**REPUBLIC OF AZERBAIJAN**

*On the rights of the manuscript*

# ABSTRACT

of the dissertation for the degree of Doctor of Science

# ASSESSMENT OF CENOPOPULATIONS OF SOME LEGUME PLANTS IN AZERBAIJAN

Specialty: 2417.01 - Botany

Field of science: Biology

Applicant: **Zulfiyya Jalal Mammadova**

**Baku - 2022**

The work was performed at the Department of Botany and plant physology of Baku State University.

Scientific consultant: Corresponding member of ANAS, doctor of biological sciences, professor, Honored scientist **Elshad Majnun Gurbanov**

Official opponents: full member of ANAS, doctor of biological sciences, professor, Honored scientist **Tariyel Huseynali Talibov**

Doctor of biological bciences **Aydin Musa Askerov**

Corresponding member of ANAS, doctor of biological sciences, professor **İbrahim Vahab Azizov**

Corresponding member of ANAS, doctor of biological sciences, professor **Ilham Khayyam Alakbarov**

Dissertation Council ED 1.26 of Supreme Attestation Commission under the President of the Republic of Azerbaijan operating at Institute of Botany of Azerbaijan National Academy of Sciences.

Chairman of the Dissertation council: biological sciences doctor, professor **Sayyara Jamshid Ibadullayeva**

Scientific Secretary of the Dissertation council: Doctor of Philosophy in biology, Associate professor **Arzu Yusif Huseynova**

Chairman of the scientific seminar: Doctor of biological sciences, professor **Eldar Novruz Novruzov**

## INTRODUCTION

**Relevance and development of the topic.** Plants being a source of organic matter, and also play an irreplaceable role in the development of industry, the national economy and agriculture, as well as the economy general. The increase of people's knowledge and experience has allowed them to use wild plant resources more skillfully and to plant soil, water allows you to compare interactions in modern times[1,2].

Very valuable and useful representatives of trees, shrubs, grasses among the legume plants in colorful vegetation (*Fabales* or *Leguminosales*) depending on the type of soil at different heights in Azerbaijan are of great importance in medicine, industry, national economy and agriculture, soil nitrogen enrichment, in the planting of greenery, etc. These plants first of all are healthy life for humans, a powerful source of food, and there is a great need for these plants. Legumes found in the species composition of organized associations are of high fodder importance and play an important role in the development of livestock, hayfields and pastures[3]. Leguminous plants of various formations in the phytocenoses, including associations consisting mainly of legumes, have a high forage value and play an important role in the development of livestock, hayfields and pastures. Legumes, along with other plants in phytocenoses, have a high impact on forage productivity in agriculture[4].

---

[1]Jgir, B.K. Plants, Food, and Health: Some Untold Truths//Plant and Human Health, Ethnobotany and Physiology. Springer- 2018,-Vol. 1,-pp.283-294

[2] National Strategy for the Protection and Sustainable Use of Biological Diversity in the Republic of Azerbaijan for 2017-2020 [Electronic resource] // - Baku: Publ. House Ganun, - 2016. http://www.e-qanun.az/framework/33817

[3]Schatz, G. Red list of the Caucasus Region / G.Schatz, T.Shulkina, J.Solomon, –Saint Louis: Missouri Botanical Garden Press, –2013. –230 p.

[4] Ibadullayeva, S., Akhundova, S., Nasibova, G. Economic Assessment Of New Feed Crops Resources In Different Ecosystems Of Lesser Caucasus (Within The Azerbaijan Republic) //J of Multidisciplinary Engineringq Sciences and Technologi (JMEST) – Berlin: -2017, -vol.4, issue 3, -6871-6877p.

