

UDC 575.2:575.22:574.3
AGRIS F30

<https://doi.org/10.33619/2414-2948/65/05>

COMPARATIVE ANALYSIS OF RARE AND ENDANGERED PLANTS OF HIRKAN DENDROFLORA

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СРАВНИТЕЛЬНЫЙ АНАЛИЗ РЕДКИХ И ИСЧЕЗАЮЩИХ РАСТЕНИЙ ГИРКАНСКИХ ЛЕСОВ

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Abstract. In the research work has been comparatively analyzed the Hirkan dendroflora and have been collected herbariums of rare and endangered trees and shrubs. There are identified 26 families, 40 genera, 60 species of rare and endangered trees and shrubs naturally spreading areas, distribution of individuals in populations, have been performed tree-ring analysis on old samples. As a result of the observations have been determined, that in the Hirkan flora the majority of species in the areas have been diminished and decreased compared to previous years, many species are in danger of being disappeared. From this point of view by the monitorings of the area were studied threat criteria, the reasons of decline in plant varieties, those plants have been identified based on version of IUCN 3.1. In the research work have been processed out the protection measures, the biological features of species, the causes of change in natural resources.

Аннотация. В ходе исследовательской работы был проведен сравнительный анализ дендрофлоры Гиркана и собраны гербарии редких и исчезающих деревьев и кустарников. Выявлено 26 семейств, 40 родов, 60 видов редких и исчезающих деревьев и кустарников на естественных ареалах распространения. Изучено распределение особей в популяциях, проведен дендрохронологический анализ на старых образцах. В результате наблюдений было установлено, что во флоре Гиркана большинство видов на территориях уменьшилось или уменьшилось по сравнению с предыдущими годами, многие виды находятся под угрозой исчезновения. При проведении мониторинга территории были изучены критерии угрозы, причины сокращения численности растений. Видовые названия растений приведены в соответствие с версией 3.1. МСОП. В ходе исследовательской работы были разработаны меры защиты растений, изучены биологические особенности видов, выявлены причины изменения численности.

Keywords: Hirkan National Park, endemic plants, forest, flora.

Ключевые слова: Гирканский национальный парк, эндемичные растения, лес, флора.

Introduction

Climate change of many years and the effects of anthropogenic factors have led to a decrease in biodiversity in the world.

The replication of rare plants on the conservation and sustainable use of biological diversity of Hirkan flora, the reduction of the human factor to the environmental impact, the distribution of rare and endangered trees and shrub plants in specially protected natural areas, the certification of dendro-chronic analysis of taxonomometric composition and nature monuments is intended [1].

The vegetation cover of the Hirkan National Park, located in the south-east of Azerbaijan's Lankaran and Astara administrative districts, is mainly referred to as the third relic period, where endemic plant species dominate. Hirkan National Park is a lively nature museum of our country and many species are included in the Red Book of the Republic of Azerbaijan [2].

It should be noted that, based on the relevant decree of the country's leadership, the Hirkan flora contains typical flora and fauna species, national wealth of the country and a specially protected nature reserve.

Hirkan National Park is crucial for the development of tourism, improving the social conditions of the population, and the satisfaction of people's oxygen needs. It was investigated 26 families, 40 genera and 60 species of rare and endangered trees and shrubs of natural areas in areas, distribution of individuals in populations and dendrochronologic studies on older samples.

Material and Methods

According to the National Strategy and Action Plan of the Republic of Azerbaijan, expeditions to the Hirkan flora planned for the purpose of investigation, the reasons of lessening the plant areals were investigated, in the result of the monitoring and analyses and threat criteria of these plants were determined based on the 3.1 version of the IUCN. During the research, in 1926 The Talysh flora by A. A. Grossheim, R. Razzade, Y. Isayev, V. Hajiyev, H. Gadirov, Q. Akhundov, S. Agajanov, flora of Azerbaijan, Prilipko L. I., Mammadov T. S., Alexander E. O. in 1950–1961, Asgarov A. M., Musayev S. and other scholars and personal research were used.

In the analyses of flora, it was based to the I, II, III volumes of “The trees and shrubs of Azerbaijan” the Red Book of Azerbaijan SSR in 1989, Red Book was published in 2013 “Rare trees and shrubs of Azerbaijan” published in 2016, 3 volumes of the Azerbaijani Dendroflora published in 2011–2018.

