International Journal of Botany Studies
ISSN: 2455-541X; Impact Factor: RJIF 5.12
Received: 07-08-2020; Accepted: 22-08-2020: Published: 06-09-2020
www.botanyjournals.com
Volume 5; Issue 5; 2020; Page No. 55-58

Environmental status of shirvan flora (Azerbaijan) and issues of protection of rare species

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Abstract
2061 species of higher spore, Gymnospermaceous and flowering plants belonging to 144 families and 764 genera have been established in the flora of the region. Herbariums based on a large number of collected plants were prepared and handed over to the Herbarium Found of the Institute of Botany of ANAS. 39 rare, endangered and 17 endemic plant species were identified. The stock of 40 species has decreased noticeably, 16 species are on the verge of extinction there, 5 species are under the threat of complete destruction and 17 species reduce their range in recent years. The composition and structure of the vegetation cover of the region under the influence of a complex of ecological, technogene, zoogenic and anthropogenic factors has changed greatly, where urgent measures for their improvement and protection are required for further use.

Keywords: ecological condition, floristic variety, rare and endangered plants, anthropogenic factors, measures, protection

Introduction
One of the main directions of biological science are the study, development, rational use and protection of vegetation cover. Priority should be given to the needs of the national economy, biological resources and environmental problems under developing of these issues. Meadows which used as summer and winter pastures which had not previously been subjected to a sufficiently detailed floristic, ecological, geobotanical and resource research predominate in the Shirvan region of the Azerbaijan Republic [Akhmedova, 2011; Nabiyeva, 2010] [1], Hundreds of tons of dry hay, food and medicinal and technical raw materials can be harvested in this area, with rational, planned use of flora and vegetation [Ibadullayeva *et al*., 2013] [4]. However, the current state is unsatisfactory as a whole, low fertility of soil and forage does not allow the use of their potential. Therefore, considering the importance of solving this problem, on May 22, 2004 the President of the Azerbaijan Republic issued a decree "State Program on the rational use of summer and winter pastures, haymaking and prevention of their desertification in the Republic of Azerbaijan "[State Program, 2004] [9].
To solve this problem the main goal of the research - the study of the ecological state, the identification of rare - endangered plants and the adoption of appropriate measures for their protection. In this connection, the following tasks were set:

1. To study the ecological state, the causes of low productivity, the composition and structure of phytocenoses.
2. Identify harmful, poisonous, endemic, relict, endangered, as well as plants with shrinking areas.
3. 5. To develop practical recommendations on the rational use, improvement, restoration and protection of rare-endangered plants.

Materials and Methods
The object of the study was the flora and vegetation of Shirvan. The results of our field research, floristic, phytocenological data, as well as materials of herbarium funds and literature sources are the main material for characterizing the floristic biodiversity of the region [Flora of Azerbaijan 1950-61]. Field research was carried out by conventional floristic, systematic, ecological, route-forwarding, stationary, semi-stationary, phenological and geobotanical methods [Method. phenol. 1975; Yaroshenko, 1961; Ramenskiy, 1971] [17, 8]. Species composition of different in composition and structure phytocoenoses was made on trial plots by sizes: 1, 5, 10 and 100 m^2. Also, the influence of grazing on grass was studied in the stationary [Prilipko, 1971] [6]. Statuses on the degree of rarity of species are determined on the basis of categories and criteria [Red Book of Azerbaijan., 2013; The Red Book of the USSR, 1984; Akhundov, 1973; IUCN, 2003] [2].

Results and Discussion
Shirvan is a mountainous and semi-desert region. This territory has different by very complex geological structure. The region in orographic sense belongs to the Transcaucasian highland and is a part of the Azerbaijan Republic. Total area of Shirvan (flat and mountain) is equal to 27,49 thousand km^2, from them more than 22% (6,06 thousand km^2) falls on the high-mountain zone, covering the altitudes of 2800-906 m above sea level. The lowland part of Shirvan lies along the left bank of the Kura river, their total area is 21, 43 km^2 [Ecol. Atlas, 2010] [3].
The climate of the area is dry and sharply continental. The greatest influx of sunlight and heat falls on the Prikura zone. The sum of effective temperatures exceeds 2000-4000° C under the annual amount of temperatures above 5^0C and 1500-3800^0 C under the annual amount of temperatures above 10^0C. The territory of Shirvan is the most intensive in terms of volatility in the whole of Azerbaijan and in the whole Caucasus. Here the volatility varies from 1400-1200 mm per year, in the Prikura plain to 400 mm [Figurosky, 1926]. This ecological situation strongly influences on the developed of soil cover, flora and vegetation of the region.
Flora and vegetation cover of the region have been studying by us since 2008 [Gasimzade, 2015] [10]. The territory of Shirvan has huge plant resources. The region an

