

ENDEMIC PLANTS OF NAKHCHIVAN AUTONOMOUS REPUBLIC (THE REPUBLIC OF AZERBAIJAN) AND THEIR FORMATION

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Abstract

The article presents the results of the formation of endemic plants in the flora of the Nakhchivan Autonomous Republic (AR). The study of endemic plants is of particular importance for determining the origin of endemic flora, the processes involved in its formation, its unique characteristics, and its similarities to the floras of neighboring regions. A total of 51 endemic plant species belonging to 15 families and 33 genera have been identified in the area, representing 1.54% of the flora.

As the result of centuries-long natural selection, migration, and adaptation processes, the formation of endemic species found in the flora of the Nakhchivan AR has been assessed. The emergence of endemism is closely linked to both climate and relief changes occurring over geological periods and the dynamics of floristic relationships. During the Miocene, orogenic processes resulting from the retreat of the Tethys Sea, the formation of new mountain belts, and associated climatic changes created favorable conditions for the development of unique floral complexes in the study area.

Studies show that the majority of endemic species in the flora of the Nakhchivan AR belong to mesophile and xeromesophile ecological groups. These species are mainly distributed in the middle and subalpine zones, as well as on dry mountain slopes. The influence of Caucasian elements played an important role in the formation of the endemic composition of the flora.

The results show that the endemic species of the Nakhchivan AR flora include both ancient paleoendemic and new species that have adapted to certain ecological conditions and are able to respond to environmental changes. This feature is related to the region's long-term geological development history, climatic conditions, and the confinement of species to limited areas (usually in specific mountainous or isolated regions). The conducted studies indicate that the emergence of endemic species in the territory of the Nakhchivan AR is primarily attributable to prolonged geological isolation, microclimatic diversity, and the historical stability of high-mountain ecosystems. Research has demonstrated that the evolution of high-mountain elements over millions of years that has facilitated the emergence of new forms. Moreover, the sharp differences in environmental conditions across short distances have generated distinct habitats, promoting the development of ecological niches and, consequently, the formation of new forms within these areas. These areas serve as refugia and, in some cases, as centers of speciation for various species when subjected to prolonged isolation. If such isolation persists over geological time scales, it can also give rise to local endemic species.

The distribution of endemic elements across the region's various zones is highly diverse. Among the regional endemic species, 37 (72.55%) are distributed across the middle and high mountain belts. Studying the endemic species of an area is of particular importance in identifying and protecting its biodiversity. The presence of endemic and relict species in the flora indicates the originality of the area.

Key words: Endemic elements; Conservation status; Species formation; Geological periods; Ecosystems.

Introduction

The flora of the Nakhchivan AR is distinguished by its species richness, ecological diversity, and high share of endemic elements. Endemic species represent key indicators for studying the evolutionary history of regional flora, biogeographical relationships, and the stability of ecosystems. The formation of endemism is frequently associated with geological and climatic changes, relief morphology, soil characteristics, and anthropogenic factors.

According to botanists, phytogeographers, and plant taxonomists, the origin of endemic species is often associated with the evolutionary development of geographically separated remnants of relict flora. Climate change, orogenic processes, and the formation of natural

barriers -such as mountain ranges, valleys, and river systems - during the Miocene and Pliocene periods promoted population isolation, thereby creating conditions for the emergence of new species (Grossheim, 1936; Talibov, 2003; Ibadullayeva & Huseynova, 2021; Fayvush *et al.*, 2023).

The modern flora of the Nakhchivan AR is characterized not only by its species richness, but also by the presence of phytogeographically distinct areal types. Alpine, subalpine, semi-desert, and steppe landscapes are spread here in a mosaic pattern (Gurbanov, 2024). This diversity creates favorable conditions for the formation and preservation of endemic species (Asgarov, 2016).

For the first time, during the middle of the Cretaceous period, a large island entirely surrounded by the sea emerged at the site of the present-day Caucasus Range. Initially, this

island was relatively small. It was even covered by sea waters at some times. Over time, the island, situated in the western part of the current Caucasus range, persisted as a Caucasian territory for an extended period. From the south, these lands were bordered by the sea that covered the territory of the present-day South Caucasus. However, in the southernmost part of the modern South Caucasus and in present-day Asia Minor, relatively small mountainous islands (corresponding to the modern Anatolian Plateau) already existed at that time (Lesquereux, 1874).

As a result of geological processes in the region, beginning with the Upper Devonian period, numerous ups and downs occurred, and the area was repeatedly submerged during the Sarmatian period. The bays, formed as a result of regression and transgression over a long geological period, were later replaced by freshwater rivers. The flora and fauna of the region have continuously adapted to these conditions, developing along coastal areas and bays as well as at higher elevations. This is evidenced by the fact that present-day endemic and relict plant species are predominantly found in the middle and high mountains (Lesquereux, 1883).

Geological evidence indicates that during the Sarmatian stage of the Miocene, extensive marine regressions of the Paratethys Sea created new terrestrial habitats that facilitated plant migration, colonization, and the establishment of vegetation. As the seas gradually retreated, plant communities expanded into newly exposed areas, contributing to the development of the modern flora of the Caucasus and Azerbaijan (Takhtajan, 1986; Popov *et al.*, 2004).

Reliable traces of plant remain have been discovered in the Caucasus of the Upper Cretaceous period. These remains were found near the village Havush (Nakhchivan AR), located in the Daralayaz range. The discovery of Upper Cretaceous remains in this region suggests that a continuous water basin did not exist during the Upper Cretaceous in the area corresponding to the present-day South Caucasus. Islands of more or less significant size existed in these areas, as evidenced by the plant remains found around Kechal mountain (Ibrahimov & Seyidov, 2024).

In particular, the development of flowering plants together with spore-bearing and gymnosperm plants during the Cretaceous period, and the diversification of flowering plants toward the end of the Cretaceous (Takhtajan, 1986), as well as changes in sea level associated with the evolution of the Paratethys Sea (Popov *et al.*, 2004), climate change, the uplift of the Greater and Lesser Caucasus, and geomorphological changes in the region (Zohary, 1973; Takhtajan, 1986), played an important role in the subsequent development and formation of the flora of the area.

The Cretaceous period is the last period of the Mesozoic era, the period that follows the Jurassic period. According to radiological data, the Cretaceous period began 145.5 million years ago and ended approximately 66 million years ago. It was first recorded as an independent geological period in 1822 by Belgian geologist Jan-Batist Omalius d'Allua (Ashworth, 2021). The Cretaceous period is usually divided into two parts - the Lower and Upper Cretaceous periods. The climate change that occurred during the early Cretaceous period led to the gradual emergence of angiosperms, along with spore-bearing and gymnosperm plants. Trees of the genera such as beech, maple, ash, walnut, and poplar, which appeared during the Cretaceous period, have survived unchanged to this day.

The evolution of alpine elements in the long historical development process has created conditions for the emergence of new forms. Sharp differences in environmental conditions over short distances lead to habitat differentiation (Dullinger *et al.*, 2012; Scherrer & Körner, 2011), which in turn creates conditions for the development of ecological niches and, consequently, the emergence of new forms (endemics) in these areas.

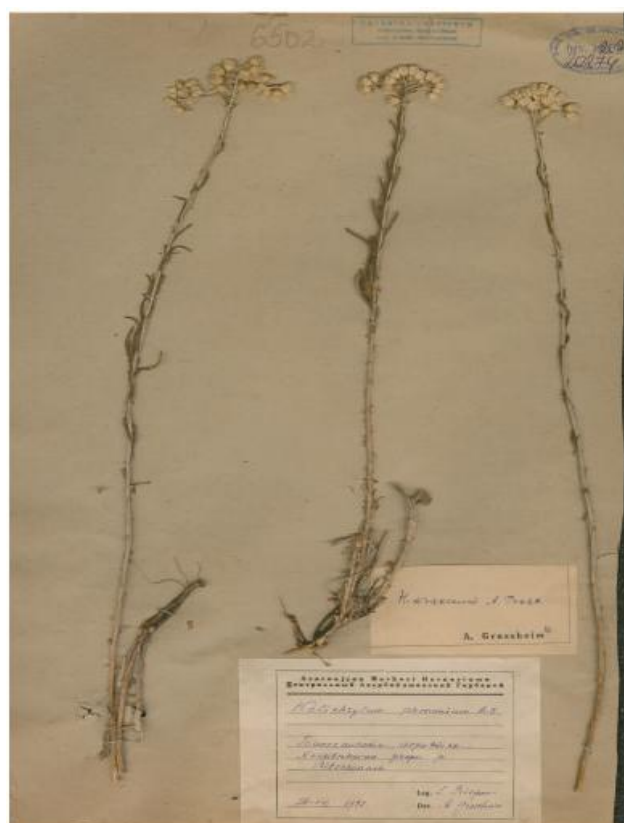
At present, the flora of the Nakhchivan AR comprises 3020 plant species, representing 910 genera across 160 families. The aim of the present investigation is to trace the history of the emergence of endemic species.