Analysis and Discussion

As a result of research in the National Park, 174 species of tree shrubs have been found in the area, of which 36 are endemic plants of Azerbaijan. Here are the main forest generators: *Fagus orientalis* Lipsky, *Quercus castaneifolia* C. A. Mey, *Carpinus shuschaensis* H. Winkl, *Parrotia persica* C. A. Mey species. The area of the Hirkan flora is located at a height of up to 1,000 m from the east to the west, to the vertical gorges of the forests, and to the lower part *Quercus castaneifolia* C. A. Mey., *Parrotiaca persica* C. A. Mey, *Albizia julibrissin* Durazz., *Gleditsia caspica* Desf., *Ficus hyrcana* A. Grossh. *Diospyros lotus* L., *Zelkova hyrcana* A. Grossh, *Carpinus betulus* L. and others. It has a forest cover of plants. As the altitude increases, *Parrotia persica* C. A. Mey, *Quercus castaneifolia* C.A. Mey species become diminished, replace the *Fagus sylvatica* L. forests.

It forms part of the National Park, mixed forests on the upper layers. According to the research it was found that about 28–30 trees and shrubs in one square kilometer can be found. On our side, samples were taken from old dendrochronic analyzes and their age limit was determined using Lintab 6 [1].

Although the area belongs to the ancient relic period, it has been discovered that the average age of the trees is about 120–347. The reason for this is the well-known events of the 1990s, such as energy shortages, anthropogenic factors, and so on. As a result of which many plant species were exposed to the threat of destruction, causing lessening. It has now been found that the Hyrcan flora's mid-bonitetis II-III average density is 0.57–0.51 [3].

As a result of the monitoring, 500–600 m above sea level, *Parrotia persica* C. A. Mey. has been lessened. *Parrotia persica* C. A. Mey, located in the lower layer. The main components of the forests of the species are *Quercus castaneifolia* C. A. Mey and *Carpinus betulus* L. In addition, *Pterocarya pterocarpa* Kunth. in the area, *Alnus subcordata* C. A. Mey, one by one *Ulmus caprinifolia* Rupp. ex Suckow. species are encountered [4]. The area has a subtropical moisture content according to its natural climate. That is why this area is endemic and is rich in many perennial herbicidal elements belonging to the third period. Historically Hirkan National Park has a rich flora, and about 1/3 of the country's flora is present in these forests.

Low mountain and foothills *Parrotia persica* C. A. Mey. in addition to the main components in the forests, *Diospyros lotus* L., *Albizia julibrissin* Durazz, *Ficus hyrcana* A. Grossh, *Fraxinus Excelsior* L., *Cydonia oblonga* Mill, *Populus hyrcana* Gross., *Zelkova hyrcana* A. Grussh. ect. Jarm. and in the water gyros, with *Salix aegyptiaca* L. and others. Various species are included. As a result of the study, it was found that the grasses in these areas are poorly developed. *Vaccinium myrtillus* L. at 1600 m above sea level, rare case *Taxus baccata* L., *Padus avium* Mill, *Laurocerasus officinalis* M. Roem. *Aesculus hippocastanum* L. (very rare) and so on plants are encountered [5].

Problems and solutions

The observations have shown that there are no conservation strategies for the part of the Hirkan flora's rare and endangered species of woody species.

As a result of monitoring in the Hirkan flora, 72% of the plants in the area are important for medication. The use of these medicinal plants has also had a negative impact on the proportion of populations in the flora [6].

In addition to air and water pollution, one of the other factors contributing to soil pollution is the use of pesticides.

One of the factors causing a reduction in the number of rare plant species in our country or the disintegration of the offspring is fires.

The criteria for the factors that led to the identification of plant species, precise list of plant species and their belonging to rare plant species were studied poorly. It should be noted that the analysis of the distribution of vegetation in our republic, the study of the population's width and ecological problems, the analysis of physiological tolerance and reproductive biology are important in the recovery of gene pool and increase of biodiversity.

To this end, the state has established a legislative basis for the protection of rare and endangered plants in the flora of Azerbaijan. Environmental protection is also reflected in the Constitution of the Republic of Azerbaijan adopted on 12 November 1995 [7]. In addition to this, the Law on Plant Protection was adopted in 1996 in our country for biodiversity. The Red Book of Azerbaijan, published in 1989, contains 140 species of rare plants. In 2013, the 2nd edition of the Red Book of Azerbaijan was issued. This book includes 300 rare plants and mushrooms.