indispensable natural and fodder base for transhumance and procurement of medicinal and technical and other useful plants for use in many industries. 2061 species of higher spore, Gymnospermaceous and flowering plants belonging to 144 families and 764 genera have been established in the flora of the region [Gasimzade, 2015] [10]. In the region, in addition to the highest spore, gymnospermaceous and flowering plants, there are 6 species of lichens - *Sollema granulatum, Fulgensia fulgens, Psora decipiens, Anapytchia ciliaris, Hanthoria paeretina, Parmelia vagans*; 1 species of algae - *Stratonost cosmonue*; there are three species of mosses: *Barbula unguiculata, Porella platypylla, and Hypnum cuprexiforme*.

Seasonal, various, succession changes, the dynamics of seed productivity, as well as productivity and the shift of the main plant phytocenoses have been studied in result of floristic and geobotanical studies. Classification of the vegetation cover has been developed, a complete conspectus of the flora has been compiled and a comprehensive analysis has been carried out. About 1,500 herbariums were created on the basis of materials collected in the field. Cereals and legumes predominates on the territory among the groups of fodder plants (Diagram 1 and 2).

Three Azerbaijanis - *Iris helena* (C.Koch) C.Koch. *Neotorularia contortuplicata* (Steph.) Hedge et. J.Leonard, *Taraxacum desertorum* Schischk.) And 14 Caucasian - *Allium leucanthum* C.Koch, *Ophrys caucasica* Woronov ex Grossh. *Populus canescens* (Ait.) Smith, *Salsola nodulosa* (Moq.) Iljin, *Astragalus stevenianus* DC. *Onobrychis cyri* Grossh, *Trinia leiogona* (C.A.Mey.) B.Fedtsh. *Nepeta mussinii* Spreng. *Kickxia elatine* (L.) Dumort, *Carduus seminudus* Bieb. *Tragopogon tuberosus* C.Koch, *Taraxacum grossheimii* Schischk. *Scorzonera biebersteinii* Lipsch. *Cladochaeta candissima* (Bieb.) DC., total 17 endemic species have been identified for the region.

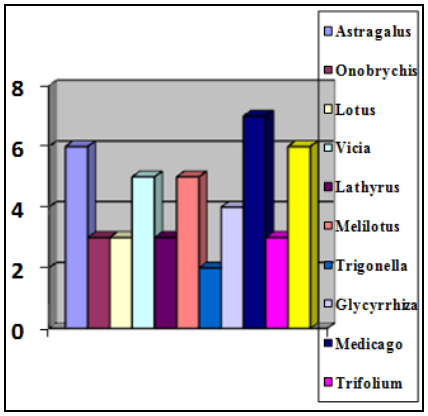

Diagram 1: Species number by genus of leguminous plants

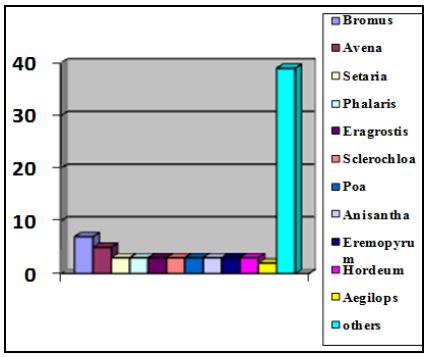

Diagram 2: Species abundance by species of cereals

From them, Asteraceae-6, Fabaceae-2, other are represented by one species (*Iridaceae, Scrophulariaceae, Alicaceae, Orchidaceae, Salicaceae, Chinopodiaceae, Apiaceae, Lamiaceae, Brassicaceae*). 8 rare, endangered species: *Sternbergia fischeriana* (Herb.) M. Roem. *Cladochaeta candissima* (Bieb.) DC., *Iris acutiloba* C.A. Mey., *Iridodictyum reticulatum* (Bieb.) Rodionenko, *Tulipa eichleri* Regel, *Ophrys caucasica* Woronow ex Grossh., *Punica granatum* L., *Vitis sylvestris* C.C. Gmel listed in the Red Book of Azerbaijan (2013).

