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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

PHYTOCENOLOGICAL COMPOSITION AND PROSPECTS OF USE OF EARLY SPRING FLORA OF THE NORTHEASTERN PART OF THE LESSER CAUCASUS

Speciality: 2417.01 – Botany

Field of science: Biology

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INTRODUCTION

Relevance of the topic and degree of elaboration. Biodiversity conservation is considered a key component of natural resource management. Habitat fragmentation, depletion of natural resources, deforestation, rapid introduction of invasive species into native flora, and severe climate change are the main driving forces in biodiversity loss. Today's cultural landscape is the result of millennia of human impact on natural ecosystems, especially the deliberate creation of landscapes for agricultural production[1,2].

International organizations are also making efforts to prevent such impacts on nature. The United Nations adopted the "Convention on Biological Diversity" in 1992[3]. The Republic of Azerbaijan, which joined this Convention in 2000, is taking continuous measures in this direction. As a continuation of these works, the "National Strategy for the Protection and Sustainable Use of Biological Diversity for 2017-2020" was approved in the Republic of Azerbaijan by the decree of the President of the Republic of Azerbaijan[4]. The main place in the plan of measures included in the strategy is occupied by the issue of protecting rare, endemic, and useful plant species in the flora of Azerbaijan.

The number of rare species included in the third edition of the Red Book of the Republic of Azerbaijan has increased to 460[5]. However, in the second edition published 10 years ago, this number

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[1] Ibadullayeva, S.J. & Huseynova, I.M. An overview of the plant diversity of Azerbaijan Biodiversity, Conservation and Sustainability in Asia / M. Öztürk et al. (eds.), Biodiversity, Conservation and Sustainability in Asia. Springer Nature Switzerland AG, – 2021. Vol.1. – p. 431-478.

[2] Roberts, L. Biodiversity and Extinction Accounting for Sustainable Development: A Systematic Literature Review and Future Research Directions/ L. Roberts, A. Hassan, A. Elamer [and et al.]// Business Strategy and Environment journal -2020. Vol 30, Issue 1, -p. 705-720.

[3] The Convention on Biological Diversity: [Electron resources]/http://www.cbd.int/

[4] Azərbaycan Respublikasında bioloji müxtəlifliyin qorunmasına və davamlı istifadəsinə dair 2017-2020-ci illər üçün Milli Strategiya: [Elektron resurs] // – Bakı: Qanun, – 3 oktyabr, 2016. №2358.

[5] Azərbaycan Respublikasının Qırmızı Kitabı. Flora: [3 cilddə] / Red.Hey.-Bakı: "Imak", -c.3.-2023.-507s.

was 300[6]. The reason for this difference in numbers is the daily growth of industry and infrastructure, and the further increase in climate and anthropogenic impacts.

Despite the existence[7,8,9,10]of certain literature on the vegetation of the North-Eastern part of the Lesser Caucasus, an inventory and classification of early spring flora has not been conducted in them. Only in V.N. Abbasova's PhD abstract on the topic of "Bioecological characteristics and resources of wild plants traditionally used in the North-Eastern part of the Lesser Caucasus" 64 species of early spring flora for the research area are shown[11].

For this reason, studying the flora and vegetation type of a specific area, identifying rare and endemic species that are widespread there, and investigating their conservation measures is of utmost importance and occupies an important place among the steps taken to protect biodiversity.

The "Year of Solidarity for a Green World" of 2024 and the hosting of COP 29 in Azerbaijan are a clear example of our country's efforts to prevent climate change and protect the environment at the national, regional, and global levels.

Taking into account the above, the study of species included in the early spring flora of the North-Eastern part of the Lesser Caucasus, the clarification of the species composition, the phytocenological composition of the flora, the identification and use of its natural resources are extremely relevant.

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[6] Azərbaycan Respublikasının Qırmızı Kitabı. Nadir və nəsli kəsilməkdə olan bitki və göbələk növləri / Red. hey., -Bakı: Şərq-Qərb, 2- ci nəşr, -2013, - 676 s.

[7]Гроссгейм, А.А. Растительный покров кавказа. / А.А. Гроссгейм, -М.: МОИП, -1948, -267с.

[8] Hacıyev,V.C.Azərbaycanın yüksək dağlıq bitkiliyinin ekosistemi / V.C.Hacıyev. -Bakı: Təhsil-Elm, -2004. 130 s.

[9] Qurbanov, E.M. Azərbaycanın bitki örtüyü / E.M. Qurbanov, -Bakı: Elm, -2024. -544 s.

[10] Bayramova, A.A. Kiçik Qafqazın bəzi mühafizə olunan ərazilərin flora və bitkiliyi/ A.A. Bayramova, -Gəncə: -2023, 561 s.

[11] Abbasova, V.N. Kiçik Qafqazın şimal-şərqində ənənəvi istifadə edilən yabanı bitkilərin bioekoloji xüsusiyyətləri və ehtiyatları:/ biologiya üzrə fəlsəfə doktoru dis... avtoreferatı/ -Bakı, 2022. – 28 s.

Object and subject of the research. The object of the research is early spring plants that are part of various phytocenoses in the North-Eastern part of the Lesser Caucasus. The subject of the study is the study of early spring flora using classical and modern botanical methods, as well as the study of the impact of climate and anthropogenic factors on flora diversity.

Purpose and objectives of the research. The main goal of the research is to study the taxonomic composition of the early spring flora of the North-Eastern part of the Lesser Caucasus, the characteristics of the vegetation cover of the area, the ontogenesis and cenopopulations of some species which numbers of individuals are decreasing tendency, and the impact of climate and anthropogenic factors on flora and vegetation.

To achieve this goal, the following tasks have been set.

- ✓ Determination of the taxonomic structure of early spring flora in the North-Eastern part of the Lesser Caucasus and their analysis.
- ✓ Botanical-geographical analysis of species;
- ✓ Distribution of species by altitudinal zones;
- ✓ Study of the ontogenesis, cenopopulation and phytocenological characteristics of some species which numbers of individuals are decreasing;
- ✓ Study of the characteristics of the vegetation cover of the study area;
- ✓ Study of the prospects for the use of useful plants of the early spring flora of the area.

Research methods. During the research, classical and modern route-reconnaissance geobotanical methods were used, classical and modern systematic determinants were used for species identification, population-ontogenetic methods, as well as mathematical-computer methods for statistical analysis.

The main provisions put forward for defense.

1. Early spring vegetation, which plays an important role in the formation of the natural flora of the North-Eastern part of the LC, reveals the adaptive capabilities of phytocenoses.
2. Despite the different comparative biomorphological and ecological structures of the early spring flora of the Lesser Caucasus,

the species composition is similar at various levels. The results of cenotic and geographical analysis show that the species are mainly derivatives of boreal and xerophilous areal types.

3. The results obtained during the study of the ontogenetic and demographic structure of some species, the number of individuals of which is decreasing in the early spring flora of the Lesser Caucasus, can be considered a scientific basis for the development of a system of measures for the protection of the gene pool;

4. There is a wide source of raw materials for useful and important plants of the early spring flora of the Lesser Caucasus:

Scientific novelty of the study. For the first time, it has been determined that the early spring flora of the North-Eastern part of the LC is represented by 256 species (17 of which are subspecies and 2 are variations) belonging to 2 divisions, 3 classes, 5 subclasses, 28 orders, 53 families, and 142 genera.

In the the North-Eastern part of the LC, vital forms, endemism, species in danger of disappearance and extinction of early spring flora were analyzed, including classification according to the modern system of vegetation. During the study, new occurrences of 6 species which numbers of individuals are decreasing (*Listera ovata* (L.) R.Br., *Cephalanthera rubra* (L.) Rich., *Epipactis palustris* (L.) Crantz and *Primula macrocalyx* Bunge, *Viola odorata* L., *Corydalis cava* subsp. *marschalliana* (Willd.) Hayek) were identified.

During the analysis of the geographical analysis, species with 8 areal types and 24 areal classes were recorded. The studied species are mainly derivatives of boreal and xerophilous areal types.