As it is known, soil and vegetation are degraded due to strong anthropogenic and man-made influences. Ecological-phytocenological researches carrying out in the relevant phytocenoses is widely given in the international scientific world. For this reason, interest in the study of different plant species at the cenopopulation level has recently increased. The study of plants at the cenopopulation level plays an important role in clarifying the species composition and development dynamics of phytocenoses. Thus, without work at the cenopopulation level is impossible to develop full measures for the protection of plants, including the efficient use of biological resources. Currently, research in most countries of the world is being studied at the level of biological cenopopulation.

As mentioned above, one of the main issues is to increase the productivity of the relevant vegetation, to improve the quality of food, as well as to make recommendations for the protection of rare and endangered legumes and the Red Book[5]. In this regard, the study of legumes at the level of cenopopulation, which is second only to grains in the importance of food and feed in the vegetation of Azerbaijan, is important not only for the development of livestock, but also in ensuring food security. Geobotanical or phytocenological research is one of the most pressing issues of modern times to improve the sowing and mowing of legumes based on the principle of rotation with other plants, the efficient use of summer and winter pastures, the study of species composition at the level of cenopopulation. This urgency is reflected in the research conducted.

**Object and subject of research.** The main object of research was different life forms of legumes distributed in different botanical-geographical regions of the Republic of Azerbaijan at an altitude of 28-3200 m above sea level.

**Objectives and tasks of the research.** To compile an conspectus of the flora of legumes distributed in the territory of the Azerbaijan Republic, to determine the ecological and geobotanical features of

[5]Red Book of the Republic of Azerbaijan. Rare and endangered plant and fungal species. Second edition. / –Baku: East-West, - 2013. - 676 p.

phytocenoses formed mainly by legumes in the natural vegetation of Azerbaijan. to study productivity, efficient use of legumes, protection, etc. The following tasks were set in order to study such features as:

- to compile conspectus of the flora of legumes distributed in the territory of the Azerbaijan Republic;
- to study the ecological and geobotanical features of phytocenoses formed mainly by legumes in the natural vegetation of Azerbaijan and to compile classification schemes of phytocenoses based on phytoecological principles;
- to compile an ecological-geobotanical map of phytocenoses formed mainly by legumes in the natural vegetation of Azerbaijan;
- to determine the age structure of the ontogenesis of cenopopulations, to assess cenopopulations of *A.glycyphyllos* L., *A.falcatus* Lam., *A.kubensis* Grossh., *A.aduncus* Willd. species of the *Astragalus* L. genus, *Vicia sativa* L., *V.crocea* (Desf.) Fritsch, *V.alpestris* Stev., *V.sepium* L. species of the *Vicia* L. genus, *Trifolium caucasicum* Tausch species of *Trifolium* L. genus, *Medicago glutinosa* Bieb. species of *Medicago* L. genus, *Caragana grandiflora* (Bieb.) DC. species of *Caragana* Fabr. genus, *Albizia julibrissin* L. species of *Albizia* Durazz. genus;
- to study the development dynamics and viability of cenopopulations of *A.glycyphyllos* L., *A.falcatus* Lam., *A.kubensis* Grossh., A.*aduncus* Willd species of *Astragalus* genus, *V.sativa* L., *V.crocea* (Desf.) Fritsch, *V.alpestris* Stev., *V.sepium* L. species of *Vicia* L. genus, *T.caucasicum* Tausch species of *Trifolium* L. genus, *M.glutinosa* Bieb. species of *Medicago* L. genus, *C.grandiflora* (Bieb.) DC. soecies of *Caragana* Fabr. genus, *A.julibrissin* L. species of *Albizia* Durazz. genus;
- to determine the productivity of cenopopulations of some legumes of Azerbaijan;
- to study the ways of effective use and protection of legumes in Azerbaijan.

**Research methods.** Field research was carried out in different botanical-geographical regions of the Republic by the route and stationary methods. At the same time, the composition and structure

of phytocenoses formed by legumes were recorded and phenological observations were made. Life forms of plants, types of geographical habitats were identified, ecological analyzes were carried out, as well as endemic, rare and endangered plants were identified, the protection status of rare species were assessed. The ontogenesis of the species was studied, the main indicators of the viability of the population classified on the basis of the maximum criteria were assessed. The seed yield and dormancy period of some legumes were determined during the study.