Materials and Methods

The research material was endemic plants found in various areas of the Nakhchivan AR. The main goal of the research was to study the formation of endemic plants distributed in the area, their adaptation to specific ecological conditions, migration characteristics to other areas, and conservation opportunities (Anon., 2013, 2023; Ghahreman & Attar, 1999; Anon., 2006; Anon., 2014).

The study area covers the high and middle mountain belts of the Zangazur and Daralayaz mountain ranges. These areas extend along the border of Nakhchivan AR and Armenia and are located at altitudes of 1600-3800 m above sea level (asl). The area has a complex orographic structure and soil composition is characterized by a climate type with cold winters and dry summers. The average annual precipitation ranges from 500 to 800 mm, with high spatial variability due to topographic influences. The average winter temperature is below 0°C, and snow cover in the highest areas can last up to 7 months (sometimes up to 9 months in areas with little snow). The increase in temperature and greater variability in precipitation in the region in recent decades have led to lot of changes in the region, especially in vegetation cover (Pörtner *et al.*, 2022). The area, recognized as one of the principal biodiversity centers of the Republic of Azerbaijan, is distinguished by the richness of its xerophytic flora, a high level of endemism, and the abundance of ancient relic plants-particularly those associated with the Tertiary period, glaciation, and xerothermic stages (Grossheim, 1936; Takhtajan, 1986; Ibadullayeva, 2011; Ibadullayeva & Huseynova, 2021).

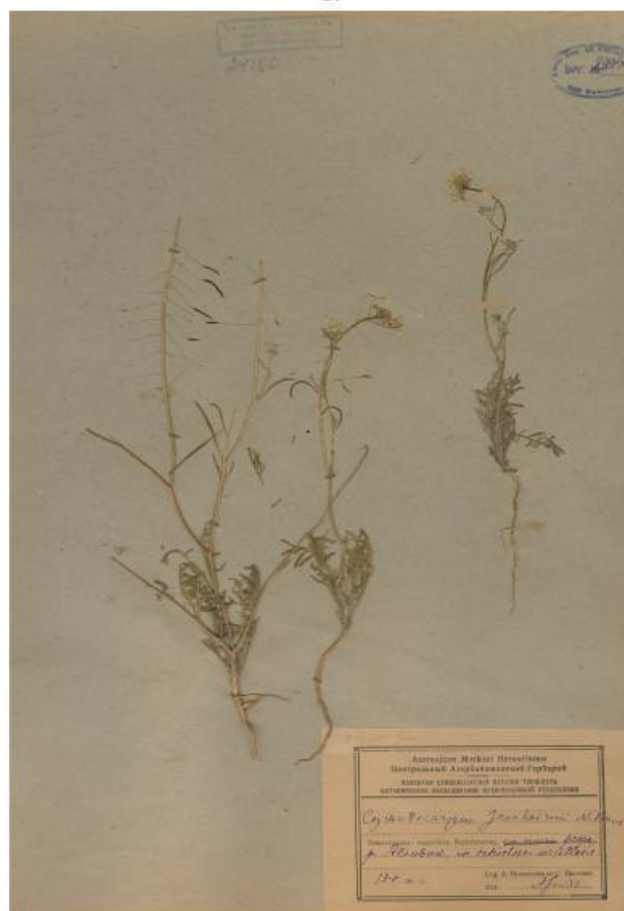
The research was carried out using generally accepted floristic and geobotanical methods. In the process of plant identification, regional floras were used as the primary reference sources, including Anon., (1950–1961), Flora of Armenia (Fayvush *et al.*, 2023), Grossheim (1948), Biodiversity of Plant Species in Iran (Ghahreman & Attar, 1999), and the Anon., (2014). Species names were verified according to the latest accepted nomenclature in the World Flora Online (Anon., 2026). Growth habit, microhabitat, and life form were determined based on field observations and morphological characteristics (Broennimann *et al.*, 2006). Life forms were classified according to Raunkiaer's classification system (Raunkier, 1934). Population size was estimated where quantitative field data were available, based primarily on direct counts of mature individuals within representative populations; for species lacking sufficient quantitative data, population size was recorded as "not registered." The number of locations was determined based on field observations, herbarium specimens (Fig. 1), published distribution records, and available floristic databases.



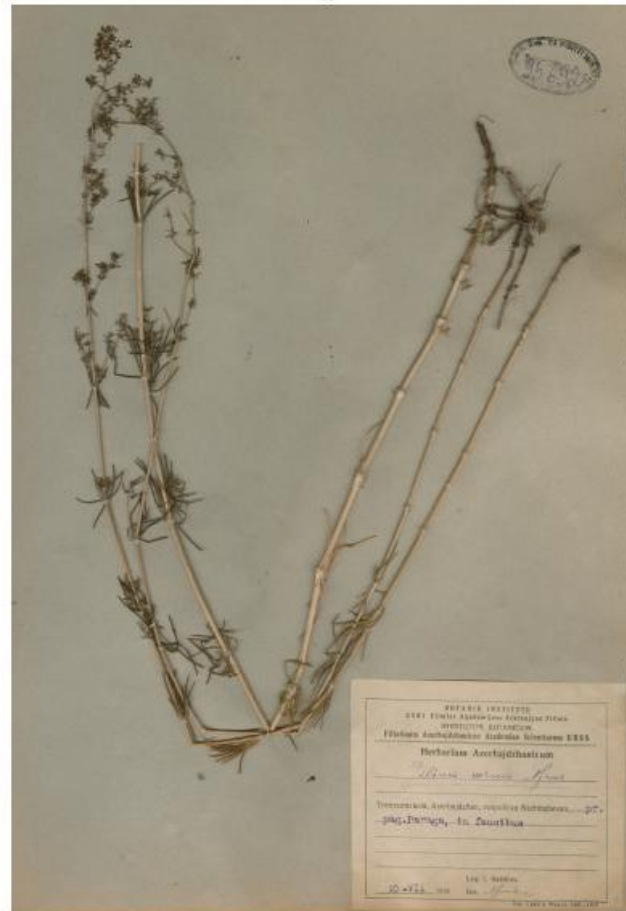
a



b



c



d

Fig. 1. Representative herbarium specimens used to determine the distribution localities and habitat types of the studied species in the study area. a: *Helichrysum araxinum* Takht. ex Kirp.; b: *Scrophularia nachitschevanica* Grossh.; c: *Cymatocarpus grossheimii* N. Busch; d: *Galium verum* L.

The ecological-geographical analysis of species distribution was conducted based on classical quantitative methods of comparative floristics. The characteristics of habitats and the phytocenotic distribution of species have been studied in separate zones.

The most challenging aspect of the present research is the lack of direct evidence concerning the nature of the changes that the flora underwent in attaining its current appearance. Unfortunately, paleobotanical research after 1930s in the region was neglected, and during this extended period, emphasis was placed solely on systematic and geobotanical studies. Information about the endemics of the area was obtained mainly from literature sources (Asgarov, 2014; Talibov *et al.*, 2021; Ibadullayeva, 2021). Nevertheless, geological and paleobotanical studies have already been initiated in the territory of Azerbaijan (Dugerdil *et al.*, 2023; 2025).

Since the formation of endemic elements in the flora of the Nakhchivan AR was analyzed, chorological research methods on areological groups could not be applied here. To facilitate the analysis, the quantitative distribution of species across individual altitudinal belts was determined, enabling the identification of the distribution patterns of endemic species (stenoendemics, euryendemics, and subendemics) among the belts, as well as the endemics within each belt. Taking all this into account, research has been launched for establishing the causes of emergence and the current status of endemic species in the flora of the Nakhchivan AR.