As a result of the study of the vegetation of the North-Eastern part of the LC, it was determined that desert-semi-desert vegetation in the areas is represented by 3 formation classes, 9 formations, mountain-xerophyte (firgana) vegetation by 5 formation classes, 12 formations and 21 associations, steppe vegetation by 3 formation classes, 10 formations, 17 associations, shrub vegetation by 2 formation classes, 9 formations and 14 associations, forest vegetation by 3 formation classes, 8 formations and 17 associations, meadow vegetation by 14 formation classes, 42 formations and 52 associations.

For the first time, the ontogenetic and demographic structure of 6 species *(Listera ovata (L.)* R.Br., *Cephalanthera rubra (L.)* Rich., *Epipactis palustris (L.)* Crantz and *Primula macrocalyx* Bunge, *Viola odorata L., Corydalis cava subsp. marschalliana* (Willd.) Hayek) which numbers of individuals are decreasing and distributed in the North-Eastern part of the Lesser Caucasus have been studied.

Theoretical and practical significance of the study.

The information obtained can be used in the preparation of new editions of the "Flora of Azerbaijan" and the "Red Book" of the Republic of Azerbaijan, as well as monographic works on the territory. The information obtained on the vegetation cover of the territory may be useful for researchers working in the field of botany and ecology in the future in the work carried out to increase flora protection measures.

Approval and application. 15 scientific works have been published, reflecting the main sections of the dissertation. Of these scientific works, 9 are articles (3 abroad), 6 are conference proceedings (2 abroad).

Materials related to the dissertation work were presented at the local and international conferences “III International Scientific and Practical Conference” (Spain, Barcelona, 2022); International Scientific Conference on Current Problems of Modern Natural and Economic Sciences Dedicated to the 99th Anniversary of the National Leader Heydar Aliyev (Ganja 2022); International Scientific Conference on Current Problems of Modern Natural and Economic Sciences Dedicated to the 100th Anniversary of the National Leader Heydar Aliyev (Ganja 2023); “International Scientific-Practical Conference “Modern Approaches in the Study of the Plant Kingdom” dedicated to the Year of Heydar Aliyev” (Baku 2023), “International Conference on Conservation of Eurasian Biodiversity, ICEB” (Turkey, Izmir, 2024); “Modern Requirements in Science and Education” (Baku, 2024).

Name of the organization where the dissertation work was carried out. The dissertation work was carried out at the Department of Biology of ASAU.

Structure of the work. The dissertation consists of 172 pages, including an introduction, 6 chapters, conclusions, suggestions and recommendations, appendices and a list of 175 references. The volume of the dissertation in terms of marks is 247618 marks (introduction-000000, chapter I -000000 marks, chapter II-.00 marks, chapter III-000 marks, chapter IV-000 marks, chapter V-000 marks, chapter VI-00 marks, conclusions-.0000 marks, recommendations-00 marks). The dissertation includes 27 figures, 23 tables, 2 figure-maps.

CHAPTER I. LITERATURE REVIEW

Literature data on the flora and vegetation of the mountainous zone of the North-Eastern part of the LC, on the bioecological and phytocenological characteristics of the flora, as well as on the study of useful plants widespread in the area are widely reflected.

This chapter of the dissertation provides a brief commentary on local and world literature on the flora of the North-Eastern part of the LC, and their comparative aspects are reflected.

CHAPTER II. NATURAL-GEOGRAPHICAL CONDITIONS OF THE NORTHEASTERN PART OF THE LESSER CAUCASUS

The Northeastern part of the LC (Dashkasan (as a whole); the main part of the mountainous areas of the North-Eastern slope of the Gadabay, Goygol and Tovuz regions) has a dry, moderately warm winter, a cold climate with drier winters in the middle mountainous belt, and a tundra climate in the highlands. The highest evaporation rate is recorded mainly in the summer months (July-August)[12]. The soil cover of the North-Eastern part of the Lesser Caucasus is mountain meadow, mountain forest and chestnut, dark gray-brown[13]. The diversity of soil-climatic and physical-geographical conditions of the Lesser Caucasus is due to the fact that in the mountain forest

[12] Ekoloji atlas / tərt. ed. Q.Ş. Məmmədov, M.Y. Xəlilov, S.Z. Məmmədova – Bakı: Bakı Kartoqrafiya fabriki, – 2010. – 176 s.

[13] Məmmədov, Q.Ş. Azərbaycan torpaq ehtiyatlarından səmərəli istifadənin sosial – iqtisadi və ekoloji əsasları / Q.Ş. Məmmədov. – Bakı: Elm, – 2007. – 856 s.

belt on the North-Eastern slopes of the Lesser Caucasus mountains, beech, beech-alder and oak forests are more common[14].

CHAPTER III. MATERIAL AND METHODS OF RESEARCH

3.1. Object of the study. The object of the study was the early spring flora of the North-Eastern part of the Lesser Caucasus. The research work was conducted in 2019-2023 under field research and route-stationary conditions.

3.2. Research routes and methods. In order to conduct field research, trips were made to the Goygol, Dashkesan, Gadabay, and Tovuz regions along the routes (Figure1.)

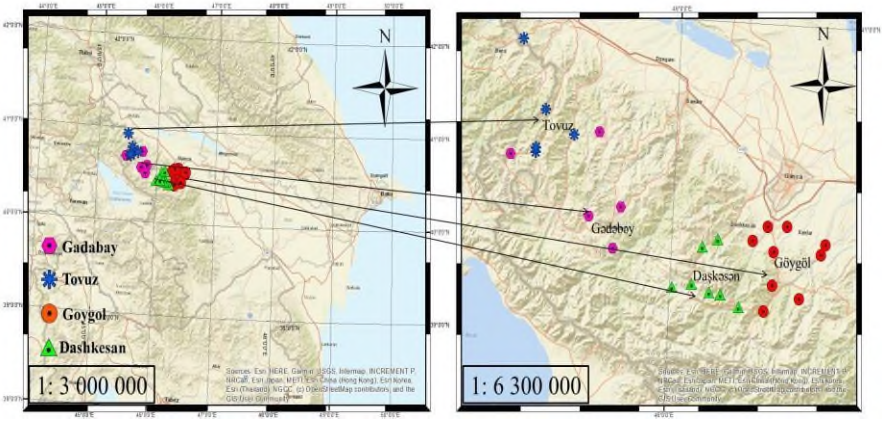

Figure 1. Research routes

3.3. Biological research methods.

3.3.1. Route, stationary-reconnaissance and geobotanical methods of the research. In order to conduct field research, trips were organized to the Goygol, Dashkesan, Gadabay, Tovuz regions along the routes (Figure 1). Expeditions to the regions (in the months of II-IV) were conducted in accordance with the accepted route, stationary, reconnaissance and geobotanical methods for research[15].

[14] Müseyibov, M.A. Azərbaycanın fiziki coğrafiyası / M.A. Müseyibov. –Bakı: Maarif, – 1988. – 399 s.

[15]Полевая геоботаника: [в 4 томах] / Ред. А.А. Корчагин и др. – Москва: Наука, – т. 2. – 1960. – 499 с.

The works of T.A. Rabotnov[16] and A.P. Shennikov[17] were used to study the projective cover and abundance of early spring plants (on a five-point scale), and P.D. Yaroshenko[18] and B.M. Mirkin[19] were used to describe phytocenoses. Biomorphological analysis was carried out according to I.G. Serebryakova[20] and C.R. Raunkier[21].

During the biogeographic analysis, we mainly took into account the system of A.A. Grossheim[22], but the system of N.N. Portenier[23] was also taken into account.

3.3.2. Population-ontogenetic methods. Observation of developmental signs in plants at the ontogenetic level was first carried out in stationary conditions by the method of T.A. Rabotnov[24]. The type of the cenopopulation was determined on the basis of the Δ-ω (delta-omega) classification of the normal population by A.A. Uranov[25] and L.A. Zhivotovsky[26].

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[16]Работнов, Т.А. Изучение ценотических популяций в целях выяснения стратегии жизни видов растений//Бюл. МОИП.Отд.биол.-1975.№(80)2.-с.5-17.

[17] Шенников, А.Н. Введение и геоботанику / А.Н.Шенников. – Л.: Ленингр. ун-та, – 1964. – 447 с.

[18] Ярошенко, П.Д. Геоботаника (Основные понятия, направления и методы) / П.Д. Ярошенко. – М.: Акад. наук СССР. – 1961. – 473 с.

