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Flora of the surrounding of the Yenikend reservoir and its analysis

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The article is dedicated to the study of the surrounding flora of the Yenikend reservoir in the Samukh district of the Lesser Caucasus. During the study, in the area, 594 species belonging to 81 families and 316 genera were determined, a new habitat of 4 species was discovered, and 3 species were already considered extinct in the area. In the flora of the area, angiosperms belonging to 14 families (between 5-26 genera each) are dominated by 187 genera and 393 species. Each of the remaining 68 families is represented by only 1-4 genera. According to biomorphological composition, its predominance with 273 species was determined. There are trees with 28 species, shrubs with 55 species, subshrubs with 7 species, and small shrubs with 11 species. More than half of the area flora is occupied by hemicryptophytes (267 species), followed by terophytes (190 species). Ecological analysis of the area of the Yenikend reservoir showed that some xerophytes are also resistant to moisture due to the rising and falling water level. In terms of number, they occupy the main place in the area with 283 species, mesoxerophytes with 117 species make up 19.7%, and xeromesophytes with 92 species make up 15.5% of the total flora. The species in the area were geographically analyzed and 17 classes and 82 groups included in 7 genetic (ancient, boreal, steppe, xerophile, desert, Caucasian, adventive) and 5 zonal (nemoral, arid, arcto-alpine, montana, cosmopolite) types of habitats were identified. The similarity coefficient of the floristic composition by the zones was calculated using the Sorensen-Czekanowski similarity coefficient (K_{sc}). The coefficient of similarity of the subalpine compared to high-mountains, the plains to the mid-mountains, the low-mountains to the mid-mountains is K_{sc}=0.45; 0.39; 0.37.

***Keywords**: Yenikend, reservoir, flora, taxon, geographical area*

INTRODUCTION

The study and protection of the modern state of flora and vegetation of Azerbaijan are at the center of attention with its relevance. The study of the modern flora and vegetation of specific areas, identifying the changes that have taken place there, and conducting research against environmental, anthropogenic and zoogenic impacts are of great theoretical and practical importance. One of such specific areas surrounded by the flora of the Lesser Caucasus is the surrounding area of the Yenikend reservoir located in the Samukh district. The area is connected with the Kura River, Ganjachay and Goshgarchay valleys. Frequent rises and falls of water and other anthropogenic impacts here led to washing of the slopes, an increase in erosion processes and changes in the composition, structure and productivity of flora and vegetation. As a result, forests and shrubs were gradually reduced, many of which were completely destroyed, and invasive plants formed the jungle in their place. Therefore, the restoration of eroded areas of the water basin on a scientific basis is considered an urgent task.

A number of prominent scientists conducted research on the flora, vegetation of various river basins and water reservoirs as well as their phytomeliorative importance: S.V.Gudoshnikov (1953), A.M.Moldoyarov (1964), R.V.Kamelin (1973), M.Darvoziyev (1977), in Azerbaijan A.G.Dolukhanov (1969), V.J.Hajiyev (1965), E.M.Gurbanov (1996), A.H.Ismayilov (2009), etc. Expedition routes to the Lesser Caucasus by

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V.J.Hajiyev (1990) conducted in 1986-2004 covered certain areas and the plant and geological materials were collected. The studies were also conducted at the border of the Samukh district, but the surrounding area of the Yenikend reservoir has been never studied as a separate research object. Taking into account all this, both the district and surrounding area of the reservoir were geobotanically inspected.

The main purpose of the research is to study the modern flora of the Yenikend reservoir surroundings. For this purpose, the following specific tasks were set: to give a complete description of the flora of the study area based on its ecobiomorphological and geographical analysis, to identify endemic, relict, rare and endangered species.

MATERIALS AND METHODS

The research was carried out in the area flora of the Yenikend reservoir located in the Samukh district of the Lesser Caucasus in 2015-2021. For this purpose, short and long-term expeditions to the basin area on 25 routes were carried out annually in spring, summer and autumn, and more than 600 herbarium materials were collected. The studies were carried out by semi-stationary and stationary methods, more than 50 geobotanical notes on the structure of phytocoenoses were taken, photos of rare species and formations were taken separately. Although the identification of species was based on the fundamental flora of the former USSR, Caucasus, and Azerbaijan, the taxa were mainly called according to the "Conspectus of the flora of Caucasus" (2006). Classical and modern - botanical, floristic, systematic, areological, ecological methods were used in the development of materials (Shennikov, 1964; Rabotnov, 1950, etc.). During the expeditions, the eco-biological characteristics of the species were clarified based on the generally accepted methodology of geobotanical search in the field, and botanical descriptions and phenological observations were made (1966). Analysis of the main life forms of plants in the flora of the study area was carried out based on the systems of I.G.Serebryakov (1964) and C.Raunkiaer (1934). The degree of similarity of the taxonomic composition comparable to the zones was calculated using the Sorensen-Czekanowski formula.

