

Preliminary study of the early spring and summer flora of the northeastern region in the Lesser Caucasus within Azerbaijan

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Abstract: The early spring and summer flora of the north-eastern area of the Lesser Caucasus was studied and a taxonomic analysis of the wild grass plants that spread here was given. As a result of the study of the area 52 species and 3 subspecies belonging to 39 genera and 17 families were identified. Among those *Traunsteinera sphaerica* Schltr., *Dactylorhiza romana* (Sebast.) Soó, *Anacamptis coriophora* (L.) R.M. Bateman, Pridgeon & M.W. Chase, *Colchicum mirzoevae* (Gabrieljan) K. Perss., *Iris caucasica* Hoffm., *Iris pumila* L., *Iris paradoxa* Steven., *Iris alexeenkoi* Grossh., *Iris camillae* Grossh., *Iris helena* K. Koch., *Platanthera bifolia* (L.) Rich. are rare species included in the latest edition Red Book of Azerbaijan. At the same time, new distribution areas of *Centaurea aucheri* (DC) Wagenitz, *Oxalis corniculata* L., *Euphorbia peplus* L. were discovered in the study area and maps were drawn up based on GPS coordinates.

Keywords: biodiversity, endemic and rare species, Goygol, new distribution area, specimen

INTRODUCTION

In the 21st century, research, protection and sustainable use of biodiversity are a primary concern governments, NGOs and the public [Hilborn. Sinclair, 2021; Sayer et al., 2021]. In recent decades, the rapid development of scientific and technical progress, overexploitation of natural ecosystems, climate change, disruption of the ecological balance and other similar factors cause a significant decrease or disappearance of biodiversity in the world [Abbass et al., 2022; Antonelli et al., 2024].

Numerous plants in nature have advantageous qualities, which humans utilize in various ways for

their own ends. At the same time, people use natural resources, carry out certain processing and the resulting wastes lead to environmental pollution, which causes ecological consequences of anthropogenic impact on the biosphere [Rua, Torres, 2016]. The growth of substances that are not characteristic of natural ecosystems plays a fundamental role in the pollution of the biosphere. Thus, many plant species leave their natural range [Beland, Oloomi, 2019]. Changes in biological diversity in recent years (especially climate changes) have had their effect on the ecosystem [Schipper et al., 2024]. Disruption of the normal functioning of natural ecosystems can lead to the deprivation of vital functions of all living things. Although the vegetation of the area has been studied from time to time since the last century, the study of plant diversity is still relevant considering the recent climate change and pollution. This article describes the condition in the Lesser Caucasus (LC) within Azerbaijan based on monitorings carried out in several sites to reveal spring and summer flora.

MATERIAL AND METHODS

Description of the area. The part of the LC in Azerbaijan mainly consists of several ridges. It includes Murovdagh, Garabagh, Mikhtokan ranges, one part of Shahdagh, Shargi-Goycha Zangazur, Daralayaz ranges, most of the volcanic Garabagh plateau, Bashkend-Dastafur depression [Hajiyev et al., 1990]. The Shahdag range extends from the Shahdag peak (2901 m) in the northwest to the Hinaldag peak (3367 m) in the southeast. North off those ridges there is Bashkend-Dastafur depression and even more to the north there is Shamkir vault elevation. That altitude is the Shahdag and Murovdagh ranges, which are up to 3000 m high. The Pant Range and the isolated Kapaz Mountain (3030 m) separate the Bashkend-Dastafur depression from the Agjakend depression in the east.

Due to the fact that the relief in the low and medium mountainous part of the region has a

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low slope and the intermountain depressions occupy a large area, the forests here have been subjected to intense deformation and transformation by people, and settlements, large cultivation and hayfield fields have been built in their place [Asgerova, 2017].

Object of the study. The object of the study was the flora of the north-eastern region of the LC. About 210 plant specimens of the above species were collected and a herbarium was prepared.