Hirkan dendroflora has been thoroughly analyzed in the research, Extracted Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR) adopted in IUCN (2001) 3.1, endangered — Endangered (EN), Vulnerable (VU), Near Threat — Near Threaten (NT), Worst Danger — Least Concern (LC), No Data Available — Data Deficient (DD), No Data — Not Evaluated (NE)

categories have been used [8] (Figure 1).



Figure 1. Old species of rare and endangered *Carpinus schuschaensis* H. Winkl. and *Gleditsia caspia* Desf.

In the study, a list of rare and endangered plants has been compiled of the bioecological features of the plant species in the Hirkan flora. At the same time, the factors causing the decline of rare and endangered trees and shrubs and their descendants have been investigated. The following table describes the types of species that have been classified and spread by age, genus, and species [9].

| № | Family | № | Genus | № | Species | Spreading land | | |
|----|---------------------------------------|-----|-----------------------------|-----|---|--|--|-----------------------|
| 1. | <i>Asparagaceae</i> Juss. | 1. | <i>Danae</i> Medic. | 1. | <i>rasemosa</i> (L.) Moench | Astara, Lankaran, Lerik | | |
| | | 2. | <i>Ruscus</i> L. | 2. | <i>hyrcanus</i> Woronow | Astara and Lankaran | | |
| 2. | <i>Anacardiaceae</i> R. Br. Lindl. | 3. | <i>Rhus</i> L. | 3. | <i>coriaria</i> L. | Lankaran, Astara | | |
| 3. | <i>Araliaceae</i> Juss. | 4. | <i>Hedera</i> L. | 4. | <i>helix</i> L. | Lankaran, Astara | | |
| | | | | 5. | <i>pastuchovii</i> Woronow | Lankaran, Astara | | |
| 4. | <i>Aquifoliaceae</i> DC. | 5. | <i>Ilex</i> L. | 6. | <i>hyrcana</i> L. | Lerik, Lankaran, Masallı and Yardımlı | | |
| 5. | <i>Buxaceae</i> Dumort. | 6. | <i>Buxus</i> Pojark | 7. | <i>hyrcana</i> Pojark. | Astara, Lankaran, Lerik and sometimes Masally, Jalilabad | | |
| 6. | <i>Betulaceae</i> S. F. Gray | 7. | <i>Alnus</i> L. | 8. | <i>subcordata</i> C. A. Mey. | Lankaran, Lerik, Yardımlı, Astara | | |
| | | | | 8. | <i>Carpinus</i> L. | 9. | <i>schuschaensis</i> H. Winkl. | in Talysh mountains |
| | | | | | | 10. | <i>macrocarpa</i> (Willk.) H. J. P. Winkl | in Lankaran mountains |
| 7. | <i>Cannabaceae</i> Martinov. | 9. | <i>Celtis</i> L. | 11. | <i>caucasica</i> Willd. | Lankaran | | |
| | | | | 12. | <i>australis</i> L. | in the lower and middle mountainousterrain the Lankaran lowlands | | |
| 8. | <i>Celastraceae</i> R. Br. | 10. | <i>Euonumys</i> L. | 13. | <i>velutinus</i> (C. A. Mey.) Fisch. & C. A. Mey. | Ismaylly-Zaqatala, Lankaran-Astara | | |
| 9. | <i>Cornaceae</i> Dumort | 11. | <i>Thelycrania</i> Fourr | 14. | <i>meyeri</i> Pojark. | in Talysh area | | |

