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## STUDY OF RARE AND ENDANGERED SPECIES OF THE *Astragalus* L. GENUS IN THE NATURAL FLORA OF AZERBAIJAN

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## ИЗУЧЕНИЕ РЕДКИХ И ИСЧЕЗАЮЩИХ ВИДОВ РОДА *Astragalus* L. В ПРИРОДНОЙ ФЛОРЕ АЗЕРБАЙДЖАНА

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*Abstract.* In the study, analysis of 29 rare and endangered plant categories of 156 species of *Astragalus* L. naturally distributed in the flora of Azerbaijan, was conducted. The study found that the area of most species is much smaller than in previous years, and the gene pool of some is endangered. The article provides information on the habitats, biological characteristics, reserves, reasons for changes in natural resources and conservation measures. In the research work, 15 species of *Astragalus* L. genus were included in the book “Rare Trees and shrubs of Azerbaijan” (2016). As a result of our research, it was determined that 30 new species of the *Astragalus* L. genus have a small area because of the exposure to anthropogenic factors, and very rare in nature due to lack of special protection. In carrying out the necessary protection measures in the studied species, it was found that 7 new species are endemic, and 23 species are recommended to be included in the Red Book of Azerbaijan as endangered shrubs and plants.

*Аннотация.* В ходе исследования был проведен анализ 29 редких и исчезающих растений из 156 видов *Astragalus* L., распространенных во флоре Азербайджана. Исследование показало, что ареал большинства видов значительно меньше, чем в предыдущие годы, а генофонд некоторых находится под угрозой исчезновения. В статье приведены сведения о местообитаниях, биологических особенностях, заповедниках, причинах изменения природных ресурсов и мерах по охране. В исследовательской работе 15 видов рода *Astragalus* L. были включены в книгу «Редкие деревья и кустарники Азербайджана» (2016). В результате наших исследований было установлено, что 30 новых видов рода *Astragalus* L. имеют небольшой ареал из-за воздействия антропогенных факторов, и очень редки в природе из-за отсутствия специальной охраны. При проведении необходимых мероприятий по охране изученных видов установлено, что 7 новых видов являются эндемиками, а 23 вида рекомендованы к включению в Красную книгу Азербайджана как исчезающие кустарники и растения.

*Keywords:* *Astragalus* L., rare species, endangered species, endemic species, flora, dendrochronological studies, Red Book.

*Ключевые слова:* *Astragalus* L., редкие виды, исчезающие виды, эндемичные виды, флора, дендрохронологические исследования, Красная книга.

### *Introduction*

The research analyzed the category of rare and endangered plants of 29 species distributed in Azerbaijan out of 156 species of *Astragalus* L. genus naturally distributed in the flora of Azerbaijan. During the preparation of the article, monitoring was carried out on the natural habitats of the species collected as a result of many expeditions, business trips and research, and distribution of the populations was studied. Observations have shown that the range of most of the species listed in the article is much smaller than in previous years and that the gene pool of some is endangered. From this point of view, the reasons for the reduction of the habitats of the studied plants were investigated, and their danger criteria were determined according to version 3.1 of the ICRC. In addition, the article provides information on the habitats, biological characteristics, reserves, causes of changes in natural resources and conservation measures. The article recommends that new species of the endemic, rare and endangered genus *Astragalus* L. studied to be included in the Red Book of Azerbaijan.

### *Materials and methods*

The study analyzed the natural distribution areas of 37 species of *Astragalus* L. shrubs distributed in the natural flora of the Republic of Azerbaijan, the reasons for shrinkage, hazard criteria, biological characteristics, reserves, causes of changes in natural resources and protection measures. The studied species are grouped according to version 3.1 of the IUCN. In the study, Flora of Azerbaijan, vol. I (1950); Trees and shrubs of Azerbaijan I C (1961, 1989); Synopsis of Azerbaijani flora, vol. I–III (2005, 2006, 2008); Dendroflora of Azerbaijan, vol. I (2011); etc., literary materials and personal research were used [1–5].

The studied species belong to the category of rare and endangered plants, and recommendations were given for inclusion in the 3rd volume of the newly published Red Book of Azerbaijan.