Research materials were collected during extensive and intensive fieldwork from different ecosystems on semi-stationary routes in early spring in Ganja. During the conducted field research, the distribution ranges of the species were determined, and GPS coordinates were taken. Main research areas were selected in the following areas: Dashkasan –Xoshbulag Bayan-Amirvari – N 41.0440 E 048 97 4930 1620 m; Xoshbulag village – N 40.304770, E.048. 98 3380 1709 m; Amirvari village, Nazli bulag restaurant N 40.303150; 0.45.983240 – 1754 m; Bayan village – N 40.54 8260, E.048. 14 1300 – 1450 m; Goygol, Hajikand, Toghana, Maralgol; Hajikand – N 40.52 0570, E.046. 330410 – 1090 m; Maralgol surroundings – N 40.38 2140, E.046. 31 0240 – 1906 m; Toghana village – N 40.38 2120, E.046. 31 1530 – 1820 m; Gadabay –Yasamal road, Slavyanka, Chanakhchi; Shamkir-Yasamal bypass- N 40. 80 1600, E.045. 99 0040 – 662 m; Slavyanka – Chanakhchi N 40. 79 3620, E.045. 96 6980 – 1040 m.

In order to more accurately study the species composition of the vegetation cover of the Ganja area, sample plots (1x50 cm in size) were selected in the research area. Based on this method, the dominant plant species in the area were studied.

Mapping. The layout of the route map that developed during the field trips was placed in the WGS 84 (UTM 38) coordinate system. The GIS map of the studied area [Avkhadiyeva, 2019], as well as the remote sensing of vegetation types [Shikhov A.N., 2020] were compiled using ArcGIS Pro (version 3.3 year 2024) software (Fig. 1). Based on the specified GPS coordinates, the boundaries, forest and water polygons of the research area were described, on the basis of which we compiled a GIS map [Avkhadiyeva, 2019].

During the years 2019-2023, numerous expeditions were organized in the territory of the LC according to the season, monitoring was carried out using classic morphological-systematic, geographical and ecological methods.

Identification of taxa. Regional floras and determination

keys were used for species identification [Linnaeus, 1753; Boissier, 1875; Grossheim, 1949; Flora..., I-VIII; Asgarov, 2005, 2006, 2008; Zernov, 2010, 2013, 2015; Mehdiyeva, 2014; Alizade et al., 2019]. The names of the taxa have been specified according to the latest nomenclature [The world flora online, The International Plant Names, The Plant List Version 1.1].

RESULTS

During the research species belonging to the families Asparagaceae, Amaryllidaceae, Iridaceae, Primulaceae, Ranunculaceae, Violaceae, Rosaceae, Lamiaceae, Crassulaceae, Asteraceae, Plantaginaceae, Boraginaceae, Euphorbaceae, Liliaceae, Thymelaeaceae, Orchidaceae, Oxalidaceae were collected and identified.

Goygol National Park is characterized by rocky-gravelly, gray-chestnut, dry soil, the lake is surrounded by meadow vegetation, and the humidity is plentiful. The river bank and vegetation type are sparsely wooded and mixed-grass meadows. Plant diversity is in different populations of the genera *Iris* Tourn. ex L., *Scilla* L., *Muscari* Mill., *Sternbergia* Waldst. & Kit., *Tulipa* L., *Puschkinia* Adams, *Ornithogalum* L., *Colchicum* L., *Gagea* Salisb. from geophytes and other early spring flowering *Ajuga* L., *Plantago* L., *Doronicum* L., *Nepeta* L., *Celtis* L., *Vinca* L., *Fragaria* L., *Ranunculus* L., *Lathraea* L., *Potentilla* L., *Myosotis* L., *Cyperus* L., *Veronica* L., *Anemone* L., *Euphorbia* L., *Primula* L., *Viola* L., *Sedum* L., *Centaurea* L., *Tussilago* L., *Sempervivum* L., *Cardamine* L., *Caltha* L., *Corydalis* DC., *Daphne* Tourn. ex L., *Orchis* Tourn. ex L., *Platanthera* Rich., *Dactylorhiza* Neck. ex Nevski, *Traunsteinera* Rchb., *Anacamptis* Rich. Species belonging to *Iris* Tourn. ex L., *Scilla* L., *Erodium* L'Hér., *Ornithogalum* L., *Orchis* L., *Platanthera* L. genera predominate in the study area. Species belonging to the *Crataegus* L., *Pyrus* L. genera prevail here.