**The main provisions of the defense.**

1. Compilation of legumes distributed on the territory of the Azerbaijan Republic on the basis of modern classifications;
2. Development of classification schemes based on the modern code, taking into account the phytoecological criteria of plant types represented by the dominance of legumes for the preparation of a modern classification of phytocenses in the natural plant ecosystem of Azerbaijan;
3. Study of phytocenoses formed by some rare and endangered legumes and perennial grasses forming the forest belt of Azerbaijan and development of classification scheme;
4. Compilation of "Ecological-geobotanical map of some phytocenoses formed by legumes in the natural vegetation of Azerbaijan" at 1: 500000 scale;
5. Determining the structure of the ontogenesis of some legumes in Azerbaijan, assessment of cenopopulations, determination of development dynamics, viability have found;
6. Determining the productivity of cenopopulations of some legumes, correlation between productivity elements, seed productivity indicators;
7. Assessment of the current status of some legumes studied at the level of cenopopulation according to the International Red List;
8. Development of ways, protection strategies and recommendations for the efficient use of legumes in Azerbaijan.

**Scientific novelty of the research.** Based on the research, a conspectus of the flora of legumes distributed in the territory of the Azerbaijan Republic was prepared, the distribution of 460 species

for 3 families, 70 genus, 13 species belonged to the *Cesalpiniacea* family, 7 species belonged to the *Mimosaceae* family, 440 species belong to the *Fabaceae* family, were prepared, phenophases, geographic and environmental types, ecological groups, endemicity and relic, rare and endangered representatives have been revised based on modern classifications and literature.

The dominance and phytoecological principles of many edifier (ecosystem engineer) legumes were accepted as the main criteria for the preparation of a modern classification of phytocenoses on the basis of geobotanical descriptions recorded during field research in the natural plant ecosystem of Azerbaijan. 79 formation groups and 126 associations, as well as new distribution areas of 18 species have been identified.

Phytocenoses formed by some rare and endangered leguminous trees and perennial grasses forming a humid plain forest belt for the first time were studied and a classification scheme was developed based on ecological-geobotanical researches. Phytocenoses formed by some rare and endangered species of legumes consist of 1 type, 1 formation class, 5 formation groups and 5 associations were determined.

Classification scheme of phytocenoses formed mainly by legumes in the natural vegetation of Azerbaijan, developed by us for the first time on the basis of the nature plantation of Azerbaijan, "Ecological-geobotanical map of some phytocenoses formed by legumes in the natural vegetation of Azerbaijan" at the level of formation classes was compiled on 1: 500000 scale.

Cenopopulations were assessed, development dynamics, viability, productivity were studied, correlations between productivity elements were identified and conservation strategies were developed on the structure of the ontogenesis of the *Astragalus glycyphyllos*, *A.falcatus*, *A.kubensis*, *A.aduncus* species of *Astragalus* genus, *Vicia sativa*, *V.crocea*, *V.alpestris*, *V.sepium* species of *Vicia* genus, *Trifolium caucasicum* species of *Trifolium* genus, *Medicago glutinosa* species of *Medicago* genus, *Caragana grandiflora* species of *Caragana* genus, *Albizia julibrissin* of *Albizia* genus.

For the first time, we have classified *Astragalus glycyphyllos*

species as “Susceptible to Extinction” (VU), *A.aduncus* and *Vicia alpestris* as “Endangered” (EN), *Astragalus kubensis* and *Caragana grandiflora* as “Critically Endangered” (CR), The *Vicia crocean* is classified as "Nearly Dangerous" (NT), while the *Trifolium caucasicum* and *Medicago glutinosa* species are classified as "Less Dangerous" (LC).