The article is based on version 3.1 of IUCN (2001), where plants were grouped to: Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CE), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD), Not Evaluated (NE) species. In the study, it was determined which rare plants belong to the categories of danger accepted by international organizations, and various protection measures were selected. The classification of taxa presented in the article is based on the APG III system.

### *Analysis and discussion*

There are about 500,000 species of plants in the flora of Azerbaijan, of which more than 4,600 species are naturally occurring trees and shrubs. It should be noted that about 156 of 3,000 species of *Astragalus* L. genus in the world are naturally distributed in Azerbaijani flora. There are 37 shrubs out of 156 species, which are included in vol. III (2016) of the Azerbaijani dendroflora. Currently, 15 species of the *Astragalus* L. genus are included in the list of rare and endangered trees and shrubs.

It should be noted that in 1975, 24, in 1984, 28, and in 1989, 45 species of rare and endangered woody plants, i.e., trees and shrubs species were identified in Azerbaijan. Due to the growing number of rare plant species, finding the causes of this problem and their protection is one of the most pressing issues.

Observations show that some of the habitats of rare and endangered plant species belonging to the *Astragalus* L. genus in the flora of Azerbaijan do not have a protection strategy. The main purpose of the research was to identify these species, to prepare accurate lists, and to classify them as rare and endangered plant categories. For this purpose, the distribution of species, population size, ecological needs, physiological tolerance, reproductive biology were analyzed. Species belonging to the *Astragalus* L. genus are mainly observed in the mountainous areas of Nakhchivan, the Greater Caucasus, the Lesser Caucasus and Hirkan.

Species belonging to the genus *Astragalus* L. (Table).

Table

ENDEMIC, RARE AND ENDANGERED AZERBAIJAN SPECIES  
 OF THE *Astragalus* L. GENUS

<i>№</i>	<i>Occurred in dendroflora</i>	<i>Area</i>	<i>Distribution in Azerbaijan</i>	<i>Status</i>
1.	<i>A. andreji</i> Rzazade	Azerbaijan	Nakhchivan, Bozdag p.	Endemic (VU C 2a)
2.	<i>A. barba-caprina</i> Al. Fed., & Fed. Rzazade	Caucasus, Azerbaijan, Nakhchivan	Nakhchivan, Shakhbuz	Endemic (VU C)
3.	<i>A. beckerianus</i> Trautv.	Caucasus, Central Asia, Pamir-Altai, Samarkand	Greater Caucasus (Guba)	NT
4.	<i>A. caspicus</i> M. Bieb.	Greater Caucasus, Russia, Turkey, Iran	Talysh mountains	NB (CR B)
5.	<i>A. caucasicus</i> Pall.	Caucasus	Lesser Caucasus	NT
6.	<i>A. compactus</i> Lam.	Azerbaijan	Nakhchivan, Ordubad, Karabakh	NT (CR B)
7.	<i>A. denudatus</i> Steven	Greater Caucasus, Russia	Karabakh, Guba (Buduq), Altiagaj	NB (CR B1)
8.	<i>A. eurylobus</i> (Barneby) Barneby	Central and Lesser Caucasus	Nakhchivan, Ordubad, Oxchachay	NB (VU A)
9.	<i>A. flavirubens</i> Theodorov et al.	Lesser Caucasus	(Gapija) Nakhchivan	NB (VU C)
10.	<i>A. gudrathii</i> Al. Fed., Fed. & Rzazade	Azerbaijan, Nakhchivan	Nakhchivan	Endemic (CR B)
11.	<i>A. hohenackeri</i> Boiss.	Azerbaijan, Zuvand, Iran	Lankaran (Diabr.)	NB (VU A)
12.	<i>A. husseinovii</i> Rzazade	Caucasus, Azerbaijan	Lerik, Goshmalayan and Hovery	Endemic (VU C)
13.	<i>A. xiphidium</i> Bunge	Lesser Caucasus	Lesser Caucasus, Ganja	NB (VU A)
14.	<i>A. insidiosus</i> (Boriss.) Boriss.	Caucasus and Azerbaijan		NB (CR B)
15.	<i>A. igniarius</i> Popov.	Azerbaijan	Kur-Araz, Absheron-Turkan, Zira, Gala, close to Khazar	NB (VU C)
16.	<i>A. jucundus</i> Al. Fed., Fed. Rzazade	Azerbaijan, Nakhchivan	Nakhchivan, Garagush mountain	Endemic (VU C)
17.	<i>A. karjagini</i> Boriss.	Northern Iran	Lankaran and Masalli	NB (VU D)