During the expedition, three species (*Pyrus eldarica* Grossh., *Prunus amygdalus* L., *P. armeniaca* L.) belonging to the genus *Pyrus* (1 species), *Prunus* (3 species) belonging to the Rosaceae family, as well as several rare and endangered species *Prunus padus* L., *Pyrus eldarica* were monitored by checking their number trend. A decrease in the number of mentioned species was observed. This can be seen as a manifestation effect climate change and global warming. According to the initial identification, 53 species and three subspecies on 15 orders, 17 families and 39 genera were revealed (Table 1).

As a result of the field expeditions conducted in the research area, a new range of distribution for three

species (*Centaurea aucheri* (DC) Wagenitz, *Oxalis corniculata* L., *Euphorbia peplus* L.) was determined. *Oxalis corniculata*, *Euphorbia peplus* are synanthropic species, mainly spread in lawns (Fig. 2).

Thus, it should be noted that the most common plants in the study area in early spring are *Gagea chlorantha*, *G. alexeenkoana*, *G. chanae*, *G. germaniae*, *G. commutata*, *Puschkinia scilloides*, *Ornithogalum gussonei*, *O. sintensisii*, *Scilla sibirica*, *S. sibirica* ssp. *caucasica*, *Muscari neglectum*, *M. caucasicum*, *M. tenuiflorum*, *Crocus adami*, *Iris pumila*, *I. caucasica*, *I. paradoxa*, *I. alexeenkoi*, *I. camillae*, *I. helena*, *Anacamptis morio* subsp. *picta*, *A. coriophora*, *Orchis mascula*, *Dactylorhiza romana*, *Ophrys caucasica*, *Galanthus transcausicus*, *Viola suavis*, *V. alba*. Species *Prunella*

vulgaris, *P. grandiflora*, *P. laciniata*, *Viola odorata*, *V. rupestris*, *V. elatior*, *Nonea lutea*, *Sedum tenellum*, *Sempervivum globiferum*, *Centaurea aucheri*, *Oxalis corniculata*, *Euphorbia peplus* were observed only in summer. But there are some species that develop and spread both in spring and summer, such as *Viola hirta*, *V. mirabilis*, *V. reichenbachiana*, *V. sieheana*, *V. canina*, *V. arvensis*, *Fumaria officinalis*, *Primula acaulis*, *P. veris* subsp. *macrocalyx*, *Prunus cerasifera*, *P. spinosa*, *Pyrus salicifolia*, *Nonea rose*, *Veronica arvensis*, *Vinca minor*.

Endemic, relict, rare, invasive and economically important plant species were also considered. The study area is rich in rare and endemic plant species and most frequently encountered were (*Traunsteinera sphaerica*, *Dactylorhiza romana*, *Anacamptis*

