

On the vegetation of the northern part of East Zangezur

Ibadullayeva Sayyara Jamshid, *Yusifov Elman Farhad

Institute of Botany, Ministry of Science and Education of the Republic of Azerbaijan, 40 Badamdar Highway, Baku AZ1004, Azerbaijan

***For correspondence:** *yusifov_e@yahoo.com*

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As a result of the conducted research, 124 species of plants belonging to 42 families were recorded in the subalpine and alpine landscapes of the area. The area has high endemism (39%). Thus, of the described species, 48 species belonging to 23 families are endemic species of different categories. Of them, 40 macroendemic species and 8 subendemic species belonging to 21 families were described. Five of the subendemic species are subendemic species for the Greater Caucasus, and three species are subendemic species for the Lesser Caucasus.

Keywords: *East Zangezur, landscapes, flora, alpine, subalpine, endemism*

INTRODUCTION

The northern part of East Zangezur mainly consists of subalpine and alpine belts. The study of high altitude is very important. Due to the extreme habitat of the area, the number of species distributed here is much smaller than in other zones. It is for this reason that the relationships between the widespread taxa and the limiting factors that surround them are relatively easy to identify and also have important scientific importance. On the other hand, the high altitude belt has high endemism. The study of the endemism of the area allows understanding of the mechanisms of florogenesis and speciation centers, to develop the theoretical basis of these processes.

On the other hand, the rational use of the natural resources of high-altitude landscapes for economic purposes remains an acute problem in the context of overgrazing. This problem is exacerbated by the fact that the territory remained neglected and out of control due to the long occupation. In this regard, the inventory of the vegetation of East Zangezur is also relevant in terms of the assessment of the category and status, as well as the resource potential of the species distributed here.

MATERIALS AND METHODS

As a result of the geobotanical research conducted during the period before the occupation of East Zangezur by the Armenian armed forces, data and herbarium specimens of 83 species belonging to 7 families were collected in the area. The main studies on taxa belong to families *Apiaceae* (21 species) and *Asteraceae* (50 species).

In the current year, monitoring and field-research works were carried out by us, information on 124 species belonging to 42 families found only in subalpine and alpine landscapes, including herbarium materials were collected.

The northern part of East Zangezur economic region mainly covers Kalbajar administrative district and partly mountainous parts of Lachin district. The average annual precipitation here is 600 mm, the average temperature of the coldest month is -10-1°C, and the average temperature of the warmest month is 5-20°C.

The relief of the area is mainly mountainous (Fig. 1). Its territory is surrounded by Eastern Goycha in the northwest, Murovdag in the north, Karabakh ridges in the east, Karabakh plateau in the west. The main mountainous areas of the

territory are Gamishdag (3724 m), Delidag (3616 m), Sarjali (3433 m), Mikhtikan (3411 m), Ketidag (3399 m), Hinaldag (3367 m), Gelingaya (3335 m) peaks. The main water basins are Tartar (200 km), Levchay (140 km), Tutgunchay (136 km), Alagoller, Garagol, Zalkhagol lakes.



Fig. 1. East Zangezur location map

The area has a rich soil cover. Nine out of 14 soil types and subtypes spread in the area are found in subalpine-alpine landscapes: Mountain-forest brown leached; Floodplain meadow (alluvial meadow); Mountain meadow primitive; Mountain meadow soddy; Mountain forest meadow; Mountain forest brown typical; Mountain gray-brown dark; Mountain meadow dark and Mountain meadow black (National Atlas of Azerbaijan Republic, 2014).

The climate of the area is mild, with dry winters in the plains and lowlands, and cold in the high altitudes.