№	Occurred in dendroflora	Area	Distribution in Azerbaijan	Status
18.	<i>A. karabaghensis</i> Bunge	Azerbaijan, Nakhchivan, East Anadolu and North-West Iran	Lesser Caucasus and Nakhchivan	NT
19.	<i>A. lussiae</i> Rzazade	Greater Caucasus, Lesser Caucasus, Nakhchivan	Nakhchivan Oxchachay, Guba-Shabran	NB (VU A)
20.	<i>A. maraziensis</i> Rzazade	Caucasus, Azerbaijan	Maraza, Gobustan	Endemic (VU D)
21.	<i>A. meyeri</i> Boiss.	Lesser Caucasus	Nakhchivan	NB (VU A)
22.	<i>A. microcephalus</i> Willd.	Lesser Caucasus	Lesser Caucasus, Nakhchivan	NT
23.	<i>A. oleifolius</i> DC.	East Azerbaijan	Nakhchivan	Endemic (CRB 1ab)
24.	<i>A. persicus</i> (DC.) Fisch. & C. A. Mey.	Azerbaijan Zuvand mountain	Nakhchivan	Endemic (CRB 2ab)
25.	<i>A. pycnophyllus</i> Steven	West and Middle Asia, Caucasus, Iran and Turkey	Lerik and Lankaran	Endemic (CRB 2ab).
26.	<i>A. strictilobus</i> Barneby	Azerbaijan Talaqon	Nakhchivan	NT
27.	<i>A. terekensis</i> Al. Fed., Fed. & Rzazade	Greater Caucasus, Dagestan	Lesser Caucasus	(VUA 2C + 3cd)
28.	<i>A. theodorianus</i> Fed. & Rzazade	Azerbaijan	Lankaran, Lerik, Sonayolja	Endemic (VU D2)
29.	<i>A. vedicus</i> Takht.	West Caucasus	Lesser Caucasus, Nakhchivan, Zangazur	NB (CR B)

#### 1. *A. andreji* Rzazade

It was first described in Nakhchivan, in the Bozdag area. It grows at an altitude of 200–300 m above sea level, on clay and rocky slopes. It is recommended to be included in the Red Book of Azerbaijan as an endemic one (VUC2a).

#### 2. *A. barba-caprina* Al. Fed., Fed. & Rzazade

Forms sparse formations in the Caucasus Mountains, Dagestan and on the shores of Lake Baikal. Grows on dry, rocky slopes, at an altitude of 1400–1500 m above sea level. Occurs naturally in Azerbaijan in the Shahbuz region (Tirkesh village) of Nakhchivan A. R. as a rare plant and recommended to be included in the Red Book (VU C).

#### 3. *A. beckerianus* Trautv.

Natural distribution in the Caucasus, Central Asia, Pamir-Altai, Samarkand mountains. It is found in the high mountain belt of the Greater Caucasus (Guba region). It is one of the rare plants of Azerbaijan (NT) and recommended to be included in the Red Book.

#### 4. *A. caspicus* M. Bieb.

It is distributed in the lower reaches of the Greater Caucasus Mountains, Russia (Dagestan), Turkey and Iran. It grows wild in the stony, sandy and clayey soils of Azerbaijan. It is a rare and endangered plant species (CR B) and included in the Red Book of Azerbaijan.

#### 5. *A. caucasicus* Pall.

It was found in the north of the Lesser Caucasus Mountains. It is spread on the rocky slopes of the middle mountain belt, in calcareous places. It is a rare and endangered plant species (NT) and recommended to include Azerbaijan in the Red Book.

6. *A. compactus* Lam.

It is widespread in Azerbaijan and found in the Ordubad region of Nakhchivan A. R. and in the foothills of Karabakh. It is an endemic plant of Azerbaijan (CRB) and included in the Red Book.

7. *A. denudatus* Steven

Widespread in the Greater Caucasus, Russia (Dagestan), naturally found in Karabakh, in Guba and Budug and in Altiagaj. It grows on rocky, rocky slopes and is light-loving. It is a rare and endangered plant species (CR B1) and recommended that Azerbaijan be included in the Red Book.