Ksc=2c/a+b Here: a-indicates the number of species in one zone, b-the number of species in the other zone, c-the number of species common to both zones (1961).

RESULTS AND DISCUSSION

The study area is located at the north-western end of the Republic of Azerbaijan and extends from the north-west to the south-east. The study areas where wastewater is discharged are mainly located on the plains on the right and left banks of the Kura River. The Gabirri and Ganikh rivers pass nearby, and the Gushgara river flows through the Garayeri settlement.

The area borders Georgia to the north and northwest, and the middle courses of the Kura River to the southwest and south. Its area is 1450 km^2, of which 53500 ha (22.1%) is used as winter pasture. The absolute altitude of the area varies between 220-871 m. It belongs to the Samukh district by administrative division. The structure of the area is complex in appearance and is characterized by a combination of micro, meso and macrorelief types. The main part is located in the plain, and there are no very high hills. Although the slope of the area is from south to north, it was observed that in some places the direction of the slope is from north-east to south-west, from east to west and from west to east.

On a sloping plain stretching along the Kura River from west to east, land resources are mainly used as winter pastures. In the foothill plain, land resources used mainly in agriculture are distributed. In the mid-mountain belt with a fragmented surface structure, there are lands that partially meet the needs of agriculture and mainly livestock, as well as forest fund lands. Land resources used as summer pastures are spread in the high mountain belt.

As a result of previous studies, the plants distributed in the flora of the area were systematically (Table 1) and taxonomically analyzed. During the study of the surrounding flora of the Yenikend reservoir, it was revealed that there are 594 species belonging to 81 families and 316 genera. New habitat of 4 species (*Cyperus rotundus* L., *Carex canescens* L. (=*Carex cinerea* Poll.), *Bryona alba* L., *Luzila multiflora* Ehrh.Lej.) was found, 3 species (*Buglossides tenuiflora* (L.f.) I.M.Johnst., *Gypsophila muralis* L., *Astragalus dzhebrailicus* Grossh.) were already considered extinct in the area.

Representatives of angiosperms (magnolia) belonging to 14 families (between 5-26 genera each) in the area flora are dominated by 187 genera (59.4%) and 393 (66.5%) species. Each of the remaining 68 (83%) families was represented by only 1-4 species (Fig. 1).

As can be seen from the floristic spectrum of the area, each of the 13 families is represented by 5 or more genera. The remaining 68 families were represented by 4 or fewer species. However, among them, there are genera that are important in the phytocoenosis with more species than others (Fig. 2).

Table 1. Systematic structure of the area flora

№	Division and classes of plants	Families		Genera		Species	
		Number	By %	Number	By %	Number	By %
1	*Equisetophyta*	1	1.21	1	0.36	3	0.50
2	*Polypodiphyta*	4	4.87	6	7.90	9	1.52
3	*Pinophyta*	2	2.43	2	0.63	5	0.84
4	*Gnetophyta*	1	1.21	1	0.31	1	0.16
5	*Magnoliophyta*	74	90.2	305	96.82	573	96.95
a	*Magnoliopsida*	62	75.6	254	80.63	469	79.35
b	*Liliopsyda*	12	14.63	51	16.19	104	17.59
Total		82	100	315	100	591	100

The number of genera with many species is much higher than the averagenumber. Each of the 13 genera in the area flora has 5 or more species, and each of the 4 genera has 10 or more species, which are polymorphic plants. Biomorphological analyzes were conducted and grasses with 273 species were found to be predominant (Table 2, Table 3).

More than half of the flora of the area is occupied by hemicryptophytes, followed by therophytes. Epiliths and epigeia which are typical for life forms of mosses are additionally included in the classification.

During the analysis of the area flora by ecological groups, life conditions of plants with different degrees of humidity were considered (Table 4). Analysis of the studied plants by ecological groups shows that the humidity degree of the plants varies. Water is one of the most important environmental factors in plant life. Adaptation of plants to habitats with different degrees of humidity, adaptation traits acquired in connection with adaptation divides them into ecological groups that are different from each other.