**Theoretical and practical significance of the research**. During the assessment and study of some legumes of the Azerbaijan Republic at the cenopopulation level, a compilation of their flora, identification of phytocenoses mainly represented by legumes, rare and endangered economic, industrial, etc. related to other seasons encountered in these phytocenoses along with legumes in the future. The study of legumes at the level of cenopopulation, which is second only to grains in terms of food and fodder, is important in ensuring food security in the country, improving the fodder base in summer and winter pastures, and developing beekeeping as beekeeping plants. At the same time, legumes as drought-resistant have special importance in the restoration of fodder resources in desert areas, crop rotation, nitrogen enrichment, anti-erosion, livestock, industrial development, planting of greenery, as well as in scientific medicine due to their medical significance.

The results obtained under studying ecological and geobotanical features of phytocenoses formed mainly by legumes in the natural vegetation of Azerbaijan, so "Ecological-geobotanical map of some phytocenoses formed by legumes in the natural vegetation of Azerbaijan" compiled on a scale of 1: 500000, also their name will be developed recommendations for the protection of endangered species, in the protection of biological diversity, in the development of comprehensive measures for environmental protection and noted in "Red Book" can be used in the "Azerbaijani flora" and "Determinants.

**Approbation and application of work.** The main provisions of the dissertation and the obtained important scientific results were presented at the following scientific-practical conferences and congresses at the national and international levels and published in relevant materials: BSU Republican Scientific Conference on

"Problems of Applied Biology" (Baku, 2007); 7th plant life of South West Asia (7th PloSWA) at the International Symposium (Eskishekhir, Turkey, 2007); At the Republican scientific conference dedicated to the 85th anniversary of academician H.Aliyev (Baku, 2008); International scientific conference dedicated to the 90th anniversary of BSU (Baku, 2009); Proceedings of the IX International Scientific and Methodological Conference (Michurinsk-Naukograd, Russia, 2010); At the II International Scientific Conference "Actual Problems of Biochemical Theories" (Ganja, 2011), at the II International Scientific Conference on "Problems of Ecology, Nature and Society" dedicated to the 105th anniversary of academician H.Aliyev (Baku, 2012); International Caucasian Forestry Symposium (Turkey, Artvin, 2013); Republican scientific conference on "Prospects for the development of experimental biology", dedicated to the 80th anniversary of the Biology Faculty of BSU (Baku, 2014); International scientific conferences on "Actual problems of modern chemistry and biology" dedicated to the 92 and 93rd anniversary of national leader Heydar Aliyev (Ganja, 2015, 2016); Symposium on Euroasian Biodiversity (Turkey, Antalya, 2016); International Conference. Innovative Approaches to conservation of Biodiversity dedicated to the 80th Anniversary of the Institute of Botany (Baku, 2016); The 3rd International Symposium on Euroasian biodiversity (Belarus, Minsk, 2017); Approved at the International Scientific Conference "Impact of Climate Change on Plant Biodiversity" (Baku, 2017), etc., as well as at the enlarged meeting of the Department of Botany and plant physology of BSU.

**Organization where the dissertation work is performed**. The dissertation work was carried out at the Department of Botany and plant physology of Baku State University.

**Volume and structure of the dissertation.** The volume of the dissertation consists of 383 pages typed on the computer, including introduction, 8 chapters, conclusion, recommendation parts; 400 thousand characters (I chapter 34000; II chapter 18000; III chapter 14000; IV chapter 201000; V chapter 74000; VI chapter 25000; VII chapter 16000; VIII chapter 16000 characters), list of references and applications, containing 321 sources. The work is enriched with 14

schemes, 47 tables, 12 diagrams, 37 geobotanical descriptions, 1 map and 22 photos.

## CHAPTER I. LITERATURE REVIEW

The literature review provides information on research conducted in various aspects by scientists engaged in the study of plants at the level of cenopopulation. The chapter identifies the level of study of the problem by analyzing their research at the cenopopulation level in order to effectively use and protect plants.

