



## Original Research Article

# Rare Plants of Ganja-Gazakh Area of Azerbaijan and Their Protection

S.J. Ibadullayeva<sup>1\*</sup>, T.S. Babakishiyeva<sup>2</sup>, A.I. Iskenderova<sup>2</sup> and A.A. Askerova<sup>2</sup>

<sup>1</sup>Botany Institute of the ANAS, AZ1073 Badamdar str, 40, Baku, Azerbaijan

<sup>2</sup>Azerbaijan State Agrarian University, 262, Ataturk Avenue, AZ2000 Ganja, Azerbaijan

\*Corresponding author.

Abstract	Keywords
The study has been aimed to report rare plants in Aghstafa, Gazakh, Dashkasan, Gadabay, Ganja, Goranboy, Naftalan, Samukh, Goygol, Shamkir and Tovuz administrative and geographical regions related to Gəncə-Gazakh zone of Western part of Azerbaijan. On the process of the carried out researches it was ascertained that 50 species of flowering plants are getting rare and threatened status in Ganja-Gazakh Area of Azerbaijan. It was considered to access 26 species of them into the Red Book for the first time was reliable. An Action Plan to protect the rare species was developed and practical activities were carried out.	Flora Ganja-Gazakh Area Protection activities Rare plants Threatened species

## Introduction

Though Azerbaijan territory is small place occupies one of the main places in the world according to its biodiversity. The reason of this richness is complexity of the territory of the Republic from the geomorphological point of view and diversity from the natural -geographical point of view. On the raw of these threatened species are more than 10% of the whole flora (The Red Book, 1989). That is why rare plants of the Azerbaijan flora is being investigated by scientists (Ibadullayeva et al., 2011; Iskender et al., 2012) from time-to-time and activities are being carried out to protect them.

Botanists in Small Caucasus (within Azerbaijan) have always been researched and the flora of the area was studied (Shahmuradova et al., 2012). However there is no accurate information about the

current state of the rare plants of the area. Taking into account all of these study of rare plants and subjected to threatening have been undertaken as a goal.

## Materials and methods

The investigation has been carried out in Aghstafa, Gazakh, Dashkasan, Gadabay, Ganja, Goranboy, Naftalan, Samukh, Goygol, Shamkir and Tovuz administrative and geographical regions related to Gəncə-Gazakh zone of Western part of Azerbaijan with the area of 12.482.000 sq.km in 2003-2013. Multi-Volume Edition of Azerbaijan and Caucasian Flora has been used in plants identification (The Azerbaijan Flora, 1952-1961; Grossheym, 1936-1967) and the recent nomenclature codes were used

(Cerepanov, 1995; Conspectus of Flora of Caucasus, 2003-2006). Central Herbarium of the Botany Institute of the ANAS and Herbarium Pool maintained under subordination of Biology Department of the Azerbaijan State Agrarian University have been basically inspected.

The following research activities were carried out to identify the rare and threatened species in the area and develop their total list/taxon: specific area and bioecological properties were identified during the floristic researches (Lavrenko, 1959; Beydeman, 1954); not widespread species were studied not depending on their different latitude. The threatened taxa and their restricted area on definite purposes were selected; endemicity of species, their possession to rare and very complicated status were taken into account; threatened and not numerous species were approached with an attention (Hajiyev et al., 1996). The herbarium materials have been acquired from various parts of the area; an assesment was carried out according to the International Red List IUCN. The plant conservation activities were carried out to protect them (IUCN Red List, 2003). Various ways were used during introducing the plant into natural habitats (Mazurenko et al., 2009).

## Results and discussion

The base of Small Caucasus botanical & geographical region is Ganja-Gazakh territory situated in the Western part of Azerbaijan. Plants have been spraed along with altitude belts of 100m to 3.767m from the sea level here. Territory of Ganja-Gazakh economical region is rich of agricultural plants. Natural vegetation in the territory have been cocentrated in Bozgyr summer pasture, Northern part of Small Caucasus, Ganja Plain, Jeyranchol and Hajynohur Areas. Flora of the area is of xerophyte type and happen in Tugay Forests surrounding Kür, Gabyrly and Ganykh Rivers.