Mainly 2 landscapes are distributed in the area's high-altitude landscapes with vegetation. These are the following:

1. Nival, subnivale, partially-glacial

landscapes of high altitude mountains (3200-3600 m) landscapes;

2. Alpine and subalpine meadows of high-altitude mountains (1800 – 3200 m) landscapes;

The subalpine landscapes of East Zangezur are mainly distributed on the western slopes of the Karabakh ridge, the Karabakh plateau, the foothills of the Murovdag ridge, the eastern foothills of the Boyuk Isigli mountain at altitudes of 1800-2900 m depending on the exposure of the slopes, the mountain slopes and high plateaus in the surrounding areas of Kalbajar and Lachin cities (Fig. 2). Alpine landscapes of the area are found around the peaks of the area, Boyuk and Kichik Alagols (Kalbajar), Karagol, Jilli lake (Lachin) between 2300 - 2500 m and 3200 m altitude (Fig. 3). Subnival landscapes are mainly found in the form of small spots at altitudes of 3200-3600 m near the peak of Gamishdag, Hinaldag, Isikhli and Kilinjdag mountains. Above it is already permanent snow, glaciers and bare rocks. There is no vegetation in these areas. Only lichens belonging to their families (*Megasporaceae*, *Rhizocarpaceae*, *Verrucariaceae*, *Teloschistaceae*, etc.) and some microorganisms (*Naviculaceae*, *Chlamydomonadaceae*) are found here.

As mentioned above, we have recorded 124 background species belonging to 42 families in the area (Table 1). As can be seen from the table, *Asteraceae* (14 species), *Lamiaceae* (10 species), *Fabaceae* (10 species), *Scrophulariaceae* (9 species), *Campanulaceae* (6 species) and *Campanulaceae* (6 species) families are the dominant families which are in development.

RESULTS AND DISCUSSION

During the one-week expedition, the eastern slopes of the Karabakh plateau, the southern slopes of the Murovdag ridge and the western slopes of the Karabakh ridge were inspected, and the background species of the area were investigated. New ranges of some plants were identified.

Asyneuma campanuloides (M.Bieb. ex Sims) Bornm. plant was previously described only in Nakhchivan and Talysh in the territory of Azerbaijan (Asgarov, 2016). The mentioned plant was recorded by us from the territory of Lachin

district, Aghbulag village surroundings, from the alpine meadow.



Fig. 2. Subalpine landscapes of the area: a – Surroundings of Boyuk Alagol Lake (Kalbajar, 2780 m); b – Surroundings of Kichik Alagol Lake (Kalbajar, 2780 m); c – The foothills of Gatirdash mountain (Lachin, 2600 m); d – Surroundings of Keshdak village (Kalbajar, 1800 m)



Fig. 3. Alpine landscapes of the area: a – Omar pass (Kalbajar, 3200 m); b – Surroundings of Delidag (Kalbajar, 3000 m); c – The foothills of Gelingaya mountain (Lachin, 3100 m); d – Agbulag plateau (Lachin, 3000 m)

Table 1. Taxonomic structure of background species found in East Zangezur economic region