Table 2. Life forms of area plants according to Serebryakov (1964)

№	Life forms	Species	
		Number	By total number, in%
1	Trees	28	4,7
2	Tree and shrubs	5	0,84
3	Shrubs	55	9,25
4	Subshrubs	7	1,17
5	Small shrubs	11	1,81
6	Grasses: including a) perennial b) biennial c) annual e)annual and biennials	273 30 172 15	45,95 5,1 28,9 2,52
Total:		594	100

Table3. Life forms of plants of the area flora according to Raunkier (1934)

№	Biomorphological groups	Species	
		Number	By total number, in%
1	Phanerophytes	90	15,15
2	Chamephytes	16	2,69
3	Hemicryptophytes	267	44,94
4	Cryptophytes Including: a) bulbous geophytes b) rhizomatous c) root tubers	31 20 4 7	5,24
5	Therophytes	190	31,98
Total:		594	100

Water has a great influence on the distribution of plants in small areas and grouping in certain areas under different climatic conditions or in the same climatic conditions. The water demand of plants living in a xerophytic environment is conditionally due to two reasons: reaching of water to the soil is limited due to low rainfall, the amount of water consumed by the plant as a result of transpiration is greater than the amount of water the plant receives from the soil.

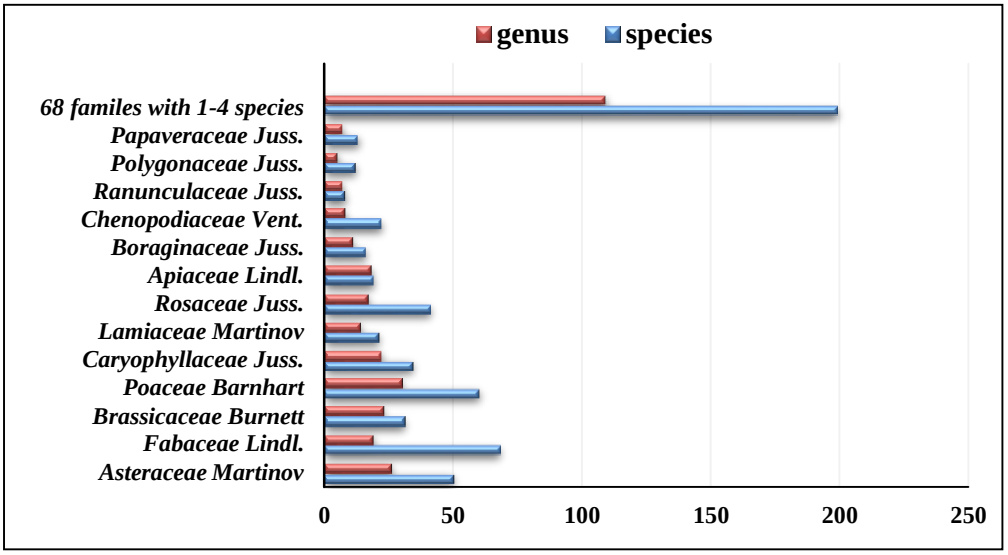

Fig. 1. Taxonomic composition of the surrounding flora of Yenikend reservoir.

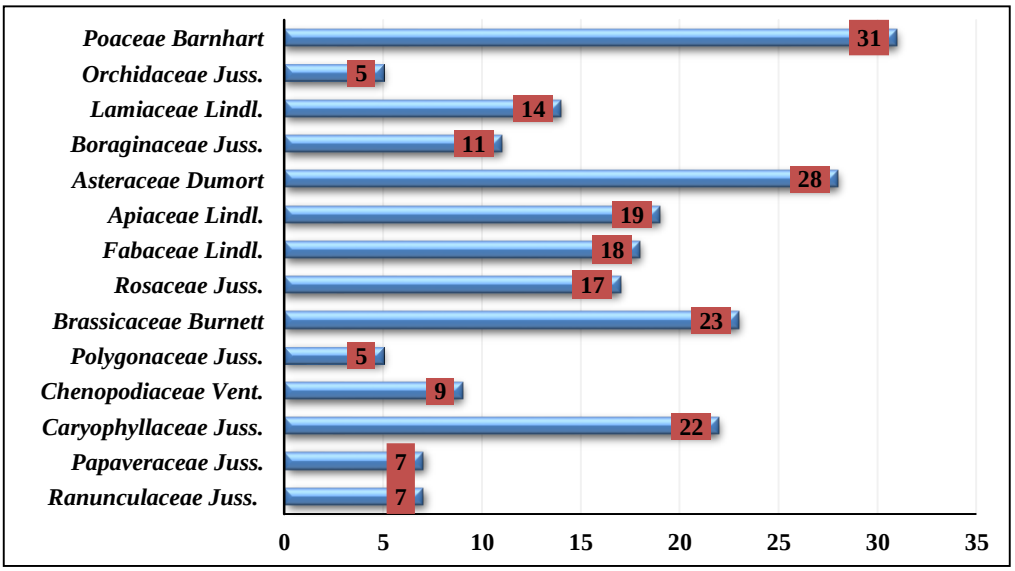

Fig. 2. Genera represented by more species in the area flora.