8. *A. eurylobus* (Barneby) Barneby

Widespread in the Central and Lesser Caucasus, it is found in the foothills of the Ordubad region of Nakhchivan A. R. in the territory of Oxchachay. It is light-resistant and grows on open dry rocky rocks in clay soils. This plant is resistant to severe frosts. It is a rare plant in Azerbaijan (VU A) and recommended to be included in the Red Book.

9. *A. flavirubens* Theodorov et al.

Naturally, it grows in the Lesser Caucasus in Azerbaijan. It is depicted on Gapija mountain of Nakhchivan A. R. It grows in the upper reaches of the mountains, on rocky dry slopes at an altitude of 1700–1800 m. above sea level. It is a rare plant in Azerbaijan (VU C) and recommended to be included in the Red Book.

10. *A. gudrathii* Al. Fed., Fed. & Rzazade

It is found in Nakhchivan A. R. in the south of the Caucasus in Azerbaijan. It is a rare and endangered plant in Azerbaijan (CR B) and recommended to be included in the Red Book.

11. *A. hohenackeri* Boiss.

It was first described in the Zuvand area of the Hirkan flora of Azerbaijan and is widespread in northern and western Iran. It is found in the Diabr area of Lankaran and grows on dry rocky slopes. This plant is resistant to heat and drought. It is a rare plant in Azerbaijan (VU A) and recommended to be included in the Red Book.

12. *A. husseinovii* Rzazade

It grows naturally in the Caucasus and Azerbaijan. It was first described on the mountain slopes near the villages of Goshmalyan and Hovari in the Lerik region. It is a rare plant of Azerbaijan (VU C) and recommended to be included in the Red Book.

13. *A. xiphidium* Bunge

It is distributed in the Lesser Caucasus Mountains. It grows in a small area near Ganja, on dry, rocky slopes and in wormwood semi-deserts. It is a rare plant in Azerbaijan (VU A) and recommended to be included in the Red Book.

14. *Astragalus insidiosus* (Boriss.) Boriss.

It grows naturally in the Caucasus and Azerbaijan. It is spread in the highest alpine meadows, dry, rocky slopes of the mountains of Ordubad region in Nakhchivan A. R. It grows at an altitude of 1000–1200 m above sea level. It is a rare plant in Azerbaijan (CR B) and recommended to be included in the Red Book.

15. *A. igniarius* Popov.

It was first described in a narrow area in Azerbaijan. It grows in sandy, sunny, humid places in the Kur-Araz plain of Azerbaijan, in the villages of Absheron-Turkan, Zira, and Gala, near the Caspian Sea. It is an endemic plant of Azerbaijan (VU C) and recommended to be included in the Red Book.

16. *A. jucundus* Al. Fed., Fed. Rzazade

It is widespread in Azerbaijan in the Lesser Caucasus, in the middle belts of the Nakhchivan Mountains. It is a rare plant in Azerbaijan. There is no wide distribution area. It is a rare plant of Azerbaijan (VU C) and recommended to be included in the Red Book.

17. *A. karjagini* Boriss.

It is found in northern Iran. It is distributed in Lankaran and Masalli in Azerbaijan. It grows on dry, rocky slopes in the middle mountain range. It is a rare plant of Azerbaijan (VU D) and recommended to be included in the Red Book.

18. *A. karabaghensis* Bunge

It was first observed in Karabakh in Azerbaijan. Widespread in Nakhchivan, Eastern Anatolia and Northwestern Iran, it is resistant to heat and drought, and grows in the upper reaches of the mountains, at an altitude of 1800–2300 m above sea level, on dry, rocky and clay slopes, in deserts and slopes. It is a rare plant of Azerbaijan (NT) and recommended to be included in the Red Book.

20. *A. maraziensis* Rzazade

Widespread in the Caucasus, Azerbaijan, it was first described in the Maraza Mountains in Azerbaijan. It is distributed in the lower regions of the Gobustan mountains, and grows on sunny, moist, rocky slopes in dry and clayey areas. It is a rare plant of Azerbaijan (VU D) and is recommended to be included in the Red Book.

21. *A. meyeri* Boiss.