Results and Discussion

Nakhchivan AR is one of the oldest floristic regions of Azerbaijan, where the richness of natural vegetation and biogeographical diversity of species attract attention. The region's mountainous relief, continental climate condition, and geological diversity have led to the formation of many unique plant complexes here. In the high mountainous areas of the region - especially in the high mountain belts of Zangazur and Daralayaz ranges - endemic species belonging to the genera *Rosa* L. (Rosaceae Juss.) *Scutellaria* L. (Lamiaceae Lindl.) *Astragalus* L. (Fabaceae Lindl.) predominate (Figs. 2-3). These plants are ecologically specialized as drought-resistant forms, common on mountain slopes, rocky areas, and light carbonate soils.

The geographical-genetic approach to the study of the history of flora is naturally based on a carefully verified summary of species (origin), patterns of endemism and relictism, and the identification of autochthonous (local) and allochthonous (adventitious) elements of the flora.

In the study of the world's mountainous flora, particular attention should be given to the origin and development of high-mountain flora. To investigate the origin of high-mountain flora, it is necessary to determine the ecological conditions of mountainous areas, including meteorological and edaphic factors, habitat characteristics, the formation of plant groupings, and ecological patterns.

The richness of the vegetation cover of the study area depends on its geographical location. Since the area is located at the intersection of three major orographic units, the Iranian Plateau, the Anatolian Plateau, and the Zangazur Range, floral elements of all three geographical regions are found here. In addition, endemic and relict plants also have their own special share here. For elucidating the floristic history of the area, phylogenetic analysis of endemic and relict species is of particular importance as it provides insight into the stages of flora formation and helps clarify its distinctive characteristics.

In addition to all of the above, such a question arises. Why is the probability of endemic species in high mountain belts higher than in lower belts? To answer this question, it is first necessary to examine the characteristics of the area's natural historical and geographical (geological) background.

As a result of the formation of altitudinal belts following the retreat of the ancient Tethys Sea during the Miocene and subsequent climatic changes, alpine biomes that historically developed on mountain peaks are particularly sensitive to climate changes both along altitudinal gradients and across short geographic distances. Consequently, these species experience pronounced contrasts in their present habitat conditions. Ongoing climate change affects the phenology and physiology of organisms, species diversity, interactions within groupings, as well as the structure and dynamics of ecosystems. Factors such as the limited number of habitats occupied by plant species, restricted distribution ranges, and the scarcity of suitable habitat surrounding existing populations contribute to increased vulnerability to threats. Therefore, habitat heterogeneity progressively reduces the survival probability of taxa inhabiting "high-mountain islands".

Historically, when the distribution of species' habitats has shifted due to climate change, species have either had to change their physical habitats locally to find conditions that permitted survival, migrate to a suitable habitat elsewhere, or become extinct (Feeley *et al.*, 2012). With the exception of the last, several of these options are applicable to alpine endemics. Endemic taxa adapted to narrow environmental conditions are unlikely to tolerate environmental change, and evidence indicates that they have historically responded to past climate shifts by tracking habitat changes over short distances (Broennimann *et al.*, 2006). Many alpine endemics occupy the highest areas of their ranges, making migration up the mountain slopes impossible. Due to habitat barriers, geographic isolation, and limited migration capabilities, most endemic plants are unlikely to migrate over long distances (Martin & Overton, 1996; Dullinger *et al.*, 2012). Adaptation to new conditions depends primarily on the innate biological properties of the species - phenotypic plasticity, genetic diversity, and evolutionary capabilities (Pärtel *et al.*, 2011). Small isolated populations of alpine endemic species are more vulnerable to extinction due to stochastic (probable) factors. For example, small populations may provide limited raw materials for adapting to new environmental conditions, leading to a decrease in genetic diversity.

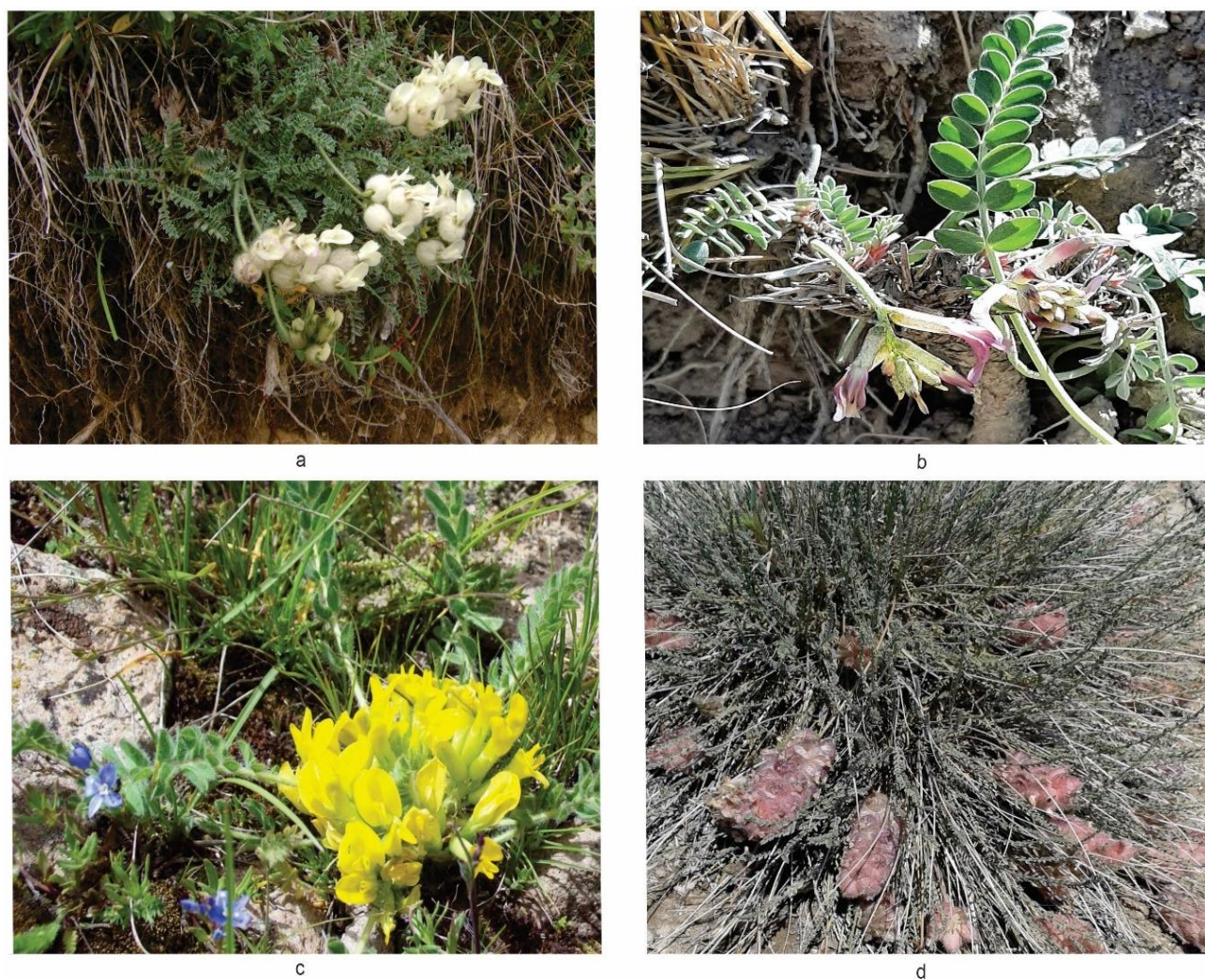


Fig. 2. Species of the genus *Astragalus* L. (Fabaceae) from the study area. **a:** *Astragalus wagneri* Bartl. ex Bunge; **b:** *Astragalus aznabjurticus* Grossh.; **c:** *Astragalus pinetorum* Boiss.; **d:** *Astragalus szovitsii* Fisch. et C.A.Mey. Photo by D. Ganbarov.



Fig. 3. Species of the genus *Rosa* L. (Rosaceae) from the study area. **a:** *Rosa azerbaijdzhanica* Novopokr. & Rzazade; **b:** *Rosa nisami* Sosn. Photo by N. Abbasov.