№	Family	Species
1.	Asteraceae Bercht. & J.Presl	<i>Achillea millefolium</i> L., <i>Anthemis iberica</i> M. Bieb. syn <i>A.cretica</i> subsp. <i>iberica</i> (M.Bieb.) Grierson , <i>Artemisia vulgaris</i> L., <i>Cirsium obvallatum</i> (M. Bieb.) Fisch., <i>C.kosmelii</i> (Adams) Fisch. ex Hohen. , <i>Erigeron caucasicus</i> Steven. , <i>E.venustus</i> Botsch. syn. <i>E.caucasicus</i> ssp. <i>venustus</i> (Botsch.) Grierson. , <i>Eupatorium cannabinum</i> L., <i>Inula helenium</i> L., <i>Psephellus transcaucasicus</i> Sosn. syn. <i>C.sevanensis</i> Sosn., <i>Senecio caucasigenus</i> Schischk., <i>Taraxacum stenolepium</i> Hand.-Mazz., <i>Tragopogon reticulatus</i> Boiss. & A.Huet
2.	Fabaceae Lindl.	<i>Astragalus aureus</i> Willd., <i>A.uraniolimneus</i> Boiss., <i>Colutea orientalis</i> Mill., <i>Lathyrus laxiflorus</i> (Desf.) Kuntze., <i>Lathyrus miniatus</i> M. Bieb. ex Steven, <i>Melilotus officinalis</i> (L.) Lam., <i>Onobrychis biebersteinii</i> Sirj., <i>O.cornuta</i> (L.) Desv., <i>O.radiata</i> (Desf.) M. Bieb., <i>Trifolium bordsilovskyi</i> Grossh.
3.	Lamiaceae Martinov.	<i>Betonica macrantha</i> K. Koch syn. <i>B.grandiflora</i>), <i>Lamium album</i> L., <i>Leonurus quinquelobatus</i> Gilib., <i>Mentha longifolia</i> (L.) Huds., <i>Nepeta pannonica</i> L., <i>Phlomis tuberosa</i> (L.) Moench., <i>Salvia nemorosa</i> (Klokov) Soó, <i>Scutellaria orientalis</i> L., <i>Scutellaria sedelmeyerae</i> Juz. , <i>Teucrium orientale</i> L.
4.	Scrophulariaceae Juss.	<i>Linaria grandiflora</i> Desf., <i>Linaria incomplete</i> Kuprian., <i>Melampyrum chlorostachyum</i> (Hohen.) Beauverd, <i>Rhynchocorys orientalis</i> (L.) Benth., <i>Scrophularia azerbaijanica</i> Grau, <i>Verbascum cheiranthifolium</i> Boiss, <i>V.marschallianum</i> Ivanina & Tzvelev, <i>V.oreophilum</i> K., <i>V.speciosum</i> Schrad
5.	Campanulaceae Juss.	<i>Asyneuma campanuloides</i> (M.Bieb. ex Sims) Bornm., <i>Campanula daralaghezica</i> (Grossh.) Kolak. & Serdyuk , <i>C.rapunculoides</i> L., <i>C.stevenii</i> M.Bieb, <i>C.trautvetteri</i> Grossh. ex Fed, <i>C.tridentata</i> Schreb.
6.	Papaveraceae Juss.	<i>Chelidonium majus</i> L., <i>Glaucium elegans</i> Fisch. & C.A.Mey., <i>Papaver dubium</i> L., <i>P.fugax</i> Poir., <i>P.orientale</i> L., <i>P.lacerum</i> Popov.
7.	Caryophyllaceae Juss.	<i>Dianthus integerrimus</i> Bunge., <i>D.orientalis</i> Adams., <i>Gypsophila</i> sp., <i>Silene caucasica</i> (Bunge) Boiss., <i>S.ruprechtii</i> Schischk. syn. <i>S.saxatilis</i> Sims.