Due to the lack of humidity in plant habitat, its periodic low or high level and increase in physiological resistance, plants occupy an intermediate position between mesophytes and xerophytes and are called mesoxerophyte and xeromesophyte plants. By origin, mesophytes are called mesoxerophytes when they adapt to the environment and lead a relatively xerophytic life, called a xeromesophyte if it adapts to a xerophic environment and leads a relatively mesophytic life.

Ecological analysis of the area of the Yenikend reservoir showed that some xerophytes are also resistant to moisture due to rising and falling of water: mesoxerophytes with 117 species make up 19.7%, and xeromesophytes with 92 species make up 15.5% of the total flora. Thus, in terms of number, xerophytic plants occupy the main place in the area with 283 species (47.9%). Xerophytes are plants of arid areas and adapt well to water shortages.

Table 4. Ecological groups of area plants according to Shennikov (1964)

No	Ecological groups	Species	
		Number	By total number, in%
1.	Xerophytes	281	47.3
2.	Mesoxerophyte	117	19.69
3.	Xeromesophyte	92	15.84
4.	Mesophyte	96	16.16
5.	Hygrophyte	5	0.84
6.	Hydrophyte	1	0.16
Total:		594	100

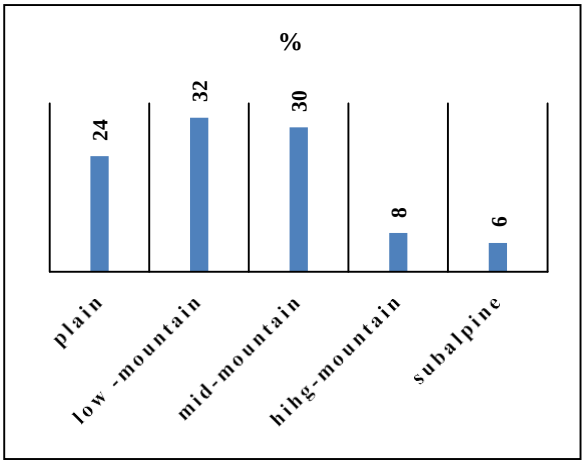

Fig. 3. Distribution of plants by altitude zones

Table 5. Coefficient of similarity to the floristic composition compared to the zones

Zones	Plain	Low- mountain	Mid-mountain	High-mountain	Subalpine
Plain	-	1.93	1.25	1.71	0.125
Low- mountain	-	-	1.06	1.62	1.71
Mid-mountain	-	-	-	1.9	0.19
High-mountain	-	-	-	-	0.34
Subalpine	-	-	-	-	-

Xerophytes, mesoxerophytes and mesophytes play an important role in the development of modern flora of the area.

Paying particular attention to species that cross the boundaries of their range, the study of geographical and genetic elements of flora, the central issues of the origin of individual plants are based on the systems of A.A.Grossheim and N.N.Portenier (which is developed for vascular plants of the Caucasus region). During the study of the area flora, the species in the area flora were geographically analyzed based on the geographical types of A.A.Grossheim, a great researcher of the Caucasian flora and 17 classes and 82 groups including in 7 genetic (ancient, boreal, steppe, xerophile, desert, Caucasian, adventive) and 5 zonal (nemoral, arid, arcto-alpine, montana, cosmopolite) types of habitats were identified.

An analysis of early spring flora was made and it was found that 84 species of plants belonging to 31 families were spread in the early spring flora of the area, of which 42 were ephemeral and 22 were ephemeroids.

Distribution patterns of plants in altitude zones were analyzed. When determining the flora and vegetation of the area by altitudes, the regularity of the distribution of the species on taken four vertical belts was studied. The number of species in the lower zone of the area is higher than in other zones (Fig. 3, Table 5). A comparison of the floristic composition of the zones was calculated using the Sorensen-Czekanowski similarity coefficient (K_{sc}). The coefficient of similarity of the subalpine compared to the highlands, the plains to the mid-mountains, the low mountains to the mid-mountains is K_{sc}=0.45; 0.39; 0.37.