The initial rise in sea level during the Upper Cretaceous period was marked by the submergence of extensive areas of the Earth's surface. Only the peaks of the high mountains remained as islands, providing conditions for the settlement of migrating plant specimens. Their adaptation and settlement led to the gradual formation of biodiversity, and the prolonged evolutionary process resulted in the emergence of new forms (endemics). As early as 1888, researchers studying the flora of the Tien Shan suggested the possibility of autochthonous development of the principal elements of the high-mountain flora, arising from the transformation of local plants that were not originally adapted to high mountainous conditions. Moreover, it has been observed that each of these taxa possesses a more or less well-developed autochthonous core at its base. Similarly, these processes occurred in the high-mountain belts of the Zangazur and Daralayaz ranges, where ancient plant species that migrated to the region in various means (water and wind) underwent diverse changes under the influence of local environmental conditions, leading to the emergence of new local forms. These new initial endemic forms, which formed in the high mountain belts of the Zangazur and Daralayaz ranges, gradually specialized in a long evolutionary process and formed local endemic species. New plant species that were formed in the high mountain belts during a long evolutionary process and that had previously migrated to these areas gradually expanded into the lower belts as the waters receded. Plant species that adapted to the ecological conditions of these new areas developed by acquiring new habitats, whereas those unable to adapt gradually became extinct. Not every species is able to survive during migration. It has been conclusively proven that the species *Dryas octopetala*, *Salix herbacea* migrated to Central Europe at a specific point in Earth's history, subsequently becoming extinct in its lowland regions.

Most endemic species are found at altitudes of 1000-2800 m above sea level. In this context, it can be stated that the proportion of endemic species increases with altitude. Although the number of endemic taxa above 2800 m is relatively low, their representation within the total flora is high (Gemici *et al.*, 1992).

The study concluded that a variety of events occurred in the region, leading to species migration and the emergence of new species.

During the Miocene, significant tectonic processes took place on the Eurasian continent as a consequence of the retreat of the ancient Tethys Sea from Southwest Asia. In the Middle Miocene, the Tethys Sea was divided into eastern and western parts, and this barrier caused major changes in Europe. In particular, the retreat of the sea from the region has led to an increase in the height of the mountains, the formation of mountain belts in the area, and most importantly, the development of altitude-related climatic differences. Thus, the retreat of the ancient Tethys Sea during the Miocene epoch led to the emergence of vast land areas in the early Tertiary period (part of the Paleogene, Neogene, and Anthropogene (IV epoch)) or earlier, and later, the formation of local vegetation cover occurred as a result of the migration of various steppe and desert elements and some species of local flora from neighboring regions to these areas.

Climatic and geodynamic changes have fostered the development of unique regional phenomena, environments, and floral communities, with migration, adaptation, extinction, and rapid evolution of plant species driving their

formation. Thus, plant species and new forms that inhabited high mountain belts migrated to lower belts.

The decrease in water levels has led to an increase in the height of the mountains, which in turn resulting in the climate differences in the mountains depending on altitude. As a result, climatic conditions have significantly affected vegetation, creating significant changes. Further development of species under the influence of climatic factors is controlled by the three conditions: migration; adaptation; extinction.

The migration of plant species within high-mountain belts has occurred in the context of changing climatic zones, reflecting their capacity to extend beyond the boundaries of their previous ranges. Migration could occur either by wind or by water. During this process, plant species migrate and settle over various distances, both near and far. This process is similar to the migration of coastal plants to the bottom of reservoirs after water is drained. As a result of migration, species adapt to new ecological conditions by expanding beyond their ranges. The positive outcome of migration depends on the adaptation of the species. It is evident that plant migration from various sources into the region occurs, and these migratory elements play an important role in the formation of the flora. There has also been a migration of endemics formed in the region to other places (*Nepeta racemosa* subsp. *haussknechtii* (Bornm.) A.L. Budantsev (syn. *Nepeta noraschenica* Grossh.), *Koeleria macrantha* subsp. *macrantha* (syn. *Koeleria bitzenachica* (Tzvelev) Tzvelev), *Astragalus pinetorum* Boiss. (syn. *Astragalus badamliensis* Chalilov), *Astragalus wagneri* Bartl. ex Bunge (syn. *Astragalus karakuschensis* Gontsch).

Adaptation is an evolutionary process that results in the emergence of migrating past and new forms as a result of adaptation to changing new environmental conditions. In some cases, this process results in the formation of new forms that are highly adapted to new ecological conditions. The future development of endemic species depends on the outcome of adaptation. If, for any reason, endemic species fail to adapt to changing climatic conditions and sustain their development, or cannot persist within their distribution area, or migrate to other areas without successfully adapting, their extinction (complete extinction) becomes inevitable. When endemic species exceeded their adaptive capacity (when it was impossible), they responded to habitat change with individual or mass extinctions.

Climate change represents a major threat to native species inhabiting high-mountain ecosystems. As temperatures and weather patterns gradually change, the displacement of many endemic species has resulted in alterations in their adaptation and distribution. In particular, since water withdrawal has facilitated the expansion of the ranges of endemic species and the spread of these species to wider areas, some factors that facilitate the formation of intraspecific polymorphism (change in plant life form, increase or decrease in area size, variability in reproduction type, etc.), especially the expansion of the range, have had a strong impact on the formation of intraspecific polymorphism.

The variability of climatic factors, the influence of diverse ecological factors, and the relatively high humidity in mountainous areas have caused changes in physiological processes of plant species, which has contributed to the emergence of various life forms. High levels of climatic factors, solar radiation, and ultraviolet rays lead to specific biochemical processes in living nature, which are reflected in the geochemical properties of the environment. In

particular, changes in orographic processes (geographical isolation) have contributed to the formation of new forms.

Since the adaptation of close groups of organisms to abrupt environmental changes facilitates the formation of new local endemic forms, several distinct forms within the same species have emerged, (in color, size, behavior) and these forms may represent the early stages in the evolutionary formation of new endemic species. Endemic plant species (these were the embryos of endemic plant species that first appeared in these areas) formed during a long evolutionary process as a result of historical development of species that migrated to the region (to the high mountain areas of the Zangazur and Daralayaz ranges)

during different geological periods gradually formed in diverse ecological conditions throughout the region and began to migrate to the region and neighboring areas.

The main elements of the region's high mountain flora have reached their present level as a result of the development of autochthonous species formed over a long evolutionary process in certain historical and geographical conditions, that is, through the formation of endemic and relict plant species.

As a result of the study, out of 51 endemic plant species found in the region, 10 species are endemic to Nakhchivan, 21 species to Azerbaijan, and 20 species to the Caucasus (Table 1).

Table 1. Endemic species found in the flora of Nakhchivan AR.