The stock of 40 species has decreased noticeably, 16 species are on the verge of extinction there, 5 species are under the threat of complete destruction and reduce their range of 17 species have been revealed in recent years. At the same time, the number and stocks of some medicinal plants used in official and folk medicine are decreasing: *Equisetum arvense* L., *Ephedra intermedia* L., *Hypericum perforatum L.*, *Polypodium vulgare* L., *Helichrysum plicatum* DC., *Papaver orientale* L., *Taraxacum stevenii* DC., *Berberis vulgaris* L., *Ribes nigrum* L., *Morus alba* L., *Rosa canina* L., *Sorbus caucaisgena* Kom. To preserve and restore the stocks of such valuable medicinal plants as *Leonurus cardiaca L., Valeriana alliarifolia Adams. Chaerohpillum aureum L.* are necessary to organize special reserves. *Stipa gaubae Bor, S. capillata L.* and other plant species are threatened to endagered due to the destruction of their ecotypes. Thus, the plowing of the steppes led to a significant reduction of the number and in some places to the complete destruction of the feather grass.

Further development of the network of natural reserves on these territory is necessary in order to protect the vegetation cover of the region taking into account a more complete coverage of the diversity of zonal vegetation types, belt differentiation of vegetation cover, unique and reference plant communities and characteristic habitats of endemic and relict plants. Protection of some rare representatives of native flora in characteristic habitats can be carried out by prohibiting or restricting their economic use, as well as propagating of botanical knowledge.

Research to identify the structure and patterns of the functioning of plant populations against the context of anthropogenic influences is needed. The protection of endemic plants have the great theoretical and practical importance.

Plantar wealth of the region is used very irrationally. At the present time, under the influence of a complex of ecological and anthropogenic factors, the composition and structure of the vegetation cover of feeding areas have changed greatly for the further use of which a number of urgent measures are required to improve and protect them. Especially on the summer pastures of the Ismayilli district, the livestock population is several times higher than the established standards and the discharge schedule is not observed. As a result, only 51% of the total area of summer pastures is suitable for grazing and for haymaking remains very small and characterized by low yields.

The soil of the lowland part of the region is highly saline, since here the secondary salinization of soils occupies thousands of hectares under the influence of anthropogenic factors [Mammadov, 2007] [13]. The reserves of many species of the subalpine belt decrease in result of regular, intensive collection: *Scorzonera latifolia* DC. *Tragopogon coloratus* C.A. Mey., *Arum nordmannii* Schott (*A. elongatum* Stev.), *Eremostachys macrophylla* Montbr. ET

Auch. Ex Benth. And etc. On the verge of extinction are: *Bryonia dioica* Jacq, *Iris musulmanica* Fomin, *Salix aegyptiaca* L., *Nectaroscordum tripedale* Grossh. And etc. Less common are: *Juniperus foetidissima* Willd. *Astragalus paradoxus* Bunge. Under the threat of complete endangered are: *Aster alpinus* L., *Ledum palustre* L., *Colutea komarovii* Takht. Reduce their range: *Taxus baccata* L., *Tulipa bibersteini* Schult. Et Schult.

Plants introduced from the wild flora of the region have not found a worthy use in Shirvan. Control over the condition and full protection of rare, endangered, endemic and relict plants is inextricably linked to the protection of the plant communities in which they are included, as well as the elements of the geographical landscape corresponding to these communities. In order to protect rare, endangered, endemic, relict plants of Shirvan by category and criterias are presented in table 1.

Table 1: The status of protection of some rare plants of Shirvan flora by category and IUCN criterion