8.	Boraginaceae Juss.	<i>Cynoglossum officinale</i> L., <i>Echium vulgare</i> L., <i>Huynhia pulchra</i> (Willd. ex Roemer & Schultes) Greuter & Burdet (M.echioides), <i>Myosotis alpestris</i> F.W.Schmidt., <i>Onosma caucasica</i> Levin.
9.	Ranunculaceae Juss.	<i>Delphinium albiflorum</i> DC., <i>Delphinium</i> sp., <i>Diedropetala freynii</i> (Conrath) Galushko, <i>Caltha palustris</i> L., <i>Thalictrum minus</i> L.
10.	Rosaceae Juss.	<i>Agrimonia eupatoria</i> L., <i>Alchemilla erythropoda</i> Juz_B., <i>Cerasus incana</i> syn. <i>Prunus incana</i> (Pall.) Batsch , <i>Filipendula ulmaria</i> (L.) Maxim., <i>Fragaria viridis</i> Weston.
11.	Caprifoliaceae Juss.	<i>Cephalaria gigantea</i> , <i>Cephalaria media</i> , <i>Scabiosa</i> sp., <i>Valeriana tiliifolia</i> Troickij
12.	Crassulaceae J.St.-Hil.	<i>Hylotelephium caucasicum</i> (Grossh.) H.Ohba syn. <i>Sedum caucasicum</i> (Grossh.) Boriss., <i>Sedum pentapetalum</i> Boriss., <i>S.stoloniferum</i> S.G.Gmel.
13.	Apiaceae Lindl.	<i>Ferula orientalis</i> L., <i>Heracleum trachyloma</i> Fisch. & Mey.
14.	Cannabaceae Martinov.	<i>Cannabis ruderalis</i> Janisch. syn. <i>C.sativa</i> , <i>Humulus lupulus</i> L
15.	Malvaceae Juss.	<i>Alcea rugosa</i> Alef., <i>Lavatera thuringiaca</i> L. syn. <i>Malva thuringiaca</i> (L.) Vis
16.	Orobanchaceae Vent.	<i>Pedicularis sibthorpii</i> Boiss., <i>Rhinanthus subulatus</i> (Chabert) Soó
17.	Polygonaceae Juss.	<i>Bistorta carnea</i> (K. Koch) Kom., <i>Rumex alpinus</i> L.
18.	Rhamnaceae Juss.	<i>Rhamnus cathartica</i> L., <i>R.pallacii</i> L.
19.	Valerianaceae Juss.	<i>Valeriana sisymbriifolia</i> Vahl., <i>V.tiliifolia</i> Troickij
20.	Solanaceae Juss.	<i>Hyoscyamus niger</i> L., <i>Lycium barbarum</i> L.
21.	Rubiaceae Juss.	<i>Galium anfractum</i> Sommier & Levier, <i>G.consanguineum</i> Boiss.
22.	Amarantaceae Juss.	<i>Chenopodium foliosum</i> Asch. syn. <i>Blitum virgatum</i> L.
23.	Amaryllaceae J.St.-Hil.	<i>Allium cardiostemon</i> Fisch. & C.A.Mey.
24.	Asparagaceae Juss.	<i>Asparagus verticillatus</i> L.
25.	Brassicaceae Burnett.	<i>Cardamine uliginosa</i> M.Bieb.
26.	Convolvulaceae Juss.	<i>Cuscuta europaea</i> L.
27.	Cucurbitaceae Juss.	<i>Bryonia dioica</i> Bojer.
28.	Elaeagnaceae Juss.	<i>Hippophae rhamnoides</i> L.
29.	Ephedraceae Dumort.	<i>Ephedra procera</i> C.A. Mey.
30.	Gentianaceae Juss.	<i>Gentiana cruciata</i> L.
31.	Grossulariaceae DC.	<i>Ribes biebersteinii</i> Berland. ex DC.
32.	Hypericaceae Juss.	<i>Hypericum polygonifolium</i> Rupr. syn. <i>Hypericum linarioides</i> subsp. <i>linarioides</i>
33.	Iridaceae Juss.	<i>Iris inbricata</i> Lindl.