[19] Миркин, Б.М. Современная наука о растительности / Б.М. Миркин, Л.Г. Наумова – Москва: Изд-во Логос, – 2001. – 264 с.

[20] Серебряков, И.Г. Экологическая морфология растений. – М.: Высшая школа, – 1962. – 277 с.

[21] Raunkiaer, C.R.the life forms of plants and statistical plant geography / C.R.Raunkiaer, - Oxford: Clarendon Press, -1934, 729 p.

[22] Гроссгейм, А.А Флора Кавказа: [в 7 томах] / А.А. Гроссгейм, - Баку. Аз ФАН СССР. -1939-1967.

[23]Портениер, Н.Н. Флора и ботаническая география Северного Кавказа / Н.Н. Портениер. – Москва: Товарищество научных изданий КМК, – 2012. – 294 с.

[24] Работнов Т. А. Жизненный цикл многолетних травянистых растений в луговых ценозах // Геоботаника – М. – Л.: 1950. С. 7-204.

[25] Уранов, А.А. Возрастной спектр фитопопуляций как функция времени енергетических волоновых процессов // Биологические науки, -1975,№ 2,-7-34

[26] Животовский, Л.А. Онтогенетические состояния, эффективность и классификация популяций растений // Экология, – 2001. № 1. – с. 3-7

The classification system was based on the "İnternational Plant Names İndex (İPNİ)"database[27], taking into account changes in nomenclature. Order, class, subclass, division, and family are listed according to the modern APG IV taxonomic classification system[28] for flowering plants.

CHAPTER IV. TAXONOMIC, BIOGEOGRAPHICAL, BIOECOLOGICAL AND BIOMORPHOLOGICAL ANALYSIS OF EARLY SPRING FLORA

4.1. Taxonomic analysis of early spring flora. As a result of the research, a preliminary classification of early spring flora was provided. According to the preliminary synopsis, the early spring flora of the regions located in the North-Eastern part of the studied LC has a fairly high species diversity[29]. The genus of flowering plants was analyzed according to the APG IV taxonomic classification system (table 1).

Table 1.

Division of early spring plants into departments and classes in the North-Eastern part of the LC

Division, class	Order		Family		Genera		Species	
	number	%	number	%	number	%	number	%
Gymnosperms	1	3.58	1	1.89	1	0.7	2	0.79
Polypodiopsida	1	3.58	1	1.89	1	0.7	2	0.79
Angiosperms	27	96.42	52	98.13	141	99.3	254	99.21
Monocots	6	21.42	9	17	29	20.42	52	20.31
Eudicots	21	75.0	43	81.13	112	78.87	202	78.9
Total:	28	100	53	100	142	100	256	100

As a result of our research, it was determined that 256 species of early spring plants (17 of which are subspecies and 2 are variations)

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[27] İnternational Plant Names İndex (İPNİ): [Elektron resurs]/ URL: https://www.ipni.org/.

[28] APG IV system [Elektron resurs] URL: https:// en.wikipedia.org/wiki /APG_IV_system

[29]Bayramova, A.A. Rzayeva, F.V. Spring flora of the northeast part of the Lesser Caucasus and its classifications // Bulletin of Science and Practice, –2021, 7(5), – p. 85-89. http://doi.org/10.33619/2414-2948/66/10.

belonging to 2 divisions, 3 classes, 5 subclasses, 28 orders, 53 families and 142 genera are widespread in the early spring flora of the North-Eastern part of the LC.

Based on the research conducted, the main leading families of the early spring flora of the North-Eastern part of the LC were noted. (Table 2).

Table 2.

Leading families of the early spring flora of the North-Eastern part of the LC

Family	Number of genera %	Share in % of total number of genera	Number of species	Share in % of total number of species
Fabaceae Juss.	7	5.04	21	8.26
Brassicaceae Burnett	16	11.51	19	7.48
Caryophyllaceae Juss.	8	5.76	16	6.3
Asteraceae Giseke	9	6.47	13	5.12
Asparagaceae Juss.	8	5.76	13	5.12
Boraginaceae Juss.	6	4.31	12	4.72
Rosaceae Juss.	7	5.04	9	3.54
Liliaceae Juss.	2	1.43	9	3.54
Plantaginaceae Juss.	2	1.43	8	33.33
Rubiaceae Juss.	2	1.43	7	2.75
Betulaceae Gray,	4	2.87	6	2.36
Lamiaceae Martinov	3	2.15	6	2.36
Caprifoliaceae Juss.	3	2.15	6	2.36
Primulaceae Batsch ex Borkh	3	2.15	6	2.36
Cyperaceae Juss.	2	1.43	6	2.36
Salicaceae Mirb.,	2	1.43	6	2.36
Violaceae Batsch	1	0.72	6	2.36
Papaveraceae Juss.	3	2.15	5	1.97

It has been determined that the families Fabaceae, *Brassicaceae, Caryophyllaceae, Asteraceae, Asparagaceae* and *Boraginaceae* are represented by the largest number of species in the early spring flora of the North-Eastern part of the Lesser Caucasus.

4.2. Biomorphological analysis of early spring flora. During the study, the vital forms of early spring plants of the North-Eastern part of the LC were assessed according to both classical classification systems.

Based on the biomorphological analysis conducted by us on the I.G. Serebryakov system, it was determined that the early spring flora of the North-Eastern part of the Lesser Caucasus is mainly represented by herbaceous plants - 209 species (81.5%). Most of them are annual (90) and perennial (95) species. The remaining species belong to annual-biennial, biennial, biennial-perennial species.

The number of woody plants is only 47 species (18.5%). Of these, 22 are trees and 9 are tree-shrubs. The number of shrubs is 15, and shrub-lianas - 1 species (Figure2).

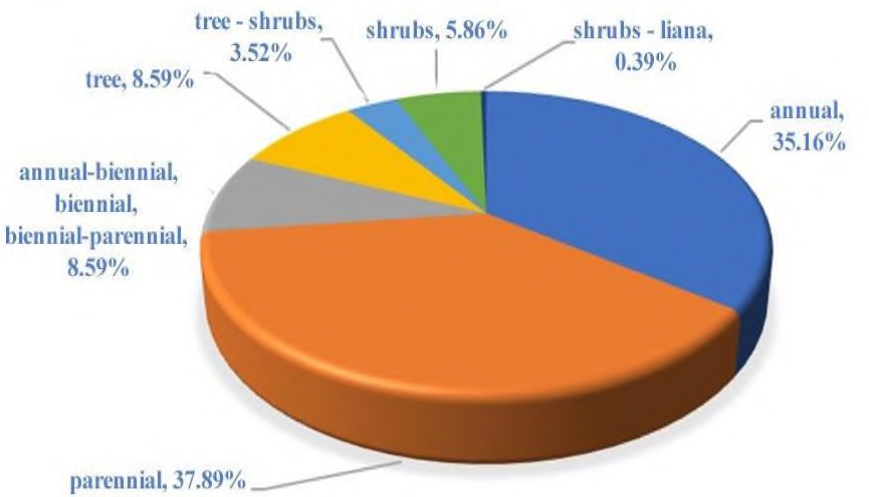

Figure 2. Distribution of early spring plants in the North-Eastern part of the LC according to their life forms (I.G. Serebryakov)

Our analysis according to the C. Raunkier life form system showed that therophytes (93 species) are the first in numerical order among early spring plants by life forms, followed by hemicryptophytes (66 species), cryptophytes (48 species) and phanerophytes (47 species)(Figure 3).

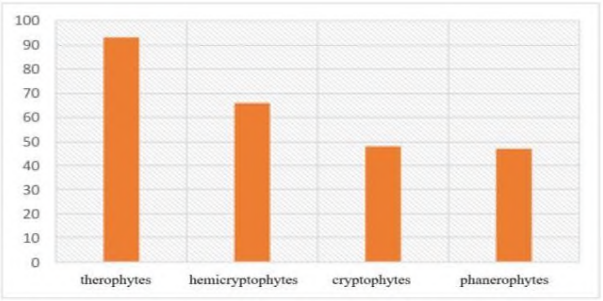

Figure 3. Distribution of early spring plants by life forms according to C. Raunkier

4.3. Bioecological analysis. We conducted an ecological analysis of the species growing in the area according to their relationship to water. It was found that xeromesophytes (67 species) and mesoxerophytes (53 species) predominate[30] (Figure 4).