## CHAPTER II. MATERIAL AND METHODS OF RESEARCH

The main object of research was various life forms of legumes distributed in different botanical and geographical regions of the Azerbaijan Republic at an altitude of -28-3200 m above sea level in 2007-2017.

Field and stationary methods were used to conduct field research in various botanical and geographical regions of the country, plant viability was analyzed, and the productivity of cenopopulations was studied. 8000 individuals were studied for the description of ontogenesis in 2007-2017 years.

Referred to "Field geobotany" (1959-1976), "Phytocoenology" (1992), "Information on large-scale geobotanical research of natural areas of the Republic of Azerbaijan" (2002), "Map of Azerbaijan" (cover)[6].

A number of scientific-methodical literature, the Herbarium of the Institute of Botany of ANAS and the Herbarium fund of BSU were used to determine the collected plants, the designated plants were handed over to the mentioned funds. "Flora of Azerbaijan" (1950-1961) and the work of A.M.Askerov (2016) were used during the appointment; life forms by K.Raunkier (1934), I.Q.Serebryakov (1964); geographical and areal types by A.A.Grossheim (1952),

[6]Instructions on typological classification units of natural fodder areas of the Republic of Azerbaijan, instructions on conventional and color symbols / –Baku: Publ.house "Vatan", –2004. –48p.

N.N.Porteniyer (2000); phenological observations by I.Beydeman (1974), D.Brown (1957); ecological analysis by A.R.Shennikov (1964), L.A.Zhukova et al. (1994); Endemic, rare and endangered plants - "Endems of the flora of Azerbaijan" (1973), "Red Book of Azerbaijan" (2013), “Red list of the Caucasus Region”. IUCN Red List Criteria were used. The assessments also took into account the recommendations of V.M.Alizadeh (2009; 2011; 2012). The population type is divided into two classifications based on the principles of the methods developed by T.A.Rabotnov (1971; 1986), A.A.Uranov (1967; 1975) and their schools were used to study the ontogenesis of species. On the basis of maximum criteria evaluated according to classifications of O.V.Smirnov et al. (1976), L.B.Zaugolnov (1994), Z.M.Ismayilova (2014), S.J.Ibadullayeva (2011) and etc.,L.A. Zhivototovsky (1991; 2001). The main indicators of the viability of cenopopulation are an assessment by Ishbridin et al. (2006), Zlobin (2011), and etc. Cenopopulations of *Albizia julibrissin* L. and *Caragana grandiflora* (Bieb.) DC. species were studied on the basis of generally accepted methods for trees and shrubs[7,8]. The seed productivity of some legumes of Azerbaijan was calculated according to I.V.Vainagiy (1974), T.A.Rabotnova (1960), V.J.Hajiyev (2004), the peace of seeds period is also defined during the study[9].

Multidimensional statistical analysis methods such as correlation were used in the analysis of quantitative and qualitative characteristics. The correlation was determined using the SPSS computer program.

---

[7] Sandanov, D.V. Vitality of individuals and cenopopulations of *Sophora flavescens* Soland //Sib. Eco.Jour., -2009. -№6,–p.891-898.

[8]Rodionova, G.N., Ilyina, V.N. Population strategies of life of selected semi-shrubs of this. Legumes (Fabaceae) under anthropogenic pressure //Izvestiya Samar. Tsentr.RAN. -2013. -t.15, - No. 3 (2), -p. 776-778.

[9]Bezdelev, A.B. Life forms of seed plants of the Russian Far East/ A.B.Bezdelev, T.A. Bezdeleva, -Vladivostok: Dalnauka, -2006.- 296p.

## CHAPTER III. CONSPECTUS OF FLORA OF A RANGE OF FABALES SPREAD IN THE TERRITORY OF THE AZERBAIJAN REPUBLIC

Systematic, biomorphological, geographical, ecological and endemic analysis of legumes distributed in the flora of Azerbaijan was studied on the basis of herbarium samples and literature sources collected during the research and "Flora abstract of legumes" was prepared (Appendix 3.1.1).