No.	Name of endemic species	Endemic to the Caucasus	Endemic to Azerbaijan	Only to Nakh. AR
1.	<i>Iris hyrcana</i> Woronow ex Grossh.		+	
2.	<i>Linum subbiflorum</i> Juz.	+		
3.	<i>Bromus induratus</i> Hausskn. & Bornm. (syn. <i>Bromopsis nachiczewanica</i> (Tzvelev) Holub)	+		
4.	<i>Scilla mischtschenkoana</i> Grossh.	+		
5.	<i>Pseudoroegneria heidemaniae</i> (Tzvelev) Á.Löve		+	
6.	<i>Bromus commutatus</i> subsp. <i>commutatus</i>		+	
7.	<i>Koeleria macrantha</i> subsp. <i>macrantha</i>		+	
8.	<i>Stipa issaevii</i> Mussajev & Sadychov		+	
9.	<i>Stipa karjaginii</i> Mussajev & Sadychov		+	
10.	<i>Delphinium lomakinii</i> Kem.-Nath.			+
11.	<i>Salsola futilis</i> İljin			+
12.	<i>Hypericum helianthemoides</i> (Spach) Boiss. (syn. <i>Hypericum atropatanum</i> Rzazade)		+	
13.	<i>Hypericum nachitshevanicum</i> Grossh.			+
14.	<i>Aethionema edentulum</i> N. Busch	+		
15.	<i>Atropatenia rostrata</i> (N.Busch) F.K. Mey.			+
16.	<i>Peltariopsis grossheimii</i> N. Busch		+	
17.	<i>Cymatocarpus grossheimii</i> N. Busch		+	
18.	<i>Crambe grossheimii</i> I.I. Khalilov			+
19.	<i>Crataegus pseudoazarolus</i> Popov			+
20.	<i>Crataegus eriantha</i> Pojark.	+		
21.	<i>Sorbus caucasica</i> Zinserl.	+		
22.	<i>Rosa azerbaijdzhunica</i> Novopokr. & Rzazade	+		
23.	<i>Rosa karjaginii</i> Sosn.	+		
24.	<i>Rosa nisami</i> Sosn.	+		
25.	<i>Rosa sosnovskyana</i> Tamam.	+		
26.	<i>Astragalus pinetorum</i> Boiss.		+	
27.	<i>Astragalus brevipes</i> Bunge		+	
28.	<i>Astragalus wagneri</i> Bartl. ex Bunge		+	
29.	<i>Astragalus chalilovii</i> Grossh.	+		
30.	<i>Astragalus szovitsii</i> Fisch.et C.A. Mey.	+		
31.	<i>Astragalus aznabjurticus</i> Grossh.	+		
32.	<i>Astragalus ordubadensis</i> Grossh.	+		
33.	<i>Lathyrus atropatanus</i> (Grossh.) Sirj		+	
34.	<i>Trifolium biebersteinii</i> Chalilov			+
35.	<i>Securigera hyrcana</i> (Prilipko) Czerep.		+	
36.	<i>Galium achurense</i> Grossh.		+	
37.	<i>Galium verum</i> L.		+	
38.	<i>Galium bullatum</i> Lipsky			+
39.	<i>Verbascum erivanicum</i> E. Wulf.	+		
40.	<i>Scrophularia nachitschevanica</i> Grossh.		+	
41.	<i>Scutellaria darriensis</i> Grossh.	+		
42.	<i>Scutellaria karjaginii</i> Grossh.	+		
43.	<i>Scutellaria rhomboidalis</i> Grossh.	+		
44.	<i>Marrubium propinquum</i> Fisch. & C.A. Mey.	+		
45.	<i>Nepeta racemosa</i> subsp. <i>haussknechtii</i> (Bornm.) A.L. Budantsev		+	
46.	<i>Stachys fominii</i> Sosn. ex Grossh.		+	
47.	<i>Salvia suffruticosa</i> Montbret & Auch. ex Benth.		+	
48.	<i>Carduus onopordioides</i> Fisch. ex M.Bieb.		+	
49.	<i>Psephellus araxinus</i> (Gabrieljan) Greuter			+
50.	<i>Crepis karakuschensis</i> Gzer.			+
51.	<i>Helichrysum araxinum</i> Takht. ex Kirp.	+		

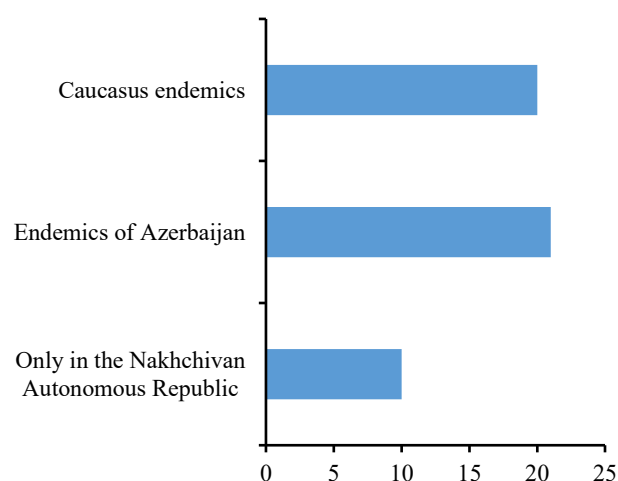


Fig. 4. Number dynamics of endemics by region.

As shown in the table, the number of endemic and subendemic species in Azerbaijan is equal (Fig. 4). Among the endemic species distributed only in the Nakhchivan AR, the localities of 10 species have been identified and mapped (Fig. 5). Additionally, 15 endemic species from the region have been included in the “Red Book” of the Republic of Azerbaijan and assessed according to IUCN criteria (Table 2). Furthermore, 4 species have been assessed internationally by the IUCN.

In terms of growth habit, the vast majority of species (39/51, ~76%) are herbs, while the remainder consists of subshrubs (5), shrubs (5), and trees (2). From the perspective of life form, the hemicryptophyte form clearly

predominates (~38 species), followed by chamaephyte (9), phanerophyte (3), and cryptophyte (1) — a composition that is characteristic of vegetation adapted to arid and mountainous conditions (Table 3).

Regarding population size, the majority of species (46/51, ~90%) have this indicator marked as “Not registered.” This should not be interpreted simply as the absence of a population, but rather as reflecting the fact that these species have not yet been thoroughly studied, have not undergone field assessment, or that insufficient monitoring data has been collected — in other words, this corresponds to a “data deficient” status. Such species have not yet been evaluated for the Red List, or sufficient scientific grounds for their assessment have not yet been accumulated. Concrete numerical figures are available for only 5 species: *Rosa nisami* (≥ 1200), *Rosa karjaginii* (≥ 1000), *Scilla mischtschenkoana* (100–150), *Astragalus pinetorum* (≤ 100), and *Hypericum helianthemoides* (~50 mature individuals).

As for distribution range, most species have been recorded at only a single location, which points to a narrow range and a likely endemic or rare distribution pattern. This picture — combining both a lack of sufficient population data and a restricted distribution area — suggests that this material likely relates to the preliminary assessment, for the Red Book, of rare plant species that may be threatened with extinction or have not yet been fully evaluated. Finally, the microhabitat descriptions make clear that most species are distributed on stony, gravelly, arid slopes in the lower and middle mountain belts — flora adapted to arid mountain ecosystems, with representatives of the genera *Astragalus*, *Scutellaria*, and *Rosa* being particularly notable.