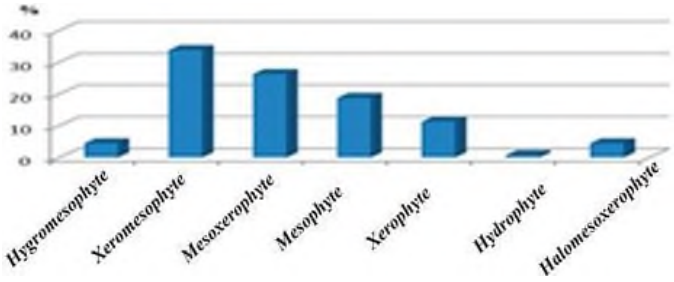

Figure 4. Ecological groups of plants according to their relationship to humidity

In the studied areas, xeromesophytes - *Draba nemorosa L.*, *Alyssum calycinum* L., *Cydonia oblonga* Mill., *Pyrus caucasica* Fed., *Cerasus avium (L.)* Moench. from mesoxerophytes - *Euphorbia condylocarpa* M Bieb., *Rhamnus spathulifolia* Fisch.:& C.A.Mey., *Viola odorata* L., *Cornus mas* L., *Vinca herbacea* Waldst. & Kit.,

[30] Bayramova, A.A., Rzayeva, F.V. Kiçik Qafqazın şimal-şərq hissəsində yayılan erkən yaz florasının ekoloji qrupları // – Gəncə: Azərbaycan Milli Elmlər Akademiyası Gəncə bölməsi. Xəbərlər məcmuəsi, – 2021. №3(82), – s. 9-13.

Myosotis sylvatica Hoffm., *Lamium maculatum* L. etc. are widespread.

4.4. Biogeographical analysis. The identification of geographical elements are, i.e. division of the studied flora into species groups with similar distribution. Recently, the system of geographical elements of the Caucasus flora, developed by N.N. Portenier, is used. Although we mainly take A.A. Grossheim's system as a basis in our studies, we also took into account the N.N. Portenier[31] system (table 3).

Table 3.

Geographical analysis of the early spring flora of the Northeastern part of the LC

№	Areal type	Areal class	Number of species	%
1	Ancient	Ancient Mediterranean	1	0,4
		Colchis	3	1,2
		Hyrcan	7	2,8
2	Boreal	Holarctic	8	3,2
		Palearctic	32	12,8
		Europe	27	10,8
		Atlantic	4	1,6
3	Steppe	Pontic-Sarmatian	2	0,8
		Pontic	3	1,2
		Caspian	1	0,4
4	Xerophilous	Mediterranean	32	12,8
		Eastern Mediterranean	17	6,8
		Iran-Turan	4	1,6
		Mediterranean - Iran-Turan	17	6,8
		Turan	1	0,4
		Iran	2	0,8
		Front Asia	13	5,2
		Central Asia	9	3,6
		Asia Minor	8	3,2
		Atropatan	2	0,8
5	Desert	Eastern Transcaucasia	7	2,8
		Eastern Caucasus	4	1,6
6	Caucasus	Caucasus	27	10.8
7	Cosmopolitan	-	4	1,6
8	Unknown	-	6	2,4

[31] Портениер, Н.Н. Методические вопросы выделения географических элементов флоры Кавказа // – Москва: Бот. журн. – 2000а, Т. 85. № 6, – с. 76-84.

As can be seen from table 3, in the boreal areal type, the most species are those belonging to the Palearctic and European areal classes. In general, the majority of species are those belonging to the xerophilous areal type[32]. In this areal type, the most species belong to the Intermediate class, and the least to Turan, Iran and Atropatan.

According to the results of the geographical analysis of the early spring flora in the North-Eastern part of the LC, the species are derivatives of boreal and xerophilous areal types. In total, species belonging to 8 areal types and 24 areal classes have been recorded.

4.5. Rare species of early spring flora of the North-Eastern part of the LC

In the North-Eastern part of the LC, 20 species belonging to 7 families and 14 genera, rare and included in the 2nd and 3rd editions of the "Red Book" of the Republic of Azerbaijan, were discovered in the spring flora. New distribution areas of these species were identified (Figure 5).

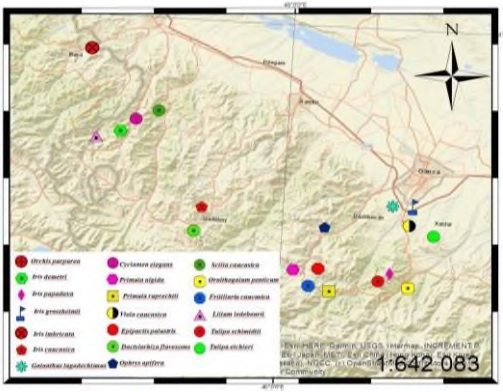

Figure 5. Map of distribution areas of rare species

4.6. Analysis of endemism of early spring flora of the Northeastern part of the Lesser Caucasus. As a result of the conducted research, 2 endemic species belonging to 2 families, 2 genera, 8 subendemic species belonging to 6 families and 8 genera are found in the early spring flora of the Northeastern part of the

[32] Bayramova, A.A. The florogenetical analysis of the vegetations of the specially protected natural territories of the Lesser Caucasus // – Poland: SYLWAN, – 2017, 161(6), – p. 509-515.

Lesser Caucasus. In general, 13 families, 24 genera, 30 species of Azerbaijani endemics, 22 families, 37 genera, 48 species of Azerbaijani subendemics and 170 species of Caucasian endemics are known for the North-Eastern part of the Lesser Caucasus[33].

A number of endemic species have been replaced by subendemics. Examples of this are *Gagea alexeenkoana* Miscz., *Ornithogalum sintenisii Freyn, Scilla caucasica* Miscz., *Muscari caucasicum (Griseb.)* Baker. Endemics belong to the families Iridaceae Juss., Amaryllidaceae Juss.[34] (Table 4). Table 4 shows the endemic and subendemic species included in the early spring flora.

Table 4.

Endemic and subendemic species of early spring flora of the North-Eastern part of the LC

Family	Genera	Species	Endemic	Subendemic
Liliaceae	*Gagea*	*Gagea alexeenokoana*		+
Hyacinthaceae	*Ornithogalum*	*Ornithogalum sintenisii*		+
	Muscari	*Muscari caucasicum*		+
	Scilla	*Scilla caucasica*		+
İridaceae	*İris*	*İris caucasica*	+	
Amaryllidaceae	*Galanthus*	*Galanthus caucasica*	+	
Fagaceae	*Quercus*	*Quercus macranthera*		+
Euphorbiaceae	*Euphorbia*	*Euphorbia iberica*		+
Boraginaceae	*Nonea*	*Nonea flavescens*		+
Scorphulariaceae	*Veronica*	*Veronica crista-galli*		+

[33] Байрамова, А.А. Ендемы и реликты особо охраняемых территорий западных регионов Азербайджана // Вестник Алтайского государсвенного университета, – 2015. № (126), – с. 66-70.

[34] Bayramova, A.A, Paşayeva, F.V. Endemic and subendemic species in the early spring flora of the northeastern part of the Lesser Caucasus // – Baku: Plant& Fungal Research, – 2022, № 2(46), – p. 50-55.

CHAPTER V. VEGETATION OF THE NORTHEASTERN PART OF LC AND STUDY OF CENOPOPULATIONS OF SOME SPECIES

5.1. Vegetation of the North-Eastern part of the LC. In the area, deserts and semi-deserts are located starting from an altitude of 100 m above sea level, plains at 650-1000 m, foothills and low mountains at 1000-1500 m, medium mountains at 1500-2000 m, high mountains at 2000-2500 m, subalpine at 2500-3000 m, alpine at 3000-3500 m, and subnival and nival zones at 3500-3724 m. The main part of the study area is made up of mountainous zones. Here, the vegetation changes vertically from plains to high mountains, creating zonality by zones[35].