34.	Linaceae DC. ex Perleb.	<i>Linum hypericifolium</i> Salisb.
35.	Lythraceae J.St.-Hil.	<i>Lythrum salicaria</i> L.
36.	Melanthiaceae Batsch ex Borkh.	<i>Veratrum lobelianum</i> Bernh.
37.	Onagraceae Juss.	<i>Chamaenerion caucasicum</i> (Hauskn.) Sosn. ex Grossh.
38.	Orchidaceae Juss.	<i>Dactylorhiza urvilleana</i> (Steud.) H. Baumann & Kunkele
39.	Resedaceae Martinov.	<i>Reseda lutea</i> L.
40.	Saxifragaceae Juss.	<i>Saxifraga cymbalaria</i> Steven.
41.	Viburnaceae Raf.	<i>Sambucus ebulus</i> L.
42.	Violaceae Batsch.	<i>Viola arvensis</i> Murray
Total		124

Table 2. Endemic species of different categories found in the East Zangezur economic region

№	Family	Species
1.	Asteraceae	<i>Anthemis iberica</i> , <i>Cirsium obvallatum</i> , <i>C.kosmelii</i> , <i>Erigeron caucasicus</i> , <i>E.venustus</i> , <i>Psephellus transcaucasicus</i> , <i>Senecio caucasicus</i> , <i>Taraxacum stenolepium</i> , <i>Tragopogon reticulatus</i>
2.	Fabaceae	<i>Astragalus aureus</i> , <i>A.uraniolimneus</i> , <i>Colutea orientalis</i> , <i>Onobrychis biebersteinii</i> , <i>Trifolium bordsilovskyi</i>
3.	Campanulaceae	<i>Asyneuma campanuloides</i> , <i>Campanula daralaghezica</i> , <i>C.trautvetteri</i> , <i>C.tridentata</i>
4.	Scrophulariaceae	<i>Linaria grandiflora</i> , <i>Linaria incomplete</i> , <i>Rhynchocorys orientalis</i> , <i>Verbascum oreophilum</i>
5.	Caprifoliaceae	<i>Cephalaria gigantea</i> , <i>Cephalaria media</i> , <i>Valeriana tiliifolia</i>
6.	Caryophyllaceae	<i>Dianthus integerrimus</i> , <i>Silene caucasica</i> , <i>S.ruprechtii</i>
7.	Boraginaceae	<i>Huynhia pulchra</i> , <i>Onosma caucasica</i>
8.	Rosaceae	<i>Alchemilla erythropoda</i> , <i>Cerasus incana</i>
9.	Lamiaceae	<i>Betonica macrantha</i> , <i>Scutellaria sedelmeyerae</i>
10.	Amaryllaceae	<i>Allium cardiostemon</i>
11.	Apiaceae	<i>Ferula orientalis</i>
12.	Grossulariaceae	<i>Ribes biebersteinii</i>
13.	Hypericaceae	<i>Hypericum polygonifolium</i>
14.	Iridaceae	<i>Iris imbricata</i>
15.	Linaceae	<i>Linum hypericifolium</i>
16.	Onagraceae	<i>Chamaenerion caucasicum</i>
17.	Orchidaceae	<i>Dactylorhiza urvilleana</i>
18.	Orobanchaceae	<i>Pedicularis sibthorpii</i> , <i>Rhinanthus subulatus</i>
19.	Papaveraceae	<i>Papaver orientale</i>
20.	Polygonaceae	<i>Bistorta carnea</i>
21.	Brassicaceae	<i>Cardamine uliginosa</i>
22.	Rubiaceae	<i>Galium anfractum</i>
23.	Valerianaceae	<i>Valeriana tiliifolia</i>
Total number of background species		124
Number of endemic species of different categories		48
Percentage of endemism		39%

The species *Allium cardiostemon* Fisch. & C.A.Mey. was previously described only from Nakhchivan in the territory of Azerbaijan (Asgarov, 2016). The mentioned plant was recorded by us from the subalpine and meadows of Lachin and Kalbajar districts.

Scrophularia azerbaijanica Grau. as a subendemic species was previously described in Azerbaijan only from Nakhchivan and Talysh, and from abroad only from the territory of Iran

(<https://www.gbif.org/species/3738979>).

Scutellaria sedelmeyerae Juz. was described from Azerbaijan (Gadabay, Soyudlu village surroundings) and Armenia (<https://www.gbif.org/species/5608187>).

This species was described by us from a new range - Kalbajar district, surroundings of Kesdak village, subalpine meadow at an altitude of 1800 m above sea level.

The results of the research show that the area

has high plant endemism (Table 2). As can be seen from the endemism tables, *Asteraceae* (9 species), *Fabaceae* (5 species), *Scrophulariaceae* (4 species), *Campanulaceae* (4 species) families are the leaders of endemism in the region. While

investigating the ranges of endemic species found in the area, we conditionally divided them into several groups. The vast majority of these species are in the regional range, the Caucasus Ecoregion (588,000 km²) range (Table 3, Fig. 4).