In the raw of anthropogenic factors occurred in the vegetation cover natural negative processes resulted with: water errosion, defoliation, resalination and other degradation; all of these have effected onto 28 families, 50 species belonged to 40 genera to become rare and subjected to be threatened. That is why each species have been evaluated in accordance with Red List on categories and subcategories as well as an action plan has been developed to protect them (Table 1).

**Table 1. Practical activities on evaluation and protection of rare and threatened species of Ganja-Gazakh territory i.a.w. International Red List.**

№	Name of plants	IUCN criteria	Protection activities					
			1	2	3	4	5	
			a	b	c	d	e	
1.	<i>Sternbergia fischeriana</i>	EN A2c+3c; B2ab (i,ii,iii,v)	█	█	█			
2.	<i>Cotinus coggygaria</i>	NT	█	█	█			█
3.	<i>Pistacia mutica</i>	NT	█	█	█			
4.	<i>Rhus coriaria</i>	VUA2c+3c	█	█	█			
5.	<i>Bupleurum wettaminnii</i>	CR B2a(i)+c(i,ii); D	█	█	█			
6.	<i>Ferula caspica</i>	NT	█	█	█		█	
7.	<i>Cousinia hohenackerii</i>	NE	█	█	█	█		
8.	<i>C. orientalis</i>	NE	█	█	█	█		
9.	<i>Buglissoides tenuiflora</i>	NE	█	█	█	█		
10.	<i>Arabis gerardii</i>	VU A2ad+B2ab (ii,iii)	█	█	█	█	█	
11.	<i>Neotorularia eldarica</i>	VU C2a(ii); D2	█	█	█	█	█	
12.	<i>Psammophiliella muralis</i>	NE	█	█	█	█	█	█
13.	<i>Atriplex cana</i>	EN B2ab (ii, iii, iv)	█	█	█	█	█	█
14.	<i>Juniperus foetidissima</i>	NT	█	█	█			
15.	<i>Euphorbia falcata</i>	NT	█	█	█			
16.	<i>Astracantha andrejii</i>	VU A2ab+B2a (ii,iii,iv); D1	█	█	█	█	█	
17.	<i>Astragalus gunaicus</i>	NT	█	█	█	█	█	
18.	<i>Scorpiurus muricatus</i>	NT	█	█	█			
19.	<i>Globularia vulgaris</i>	VU D2	█	█	█			
20.	<i>Eriophorum latifolium</i>	VU B2ab (ii) + c (ii)	█	█	█			