Desert and semi-desert vegetation is represented by 3 formation classes, 9 formations, as well as a large number of associations and microgroupings. The edificators of the saline-wormwood formation in desert and semi-desert vegetation are the plant species *Artemisia szowitsiana, Salsola nodulosa, and Salsola dendroides,* which are from the xerophytic subshrubs.

As in the ephemeral-wormwood formation, seasonal development is characteristic of the Salsola nodulosa cenoses. In the formation, Salsola nodulosa and wormwood plants create a background.

Mountain-xerophilous (firgana) vegetation. This vegetation type is located at an altitude of 1200-1500 m. above sea level and has a zonal character. The Firgana type is represented by 5 formation classes (tragacanths, thorny shrubs, shrubs and semi-shrubs, firqana and perennial herbs) and 12 formations and 21 associations.

Steppe vegetation. The steppe vegetation of the region covers an altitude of 1500-1700 m above sea level. In the territory of the Lesser Caucasus, 3 formation classes, 10 formations, and 17 associations have been determined in the steppe vegetation.

Shrub vegetation. The bushes are distributed in the areas of the villages of Hajikend, Shahriyar, and Toghana in the LC at an

[35] Bayramova, A.A., Rzayeva, F.V. Kiçik Qafqazın şimal-şərq hissəsində subalp çəmənlərinin erkən yaz florası // – Gəncə: Azərbaycan Texnologiya Universiteti Elmi Xəbərlər məcmuəsi, – 2021. №4/37, – s. 87-90.

altitude of 1200-1300 m above sea level. In the area, this vegetation is divided into 2 formation classes, 9 formations, and 14 associations.

Forest vegetation. This vegetation type consists of several forests spread mainly around the Khoshbulag, Shahriyar and Goygol areas at an altitude of 1500-2700m above sea level. The species *Betula pendula* Roth., *Quercus macranthera* Fisch.&C.A.Mey., *Fraxinus excelsior* L., etc. dominate in the formation of these forests. 3 formation classes, 8 formations, and 17 associations have been identified in this vegetation type.

Meadow vegetation. This vegetation type can be found in all altitudinal belts that constitute vertical zonation. Floodplain, scrub meadow, undershrub, post-forest meadow-shrub, subalpine, alpine and alpine carpet meadows belong to the subtypes of this vegetation type and are distributed in 14 formation classes, 42 formations, and 52 associations.

Water-wetland vegetation. Wetlands are mainly formed in areas where rainwater is concentrated in one place in the plains and groundwater is close to the surface. Wetlands are found in the high mountain belt, around springs, natural and artificial lakes. *Veronica anagalis-aquatica, Mentha longifolia, Mentha aquatica,* etc. species dominate in the formation of these wetlands.

Rock and scree vegetation. This vegetation type, which covers all mountainous zones, is distributed in 2 formation classes (rock and scree vegetation). In rocky areas, the species *Saxifraga pontica* Albov., *Sedum tenellum* Bieb., *Erysimum pulchellum* (Willd.) Gay, *Dianthus orientalis* Adams., *Campanula bayerniana* Rupr. are most common.

Oasis vegetation. The basis of plain areas, gardens settled in the middle mountainous belt and irrigated cultivated fields is the oasis vegetation type. This vegetation type includes the following tree and shrub species: *Platanus orientalis* L., *Juglans regia* L., *Populus gracilis Grossh., Fraxinus excelsior* L., etc., and perennial grasses: *Onobrycis transcaucasica Grossh., Hordeum bulbosum* L., etc.

5.1.1 Analysis of the early spring flora of the North-Eastern part of the LC section. As a result of the analysis of the early spring flora, the existing vegetation cover, especially the adaptation strategy

to the environment in the early spring months, has been investigated. Although the plant is not yet fully developed in early spring, this period is distinguished by its unique characteristics. It grows rapidly and blooms after the cold conditions of winter. At this time, the range of some species expands widely:*Gagea chanae* -Gagea, *Polygonatum verticillatum*, *Aconitum ranunculoides* L.–Crowfood monkshood, *A.caucasica* Willd. – Caucasus monkshood, *Ficaria caltifolia* Reichenb.(=*F.ledebourii* Grossh. et Schischk.) – ficariya, *Papaver orientale* L. – East tulip, *Corydalis marschalliana* Pers. – Marshall fumitory, *Fumaria officinalis* L. – Pharmacy fumitory.

5.1.2 Subalpine meadows of the early spring flora of the Northeastern part of the LC. The main characteristic of subalpine meadows is their tall vegetation and rich floristic composition, and they are found in narrow strips in the northeastern part of the LC.

5.1.3 Early spring flora of the northeastern forests of the LC. The forest vegetation of the North-Eastern part of the LC can be divided into three parts: 1. Mountain-meadow-forest belt (1700-2100 m), upper mountain-forest sub-belt (1600-2000 m), middle mountain-forest sub-belt (1000-1700 m). Here, mixed forests are formed as a result of the joint spread of beech, oak, pine, birch, etc. trees.

5.2. Ontogenetic characteristics and state of cenopopulations of some species distributed in the North-Eastern part of the LC.

We studied the ontogenetic characteristics and state of cenopopulations of some species distributed in the North-Eastern part of the LC, and determined their ontogenetic and demographic structure. The species *Listera ovata* (L.) R.Br., *Cephalanthera rubra* (L.) Rich., *Epipactis palustris* (L.) *Crantz and Primula macrocalyx* Bunge, *Viola odorata* L., *Corydalis cava* subsp. *marschalliana* (Willd.) Hayek were selected as the objects of research[36].

[36] Bayramova, A.A., Paşayeva, F.V. Kiçik Qafqazın şimal-şərq hissəsində yaz florasında rast gələn nadir növlərin populyasiyalarının vəziyyəti // – Naxçıvan: Naxçıvan Dövlət Universitetinin Elmi Əsərləri, Təbiət və Tibb Elmləri Seriyası, – 2022. №3(116), – s. 57-64.

5.2.1. Ontogenesis and state of cenopopulations of species *Listeria ovata* (L) R.Br.

In the ontogenesis of *Listeria ovata* species, 3 periods and 8 ontogenetic age states (juvenile (j), immature (im), virginal (v), young generative (G1), middle-aged generative (G2), old generative (G3), subsenil (ss), senile (s)) were studied, their morphological features and sizes were investigated[37](Table5).

The 1st cenopopulation of *Listeria ovata* species (CP 1) was discovered in the village of Ashagi Dashkesan in the Dashkesan region, at an altitude of 1325 m above sea level, in a forest massif, CP 2 - in the vicinity of the village of Asrik Jirdakhan in the Tovuz region, at an altitude of 764 m above sea level, in an open forest, and the 3rd cenopopulation (CP 3) was discovered in the vicinity of the village of Isabey in the Tovuz region.

Table 5.

Ontogenetic structure of the species Listeria ovata (L) R.Br.

Ontogenetic periods/ CP	**J**	**Im**	**V**	**G_1**	**G_2**	**G_3**	**Ss**	**S**	**∑**
CP 1	**2**	**3**	**7**	**6**	**2**	**1**	**2**	**0**	**23**
CP 2	**1**	**2**	**3**	**7**	**3**	**2**	**1**	**0**	**19**
CP 3	**0**	**2**	**2**	**8**	**2**	**1**	**7**	**5**	**27**
∑	**3**	**7**	**12**	**21**	**7**	**4**	**10**	**5**	**69**

A histogram depicting the age groups of the ontogenetic spectrum is depicted (Figure 6).

In the 3 studied cenopopulations, the percentage of pregenerative individuals was 51%-32%-14.82%, generative individuals 38%-64%-50.74%, and postgenerative individuals 9%-5%-44.44%, respectively (Figure 6). Demographic values of cenopopulations of the *Listera ovata* plant are presented in Table 6.

[37] Paşayeva, F.V. Ontogenetic characterics and coenopopulation status of the rare and endangered species *Listera ovata* (L.) R.Br. in the northeastern part of the Lesser Caucasus // – Россия.Нижневартовск: Бюллетень науки и практики», – 2024.Vol-10, İssue 2, – p. 33-37.