It is widespread in the Lesser Caucasus Mountains and occurs naturally in Nakhchivan. It grows in the middle mountain ranges, mainly in the south and in dry rocky places. This plant is rare in Azerbaijan (VU A) and recommended to be included in the Red Book.

22. *A. microcephalus* Willd.

It is distributed in the northern part of the Lesser Caucasus Mountains and grows in Nakhchivan in the middle mountain ranges and in some cases in the upper mountain ranges. It is a rare plant of Azerbaijan (NT) and recommended to be included in the Red Book.

23. *A. oleifolius* DC.

It was first described in the eastern part of Azerbaijan and distributed in the foothills of the Nakhchivan Autonomous Republic, in the middle mountain belts, on the rocks and sometimes on the slopes with more or less humidity. It is a rare plant of Azerbaijan and recommended to be included in the Red Book.

24. *A. persicus* (DC.) Fisch. & C. A. Mey.

It was first described in the Zuvand Mountains of Azerbaijan. Naturally distributed in a narrow area in Nakhchivan A. R., it grows on dry slopes in mountainous areas. It is a rare plant of Azerbaijan (CRB2ab) and recommended to be included in the Red Book.

25. *A. pycnophyllus* Steven

It is found in natural conditions in South and Central Asia, the Caucasus, Iran and Turkey in a narrow area in Lerik and Lankaran in Azerbaijan. It is a rare plant of Azerbaijan (CRB2ab) and recommended to be included in the Red Book.

26. *A. strictilobus* Barneby

It was first found in the Talagon gorge in Azerbaijan. It grows in Nakhchivan on the middle and upper mountain ranges, on dry rocky slopes. It is a rare plant of Azerbaijan (NT) and recommended to be included in the Red Book.

27. *A. terekensis* Al. Fed., Fed. & Rzazade

It is distributed in the northern and eastern part of the Greater Caucasus Mountains, in Dagestan and found in the upper mountains of the Lesser Caucasus. It grows in the middle

mountains, on dry and bare slopes. This plant is rare in Azerbaijan (VUA2C + 3cd) and recommended to be included in the Red Book.

28. *A. theodorianus* Fed. & Rzazade

It was first encountered in Azerbaijan. It is found in Lankaran, around Sonayolja village in the Lerik region and grows on dry, sandy slopes in the middle mountain belts. It is an endemic plant of Azerbaijan (VU D2) and recommended to be included in the Red Book.

29. *A. vediticus* Takht.

It is endemic to the South Caucasus, and naturally distributed in the Caucasus and Azerbaijan. It grows wild in Nakhchivan, Ordubad and Karabakh. This plant is rare (CR B), its inclusion in the Red Book is expedient.

### Conclusion

Studies have shown that many species of the genus *Astragalus* L. are on the verge of extinction in our flora, and it is important to take a number of measures to ensure the survival and protection of such species. At the same time, it is expedient to add some *Astragalus* L. species that are not in the Red Book of Azerbaijan to the new book. From this point of view, it is important to protect and justify the species of *Astragalus* L. species in the natural flora of our country.

First of all, the factors that led to the reduction of the range of rare and endangered species of trees and shrubs in the country and their extinction were studied. As a result of many anthropogenic factors, the range of species of this genus has been reduced, and even endangered.

One of the factors contributing to the decline or extinction of these species is fires. Many areas of the country have tree-shrub vegetation. Such areas are very sensitive to fire. During fires, some species of the genus *Astragalus* L. growing in these areas may be threatened with extinction. Therefore, it is necessary to take some protective measures to prevent fires.

The book "Rare trees and shrubs of Azerbaijan" (Baku, Science 2016) provides information on 189 rare and endangered species of trees and shrubs belonging to 71 genera in 42 seasons naturally distributed in the flora of the country. In my research work, 15 species of *Astragalus* L. genus were included in the book "Rare Trees and Shrubs of Azerbaijan" Baku, Elm, (2016). As a result of my research, it was determined that 30 new species belonging to the genus *Astragalus* L., have a small distribution area, have been exposed to anthropogenic factors and are very rare in nature due to lack of special protection. In carrying out the necessary protection measures in the studied species, it was found that 7 new species of endemic and 23 species of rare, endangered shrubs and plants should be included in the Red Book of Azerbaijan.

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