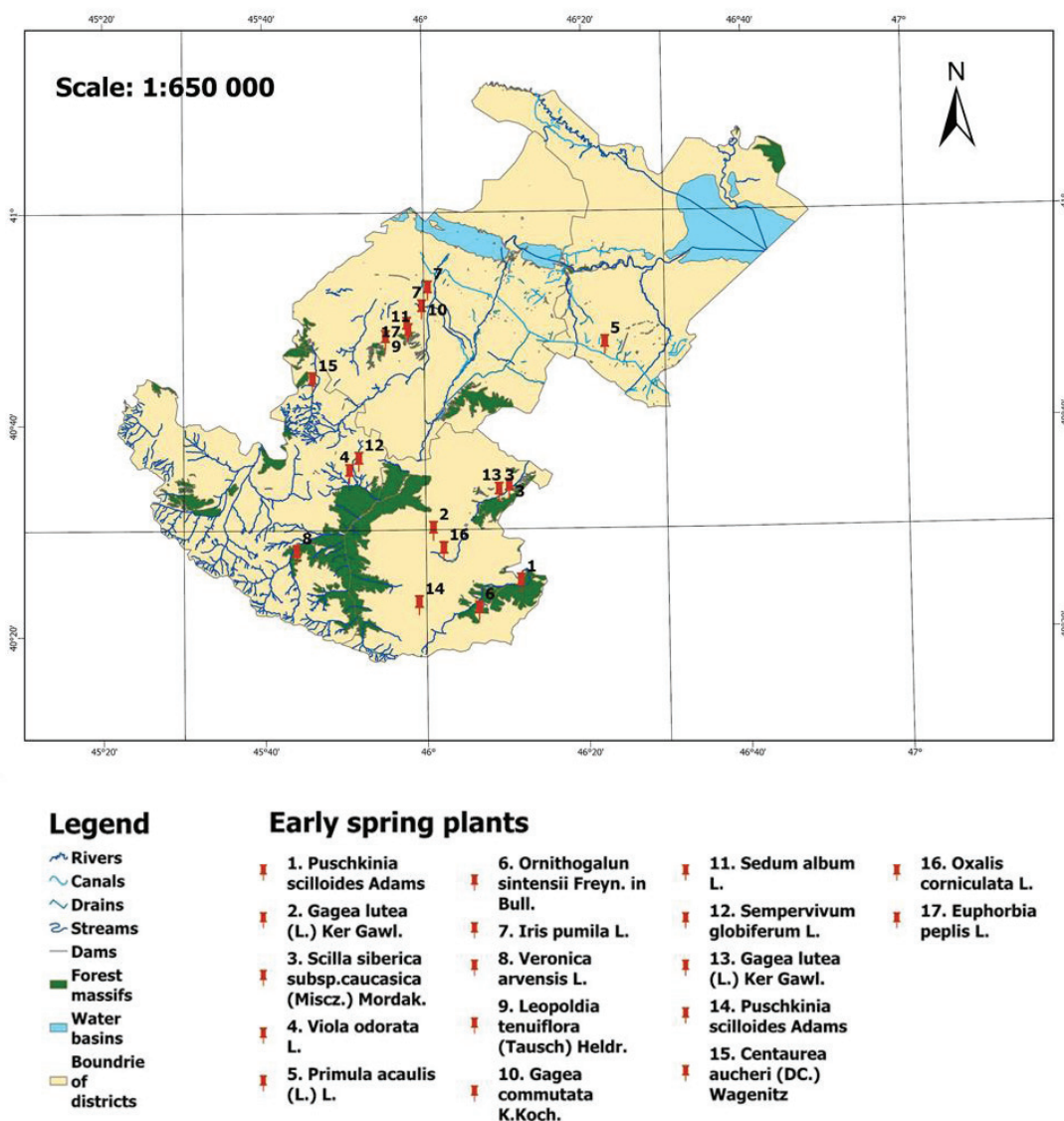


Figure 1. Plant diversity in the north-eastern territory of the Lesser Caucasus.

Table 1. List of species collected from the northeastern territory of the Lesser Caucasus.

