

## Lichens of Azerbaijan

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### Abstract:

*The result of the generalization of original and published data, while considering the changes in nomenclature it was identified the level of diversity of lichens of Azerbaijan, which accounts 824 species, 158 genera and 54 families till present moment.*

**Key words:** lichens, family, genus, species, Azerbaijan

Azerbaijan is located in Western Asia, in its Transcaucasian part between the Caucasus ridge to the north and the Karabakh and Talysh mountains to the south. About half of the territory of Azerbaijan is occupied by mountains. In the north - Caucasus ridge, Karabakh plateau in the southwest, in the middle there is Kura-Araz lowland, in the southeast - Talysh Mountains and the Lankaran Lowland. Total area of Azerbaijan is around 86.6 square kilometers. The territory of Azerbaijan extends 400 km from north to south, and 500 km from west to east.

Natural conditions of Azerbaijan is various, from the warm and humid subtropical of Lankaran and Talysh lowland, to the snowy highlands of the Caucasus. Most of Azerbaijan is located in the subtropical zone. Within the country there are several types of climate, from dry and humid subtropical to mountain tundra ones.

The early stages of the study of lichen flora of Azerbaijan refers to XIX century when individual botanists along with flowering plants lichens were collecting too. The main contribution to the lichen flora of Azerbaijan was made by the well-known lichenologist Sh.O. Barkhalov whose researches were reflected in his works since 1936 [11-17]. However, the current study of the lichen flora of Azerbaijan can not be considered as extensive. Studies of Sh.O. Barkhalov later continued by V.S Novruzov, who researched the lichen flora of the Greater Caucasus [21-24], S.M Alverdieva who is researching Absheron and the Lesser Caucasus, as well as some areas of the Greater Caucasus [1-8], and also other lichenologists [9-10, 25-26, 27-28].

## **Materials and methods**

The basis for this work composed of the material collected in Azerbaijan in various years (1981-2012 years). Processing and analysis of the collected material were carried out in the Department of Systematics of lower plants of the Institute of Botany of ANAS. Microscopic sections of the thallus and fruiting bodies were made by hand by binocular microscope MBS-9. Anatomical sections were examined using a microscope MBR-3.

## **Results and discussion**

In the result of the summary of all the lichenological data of Azerbaijan it was identified the level of diversity of lichens from 824 species, 4 subspecies, 14 orders, 54 families and 158 genera, from which 32 species are new to the region and 10 for the lichen flora of the Caucasus [4,6,7].

The basis of species diversity of lichens represents the order of *Lecanorales*. It includes 441 species (53.5% of total) from 79 genera and 17 families. The remaining 13 orders have 383 species from 79 genera and 37 families.

As noted above there are 54 families in the composition of lichens of Azerbaijan. The average number of species in the families is 15. There are 15 families which are considered the leaders in lichens of the region and have the species diversity level higher than the average (table 1).

**Table 1: The composition of the leading number of families of species of lichens of Azerbaijan**

Family	Number of species	% from all number of species
<i>Parmeliaceae</i>	93	11.3
<i>Lecanoraceae</i>	83	10.0
<i>Physciaceae</i>	67	8.13
<i>Teloschistaceae</i>	69	8.37
<i>Ramalinaceae</i>	60	7.28
<i>Cladoniaceae</i>	51	6.18
<i>Verrucariaceae</i>	46	5.58
<i>Hymeneliaceae</i>	39	4.73
<i>Pertusariaceae</i>	35	8.24
<i>Lecideaceae</i>	28	3.39
<i>Acarosporaceae</i>	25	3.03
<i>Collembataceae</i>	25	3.03
<i>Roccellaceae</i>	23	2.79
<i>Peltigeraceae</i>	21	2.54
<i>Arthoniaceae</i>	17	2.06
<b>Total</b>	<b>682</b>	<b>82.7</b>

These include 682 species, representing 82.7% of the total. The remaining 38 families account for 142 species (17.2%). Four families *Caliciaceae*, *Rhizocarpaceae*, *Umbilicariaceae*, *Arthopyreniaceae* comprise 11-14 species. In the 23 families -2-10 species, 10 families are represented by 1 species each. Lichens of one-species families usually do not play a significant role in the vegetation cover.