**3.1. Systematic structure.** 3 families, 70 genus and 460 species of legumes, which make up 10% of the 4557 species and 7% of the Caucasian flora (6350 species) have been found in the flora of Azerbaijan as a result of the analysis (Diag. 1). 7 genus (1.5%), 13 species (2.8%) belong to the *Cesalpiniacea* family was found, 4 genus (0.8%), 7 species (1.5%) belong to the *Mimosaceae* family, 59 genus (12.8%), 440 species (95.7%) belong to the *Fabacea* family. 43 genus are represented by two or more two species, and 27 genus by 1 species was clarified under analyzing the most represented species of the series.

**3.2. Life forms.** Life forms of legumes included in the flora of Azerbaijan were determined by Raunkier and 238 species (51.7%) are hemicryptophytes and 144 (31.3%) species are therophytes was established. The next places are occupied by 60 species (13.1%) of phanerophytes and 18 species (3.9%) of chamefites. Legumes are dominated by 382 species of grasses and consist of 83% according to Serebryakov. Thus, from them 238 species are perennials with 51.7%, 127 species of shrubs with 27.6% in the first place, 43 species of shrubs with 9.4%, 13 species of trees

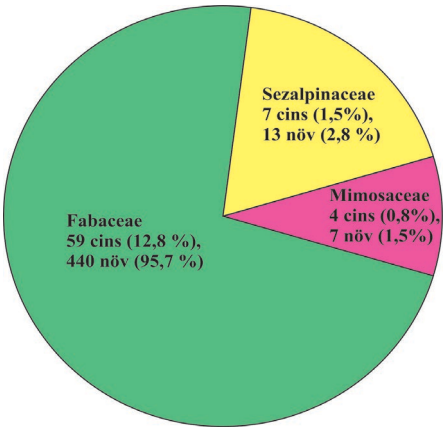


Diagram 1. Families belonging to the legumes genus in the flora of Azerbaijan

with 2.8%, 10 species of prostrate shrubs with 2,2%, annual or biennial grasses are represented by 9 species with 2%, semi-shrubs by 8 species with 1.7%, and biennial grasses by 6 species with 1.3%. Trees or shrubs by 4 species with 0,9%, and annual or perennial species are represented by 2 species with 0.4%.

**3.3. Geographical and areal types.** Ancient Mediterranean (40.7% of 187 species), Caucasian (25% of 115 species) and boreal (14.6% of 67 species) areal type species predominate in the formation of species of legumes widespread in the flora of Azerbaijan. Other habitat types are represented by a small number: 25 adventive species with 5.4%, Ancient (III period forest) area type with 19 species with 4.1%, steppe 13 species with 2.8%. The habitat type of 34 species has not been determined. This is 7.4% of the total species.

**3.4. Ecological groups.** Xerophytes are dominated by 368 species (80%) and mesophytes by 63 species (13.7%) according to the ecological groups of legumes. Species included in the list of legumes on water requirements of plants are defined in 3 groups according to ecological groups, among legumes, xerophytes are dominated by 368 species (80%) and mesophytes by 63 species (13.7%).These two groups make up 431 species or 93.7% of the total flora. Mesoxerophytes from other ecological groups are represented by 29 species and make up 6.3%. Xerophytic representatives of legumes spread over a wide area and form the main association and formations in phytocenosesin the flora of Azerbaijan.

**3.5. Endemicity.** Usually, the index of flora depends on the degree of endemicity. 548 species - endems (146) and subendem (402) (together with Caucasian and Azerbaijani endem) species are distributed in the flora of Azerbaijan, which is 17.7% of the flora according to the literature [10]. Among these endemics, only 81 species of 13 genus were found in the flora of Azerbaijan, of which 24 species are endemic and 57 species are subendem.