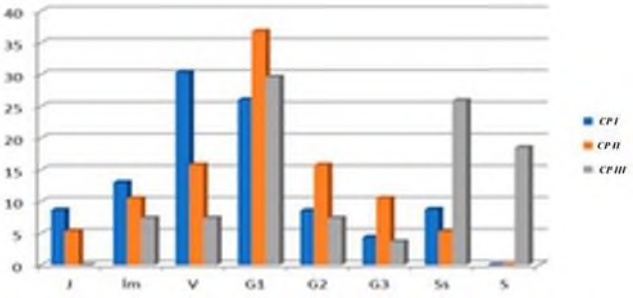

Figure 6. Ontogenetic spectrum of cenopopulations of *Listera ovata* (L.) R.Br.

The number and average density of individuals were determined to be the highest in CP3. and the lowest in CP2. The recovery index reached its highest value in SP2. Based on the indicators of Δ and ω indices, the SP1 and SP2 cenopopulations are of the "growing" type, while CP3 is of the "old" type.

Table 6.

Demographic indicators of cenopopulations of *Listera ovata* (L.) R.Br.

Indexes/ CP	n	Td	Ai	Ri	Ir	Δ	ω	Type
CP 1	23	1,5	0,417	0,417	0	0,333	0,681	Growing
CP 2	19	1,3	0,437	0,437	0	0,295	0,685	Growing
CP3	27	1,6	0,401	0,36	0,173	0,561	0,523	Old

Note: n – number of individuals; Td – total density of individuals; Ri – regeneration index; Ai– aging index.; Ir– replacement index.; Δ – age index; ω – efficiency index.

5.2.2. Ontogenesis and state of cenopopulations of species *Cephalanthera rubra* (L.) Rich.

3 periods and 8 ontogenetic age states were studied in the ontogenesis of the *Cephalanthera rubra* species, and their morphological characteristics and sizes were investigated[38].

The 1st cenopopulation of *Cephalanthera rubra* (CP1) was found in a forest massif at an altitude of 492 m above sea level near

[38] Paşayeva, F.V. Ontogenetic and demographic structure of the cenopopulation of the species *Cephalanthera rubra* (L.) Rich. // – Gəncə: ADAU-nun Elmi Əsərləri, – 2024.

– s. 11-18.

the village of Toganali in the Goygol region, CP2 was found in the forest at an altitude of 1364 m in the area called Namardgala in the Gadabay region, CP 3 was found in the Goygol National Park in the vicinity of Maral Lake (Table 7).

Table 7.

Ontogenetic structure of the species *Cephalanthera rubra* (L.) Rich.

Ontogenetic periods/ CP	J	Im	V	G_1	G_2	G_3	Ss	S	∑
CP 1	3	5	2	4	2	1	2	1	20
CP 2	2	3	5	6	3	1	1	2	23
CP 3	9	11	14	11	9	9	8	5	76
∑	14	19	21	21	14	11	11	8	119

An image depicting the ontogenetic spectrum age groups is depicted (Figure 7).

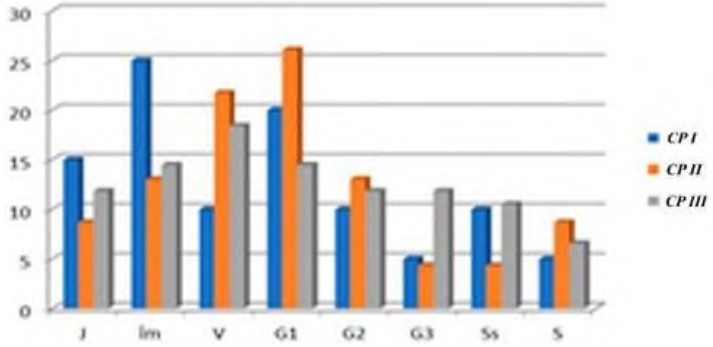

Figure 7. Ontogenetic spectrum of cenopopulations of *Cephalanthera rubra* (L.) Rich.

In the 3 cenopopulations of *Cephalanthera rubra* (L.) Rich. studied, the percentage of pregenerative individuals was 45%-34%-44.73%, generative individuals 35%-43%-38.15%, and postgenerative individuals 15%-13%-17.11%, respectively.

The demographic values of cenopopulations of the *Cephalanthera rubra* are presented in Table 8.

Table 8.

Demographic indicators of cenopopulations of *Cephalanthera rubra* (L.) Rich.

Indexes/CP	n	Td	Ai	Ri	Ir	Δ	ω	Type
CP 1	20	1,33	1,2	1,2	0	0,291	0,489	Young
CP 2	23	1,53	0,2	0,21	0,042	0,458	0,769	Mature
CP3	76	5,05	0,5	1,712	0,708	0,372	0,493	Transition

Note: n – number of individuals; Td – total density of individuals; Ri – regeneration index; Ai– aging index.; Ir– replacement index.; Δ – age index; ω – efficiency index.

The number and average density of individuals of this species were recorded at the highest level in CP3. The recovery index and replacement index reached the highest values in CP3. Based on the Δ and ω indices, CP1 is a young, CP2 is an mature, and CP3 is a transitional type.

5.2.3. Ontogenesis and state of cenopopulations of *Epipactis palustris* (L.) Crantz.

3 periods and 8 ontogenetic age states were studied in the ontogenesis of the species *Epipactis palustris*, and their morphological characteristics and sizes were investigated (Table 9).

The 1st cenopopulation (CP 1) of Epipactis palustris was studied in the forest area at an altitude of 1317 m above sea level in the village of Uchbulag, Goygol region, CP 2 – in the forest area around the village of Keshku, Goygol region, CP 3 – in the village of Gadabay Zahmetkend.

Table 9.

Ontogenetic structure of the species *Epipactis palustris* (L.) Crantz

Ontogenetic periods/ CP	J	Im	V	G_1	G_2	G_3	Ss	S	∑
CP I	2	7	12	18	10	7	2	1	60
CP II	1	3	3	5	2	1	1	0	16
CPIII	-	2	5	11	9	5	6	6	44
∑	4	12	20	34	21	13	9	7	120

A histogram depicting the age groups of the ontogenetic spectrum is depicted (Figure 8).

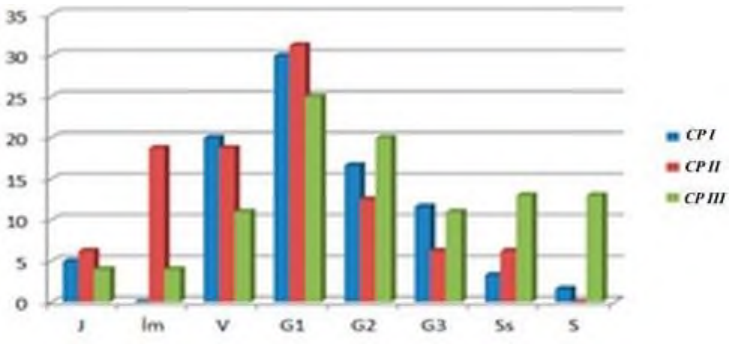

Figure 8. Ontogenetic spectrum of cenopopulations of *Epipactis palustris* (L.) Crantz

In cenopopulations I and II of the studied species, the percentage of pregenerative individuals was 37%-35%, generative individuals 54%-50%, and postgenerative individuals 6%-7%, respectively. In cenopopulation III, the number of ss+s individuals was 26%.

Demographic values of the cenopopulations of the *Epipactis palustris* plant are presented in Table 10.

Table 10.

Demographic indicators of cenopopulations of *Epipactis palustris* (L.) Crantz

Indexes	n	Td	Ai	Ri	Ir	Δ	ω	Type
CP 1	60	4	0,304	0,359	0,117	0,468	0,674	Transition
CP 2	16	1,2	0,772	0,895	0,077	0,428	0,532	Transition
CP3	44	2,9	0,556	0,28	0,189	0,539	0,6915	Transition

Note: n – number of individuals; Td – total density of individuals; Ri – regeneration index; Ai– aging index.; Ir– replacement index.; Δ – age index; ω – efficiency index.

The number and average density of individuals were the highest in CP I and the lowest in CP II. The recovery index and aging index

reached the highest values in CP2. Based on the indicators of Δ and ω indices, all three cenopopulations are transitional.

5.2.4. Ontogenetic structure and status of cenopopulations of the species *Primula macrocalyx* Bunge.

3 periods and 8 ontogenetic age states were studied in the ontogenesis of *Primula macrocalyx*, and their morphological characteristics and sizes were investigated (Table 11).