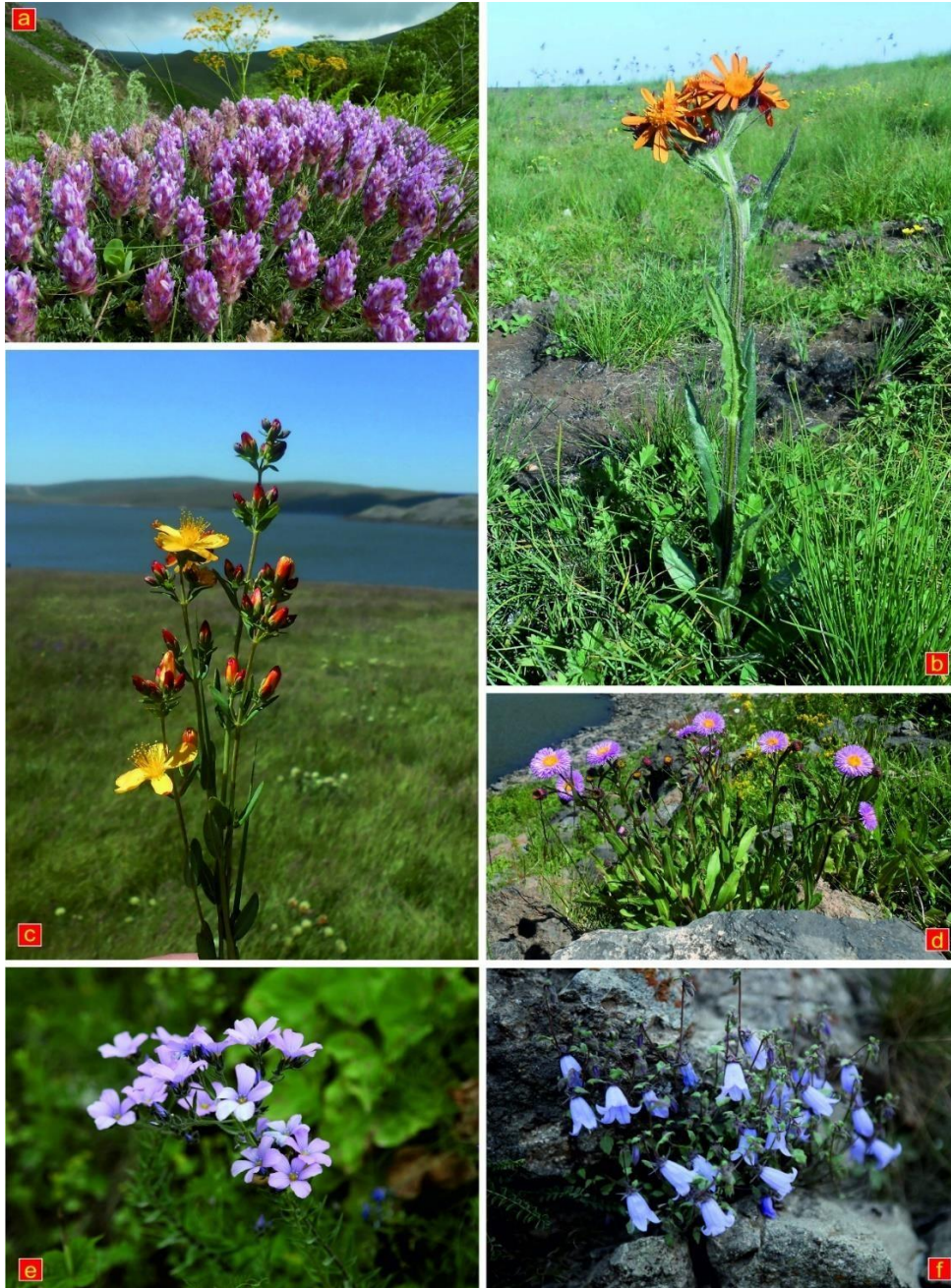


Fig. 4. Subendemic species on the Caucasus ecoregion: **a** – *Astragalus uraniolimneus* Boiss.; **b** - *Senecio caucasigenus* Schischk.; **c** - *Hypericum polygonifolium* Rupr.; **d** - *Erigeron caucasicus* Steven.; **e** - *Linum hypericifolium* Salisb.; **f** - *Campanula daralaghezica* (Grossh.) Kolak. & Serdyuk