| № | Family | № | Genus | № | Species | Spreading land |
|-----|----------------------------------|-----|----------------------------|-----|--|--|
| 10. | <i>Ebenaceae</i> Vent. | 12. | <i>Diospyros</i> L. | 15. | <i>lotus</i> L. | Lankaran, Lerik, Astara, Yardymly and Masally |
| 11. | <i>Leguminosae</i> Juss. | 13. | <i>Albizia</i> Durazz. | 16. | <i>julibrissin</i> Durazz. | Talysh region |
| | | 14. | <i>Astragalus</i> L. | 17. | <i>husseinovii</i> Rzazade | The average mountain terrain in Lerik (Diaber, Gosmalyan, Heveri villages) |
| | | | | 18. | <i>caspicus</i> M. Bieb. | The highest alpine meadows of the mountains in the Talysh zone |
| | | 15. | <i>Gleditsia</i> L. | 19. | <i>caspia</i> Desf. | Astara, Lankaran |
| 12. | <i>Fagaceae</i> Dumort. | 16. | <i>Quercus</i> L. | 20. | <i>macranthera</i> Fisch. & C. A. Mey. ex Hohen. | in Lankaran mountains |
| | | | | 21. | <i>longipes</i> Steven | Lankaran, |
| | | | | 22. | <i>crispate</i> Steven | Lankaran, |
| | | | | 23. | <i>castaneifolia</i> C. A. Mey. | Astara, Lankaran, Lerik, Masally, Lerik |
| 13. | <i>Hamamelidaceae</i> R. Br. | 17. | <i>Parrotia</i> C. A. Mey. | 24. | <i>persica</i> C. A. Mey | Lankaran, Astara, Masally |
| 14. | <i>Lamiaceae</i> Lindl. | 18. | <i>Thymus</i> L. | 25. | <i>trautvetteri</i> Klokov & Des.-Shost. | It spreads around the Lankaran Mountains |
| 15. | <i>Lythraceae</i> Jaume St.-Hil. | 19. | <i>Punica</i> L. | 26. | <i>granatum</i> L. | Lankaran, Astara |
| 16. | <i>Moraceae</i> Lindl. | 20. | <i>Ficus</i> L. | 27. | <i>carica</i> L. | Lankaran |
| | | | | 28. | <i>hyrcana</i> A. Grossh | Lankaran, Astara |
| 17. | <i>Oleaceae</i> Hoffm. & Link. | 21. | <i>Fraxinus</i> L. | 29. | <i>coriariifolia</i> Scheele. | Talysh-Alazan-Airichai valleys |
| | | 22. | <i>Jasminum</i> L. | 30. | <i>officinale</i> L. | Lankaran |
| 18. | <i>Rhamnaceae</i> Juss. | 23. | <i>Frangula</i> Mill. | 31. | <i>grandiflora</i> Grub | Lankaran (surrounding villages of Aleppo Apu), Lerik (Siov village) |
| 19. | <i>Rosaceae</i> Juss | 24. | <i>Laurocerasus</i> Duham | 32. | <i>officinalis</i> M. Roem | Astara |
| | | 25. | <i>Pyrus</i> L. | 33. | <i>boissieriana</i> Buhse | Astara and Lankaran regions |
| | | | | 34. | <i>grossheimii</i> Fed. | Lankaran, Lerik |
| | | | | 35. | <i>hyrcana</i> Fed. | Astara, Lankaran |
| | | | | 36. | <i>salicifolia</i> Pall. | in Lankaran, in Astara |
| | | | | 37. | <i>Sorbus caucasica</i> Zins. | The upper mountain range of Lankaran districts |
| | | 26. | <i>Sorbus</i> L. | 38. | <i>luristanica</i> Schonb.-Tem | From the low mountain range in the Lankaran, the middle mountain slopes |
| | | 27. | <i>Crataegus</i> L. | 39. | <i>caucasica</i> C. Koch | Talysh region |
| | | 28. | <i>Rubus</i> L. | 40. | <i>hyrcanus</i> Juz. | Talysh region |
| | | | | 41. | <i>persicus</i> Boiss. | in the territory of Lankaran region |
| | | | | 42. | <i>lanuginosus</i> Stev. ex Ser. | Lankaran, Astara region (Astara riverside). |
| | | 29. | <i>Rosa</i> L. | 43. | <i>nizami</i> D. Sosn | Lerik |
| | | | | 44. | <i>koslowskii</i> Chrshan | Lankaran (Gazo, Durzaband mountain) |