Caucasus endemics and subendemes are represented by 57

[10]Askerov, A.M. Subendems of Azerbaijan flora // – Baku: News of ANAS, biol. and medical science series, –2014. – №1, –p.81-89.

species of 9 genus, Azerbaijani endemics and subendemes by 24 species by 7 genus. *Astragalus* (53 species) has more endemic and subendemic species was found. Cenopopulation studies assessed the current status of rare and endangered species listed in the Red Data Book of Azerbaijan, as well as some of the studied species, taking into account the criteria for IUCN risk categories (Table 1)[11, 12]. Protective measures have been developed to protect these plants.

Table 1.

Assessment of modern situation of some legumes are according to the International Red List

| № | Name of species | Danger category (İUCN) | Assessment criteria | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| 1. | *Astragalus glycyphyllos* L. | VU | $A_1$ (a,b,c) | B2(i,ii) | | |
| 2. | *Astragalus kubensis* Grossh. | CR | A2 | B1(a,c) | C1 | D1 |
| 3. | *Astragalus aduncus* Willd. | EN | $A_1$abc | B1, B2 | C1 | |
| 4. | *Vicia crocea* (Desf.) Fritsch | NT | $A_1$(a,c) | B1(a) | | |
| 5. | *Vicia alpestris* Stev. | EN | A1(a)-(d) | $B_1$b (i, ii, iii) c(iv) | C2(b) | |
| 6. | *Trifolium caucasicum* Tausch | LC | $A_1$(a,c) | | | |
| 7. | *Medicago glutinosa* Bieb. | LC | $A_1$(a,c) | | | |
| 8. | *Caragana grandiflora* (Bieb.) DC. | CR | $A_1$(a,c) A2 | B(a,b,c) | C1C2 | D1 |

[11]Mammadova, Z.J. Some rare fragrant bean plants and their paths //–Moscow: MSU Publishing House, The Bulletin of the Moscow State University, "Natural Sciences" series, ISSN 2072-8352. -2014. -№5, -p.32-36.

[12]Mammadova, Z.C. Economic importance of some rare and endangered species of legumes distributed in the territory of the Republic of Azerbaijan // -Baku: Scientific works of the Institute of Microbiology of ANAS. ISSN2224-0683. -2013.-Volume 11, -№2, -p.124-127.

## CHAPTER IV. ECOLOGICAL AND GEOBOTANICAL CHARACTERISTICS OF PHYTOSENOSES PRODUCED BY LEGUME PLANTS IN THE NATURAL PLANT OF AZERBAIJAN

Groupings formed mainly by legumes in natural vegetation were identified in the researches carried out on the basis of ecological-geobotanical researches, geobotanical descriptions were systematized by analyzing ecological-geobotanical features according to vertical zoning in the distribution of soil vegetation in the country.

**4.1. Alpine meadow and carpets vegetation type.** Alpine meadows and alpine carpets with the predominance of legumes registered in the high mountains of Azerbaijan are distributed in mountain-meadow soils up to 3600-3800m (Shahdag range), 3300-3500m and 2500-3200m altitude due to their vertical location above sea level, as well as soil ecological parameters. This type of vegetation is concentrated in 6 formation classes, 14 formation groups and 31 associations have shown studies.

**4.2. Subalpine meadow vegetation type.** "Subalpine meadow vegetation type" consists of 7 formation classes, 12 formation groups and 18 associations was determined in the subalpine meadows of the country, formed mainly from legumes and developed on the basis of ecological and geobotanical parameters of phytocenotic groupings,.

**4.3. Mountain meadows and meadow-steppe zone vegetation.** Mountain meadow vegetation in our country consists of 1 type, 2 formation classes, 9 formation groups and 9 associations, and meadow steppe vegetation consists of 1 type, 2 formation classes, 3 formation groups and 4 associations have shown in studies.