Order	Family	Genera	Species
1	2	3	4
Liliales	Liliaceae	<i>Gagea</i>	<i>G. chlorantha</i> (M. Bieb.) Schult. & Schultf.
			<i>G. alexeenkoana</i> Mischz <i>G. chanae</i> Grossh. <i>G. germaniae</i> Grossh. <i>G. commutata</i> K. Koch.
Asparagales	Asparagaceae	<i>Puschkinia</i>	<i>P. scilloides</i> Adams
		<i>Ornithogalum</i>	<i>O. gussonei</i> Ten.
			<i>O. sintenisii</i> Freyn
		<i>Scilla</i>	<i>S. sibirica</i> Andrews
			<i>S. sibirica</i> ssp. <i>caucasica</i> Mischz
	<i>Muscari</i>	<i>M. neglectum</i> Guss. ex Ten.	
		<i>M. caucasicum</i> (Griseb.) Baker <i>M. tenuiflorum</i> Tausch	
	Iridaceae	<i>Crocus</i>	<i>C. adami</i> J. Gay
			<i>C. speciosus</i> M.B.
		<i>Iris</i>	<i>I. pumila</i> L.
<i>I. caucasica</i> Hoffm.			
<i>I. paradoxa</i> Steven. <i>I. alexeenkoi</i> Grossh. <i>I. camillae</i> Grossh. <i>I. helena</i> K. Koch.			
Orchidaceae	<i>Anacamptis</i>	<i>A. morio</i> subsp. <i>picta</i> (Loisel.) Jacquet & Scappat.	
	<i>Orchis</i>	<i>A. coriophora</i> (L.) R.M. Bateman, Pridgeon & M.W. Chase	
	<i>Dactylorhiza</i>	<i>O. mascula</i> (L.) L.	
	<i>Ophrys</i>	<i>D. romana</i> (Sebast.) Soó <i>O. caucasica</i> Woronow ex Grossh.	
Amaryllidaceae	<i>Galanthus</i>	<i>G. transcaucasicus</i> Grossh.	
Lamiales	Lamiaceae	<i>Prunella</i>	<i>P. vulgaris</i> L.
			<i>P. grandiflora</i> (L.) Jacq. <i>P. laciniata</i> (L.) L.
Malpighiales	Violaceae	<i>Viola</i>	<i>V. odorata</i> L.
			<i>V. suavis</i> M.B.
			<i>V. alba</i> Bess.
			<i>V. hirta</i> L.
			<i>V. mirabilis</i> L.
			<i>V. reichenbachiana</i> Boreau
			<i>V. sieheana</i> W. Bckr.
			<i>V. rupestris</i> F.W. Schmidt
			<i>V. elatior</i> Fries
			<i>V. canina</i> L. <i>V. arvensis</i> Murr.
Ranunculales	Papaveraceae	<i>Fumaria</i>	<i>F. officinalis</i> L.
Brassicales	Brassicaceae	<i>Cardamine</i>	<i>C. bulbifera</i> (L.) Crantz
Ericales	Primulaceae	<i>Primula</i>	<i>P. acaulis</i> (L.) L.
			<i>P. veris</i> subsp. <i>macrocalyx</i> (Bunge) Lüdi
Rosales	Rosaceae	<i>Prunus</i>	<i>P. cerasifera</i> Ehrh.
			<i>P. spinosa</i> L.
		<i>Pyrus</i>	<i>P. salicifolia</i> Pall. <i>P. eldarica</i> Grossh.

1	2	3	4
Boraginales	Boraginaceae	<i>Nonea</i>	<i>N. lutea</i> (Desrp.) Rchb. <i>N. rose</i> (M.B.) Link.
Lamiales	Plantaginaceae	<i>Veronica</i>	<i>V. arvense</i> L.
Gentianales	Apocynaceae	<i>Vinca</i>	<i>V. minor</i> L.
Saxifragales	Crassulaceae	<i>Sedum</i> <i>Sempervivum</i>	<i>S. tenellum</i> M. Bieb. <i>S. globiferum</i> L.
Asterales	Asteraceae	<i>Centaurea</i>	<i>C. aucheri</i> (DC) Wagenitz
Oxalidales	Oxalidaceae	<i>Oxalis</i>	<i>O. corniculata</i> L.
Malpighiales	Euphorbiaceae	<i>Euphorbia</i>	<i>E. peplus</i> L.