№	Name of plants	IUCN criteria	Protection activities										
			1	2	3	4	5						
							a	b	c	d	e		
21.	<i>İris camillae</i>	VU D2	█	█		█		█	█	█			
22.	<i>İ. iberica</i>	VU D2	█	█		█		█	█	█			
23.	<i>İ. pumila</i>	VU C1	█	█		█		█	█	█			
24.	<i>İ. alexeenkoi</i>	CR B2b (iii, iv,v) c (ii, iii)	█	█		█		█	█	█			
25.	<i>İ. schelkownikowii</i>	CR B2ab (v)	█	█		█		█	█	█			
26.	<i>Tulipa eichleri</i>	VU A2c + 3c	█	█		█		█	█	█			
27.	<i>T. biebersteiana</i>	VU A2c+3c	█	█		█		█	█	█			
28.	<i>Juncus littoralis</i>		█	█		█		█	█	█			
29.	<i>Acantholimon fominii</i>	VU B2a	█	█		█		█	█	█			█
30.	<i>A. lepturoides</i>	DD	█	█		█		█	█	█			█
31.	<i>A. tenuiflorum</i>	EN B1ab (iii, v) + 2ab (iii,v)	█	█		█		█	█	█			
32.	<i>Hemerocallis fulva</i>	VU A2d	█	█		█		█	█	█			
33.	<i>Malva sylvestris</i>	VU A2ab	█	█		█		█	█	█			
34.	<i>M. parviflora</i>	VU A2ab	█	█		█		█	█	█			
35.	<i>Himantoglossum formosum</i>	ENA2acd+3bc	█	█		█		█	█	█			
36.	<i>Pinus eldarica</i>	NT	█	█		█		█	█	█			█
37.	<i>Stipa caucasica</i>	NT	█	█		█		█	█	█			█
38.	<i>Leersia oryzoides</i>	NT	█	█		█		█	█	█			█
39.	<i>Pyrola media</i>	DD	█	█		█		█	█	█			█
40.	<i>Ranunculus illyricus</i>	CRA4b(i,ii,iii)	█	█		█		█	█	█			█
41.	<i>Pyracantha coccinea</i>	VUB1ab (iii) + 2ab (iii)	█	█		█		█	█	█			█
42.	<i>Crataegus erinatha</i>	ENA1ac + d	█	█		█		█	█	█			█
43.	<i>Cotoneaster saxatilis</i>	ENB2ab (ii,iii,iv,v)	█	█		█		█	█	█			█
44.	<i>Pyrus eldarica</i>	CR A2abc; C1	█	█		█		█	█	█			█
45.	<i>Galium eldaricum</i>	LC	█	█		█		█	█	█			█
46.	<i>Punica granatum</i>	VUB1ab (ii,iii,v) + 2ab (i,ii,v)	█	█		█		█	█	█			█
47.	<i>Veronica arcmultifida</i>	LC	█	█		█		█	█	█			█
48.	<i>Leptorhabdos parviflora</i>	NE	█	█		█		█	█	█			█
49.	<i>Valerianella lipskyi</i>	VU B2ac (i,ii,iii)	█	█		█		█	█	█			█
50.	<i>Vitis sylvestris</i>	LC	█	█		█		█	█	█			█

**Note:**

1. Practical activities implementation to protect the plant grown area;
2. Permanent protection against persons who cut trees and bushes, collect seeds and flowers without permission;
3. Protection of biological monuments, endemic plants as a natural monument;
4. Introduction of plant gene pool in the condition of crops and culture;
5. Optimizing of growing condition:
  - a. specifying of grazing areas;
  - b. specifying of reaping period;
  - c. reproduction of the characteristic plants in natural areas;
  - d. control for excessive collection of seed, fruit, flower etc.;
  - e. strengthening combat against pests and insects.

Twenty four of these species have got their attraction in the 2<sup>nd</sup> Edition of the Red Book of Azerbaijan (The Red Book, 2013). However there are such species that (on the raw of population creation) they were not evaluated as rare species though their sole spreading center is Ganja-Gazakh Area. Some activities have been implemented for conservation and protection of such species possessing a special status.

*Bupleurum wittmannii* Stev. is one of rare species of Bozgyr Plateau. Its protection is urgent because it is not widespread in the Republic. Its seeds have been collected in Bilasuvar Area for its reintroduction in the Bozgyr Plateau.

*Ferula caspica* Bieb. is not a widespread species in Azerbaijan flora; it is very rarely encountered around Khanabad Village, in foothills and lowlands,

dry steppes, in desert slopes, salty areas of the Bozgyr Plateau. The plant is rarely happened in Turyanchay National Reservation; it is protected there and it is one of the main control activities to collect seeds and sow in relevant areas; strengthening phenological observations on plant specimen. At present it has been reintroduced.

*Cousinia hohenackeri* Fisch. et. C.A.Mey. is a species of limited area. Inspection of the herbarium materials shows that it has been collected in Bozdagh Range. However in a period of more than 80 years the plant hasn't collected even once and it has perhaps completely perished.