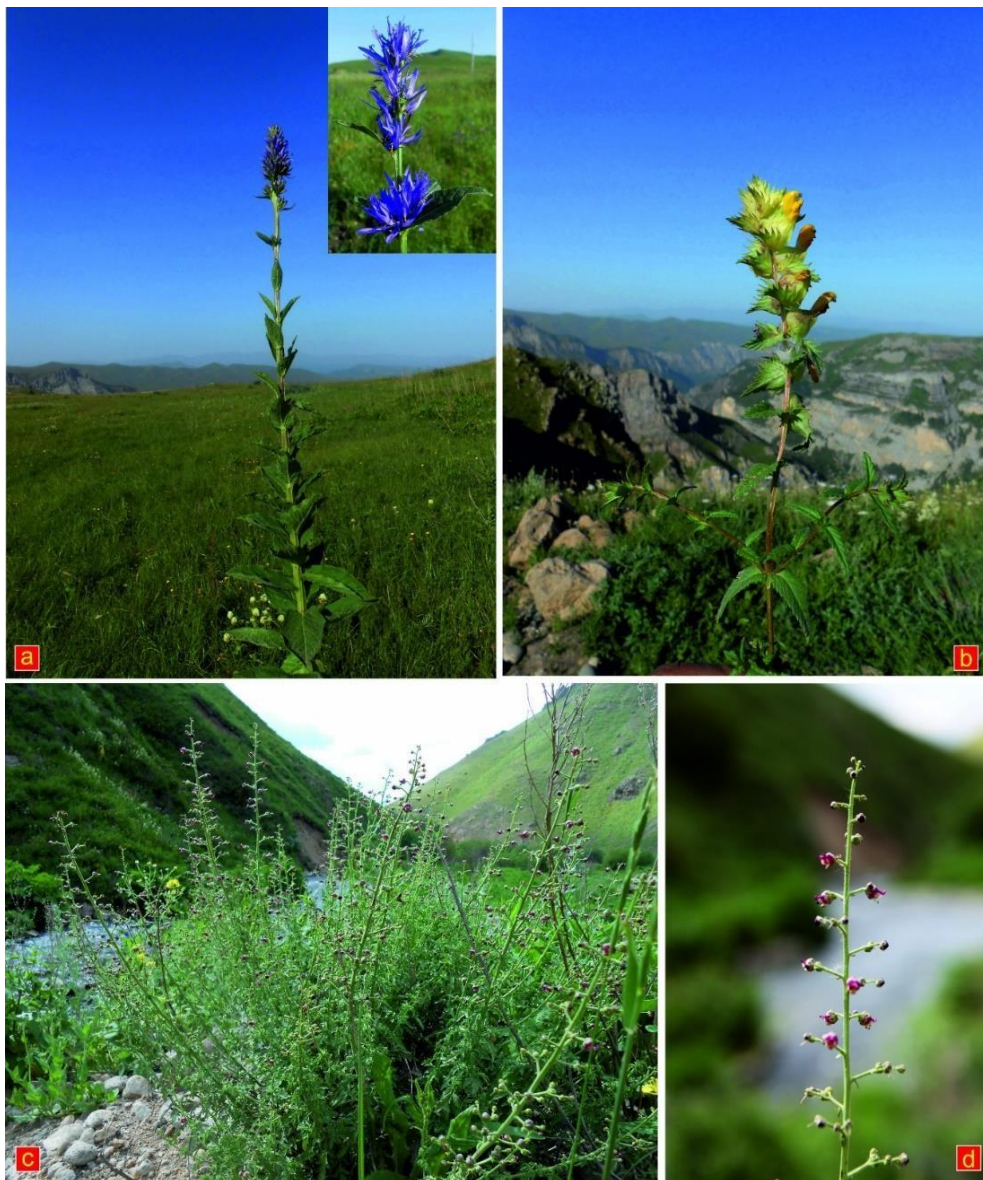


Fig. 5. Subendemic species of Azerbaijan on the Greater Caucasus (Caucasian endemics): a – *Asyneuma campanuloides* (M. Bieb. ex Sims) Bornm. (Lachin, 2930 m); b - *Rhinanthus subulatus* (Chabert) Soó (Lachin, Surroundings of Agbulag village, 2800 m); c and d - *Scrophularia azerbaijanica* Grau, (Kalbajar, Istisu, 2340 m)



Fig. 6. Subendemic species on the South Caucasus (Eastern slopes of Greater Caucasus and Lesser Caucasus): a – *Trifolium bordsilovskyi* Grossh (Kalbajar, the shore of Boyuk Alagol); b - *Scutellaria sedelmeyerae* Juz. (Kalbajar, Kesdaq village surroundings, 1900 m); c - *Psephellus transcaucasicus* Sosn. syn. *C.sevanensis* Sosn. (Kalbajar, coast of Boyuk and Kichik Alagol, 2810 m)

These species are limited by the Main Caucasus mountain system (Greater Caucasus, Lesser Caucasus, Nakhchivan and Talysh mountains), Pontic Mountains (Turkey) and Albus mountains (Iran) (Zazanashvili and Mallon, 2009). We note these species as macroendemic species.

We consider the plants found in this region as endemics with a broad category. In terms of the ecoregion, they are endemic to the Caucasus Ecoregion. Among the background species in this category, 40 species belonging to 21 families

were mentioned. Here, the *Asteraceae* family dominates with 9 species.