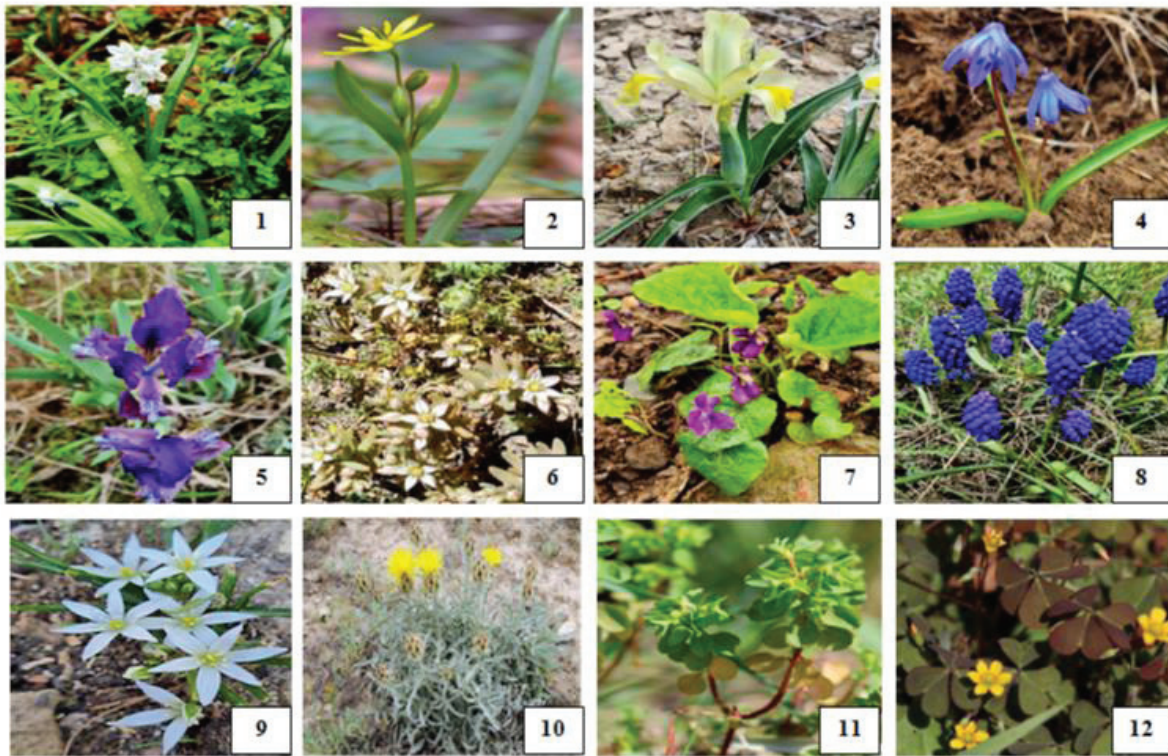


Figure 2. Some plant species collected during the study: 1. *Puschkinia scilloides* Adams, 2. *Gagea lutea* (L.) Ker Gawl., 3. *Iris caucasica* Hoffm., 4. *Scilla siberica* Andrews, 5. *Iris pumila* L., 6. *Sedum album* L., 7. *Viola odorata* L., 8. *Muscari neglectum* Guss., 9. *Ornithogalum sintenisii* Freyn., 10. *Centaurea aucheri* (DC) Wagenitz., 11. *Oxalis corniculata* L., 12. *Euphorbia peplus* L.

coriophora, *Colchicum mirzoevae*, *Iris caucasica*, *I. pumila*, *I. paradoxa*, *I. alexeenkoi*, *I. camillae*, *I. helena*, *Platanthera bifolia*) [Red Book of Azerbaijan, 2023; Solomon et al, 2014].