*Cousinia orientalis* (Adams.) C.Koch. is a species of limited area. It has been collected between Poylu and Salahly Villages of Kür River Plain and Hajynohur Steppes of Bosgyr Plateau. During more than recent 85 years period the plant hasn't collected even once. The species has perhaps perished.

*Buglossoides tenuiflora* (L. fil.) Johnst. is a rare plant. Study of its species spread only in Azerbaijan within Caucasus flora (Grossheym, 1967; Conspectus of flora of Caucasus, 2003), and maintenance of its gene pool has got much importance. It is a rare and restricted range species; amount of its specimen gradually has decreased and perhaps it has completely perished. May be natural calamity, land erosion and excessive grazing in pastures were the main wipe out factors. There is not any information concerning to its spread in the wild nature yet.

*Arabis gerardii* (Bess.) Koch. is found in limited area; rare, decorative and fodder crop. It is a very interesting material from the Genetic point of. Comprehensive study of this species to maintain its gene pool is purposeful. It is seldom happen in shrubbery, forest glades and small hills of Bozgyr Plateau. Its spread areas excessive grazing of pastures, subjection to trampling down new sprouts and grasses by artiodactyls effect onto its uninterrupted quantity reduce. Taking into account all of these urgency of the plant reintroduction in its spread area to maintain the gene pool was stressed; seed stocking was carried out and some activities were carried out in the direction of it cultivation.

*Neotorularia eldarica* (Grossh.) V.Avet. is one of rare species of the family. It is endemic plant of narrowing areal. They happen in less biotops in Bozgyr Plateau and Kür River Plains of Azerbaijan

and amount of individuals decreases day-by-day. Not rational use of the area and natural calamities are the basic influential factor of its becoming rare. Taking into account grazing of its spread areas and development of scientific arrangement of its seeds' reproduction in appropriate areas was done by collecting them. In 2013 a reintroduction by the seed got of about 30 specimen belonged to this plant has been carried out for its protection.

*Psammophiliella muralis* (L.) İkon. (= *Gypsophila muralis* L.) is a rare plant. May be it has completely perished in the area. That is why its investigation assumes is a sole species of the genus in Azerbaijan it protection is urgent for conservation of the gene pool. On the base of the Central Herbarium inspection we can say though it had been collected in 1929 it was not collected any more during 80 years. It is supposed that anthropogenic factors have been caused its complete perish.

*Atriplex cana* C.A.Mey. is rare species happened only in Böyrük-Enci Plateau of Bozgyr Range of Azerbaijan. Excessive grazing of the area, use of plant cortex as a firewood material has caused the specimen's such sharp decrease of its number. Natural calamities including soil erosion, grazing the area are one of the negative factors effecting onto the plant. As saxaul *Haloxylon* is a plant of firewood material conservation and protection of its gene pool is purposeful.

*Astracantha andrejii* (Rzazade) Czer. as it is endemic, of narrow-area and its spread only in Bozgyr Plateau botanical-geographical region in Caucasus flora make conservation and protection of the plant more urgent. According to the herbarium materials it is realized that it has been collected in 200-300m altitude of sea level of Palantökən Range and around Çomaxlı Station of Azerbaijan. The mentioned area's protection within reservations type as well as development of an action plan for its protection is recommended.

*A. gjuhaicus* Grossh. has been spread in draught stony slopes of the upper mountainous belt of Kapaz Mountain in Northern part of the Small Caucasus Range. Natural erosion, soil degradation occurred in the area has caused decrease of the specimen. Because of war condition it has been observed in 2000 last. We consider that the taxon shall perhaps to be exposed to threat in the near future. Its sample is maintained in the Herbarium of the ASAU.