| № | Family | № | Genus | № | Species | Spreading land |
|-----|--------------------------------------|-----|-----------------------|-----|-------------------------------------|--|
| | | 30. | <i>Prunus</i> Mill. | 45. | <i>marschalliana</i> Sosn. | Lankaran |
| | | | | 46. | <i>hracziana</i> Tamamsch | Talysh region |
| | | | | 47. | <i>divaricata</i> Ledeb. | From the Lankaran lowland to the average mountain terrains |
| | | | | 48. | <i>caspica</i> Koval et Ekim. | Lankaran middle mountain terrain |
| | | | | 49. | <i>fenzliana</i> Lipsky | Talysh |
| 20. | <i>Salicaceae</i> Lindl. | 32. | <i>Salix</i> L. | 50. | <i>aegyptiaca</i> L. | Talysh |
| | | | | 51. | <i>hyrcana</i> Grossh. | Lankaran region |
| 21. | <i>Sapindaceae</i> Juss. | 34. | <i>Acer</i> L. | 52. | <i>hyrcanum</i> Fisch. & C. A. Mey. | In Lankaran mountains (Diabar) |
| | | | | 53. | <i>ibericum</i> M. Bieb. | In Lerik (Zuvand) shrubbery content |
| 22. | <i>Taxaceae</i> Lindl. | 35. | <i>Taxus</i> L. | 54. | <i>baccata</i> L. | Lankaran, Lerik |
| 23. | <i>Tiliaceae</i> Juss. | 36. | <i>Tilia</i> L. | 55. | <i>begoniifolia</i> Stev. | Lankaran, Great and Lesser Caucasus |
| 24. | <i>Juglandaceae</i> A. Rich.ex Kunth | 37. | <i>Juglans</i> L. | 56. | <i>regia</i> L. | Lankaran |
| | | | | 38. | <i>Pterocarya</i> Kunth | 57. |
| 25. | <i>Ulmaceae</i> Mirb. | 39 | <i>Zelkova</i> Spach. | 58. | <i>carpinifolia</i> (Pall.) Dippel | Lankaran, Yardımyly, Lerik, Masally, Astara |
| | | | | 59. | <i>hyrcana</i> A. Grossh. et. Jarm. | Lankaran, Yardımyly, Lerik, Masally, Astara |
| 26. | <i>Vitaceae</i> Juss. | 40. | <i>Vitis</i> L. | 60. | <i>sylvestris</i> C. C. Gmel. | Lerik, Yardımyly |

Thus, as a result of the research *Hirkan dendroflora* revealed 26 family, 40 genera, 60 species of rare, endangered species, common distribution of species studied, distribution in Azerbaijan, status, expiration, natural resources, biological characteristics, reproduction, causes of change in natural resources, adopted safeguard measures, and protective measures have been developed on a scientific basis. Based on the dendro-chronic analysis, 32 species of Hirkan flora were found to be between 120 and 347 years, and their sustainability criteria were analyzed [10]. These species were certified as a natural monument (Figure 2).

In the future, recommendations were made to include most of these species into the new Red Book of Azerbaijan.



Figure 2. Sampling, preparation and dendrochronologic analysis of LINTAB6 equipment in Hirkan dendroflora

Result

There are identified 26 families of 40 genera 60 species of rare and endangered trees and shrubs naturally spreading areas, distribution of individuals in populations, have been performed dendrochronical analyzes on old samples.

As a result of the observations have been determined, that in the Hirkan flora the majority of species in the areas have been diminished and decreased compared to previous years, many species are in danger of being disappeared.

From this point of view by the monitorings of the area were studied threat criterias, the reasons of decline in plant varieties, those plants have been identified based on version of IUCN 3.1.

Also, endemic herbs included in the Red Book of the Republic of Azerbaijan have been significantly reduced in the National Park as a result of the influence of anthropogenic factors and climate variability [11]. As a result of the research, it is necessary to note that, due to the reasons for the change of natural resources, the anthropogenic factors are more influenced. Safeguarding of some areas in the protection of territories is purposeful [12].

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Работа поступила
в редакцию 29.03.2021 г.

Принята к публикации
04.03.2021 г.

Ссылка для цитирования:

Mammadov T., Rasulova A., Bagirova S. Comparative Analysis of Rare and Endangered Plants of Hirkan Dendroflora // Бюллетень науки и практики. 2021. Т. 7. №4. С. 37-44. <https://doi.org/10.33619/2414-2948/65/05>

Cite as (APA):

Mammadov, T., Rasulova, A., & Bagirova, S. (2021). Comparative Analysis of Rare and Endangered Plants of Hirkan Dendroflora. *Bulletin of Science and Practice*, 7(4), 37-44. <https://doi.org/10.33619/2414-2948/65/05>