Lichens of Azerbaijan include 158 genera. The average number of species in the genus is 5. Species diversity above the average is noted in 21 genera (table 2). The latter contain in its composition more than 11 species, and are leaders in the region. They combine 469 species (56.9%) of the total. The remaining 137 genera included 358 species (43.4%) of the total number of species, out of which genus of *Endopyrenium* contains 11

species (1.33%), two genera - *Bryoria* and *Melanelia* contain 10 species, *Arthopyrenia* - 9 species (1.09%), genera of *Calicium*, *Toninia* contain 8 species (0.97%), genera of *Candelariella*, *Ochrolechia*, *Placodium* and *Xanthoria* are presented each of 7 species (0.84%), 4 genera (*Diploschistes*, *Gyalecta*, *Leptogium*, *Phaeophyscia*) contain 6 species (0.73%), 5 genera (*Anaptychia*, *Buellia*, *Hypogimnia*, *Catillaria*) account for 5 species (0.60%), 18 genera are presented each by 4 species (0.48%). Other genera account for 1-3 species, including 64 genera are presented only by a single species (7.76%) of the total species.

**Table 2 The composition of the leading numbers of species of genus of lichens of Azerbaijan**

Genus	Number of species	% of total number of species
<i>Lecanora</i>	55	6.67
<i>Cladonia</i>	46	5.58
<i>Caloplaca</i>	38	4.61
<i>Aspicilia</i>	36	4.36
<i>Pertusaria</i>	28	3.39
<i>Lecidea</i>	26	3.15
<i>Rinodina</i>	20	2.42
<i>Verrucaria</i>	20	2.42
<i>Acarospora</i>	20	2.42
<i>Collema</i>	18	2.18
<i>Parmelia</i>	18	2.18
<i>Peltigera</i>	17	2.06
<i>Opegrapha</i>	16	1.94
<i>Lecania</i>	15	1.82
<i>Physcia</i>	15	1.82
<i>Ramalina</i>	15	1.82
<i>Arthonia</i>	15	1.82
<i>Usnea</i>	14	1.69
<i>Umbilicaria</i>	13	1.57
<i>Bacidia</i>	12	1.45
<i>Rhizocarpon</i>	12	1.45
<b>Total:</b>	<b>469</b>	<b>56.9</b>

The greatest number of families has been observed in orders of *Lecanorales*, *Peltigerales* and *Teloschistales*. Analyzing the composition of the leading families and genus of lichens of the reserahced region, it should be noted that their basis are

composed of polymorphic families and genus typical to the lichen flora of mild Holarctic.

The leading position of families of *Lecanoraceae*, *Physciaceae*, *Teloschistaceae* in lichens of Azerbaijan underlines the specificity of the flora of arid region. On the other hand, a high position in the flora of such families as *Parmeliaceae*, combining a significant number of epiphytic lichens, especially from genus *Bryoria*, *Parmelia*, *Usnea*, and *Cladoniaceae*, *Peltigeraceae*, species of which are involved in the formation of ground cover, forest communities, characterized by its membership to the lichen flora of immoral and boreal forest flora of the Holarctic. Characterized by a large number of species of the family lichens of *Lecideaceae*, *Physciaceae*, *Rhizocarpaceae*, *Umbilicariaceae*, *Verrucariaceae* emphasizes its mining origins. The presence of families of *Acarosporaceae*, *Collemataceae*, *Hymeneliaceae* brings it closer to the lichen flora of the ancient Mediterranean.

Thus, on the basis of the above-mentioned information, the characterized lichens combine features on one hand specific to arid, on the other hand to immoral, boreal and Mediterranean lichen flora of the Holarctic, which indicates the heterogeneity of lichens of Azerbaijan. This is obviously preliminary due to the environmental conditions of the researched area, as well as features of the history of the formation of the flora.

Analysis of the classification of lichens on biomorphs has showed that all types of life forms of lichen (at biomorphological analysis was based on life forms developed by N.S Golubkova) [19] have been presented in the researched lichens. The diversity of life forms reflects the diversity of environmental conditions (mountain, steppe, desert, subtropical al.). Among ecobiomorphs of lichens Azerbaijan the plagiotroph lichens are prevailing (722 species or 87.6%). Greatest number belongs to a class of crustose (572 species, ie 69.4%). They are spread in all vegetation zones and confined mostly to the wood and rocky substrates. Foliose life forms presented to 150 species (18.2%)

and prevailing in forest zones, where they are well represented in the epiphytic flora.

With respect to the types of substrate lichens Azerbaijan is divided into three major environmental groups: epiphytes, epilithic and epigeic. The major part belongs to epiphytic lichens - 359 species, followed by epilithic lichens - 304 species. and fewer part - 161 species are presented by epigeic lichens. The analysis of environmental groups of lichens of researched area has showed that in all groups the great bulk of species are represented by crustose forms. These observations are consistent with the literature data of N.S Golubkova and Z. Djuraeva, that the crustose thallus is the main adaptation place of lichens growing in the severe conditions of hot and cold deserts [18,20].

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