*Scorpiurus minimus* Losinsk. is not widespread rare and leguminous bean plant. It seldom happens in dry grassy slopes of Bozgyr Plateau. As the species has been spread in fewer areas and on the result of anthropogenic factors number of specimen decreases day-by-day. Control strengthening upon the plant in the wild nature, wide implementation of its reproduction in appropriate areas are of basic protection activities.

*Eriophorum latifolium* Hoppe. Species is rare plant that spread only in the North of Small Caucasus of the Azerbaijan territory. It should be protected for conservation and maintenance of its gene pool as it is not widespread a high mountainous marshy plant.

*Acantholimon fominii* Kusn. is endemic plant with narrow areal. Though there is information about its spreading in mountain hem, foothills, clayey and stony areas of Ellər Oyuğu (Peoples Hollow) of Bozdagh Range it was not re-collected even once during the last 90 years. The required data to evaluate the risk of lost of *A. fominii* Species are not enough; perhaps the species has perished completely. The research activities are going on.

*Acantholimon lepturoides* (Caub. et Spach) Boiss. is endemic plant of Caucasus. That is why conservation and maintenance of its gene pool is urgent. It has spread in dry clayey and stony slopes of Bozgyr Plateau and north area of the Small Caucasus of the Azerbaijan territory.

*Hemerocallis fulva* L. is rare species of which areal is restricting. It happens in Dəhndağ Area of Bozqır Plateau. Collection of its bulbs, pasturing livestock, sheep and goats here should be strictly prohibited.

*Malva sylvestris* L. and *Malva parviflora* L. Species rarely happen in Bozqır Plateau. Perfunctoril improvement of pastures, anthropogenic factors cause decrease the number of specimen. The species should be protected for its gene pool conservation because it is medicinal, vitaminous and decorative valuable plant.

*Stipa caucasica* Schmalh. Species is localized in pastures of the area; its amount is continuously decreasing as it is misallocated. Collecting ears of the plant is one of the basic factors that the plant becomes rare. Supposedly it will be concerned to any grade of threat in near future.

*Pyrola media* Sw. Species is very rare and less spreading plant. It's being realized that according to herbarium material if Northern part of Small Caucasus this species is only in the surroundings of Göygöl of Azerbaijan. However we couldn't acquire any new data as Azerbaijan authorities give no special permit/pass to the lake surroundings since 2002.

*Ranunculus illyricus* L. is rare endemic plant of Azerbaijan. It happens only in Gobistan and Bozqır Plateaus of the Azerbaijan territory. Plant wasn't re-collected even once during the last 50-60 years. Amount of the specimen has decreased, its areal has restricted on the result of anthropogenic factors or natural factors; perhaps it has perished.

*Crataegus eriantha* Pocar. is endemic plant of Azerbaijan. As the plant has been spread close to areas where refugees and forced migrants settled on the score of war condition in the territory they cut them on the purpose of firewood material et.al. So, the anthropogenic factors caused decrease of the specimen number. Protection of its gene pool is urgent as there is a hypothesis that the species is under a high risk of threat in the wild nature; this taxon has got a special role in creation of species generation process and in the study of diversities.

*Galium eldaricum* Grossh. is rare plant with restricting area. Its content is rich of colouring substances. Excessive and unsystematic grazing of its spread area causes decrease of specimen number. It is endemic species of Azerbaijan. Its spreading in the stony and gravelly slopes of Bozqır Plateau only and its endemicity demand species protection. It is protected in the Ellər Oyuğu (Peoples Hollow) National Reservation of Samukh Region of Azerbaijan.

*Leptorhabdos parviflora* (Benth.) Benth. is a rare species, less happening one in the Azerbaijan flora. This plant wasn't re-collected even once during the last 20-30 years and new data haven't acquired about it as it is rarely happened in the wild nature. As it is not any literature information about current state of the species subpopulations, it never seen by us in the wild nature. May be it has completely perished.