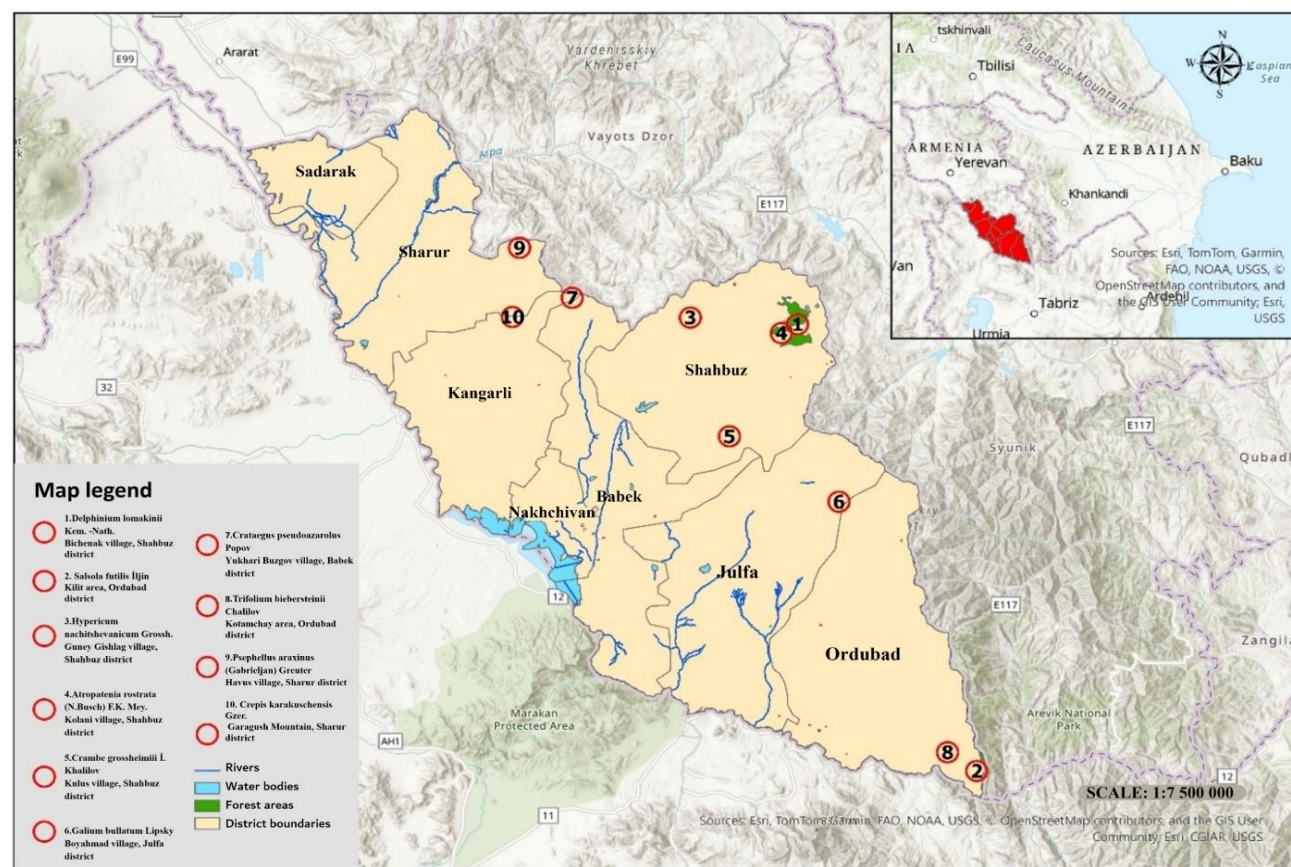


Fig. 5. Distribution of endemic species characteristic only for the Nakhchivan AR.

Table 2. Regional and international assessment of subendemics in the Nakhchivan AR.

No.	Name of endemic species	Red Book of		International assessment (IUCN, 2026)
		Azerbaijan RB (2023)	Nakhchivan AR RB (2010)	
1.	<i>Scilla mischtschenkoana</i> Grossh.	VU D2	VU B2bc (i)	-
2.	<i>Stipa issaevii</i> S.G. Musajev et Sadychov	-	CR B1ac (i)	-
3.	<i>Stipa karjaginii</i> S.G. Musajev et Sadychov	-	VU A2cd; B1b (ii, iii) c (ii, iii)	-
4.	<i>Hypericum helianthemoides</i> (Spach) Boiss. (syn. <i>H. atropatanum</i> Rzazade)	VU D2	-	-
5.	<i>Rosa azerbaijdzhanica</i> Novopokr. & Rzazade	EN B1ab (i, iii) +2b (ii, iii, v)	-	-
6.	<i>Rosa karjagini</i> Sosn.	NT	CR A3c; C2a (i)	-
7.	<i>Rosa nisami</i> Sosn.	NT	EN B2ac (iii)	-
8.	<i>Rosa sosnovskyana</i> Tamam.	EN B2ab (ii, iii, iv, v)	VU A2cd; B1b (ii) c (iii)	-
9.	<i>Astragalus pinetorum</i> Boiss.	CR A2c+3c; B1ac (i)+2ab (i, ii, iii)	-	-
10.	<i>Astragalus szovitsii</i> Fisch.et C.A. Mey.	VU A2c+3c	VU C2a(i)	-
11.	<i>Astragalus aznabjurticus</i> Grossh.	EN B1ab (i, ii, iii) +2ab (ii, iii, v)	-	-
12.	<i>Astragalus ordubadensis</i> Grossh.	CR B2a	-	-
13.	<i>Scrophularia nachitschevanica</i> Grossh.	DD	-	-
14.	<i>Scutellaria darriensis</i> Grossh.	VU D2	-	-
15.	<i>Marrubium propinquum</i> Fisch. & C.A. Mey.	NT	-	-
16.	<i>Stachys fominii</i> Sosn. ex Grossh.	-	-	LC
17.	<i>Galium verum</i> L.	-	-	LC
18.	<i>Crataegus eriantha</i> Pojark	-	-	VU B2ab (ii, iii)
19.	<i>Scutellaria rhomboidalis</i> Grossh.	-	-	CR B1ab (i, ii, v) +2ab (i, ii, v)

Changes in the physical and geographical conditions of mountainous regions push ecological conditions beyond their limits in the alpine zone, result in a pronounced impoverishment of biocenotic composition. As a consequence, the harsh climatic conditions of the alpine zone have led to the spread, migration, or extinction of newly adapted endemic species, resulting in a gradual decline in their populations. While endemic species are relatively abundant in the mid-mountain (subalpine) zones, their decline in the alpine zone is associated with the predominance of mono- (oligo-) environmental conditions. In other words, within the ecological complex of alpine zone habitats, one or several factors predominate which are decisive for the entire life activity of the plant.

The criterion of endemism is the concentration of a species to a specific locality and its restriction to a limited area. Species with similar status act as an indicator of the originality of the studied flora and its difference from other floras. Furthermore, endemism represents an important component of biodiversity, particularly in mountainous areas that are more elevated than plains (Grossheim, 1936; Murtazaliev, 2011).

Geographic isolation, climatic and edaphic factors, and biotic and abiotic factors are of particular importance in the development of endemism. A plant species that had a wide distribution range during a certain geological period may subsequently disappear as environmental conditions change. Individuals capable of adapting to new ecological conditions and finding refuges through migration can continue their existence under specific ecological conditions. The formation of endemic plant species in the high mountain flora of Zangazur and Daralayaz is determined by a complex set of geological, climatic and geographical factors. In particular, significant elevation differences in the relief create conditions for the formation of altitudinal zones in the flora. The migration of endemic plant species to lower elevations and the presence of endemic species that thrive in local conditions play a major role.

Of course, plant migration from various areas to the region is undeniable. In particular, the migration of floristic elements from Western Asia, Central Asia, Mediterranean Region, Caucasus and the north played an important role in the formation of the region's flora. "The study revealed that, of the 51 endemic species present in the region, 26 migrated from other areas and entered in the flora of the region under question. These endemic plant species include the following: *Iris hyrcana* Woronow ex Grossh., *Linum subbiflorum* Juz. (avtotrof), *Scilla mischtschenkoana* Gros., *Pseudoroegneria heidemaniae* (Tzvelev) Å.Löve, *Stipa issaevii* S.G. Musajev et Sadychov, *Stipa karjaginii* S.G. Musajev et Sadychov, *Peltariopsis grossheimii* N. Busch, *Cymatocarpus grossheimii* N. Busch, *Verbascum erivanicum* E. Wulf. and etc.

Similarly, there are many endemic plant species that have evolved over a long evolutionary process in the local flora, migrating from the region to the surrounding areas. Examples of endemic species that have migrated to regions outside the area and are currently doing so include *Bromus commutatus* subsp. *commutatus* (syn. *Bromus tzelevii* S.G. Mussajev), *Koeleria macrantha* subsp. *macrantha* (syn. *Koeleria bitzenachica* (Tzvel.) Tzvel.), *Rosa azerbaijdzhanica* Novopokr. & Rzazade, *Rosa nisami* Sosn., *Astragalus wagneri* Bartl. ex Bunge, *Astragalus chalilovii* Grossh., *Astragalus nachitschevanicus* Rzazade, *Galium achurense* Grossh., *Galium verum* L., *Scrophularia nachitschevanica* Grossh (Table 4). At present, 25 local endemic plant species have been identified as migrating from the region to adjacent areas. These species have been frequently found in the flora of Iran and Armenia, especially recently.

Of the 51 endemic plant species included in the high mountain flora of Zangazur and Daralayaz, 25 were formed autochthonously, meaning that the endemic species in these areas emerged and developed independently from the migration of new species to the area from other regions. The region's endemic species did not originate from the migration of new species from elsewhere, but from ancient local elements that developed in the area through a long evolutionary process under high-mountain conditions.

Table 3. Biocological and population characteristics of endemic plant species distributed in the Nakhchivan Autonomous Republic.