Species included in the second category are partial or subendemic species for the Greater Caucasus. These species are common on both slopes of the main and lateral ranges of the Greater Caucasus (Table 4, Fig. 5). These species are found both in the Caucasus part of the Russian Federation and in the territories of Georgia (Georgian Biodiversity Database; Ivanov, 2019).

Table 4. Caucasian endemics found in the area (subendemic species of Azerbaijan on the Greater Caucasus)

№	Family	Endemic species
1.	<i>Onobrychis biebersteinii</i>	<i>Fabaceae</i>
2.	<i>Asyneuma campanuloides</i>	<i>Campanulaceae</i>
3.	<i>Rhinanthus subulatus</i>	<i>Orobanchaceae</i>
4.	<i>Galium anfractum</i>	<i>Rubiaceae</i>
5.	<i>Scrophularia azerbaijanica</i>	<i>Scrophulariaceae</i>

Table 5. South Caucasus endemics found in the area (subendemic species of Azerbaijan on the Lesser Caucasus).

№	Family	Endemic species
1.	<i>Psephellus transcaucasicus</i>	<i>Asteraceae</i>
2.	<i>Trifolium bordsilovskyi</i>	<i>Fabaceae</i>
3.	<i>Scutellaria sedelmeyerae</i>	<i>Lamiaceae</i>

The species of the third category are subendemics of the Lesser Caucasus. *Psephellus transcaucasicus* Sosn. syn. *C.sevanensis* Sosn. species was described from Azerbaijan, Georgia and Armenia (<https://www.gbif.org/species/3137957>). *Trifolium bordsilovskyi* Grossh. syn. *Amoria bordsilovskyi* (Grossh.) Roskov was described from Azerbaijan (Nakhchivan, Zangezur) and Armenia (<https://www.gbif.org/species/5358771>).

Species belonging to the third category are subendemic species found only in the South Caucasus. We conventionally call these species the subendemics of Lesser Caucasus (Table 5, Fig. 6).

Thus, as a result of a partial inspection in East Zangezur, out of 124 background species belonging to 42 families found in the area, 40

macroendemic species and 8 subendemic species belonging to 21 families were described. Of these, 5 species are subendemic to the Greater Caucasus, and 3 species to the Lesser Caucasus.

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Şərqi Zəngəzurun şimal hissəsinin bitkiliyinə dair

İbadullayeva Səyyarə Cəmsid qızı, Yusifov Elman Fərhad oğlu

Azərbaycan Respublikası Elm və Təhsil Nazirliyinin Botanika İnstitutu, Bakı, Azərbaycan

Aparılan tədqiqatlar nəticəsində ərazinin subalp və alp landşaftlarında 42 fəsiləyə aid 124 növ bitki qeydə alınıb. Ərazi yüksək endemizmə malikdir (39%). Beləliklə, təsvir olunan növlərdən 23 fəsiləyə aid olan 48 növ müxtəlif kateqoriyalı endemik növlərdir. Onlardan 21 fəsiləyə aid 40 makroendemik və 8 subendemik növ təsvir edilmişdir. Subendemik növlərdən beşi Böyük Qafqaz, üçü isə Kiçik Qafqaz üçün subendemik növlərdir.

Açar sözlər: Şərqi Zəngəzur, landşaftlar, flora, alp, subalp, endemizm

О растительности северной части Восточного Зангезура

Ибадуллаева Сайяра Джамшид гызы, Юсифов Эльман Фархад оглу

*Институт ботаники Министерства науки и образования Азербайджанской
Республики, Баку, Азербайджан*

В результате проведенных исследований в субальпийских и альпийских ландшафтах района зарегистрировано 124 вида растений, относящихся к 42 семействам. Район имеет высокий эндемизм (39%). Таким образом, из описанных видов, 48 видов, принадлежащих к 23 семействам, являются эндемичными видами разных категорий. Среди них описано 40 макроэндемичных и 8 субэндемичных видов, принадлежащих к 21 семейству. Пять из субэндемичных видов являются субэндемичными для Большого Кавказа, а три – субэндемичными для Малого Кавказа.

Ключевые слова: *Восточный Зангезур, ландшафты, флора, альпийский, субальпийский, эндемизм*