Rare and endemic species are mainly found in mountainous and foothill areas, for example, *Iris paradoxa*. While the species is found in areas from the plains to the lower mountain belt, the *Iris pumila* species grows in stony and gravelly places from the middle mountain belt to the high mountain belt. *Platanthera bifolia* species is more often found in forests. *Dactylorhiza romana* subsp. *georgica*, *Anacamptis coriophora* species

are inhabitants of areas from the lower mountain belt to the middle mountain belt. Despite growing in various areas, these plants, which are considered rare species of nature, are gradually decreasing, which is due to the influence of anthropogenic, zoogenic and climatic factors.

We consider it important to study the plant diversity of certain areas as a whole, taking into account the influence of changing climatic conditions, anthropogenic and zoogenic factors. We intend to conduct our future research in this aspect.

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Azərbaycan hüdudlarında Kiçik Qafqazın şimal-şərq bölgəsinin erkən yaz və yay florasının ilkin araşdırılması

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Kiçik Qafqazın şimal-şərq ərazisinin erkən yaz və yay florası öyrənilmiş, burada yayılmış yabani ot bitkilərinin taksonomik təhlili verilmişdir. Ərazinin tədqiqi nəticəsində 17 fəsilə və 39 cinsə aid 52 növ və 3 yarımnöv müəyyən edilmişdir. Onların arasında *Traunsteinera sphaerica* Schltr., *Dactylorhiza romana* (Sebast.) Soó, *Anacamptis coriophora* (L.) R.M. Bateman, Pridgeon & M.W. Chase, *Colchicum mirzoevae* (Gabrieljan) K. Perss., *Iris caucasica* Hoffm., *Iris pumila* L., *Iris paradoxa* Steven., *Iris alexeonoi* Grossh., *Iris camillae* Grossh., *Iris helena* K. Koch., *Platanthera bifolia* (L.) Rich nadir növlərdir və Azərbaycanın Qırmızı Kitabının üçüncü nəşrinə daxil edilmişdir. Eyni zamanda, tədqiq olunan ərazidə *Centaurea aucheri*

(DC) Wagenitz, *Oxalis corniculata* L., *Euphorbia peplus* L. növlərinin yeni yayılma sahələri aşkar edilmiş, GPS koordinatları əsasında xəritələr tərtib edilmişdir. **Açar sözlər:** *biomüxtəliflik, endemik və nadir növlər, Göygöl, yeni yayılma sahəsi, nümunə*

Предварительное исследование ранневесенней и летней флоры северо-восточного региона Малого Кавказа в Азербайджане

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Изучена ранневесенняя и летняя флора северо-восточной части Малого Кавказа, дан таксономический анализ распространенных здесь дикорастущих злаковых растений. В результате изучения территории выявлено 52 вида и 3 подвида, относящихся к 17 семействам и 39 родам. Среди них *Traunsteinera sphaerica* Schltr., *Dactylorhiza romana* (Sebast.) Soó, *Anacamptis coriophora* (L.) R.M. Bateman, Pridgeon & M.W. Chase, *Colchicum mirzoevae* (Gabrieljan) K. Perss., *Iris caucasica* Hoffm., *Iris pumila* L., *Iris paradoxa* Steven., *Iris alexeonoi* Grossh., *Iris camillae* Grossh., *Iris helena* K. Koch., *Platanthera bifolia* (L.) Rich. являются редкими видами и включены в третье издание Красной книги Азербайджана. В то же время на исследуемой территории были обнаружены новые ареалы распространения видов *Centaurea aucheri* (DC) Wagenitz, *Oxalis corniculata* L., *Euphorbia peplus* L. и составлены карты на основе координат GPS.

Ключевые слова: *биоразнообразие, эндемичные и редкие виды, Гёйгёль, новый ареал распространения, образцы*