Species	Growth habit	Microhabitat	Life form (Raunkiaer classification)	Estimated population size	Number of locations
<i>Iris hyrcana</i> Woronow ex Grossh.	Herb	On grassy slopes	Cryptophyte	Not registered	1 location
<i>Linum subofficinarum</i> Juz.	Herb	Dry slopes and rocky areas	Hemicryptophyte	Not registered	1 location
<i>Bromus indianus</i> Hausskn. & Bornm. (syn. <i>Bromopsis nachtschewanica</i> (Tzvelev) Holub)	Herb	Dry slopes and rocky, steppe, edges and sparse forests	Hemicryptophyte	Not registered	1 location
<i>Scilla mischtschenkiana</i> Grossh.	Herb	Clayey, rocky and gravelly slopes, in the alpine zone	Hemicryptophyte	Approximately 100-150 mature individuals	2 locations
<i>Pseudoroegneria heidenianae</i> (Tzvelev) A. Love	Herb	Rocky, petrophilic habitats	Hemicryptophyte	Not registered	3 locations
<i>Bromus commutatus</i> subsp. <i>commutatus</i>	Herb	Rocky and gravelly slopes	Hemicryptophyte	Not registered	1 location
<i>Koeleria macrantha</i> subsp. <i>macrantha</i>	Herb	Stone slopes and outcrops of rocks, sandy areas	Hemicryptophyte	Not registered	1 location
<i>Stipa issaevii</i> S. G. Musajev et Sadychov	Herb	Dry rocky, sandy and grassy slopes	Hemicryptophyte	Not registered	1 location
<i>Stipa karjaginii</i> S. G. Musajev et Sadychov	Herb	Rocky and gravelly slopes	Hemicryptophyte	Not registered	2 locations
<i>Delphinium lomakinii</i> Kenu. -Nath.	Herb	Alpine meadows	Hemicryptophyte	Not registered	1 location
<i>Salix filifolia</i> Tjinn	Subshrub	Clayey and rocky slopes	Chamaephyte	Not registered	1 location
<i>Hypericum helianthemoides</i> (Spach) Boiss.	Subshrub	Dry rocky slopes	Chamaephyte	Approximately 50 mature individuals	1 location
<i>Hypericum nachtschewanicum</i> Grossh.	Herb	Dry rocky and grassy slopes	Chamaephyte	Not registered	1 location
<i>Aethionema edentulum</i> N. Busch	Subshrub	Dry rocky slopes	Chamaephyte	Not registered	1 location
<i>Anagallis rostrata</i> (N. Busch) F. K. Mey.	Subshrub	Rocky places	Chamaephyte	Not registered	1 location
<i>Peltiopis grossheimii</i> N. Busch	Herb	Rocky and calcareous slopes	Hemicryptophyte	Not registered	1 location
<i>Cymatocarpus grossheimii</i> N. Busch	Herb	On dry, stony slopes	Hemicryptophyte	Not registered	1 location
<i>Crambe grossheimii</i> I. I. Khalilov	Herb	On rocky slopes, scree and rock outcrops	Hemicryptophyte	Not registered	1 location
<i>Crotogeus pseudocarolus</i> Popov	Tree	On mountain slopes, forest edges, and sparse forests	Phanerophyte	Not registered	1 location
<i>Crotogeus oriantalis</i> Pojark	Shrub / Tree	On stony slopes	Phanerophyte	Not registered	4 locations
<i>Sorbus caucasica</i> Zusselt	Shrub	On gravelly and stony slopes	Phanerophyte	Not registered	3 locations
<i>Rosa azerbaijatica</i> Novopokr. & Rzanade	Shrub	On rocky slopes	Chamaephyte	Not registered	7 locations
<i>Rosa karjaginii</i> Sosn.	Shrub	Gravel and rocky slopes	Chamaephyte	Approximately mature individuals ≥ 1000	1 location
<i>Rosa nisami</i> Sosn.	Shrub	In the forest	Chamaephyte	Approximately mature individuals ≥ 1200	4 locations
<i>Rosa sornskiyana</i> Tamam	Shrub	In dry, mountainous areas	Chamaephyte	Not registered	2 locations
<i>Asragalus piniotum</i> Boiss.	Herb	On dry, gravelly and stony slopes	Hemicryptophyte	Not registered	1 location
<i>Asragalus brevipes</i> Bunge	Herb	On dry, gravelly and stony slopes	Hemicryptophyte	Not registered	1 location
<i>Asragalus wagneri</i> Bartl. ex Bunge	Herb	On dry, gravelly and stony slopes	Hemicryptophyte	Not registered	1 location
<i>Asragalus chailovii</i> Grossh.	Herb	Limestone outcrops	Hemicryptophytes	Not registered	4 locations
<i>Asragalus zovitsii</i> Fisch et C. A. Mey.	Herb	Dry, gravelly, clayey, stony-rocky and grassy slopes	Hemicryptophytes	Not registered	1 location
<i>Asragalus aznaburticus</i> Grossh.	Herb	Dry, gravelly and stony slopes	Hemicryptophyte	Not registered	1 location
<i>Asragalus orbudensis</i> Grossh.	Herb	Gravelly and limestone slopes	Hemicryptophyte	Not registered	2 locations
<i>Lathyrus arpatanus</i> (Grossh.) Surj	Herb	In upper mountainous meadows	Hemicryptophyte	Not registered	1 location
<i>Trifolium biebersteinii</i> Chailov	Herb	In meadows, forest edges	Hemicryptophyte	Not registered	1 location
<i>Securigera hyrcana</i> (Prilipko) Czer.	Herb	In meadows, forests and bushes	Hemicryptophyte	Not registered	4 locations
<i>Gallium achurense</i> Grossh.	Herb	On stony and gravelly slopes	Hemicryptophyte	Not registered	1 location
<i>Gallium verum</i> L.	Herb	On steppe slopes	Hemicryptophyte	Not registered	1 location
<i>Gallium bullatum</i> Lipsky	Herb	On dry, in middle mountainous belts	Hemicryptophyte	Not registered	1 location
<i>Verbascum arvanicum</i> E. Wulf	Herb	On rocky and limestone slopes, river pebbles	Hemicryptophyte	Not registered	2 locations
<i>Scrophularia nachtschewanica</i> Grossh.	Herb	On dry, clayey and stony slopes, on rocky debris	Hemicryptophyte	Not registered	2 locations
<i>Scutellaria darritensis</i> Grossh.	Herb	On dry clayey and stony-rocky slopes	Hemicryptophyte	Not registered	1 location
<i>Scutellaria karjaginii</i> Grossh.	Herb	On clayey and rubble slopes, scree, limestone	Hemicryptophyte	Not registered	1 location
<i>Scutellaria rhomboidalis</i> Grossh.	Herb	On gravel and dry slopes	Hemicryptophyte	Not registered	1 location
<i>Marrubium propinquum</i> Fisch. & C. A. Mey.	Herb	On dry clay and stony slopes	Hemicryptophyte	Not registered	1 location
<i>Nepeta racemosa</i> subsp. <i>hirsuticnehrni</i> (Bornm.) A. L. Budantsev	Herb	On stony slopes	Hemicryptophyte	Not registered	2 locations
<i>Stachys fominii</i> Sosn. ex Grossh.	Herb	On dry, stony slopes	Hemicryptophyte	Not registered	1 location
<i>Salvia suffruticosa</i> Montbret & Auch. ex Benth.	Subshrub	On clay and stony slopes	Chamaephyte	Not registered	1 location
<i>Carduus onopordoides</i> Fisch. ex M. Bich	Herb	On dry clayey, gravelly, rocky slopes, stone scree, on pebbles of dried-up rivers	Hemicryptophyte	Not registered	3 locations
<i>Psophellus araxinus</i> (Gabeljan) Greuter	Herb	Dry rocky and gravelly slopes, steppe areas	Hemicryptophyte	Not registered	1 location
<i>Crepis karakuschensis</i> Gzer.	Herb	On rocky slopes and scree	Hemicryptophyte	Not registered	1 location
<i>Helichrysum araxinum</i> Taktik ex Kerp	Herb	On dry stony slopes	Hemicryptophyte	Not registered	1 location

Table 4. Subendemic species that migrate from the region to outside areas and species that have migrated from outside areas into the region.