*Valerianella lipskyi* Lincz. is rare species being under threat. Its spreading in Bozqır Plateau of its spread area of the territory all around Caucasus only

in little fragments demands its evaluation. Though it is not threatened yet currently However narrowness of its populations, control strengthening on plant specimens as a species of sensitive to be threatened, cultivation in extensive areas, are of urgent terms.

*Vitis sylvestris* C.C.Gmel. is rare plant of restricted areas. It is considered that its accession into the list as rare plant in the Ganja-Gazakh territory and its protection is urgent. The principal cause of its day-by-day decrease is cut of the plant on firewood purposes using riverside forests. Use of its flowers should be strictly prohibited to protect its gene pool. It is possible increase the productivity of grapes by this way. Its importance is great at the gene pool protection, as its initial varieties are resistant to hot and cold, creating of new hybrid varieties of selection significance, at increase of productivity of vine cultivars.

Research activities on protection and reproduction of the rare and threatened species have been carried out in the following direction: spread zones of the rare species have been identified; areal maps have been compiled; reasons of their lost have been ascertained and their gene pool created. Action plan for protection of the species subjected to perish has been developed to reproduct them as: strengthening of the protection in inhabitancies; strict controlling on their collection without permission; maintaining the narrower areals as a natural monument; introduce reproduction for creation of their gene pool.

It has been defined how much perspective were the introduced species in new climatic conditions; resistance of some species to hot and cold in dry climatic condition within the experimental plot has been studied; all agro-technical methods were used, including: plant collection from the nature and maintenance them till planting (period and instructions); selecting the plot; soil preparation; planting and sowing (period and instructions); plant care; propagation instructions. Activities against diseases, pests and insects have been carried out.

## References

Beideman, I.N., 1954. Phenological methods in the geobotanical investigations. M-L., 127 p.

- Cerepanov, S.K., 1995. Vascular Plants of Russia and Agrocent states the former USSR. North American Branch. Cambridge Branch. Cambridge University Press, 992 p.
- Hajiyev, V.J., Musayev, S.H., 1996. Plants and plant formations recommended for the Red and Green Books of Azerbaijan. Baku, P/h 'Elm': 40.
- Ibadullayeva, S., Movsumova, N., Gasymov, H., Mamedli, T., 2011. Protection of some rare and endangered vegetable plants in the flora of the Nakhichevan AR. *Int. J. Biodiv. Conserv.* 3(6), 224-229.
- Iskender, E.O., Gurbanov, M.R., Veliyeva, L.I. (2012). Studying of ontogenetic features of rare and endangered plants in different condinions. *ANAS Xeberler J.* 89-95.
- IUCN Red List Categories and Criteria. (2003). Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge: UK. ii + 30 pp.
- Menitski. Y.L., Popov, T.N. (Ed.), 2006. *Conspectus of Flora of Caucasus. 2003-2006.* T. 1-2 / Sankt-Petersburg,
- Lavrenko, Y.M., 1959. The basic laws of vegetative communities and the ways of their study. Moscow. *Field Geobot.* 1, 13-75.
- Mazurenko, M.T. 2009. Biomorphological method in plant introduction. Materials of the International Conference dedicated to "Plant introduction: theoretic, methodic & applied problems". Yoshkar-Ola: Mary Technical State University, pp.47-56.
- Grossheym, A.A., 1936. The Caucasian flora: The T. 1-7, M.-L.: 1936-1967.
- Shahmuradova, M.J., İbadullayeva S.J., 2013. Systematic ecological analysis of useful plants of Göygöl Region of Azerbaijan. News Proceedings of Ganja Department of the ANAS, N-53 Ganja, pp.9-19.
- The Red Book of the Azerbaijan SSR. (1989). Baku, P/h 'Ishyg': 554.
- The Red Book of the Azerbaijan R. (2013). Baku, P/h 'Second edition': 666.
- The Azerbaijan Flora, 1952-1961. Volumes I-VIII. Baku.