№	Name of species	Categories and criteria
1.	*Taxus baccata* L.	LC
2.	*Juniperus foettidisma* Willd.	LC
3.	*Tulipa biebersteiniana* Schult. et Schult	VUA2c+3c
4.	*T. bifora* Pall.	VUA2c+3c
5.	*T.eichleri regel*	VUA2c+3c
6.	*Epipactis palustrbs* (L.) Crantz.	VU C2
7.	*Epipactis microphylla* (Ehrh.) Sw.	VUD2
8.	*Ophrys caucasica* Woronow ex Grossh.	VUA2c+3c
9.	*O. oestrifera* Bieb.	ENB1ab(iii)+2ab(iii)
10.	*Orchis caspica* Trautv.	VUA2c+3c
11.	*O.purpurea* Huds.	ENB1ab (I, iii, iv)+2ab(iv)
12.	*Crocus adami* J.Gay	VU B1ab (i, ii, ıv); 2ab(iii)
13.	*Iris acatiloba* C.A.Mey.	VU A2b (iii); B1ab(iii)
14.	*I.alexeenkoi* Grossh.	CR B2b(iii, iv,v) c(ii,iii)
15.	*I.caucasica* Stev.	NT
16.	*I.iberica* D.Sosn.	VU D2
17.	*I.pseudacorus* L.	VUB1ab(iii)+2ab(iii)
18.	*Iridoctum reticulata* (Bieb.) Rodinenko	NT
19.	*Leopoldia longipes* (Boiss.) Losinsk.	EN2abc+3bc+4abc;B1ab(iii)+2b(iii,iv,v)
20.	*Ornithogalum ponticum* Zahar.	VUB1ab(iii)+2ab(iii)
21.	*Strenbergia colchiflora* Waldst. Et Kit.	VU D2
22.	*Asparagus persicus* Baker	ENA2c+3c;B2ab(iv,v)
23.	*Nectaroscordum tripedale* (Trautv.) Grossh.	CR B2ab(ii)
24.	*Nymphae alba* L.	VUD2
25.	*Nelumbo caspica* (DC.) Fisch.	VUD2
26.	*Paronychia kurdica* Boiss.	NT
27.	*Gipsophylla robusta* Grossh.	ENB11ab(i,ii,iii) c(iii,iv)+2b(i,ii)
28.	*G.szovitsii* Fisch.et C.A.Mey.ex Fenzl	ENB1ab(i,ii,iii)
29.	*Punica granatum* L.	CR C2a (ii)
30.	*Bienetria cycloptera* Bunge	VUA2c+3c
31.	*Camphorosma* lessingi Litv.	NT
32.	*Salsola tragus* L.	VUD2
33.	*Acantalimon tenuflorum* Boiss.	ENB1ab(iii,v)+2ab(iii,v)
34.	*Alcea lenkoranica* Iljin	ENB2ab(ii,iii,iv,v)
35.	*Pistaca mutica* Fisch.et C.A.Mey.	NT
36.	*Rhus coriaria* L.	VUB2ab(iii)
37.	*Euonimus velutina* Fisch.et C.A.Mey	VUD2
38.	*Tragagon karjaginii* Kuth.	ENB1ab(v)
39.	*Linaria schirvanica* Fomin	VUB1ab(i,ii,iii)+2ab(ii, iii, iv)

The status of rare species is not the same as shown from the table. They are parceling by category and criterion unevenly. Each category and criteria (except EX and EW) have representatives of rare plants. For example: endangered - Extinct - EX, extinct in the wild flora - Extremely in the wild – EW, in critical condition - Critically endangered - CR (*Iris alexeenkoi* Grossh.), vulnerable - VU (*Rhus coriaria* L., *Euonimus velutina* Fisch.et CAMey., *Crocus adami* J. Gay *et al.*), in a state near the threatened - NT (*Pistaca mutica* Fisch.et CAMey.), causing the least concern - LC (*Taxus baccata* L.), Endangered - EN (*Asparagus persicus* Baker).

Number of measures to improve the botanical composition of vegetation as a whole, increase productive areas, prevent desertification, erosion, soil degradation, and rational use of plant resources are necessary to carry out for preserve the genetic resources of rare, endangered, relict, endemic plant species.

First of all, for rationally use natural plant resources for the benefit of mankind and transfer it to the future generation is necessary to take into account the huge role of their formation, create new reserves, national parks and specially protected areas, and also introduce and restore rare, endangered plant species.

Conclusions

17 endemic species (3 Azerbaijani and 14 Caucasian) were identified for the region. 39 rare, endangered plants species subdivided according to the degree of rarity into the following categories were also identified: shrinking areas - 10.65% species, rare 7.14%, endangered 1.29%, extensively exterminated 2.49%

Offers

1. We propose to actively propagate the ideas of nature protection among the population in order to protect rare, endangered, relict and shrinking areas of species. Create specially protected areas to prevent the death of rare plants and their phytocenoses.
2. We propose at the state level to organize protective afforestation, sowing and seeding of valuable fodder plants in the cut-off areas with mandatory engineering, agrotechnical work in order to prevent further erosion of the soils of summer and winter pastures and their desertification and to create new artificial highly productive hayfields and pastures.

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