The 1st cenopopulation (CP1) of the *Primula macrocalyx* species was studied in the forest at an altitude of 1459 m above sea level in the territory of the Goygol National Park, CP 2 – in the forest around the village of Uchbulag in the Goygol region, CP 3 – in the village of Ashagi Agjakand in the Goygol region, at an altitude of 895 m.

Table 11.

Ontogenetic structure of the species *Primula macrocalyx* Bunge

Ontogenetic periods/ CP	J	Im	V	G_1	G_2	G_3	Ss	S	∑
CP I	10	12	15	26	18	11	3	1	96
CP II	7	11	15	22	12	6	2	0	75
CP III	-	7	8	18	5	5	17	18	78
∑	17	30	38	66	35	22	22	19	249

A histogram depicting the age groups of the ontogenetic spectrum is depicted(Figure9).

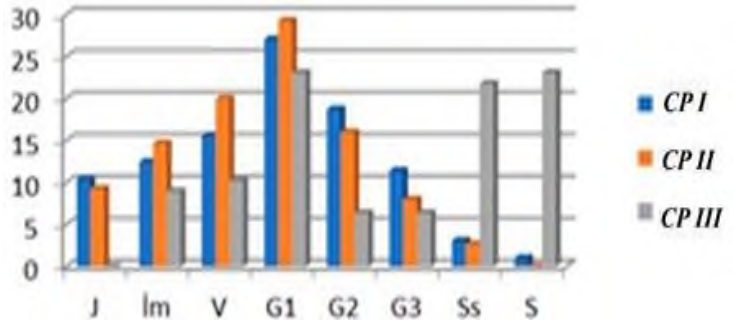

Figure 9. Ontogenetic spectrum of cenopopulations of *Primula macrocalyx* Bunge

In cenopopulations I and II of the studied species, the percentage of pregenerative individuals was 38%-45%, generative individuals 57%-54%, and postgenerative individuals 4%-3%, respectively. In CP III, the amount of pregenerative individuals was 23.1%, and the amount of generative and postgenerative individuals was 44.9% (23.1% + 21.3%).

Demographic values of the cenopopulations of *Primula macrocalyx* are shown in Table 12.

Table 12.

Demographic values of the cenopopulations of *Primula macrocalyx Bunge*

Indexes	n	Td	Ai	Ri	Ir	Δ	ω	Type
CP 1	96	6,4	1,2	1,263	0,023	0,264	0,505	Young
CP 2	75	5	1,461	1,688	0,055	0,303	0,464	Young
CP 3	78	5,2	1,53	0,55	0,24	0,553	0,488	Old

Note: n – number of individuals; Td – total density of individuals; Ri – regeneration index; Ai– aging index.; Ir– replacement index.; Δ – age index; ω – efficiency index.

The number and average density of individuals were highest in SP 1, while SP 2 and SP 3 were relatively low.The recovery index was highest in CP 2, and the replacement index was highest in CP 3. According to the results of Δ and ω indices, CP 1 and CP 2 are young, while CP 3 is an old-type cenopopulation.

5.2.5. Ontogenetic structure and state of cenopopulations of *Viola odorata* L. species.

3 periods and 8 ontogenetic age states were studied in the ontogenesis of Viola odorata, and their morphological characteristics and sizes were investigated[39] (Table 13).

[39] Paşayeva, F.V. Kiçik Qafqazın şimal-şərq hissəsində erkən yaz florasında rast gələn Violaceae fəsiləsinin bioekoloji xüsusiyyətləri // Ümumilli Lider Heydər Əliyevin 99-cu il dönümünə həsr olunmuş "Müasir təbiət və iqtisad elmlərinin aktual problemləri" adlı beynəlxalq elmi konfransın materialları. II hissə. – Gəncə: – 2022. – s. 78-84.

Table 13.

Ontogenetic structure of the species *Viola odorata* L.

Ontogenetic periods/ CP	J	Im	V	G_1	G_2	G_3	Ss	S	∑
CP 1	13	18	22	74	34	22	2	1	186
CP 2	9	6	12	8	6	3	1	0	45
CP 3	15	24	28	28	11	5	15	14	140
∑	37	48	62	110	51	30	18	15	371

The first cenopopulation (CP1) of the *Viola odorata* species was studied in the forest around the village of Mollalar in the Tovuz region at an altitude of 931 m above sea level, CP2 - in the forest around the village of Toganali in the Goygol region, and CP3 - around the village of Slavyanka in the Gadabay region, in the vicinity of Ashagi Narzan.

In the 3 cenopopulations of the studied species, the percentage of pregenerative individuals was 28.49%-60%-47.85%, generative individuals 69.89%-37.77%-31.43%, and postgenerative individuals 1.61%-2.22%-20.71%, respectively.

A histogram depicting the age groups of the ontogenetic spectrum is depicted (Figure 10).

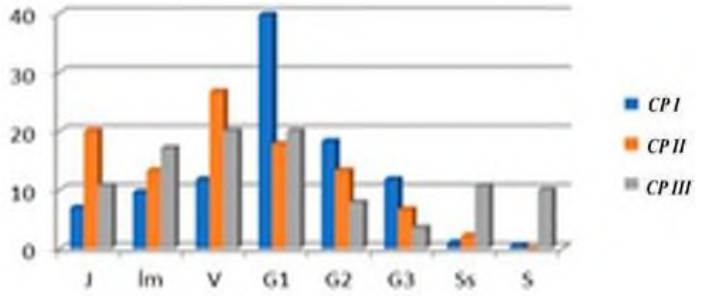

Figure 10.Ontogenetic spectrum of Viola odorata L. Cenopopulations

Demographic values of *Viola odorata* cenopopulations are shown in Table 14.

Table 14.

Demographic values of *Viola odorata* L. cenopopulations

Indexes/CP	n	Td	Ai	Ri	Ir	Δ	ω	Type
CP 1	186	12,4	0,41	0	0,41	0,33	0,67	Growing
CP 2	45	3	1,59	0	1,59	0,261	0,492	Young
CP 3	140	9	0,89	0,66	0,56	0,36	0,45	Transition

Note: n – number of individuals; Td – total density of individuals; Ri – regeneration index; Ai– aging index.; Ir– replacement index.; Δ – age index; ω – efficiency index.

The number and average density of individuals were highest in CP1 and lowest in CP2. The replacement index had the highest value in CP 2. Based on the Δ and ω indices, CP1 is a growing type, CP2 is a young type, and CP3 is a transitional type.

5.2.6. Ontogenesis and state of cenopopulations of species Corydalis cava subsp. marschalliana (Willd.) Hayek

3 periods and 8 ontogenetic age states were studied in the ontogenesis of *Corydalis cava* subsp. *marschalliana*, and their morphological features and sizes were investigated (Table 15).

Table 15.

Ontogenetic structure of the species *Corydalis cava* subsp. *marschalliana* (Willd.) Hayek.

Ontogenetic periods/ CP	J	Im	V	G_1	G_2	G_3	Ss	S	∑
CP 1	25	34	62	71	52	23	15	0	282
CP 2	10	5	13	26	35	17	9	5	120
CP 3	19	27	46	18	11	7	17	18	163
∑	54	66	121	115	98	47	41	23	565

The 1st cenopopulation (CP1) of the taxon *Corydalis cava* subsp. *marschalliana* was studied in the forest around Turshsu village in Gadabay region at an altitude of 1052 m above sea level, CP 2 – in the forest around Toganali village in Goygol region, and around Mollalar village in Tovuz region.

A histogram depicting the age groups of the ontogenetic spectrum is depicted (Figure 11).

