichen species over botanic and geographic regions of the Minor Caucasus has demonstrated that 104 species grow in the Talish, 69 in Nakhchivan Autonomous Republic, 44 in north-east part, 24 in south-west part and 17 in Nagorno-Karabakh.

Since the region still has territories not covered by research and considering the variety of natural conditions associated with the presence of mountainous and lowland landscapes, there is a possibility of increasing the list of species in the process of further research of the flora.

Conclusion

In the result of conducted work it was identified that at present the flora of the Minor Caucasus numbers 696 lichens from 159 genera, 55 families, 18 orders, 7 classes of the section *Ascomycota*. Whereas 16 families, 45 genera and 7 species have proved to be new for the researched region. The statistical analysis of distribution of lichens revealed that the highest number was recorded in the Talish region and the lowest number in Nagorno-Karabakh region.

A brief evaluation of the lichen flora of the Minor Caucasus showed its heterogeneity. This is explained by the environmental conditions and geographic location of the region.

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