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Yenikənd su anbarı ətrafının florası və onun təhlili

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Məqalə Kiçik Qafqazın Samux rayonu ərazisində Yenikənd su anbarının ətraf florasının öyrənilməsinə həsr edilmişdir. Tədqiqat zamanı ərazi florasından 81 fəilə, 316 cinsə aid 594 növün olması müəyyən edilmiş, 4 növün yeni arealı aşkar edilmiş, 3 növ isə artıq ərazidə itmiş hesab edilmişdir. Ərazi florasında 14 fəsiləyə aid örtülütoxumlular (hərəsi 5-26 cins arasında) 187 cins və 393 növlə üstünlük təşkil edirlər. Qalan 68 fəsilənin hər biri cəmi 1-4 cinslə təmsil olunmuşdur. Biomorfoloji tərkibə görə 273 növlə üstün olması müəyyən edilmişdir, ağaclar 28, kollar 55, yarımkollar 7, kolcuqlar 11 növlə rast gəlinir. Ərazi florasının yarıdan çoxunu hemikriptofitlər (267 növ), ikinci yeri isə terofitlər (190 növ) tutur. Yeni Kənd su anbarı ərazisinin ekoloji təhlili göstərdiki suyun qalqıb-enməsilə bağlı bəzi kserofitlər də rütubətə davamlılıq göstərirlər. Onlar ərazidə say tərkibinə görə 283 növü əhatə etməklə əsas yeri tutur, mezokserofitlər 117 növlə ümumi floranın 19,7%-ni, kseromezofitlər isə 92 növ olmaqla 15,5 % təşkil edir. Ərazi florasındakı növlər coğrafi təhlil edilməklə, arealın 7 genetik (qədim, boreal, bozqır, kserofil, səhra, qafqaz, adventiv), 5 zonal (nemoral, arid, arkto-alp, montan, kosmopolit) tipinə daxil olan 17 sinif və 82 qrupu müəyyən olunmuşdur. Bitkilərin qurşaqlara görə paylanması floristik tərkibinin müqayisəsi Serensen-Çekanovski oxşarlıq əmsalından istifadə etməklə hesablanmışdır: subalpın yüksəkdağlığa, düzənliyin orta dağlıqla, aşağıdağlığın orta dağlıqla müqayisəsində oxşarlıq əmsalı K_{sc}=0,45; 0,39; 0,37 .

Açar sözlər: *Yenikənd, su anbarı, flora, takson, coğrafi areal*

Флора вокруг водохранилища Йеникенд и ее анализ

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Статья посвящена изучению флоры вокруг водохранилища Йеникенд в Самухском районе Малого Кавказа. В ходе исследований установлено, что во флоре района насчитывается 81 семейство, к которым относятся 594 вида 316-ти родов. Обнаружены новые ареалы 4 видов, 3 из которых считаются исчезнувшими для данной территории. Во флоре территории преобладают Покрытосеменные с 14 семействами (от 5 до 26 видов в каждом), 187 родами и 393 видами. Каждое из оставшихся 68 семейств представлено только 1-4 родами. По биоморфологическому составу преобладают 273 вида,

28 видов деревьев, 55 видов кустов, 7 видов полукустарников и 11 видов кустарничков. Более половины флоры района представлены гемикриптофитами (267 видов), за ними следуют терофиты (190 видов). Экологический анализ территории водохранилища Йени йол показал, что при притоке и оттоке воды в водохранилище некоторые ксерофиты также проявляют устойчивость к влажности. Они, с численностью 283 вида, занимают основное место, мезоксерофиты со 117 видами составляют 19,7%, а ксеромезофиты с 92 видами составляют 15,5% всей флоры исследуемой территории. При географическом анализе видов во флоре района выделено 7 генетических (древние, бореальные, степные, ксерофильные, пустынные, кавказские, адвентивные), 5 зональных типов (неморальные, аридные, арктоальпийские, монтанные, космолитные), включающих 17 классов и 82 группы. Распределение растительности по поясам при сравнение флористического состава рассчитан с использованием коэффициента сходства Серенсена-Чекановского: коэффициент схожести Ksc=0,45; 0,39; 0,37 определен при сравнении субальпийской флоры с высокогорной, равнинной со среднегорной, предгорной со среднегорной.

Ключевые слова: *Йеникенд, водохранилище, флора, таксон, географический ареал*