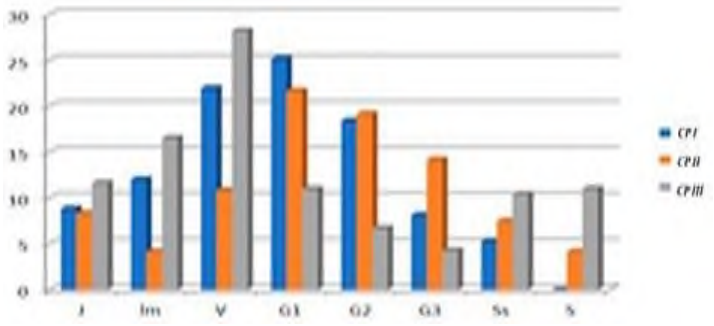

Figure 11.Ontogenetic spectrum of cenopopulations of *Corydalis cava* subsp. *marschalliana* (Willd.) Hayek

The percentage of pregenerative individuals in the 3 cenopopulations of the studied species was 42.91%-23.33%-56.44%, generative individuals were 51.77%-65%-22.03%, and postgenerative individuals were 5.32%-11.67%-21.47%, respectively.

The demographic values of the cenopopulations of the *Corydalis cava* subsp. *marschalliana* are presented in Table 16.

Table 16.

Demographic indicators of cenopopulations of *Corydalis cava* subsp. *marschalliana* (Willd.) Hayek

Indexes	n	Td	Ai	Ri	Ir	Δ	Ω	Type
CP 1	282	18,8	0,751	0,053	0,828	0,328	0,589	Young
CP 2	120	8	0,304	0,117	0,359	0,468	0,674	Transition
CP 3	163	10,86	0,98	1,29	2,55	0,336	0,435	Young

Note: n – number of individuals; Td – total density of individuals; Ri – regeneration index; Ai– aging index.; Ir– replacement index.; Δ – age index; ω – efficiency index.

The number (n) and average density of individuals were higher in CP1 and lower in CP2. The replacement index indicator had the highest value in CP3. The Δ and ω indices indicated that CP1 and CP 3 were young, while CP2 was transitional.

CHAPTER VI. USEFUL PLANTS OF THE EARLY SPRING FLORA OF THE NORTHEASTERN PART OF THE LESSER CAUCASUS AND THEIR PROSPECTS OF USE

6.1.1 Forage plants of the early spring flora of the North-Eastern part of the LC. As a result of the conducted research, it was determined that 15 families, 26 genera, and 35 species of forage plants are distributed in the early spring flora of the North-Eastern part of the LC[40].

6.1.2. Food plants of the early spring flora of the North-Eastern part of the LC. It has been recorded in the scientific literature that the systematic composition of the wild food plants of the early spring flora of the North-Eastern part of the LC includes 39 species of edible wild food plants belonging to 16 families and 30 genera[41].

6.1.3. Medicinal plants of the early spring flora of the North-Eastern part of the LC. It has been determined from scientific sources that 104 species of medicinal plants belonging to 43 families and 78 genera are widespread in the early spring flora of the North-Eastern part of the LC.

6.1.4. Decorative plants of the early spring flora of the North-Eastern part of the LC. 27 species of decorative plants belonging to 18 families and 20 genera are widespread in the early spring flora of the North-Eastern part of the LC.

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[40] Paşayeva, F.V. Kiçik Qafqazın şimal-şərq hissəsində erkən yaz florasında yayılan yem bitkiləri. Ümumilli Lider Heydər Əliyevin 100 illiyinə həsr olunmuş "Müasir təbiət və iqtisad elmlərinin aktual problemləri" adlı beynəlxalq elmi konfransın materialları. III hissə. – Gəncə: 05-06 may, – 2023. – s. 74-77.

[41] Bayramova, A.A., Paşayeva, F.V. Wild Vegetable vegetation of early spring flora spreading in the north-eastern part of the Lesser Caucasus // 2nd International Conference on Conservation of Eurasian Biodiversity. ICEB, –Izmir: – 2024, – p. 99-101.

RESULTS

1. It was determined for the first time that the early spring flora of the North-Eastern part of the Lesser Caucasus is represented by 256 species (17 of which are subspecies and 2 are variations) belonging to 2 divisions, 3 classes, 5 subclasses, 28 orders, 53 families and 142 genera. Most of these species belong to the Angiosperm department - 254 species (99.2%), and only 2 species (0.8%) belong to the Gymnosperm department. In terms of the number of species, the Eudicots class (23 orders, 39 families, 109 genera and 202 species) is richer than the Monocots class (6 orders, 12 families, 29 genera and 52 species).

2. Based on biomorphological analysis, it was determined that the early spring flora is mainly represented by herbaceous plants (209 species), most of which are annual (90) and perennial (95) species. The remaining species are annual-biennial, biennial, biennial-perennial species. Of the woody species, 22 are trees, 6 are tree-shrubs, 15 are shrubs and 1 is a shrub-liana. According to C. Raunkier, therophytes (93 species) are in the first place in numerical order, followed by hemicryptophytes (66 species), cryptophytes (48 species) and phanerophytes (47 species). According to the results of ecological analysis, xeromesophytes (67) and mesoxerophytes (53) predominate.

3. According to the results of the geographical analysis of the early spring flora, a total of 8 areal types and 24 areal classes of species were recorded. The species are mainly derivatives of boreal and xerophilous areal types. In the early spring flora, new occurrence place of 20 species belonging to 7 families and 14 genera included in the 2nd and 3rd editions of the “Red Book” of the Republic of Azerbaijan were identified.

4. As a result of studying the ontogenetic and demographic structure of some species which individuals numbers are decreasing, it was found that the 1st and 2nd cenopopulations of *Listera ovata* (L.) R.Br. are mature, the 3rd is old, the 1st cenopopulation of *Cephalanthera rubra* (L.) Rich. is the young, the 2nd is the mature, the 3rd is the transition, all three cenopopulations of *Epipactis palustris* (L.) Crantz are the transition, two cenopopulations of *Primula macrocalyx* Bunge are the young, one is the old, 1st of *Viola*

odorata L. is the mature, the other is the young, the third is the transition, the 1st and 3rd cenopopulations of the *Corydalis cava* subsp. *marschalliana* (Willd.) Hayek taxon are the young, and the 2nd is the transition.

5. As a result of the study of the vegetation of the early spring flora, it was determined that desert-semi-desert, mountain-xerophyte (firgana), steppe, shrubland, forest and meadow vegetation is represented by 30 formation classes, 81 formations and more than 121 associations and microgroupings.6. As a result of the conducted research, it has been determined in scientific sources that among the useful plants included in the early spring flora of the North-Eastern part of the Lesser Caucasus, there are 15 families, 26 genera and 35 species of fodder plants, 39 species of edible wild food plants belonging to 16 families and 30 genera, 104 species of medicinal plants belonging to 43 families and 78 genera, and 27 species of ornamental plants belonging to 18 families and 20 genera.

RECOMMENDATIONS

1. The taxonomic structure of the species composition of the early spring flora of the North-Eastern part of the Lesser Caucasus, the information obtained on the new distribution areas of rare and endangered species, and the compiled maps can be used in the next editions of the "Red Book" of the Republic of Azerbaijan and "Flora of Azerbaijan".

2. Taking into account the decorativeness of some long period-flowering 27 species found in the early spring flora of the North-Eastern part of the Lesser Caucasus, they can be used in the greening of cities and towns, areas where oil and gas pipelines pass, and in decorative floriculture.

3. The organization of protection of the cenopopulations of 6 species which numbers of individuals are decreasing (*Listera ovata* (L.) R.Br., *Cephalanthera rubra* (L.) Rich., *Epipactis palustris* (L.) Crantz and *Primula macrocalyx* Bunge, *Viola odorata* L., *Corydalis cava* subsp. *marschalliana* (Willd.) Hayek) where the recovery process is weak is important in terms of preserving biodiversity.

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3. Bayramova, A.A., Rzayeva, F.V. Kiçik Qafqazın şimal-şərq hissəsində yayılan erkən yaz florasının ekoloji qrupları // – Gəncə: Azərbaycan Milli Elmlər Akademiyası Gəncə bölməsi. Xəbərlər məcmuəsi, – 2021. №3(82), – s. 9-13.

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problemləri” adlı beynəlxalq elmi konfransın materialları. II hissə. – Gəncə: – 2022. – s. 78-84.

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12. Paşayeva, F.V. Ontogenetic characterics and coenopopulation status of the rare and endangered species *Listera ovata* (L.) R.Br. in the northeastern part of the Lesser Caucasus // – Россия. Нижневартовск: Бюллетень науки и практики», – 2024.Vol-10, İssue 2, – p. 33-37.

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