No.	Name of endemic species	Migration	
		To the area	From the area
1.	<i>Iris hyrcana</i> Woronow ex Grossh.	+	
2.	<i>Linum subbiflorum</i> Juz.	+	
3.	<i>Bromus induratus</i> Hausskn. & Bornm.	+	
4.	<i>Scilla mischtschenkoana</i> Gros.	+	
5.	<i>Pseudoroegneria heidemaniae</i> (Tzvelev) Á.Löve	+	
6.	<i>Bromus commutatus</i> subsp. <i>commutatus</i>		+
7.	<i>Koeleria macrantha</i> subsp. <i>macrantha</i>		+
8.	<i>Stipa issaevii</i> S.G. Musajev et Sadychov	+	
9.	<i>Stipa karjaginii</i> S.G. Musajev et Sadychov	+	
10.	<i>Delphinium lomakinii</i> Kem. -Nath.		+
11.	<i>Salsola futilis</i> Iljin		+
12.	<i>Hypericum helianthemoides</i> (Spach) Boiss. (syn. <i>Hypericum atropatanum</i> Rzazade)		+
13.	<i>Hypericum nachitshevanicum</i> Grossh.		+
14.	<i>Aethionema edentulum</i> N.Busch	+	
15.	<i>Atropatenia rostrata</i> (N.Busch) F.K. Mey.		+
16.	<i>Peltariopsis grossheimii</i> N. Busch	+	
17.	<i>Cymatocarpus grossheimii</i> N. Busch	+	
18.	<i>Crambe grossheimii</i> İ. Khalilov		+
19.	<i>Crataegus pseudoazarolus</i> Popov		+
20.	<i>Crataegus eriantha</i> Pojark	+	
21.	<i>Sorbus caucasica</i> Zinserl.	+	
22.	<i>Rosa azerbaijdzhanica</i> Novopokr. & Rzazade		+
23.	<i>Rosa karjaginii</i> Sosn.	+	
24.	<i>Rosa nisami</i> Sosn.		+
25.	<i>Rosa sosnovskyana</i> Tamam.	+	
26.	<i>Astragalus pinetorum</i> Boiss.		+
27.	<i>Astragalus brevipes</i> Bunge	+	
28.	<i>Astragalus wagneri</i> Bartl. ex Bunge		+
29.	<i>Astragalus chalilovii</i> Grossh.		+
30.	<i>Astragalus szovitsii</i> Fisch.et C.A.Mey.	+	
31.	<i>Astragalus aznabjurticus</i> Grossh.		+
32.	<i>Astragalus ordubadensis</i> Grossh.	+	
33.	<i>Lathyrus atropatanus</i> (Grossh.) Sirj		+
34.	<i>Trifolium biebersteinii</i> Chalilov		+
35.	<i>Securigera hyrcana</i> (Prilipko)Czer	+	
36.	<i>Galium achureense</i> G.rossh		+
37.	<i>Galium verum</i> L.		+
38.	<i>Galium bullatum</i> Lipsky		+
39.	<i>Verbascum erivanicum</i> E. Wulf.	+	
40.	<i>Scrophularia nachitschevanica</i> Grossh.		+
41.	<i>Scutellaria darriensis</i> Grossh.	+	
42.	<i>Scutellaria karjaginii</i> Grossh.	+	
43.	<i>Scutellaria rhomboidalis</i> Grossh.	+	
44.	<i>Marrubium propinquum</i> Fisch. & C.A. Mey.	+	
45.	<i>Nepeta racemosa</i> subsp. <i>haussknechtii</i> (Bornm.) A.L. Budantsev		+
46.	<i>Stachys fominii</i> Sosn. ex Grossh.	+	
47.	<i>Salvia suffruticosa</i> Montbret & Auch. ex Benth.	+	
48.	<i>Carduus onopordioides</i> Fisch. ex M.Bieb.		+
49.	<i>Psephellus araxinus</i> (Gabrieljan) Greuter		+
50.	<i>Crepis karakuschensis</i> Gzer.		+
51.	<i>Helichrysum araxinum</i> Takht. ex Kirp.	+	

Mechanisms and historical stages of endemism formation: The formation of endemic species in the Nakhchivan region occurred mainly in three geological stages: Miocene period - the emergence of the primary mountain flora as a result of the withdrawal of the Tethys Sea and the activation of orogenesis (the formation and rise of mountains) processes; Pliocene epoch - a change in the composition of phytocenoses and the emergence of species adapted to new climatic conditions as a result of a decrease in temperature and the occurrence of drought; The fourth period is characterized by the persistence of endemic species within restricted areas (narrow endemics) as a consequence of environmental and climatic changes, accompanied by their morphological, genetic, and ecological differentiation through adaptation to diverse ecological conditions within limited territories.

The natural barriers (mountain ranges, valleys, and river systems) that emerged during these stages limited gene exchange between species, leading to differentiation in local populations and the emergence of new endemic forms.

Many modern endemic species are few in number and have limited ranges. Many of them are distributed only in certain ecological areas - dry slopes, cliffs, mountain meadows and watersheds. Some species are *Crataegus pseudoazarolus* Popov (*Crataegus cinovskisii* Kassymova), *Astragalus pinetorum* Boiss. (*Astragalus badamliensis* Chalilov), *Astragalus wagneri* Bartl. ex Bunge (*Astragalus karakuschensis* Gontsch), *Lathyrus atropatanus* (Grossh.) Sirj. (*Orob. atropatanus* Grossh.), *Trifolium biebersteinii* Chalilov, *Galium bullatum* Lipsky, *Crepis karakuschensis* Gzer.

The results of the research show that a comprehensive approach is essential to ensure the protection and sustainable development of endemic species in the flora of Nakhchivan. The following measures are recommended for this:

- The mapping of endemic species' distribution ranges, identification of their habitats, and systematic monitoring of their ecological characteristics should be conducted on a scientific basis;
- The *in-situ* (in natural habitats) and *ex-situ* (in botanical gardens and seed banks) conservation of especially rare and sparsely distributed endemic species should be strengthened;
- The distribution dynamics of endemic species should be analyzed in order to assess the impact of climate change on their distribution;
- The study of the genetic diversity and population dynamics of endemic species is recommended as a new research direction.

Thus, the formation of endemic species in the flora of Nakhchivan AR should be regarded as a result of the region's unique natural-geographical conditions and long-term ecological-evolutionary processes. The protection of these plants is important for preserving regional biological diversity and for facilitating a deeper scientific study of the evolutionary history of the flora of Nakhchivan AR.

Thus, the genesis of the endemic elements of the high-mountain flora of region is the result of the complex interaction of relief, climate, and migration processes, leading to the formation of unique plant communities.

Conclusions

The formation of endemic species within the flora of the Nakhchivan AR is closely related to the influence of

long-term geological and climatic processes, the diverse relief structure, and the existence of various microclimate zones. At the same time, these processes have led to the creation of natural geographical isolation conditions in the region and the spatial separation of populations. The presence of 51 endemic species within the flora proves the phytogeographical originality of the region and its significant role in the florogenesis of the Caucasus. The application of paleobotanical and molecular genetic methods in future studies will enable a more detailed study of the evolutionary relationships among endemic species.

The following results were obtained during research conducted to study the formation of endemic species in the high mountain belts of Zangazur and Daralayaz ranges.

As a result of the study, it was determined that out of 51 endemic plant species belonging to 15 families and 33 genera in the region, 20 species are endemic to the Caucasus, 21 species to Azerbaijan, and 10 species to the Nakhchivan AR (map 1).

It was determined that out of 51 endemic plant species belonging to 15 families and 33 genera existing in the region, 26 species migrated to the region from other areas, while 25 species of endemic plants were formed autochthonously in the region and are migrating to neighboring areas.

At the end of the research, it was concluded that:

1. During the migration of endemic plants to ecogeographical similar areas, favorable ecological conditions promote a high adaptive capacity, resulting in relatively low mortality rates and creating conditions for an increase in the number of endemic species in those areas.
2. During the migration of endemic species to areas with markedly different ecogeographical characteristics, mortality rates are high due to their limited capacity to adapt to the prevailing ecological conditions.
3. On the other hand, seed dispersal in plants also depends on the size of the radius of the activity of the individual species. In other words, as the distance increases, the intensity of plant seed dispersal becomes weaker. Therefore, for instance, the dispersal of plant seeds from the alpine zone to the plains should be assessed in relation to distance.

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taxonomic verification, literature analysis; **Khudaverdiyeva Samira**: field investigation, collection of floristic and distributional data; **Ibrahimov Anvar**: literature review, data compilation and curation; **Mammadova Ulkar**: literature review, data compilation and curation; **Gurbanov Ali**: field investigation, collection and verification of distributional data.

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