**4.4. Forest vegetation type.** The classification of wet forest vegetation monodominant with legumes and perennial grasses was developed based on ecological-geobotanical research, the relevant forest vegetation groupings consist of 1 type, 1 formation class, 5 formation groups and 5 associations was determined.

**4.5. Shrub vegetation type.** 4 formation classes, 5 formation groups and 10 associations have been identified in the leguminous phytocenoses distributed in the mountain-brown soils of the shrub-

type vegetation.

**4.6. Xerophyte sparse forest vegetation type.** 1 type, 1 formation class, 2 formation groups and 2 associations were identified during ecological-geobotanical research, taking into account the leguminous shrub and xerophyte tree species of xerophyte (arid) sparse forest vegetation type.

**4.7. Mountain xerophyte (Frigana) vegetation type**. This type of vegetation has been determined to consist of 1 type, 3 formation classes, 6 formation groups and 7 associations of frigana legume phytocenoses distributed in mountain-gray brown soils.

**4.8. Steppe vegetation type.** Phytocenoses formed by legumes in this vegetation type is represented by 1 type, 2 formation classes, 3 formation groups and 2 associations have shown in studies.

**4.9.Semi-desert vegetation.** Phytoceneological features and the principle of dominance have been adopted as the main criteria for identifying 1 plant types, 3 formation classes, 3 formation groups and 4 associations in semi-desert vegetation types.

**4.10. Desert vegetation type.** Shrub-legume-motley grasses saline deserts are represented by 1 formation group and 1 association as a transition from semi-deserts to saline (halophytic) deserts of this vegetation type have revealed ecological-geobotanical researches.

**4.11. Coastal sandy desert vegetation type.**The coastal sandy desert vegetation formed mainly by the dominance and subdominance of legumes consists of 1 type, 4 formation classes, 5 formation groups and 6 associations was determined in psammophytic-litoral legume phytocenoses prevalent in sandy soils

**4.12. Chal-meadow vegetation type (Introzonal vegetation).** Mesophytic plants of this vegetation type are introzonal. The meadow vegetation was formed of 1 type, 7 formation classes, 9 formation groups and 11 associations was determined in this regard.

**4.13. Wetland vegetation type (Azonal vegetation).** 1 type, 1 formation class and one group, 1 association were identified in the relevant vegetation in the territory of Azerbaijan, consisting mainly of legumes, in the Samur-Shabran lowland, especially in the territory of Agzibir Lake, formed at 28m above sea level in the territory of Shabran districts.

Ecological-geobotanical characteristics of the species composition and structure of the formations characteristic of Alpine meadows and carpets, subalpine meadows and tall herbaceous vegetation, mountain meadows and meadow steppes, forests, shrubs, xerophytic sparse forests, mountain xerophytes, steppes, semi-deserts and deserts, chal-meadows, wetland and coastal sandy deserts vegetation type are given on the basis of 14 classification schemes, 36 geobotanical description [13], 13 types, 44 formation classes, 79 formation groups and 126 associations and new distribution areas of 18 species have been identified in phytocenoses mainly represented by legumes. "Ecological-geobotanical map of some phytocenoses formed by legumes in the natural vegetation of Azerbaijan" was compiled on a scale of 1: 500000 for the first time on the basis of the classification scheme of phytocenoses formed mainly by legumes in the natural vegetation of Azerbaijan at the level of formation classes.

## CHAPTER V. ASSESSMENT OF ONTOGENESIS OF CENOPOPULATIONS OF DIFFERENT VITAL FORMS OF SOME LEGUMES IN AZERBAIJAN

Assessment of the ontogeny of cenopopulations of some legumes of different life forms (grasses, shrubs, trees), including those with new areas have been provided in the chapter.

5.1. Assessment of ontogeny of cenopopulations of *A.falcatus* Lam., *Astragalus glycyphyllos* L. and *Astragalus kubensis* Grossh. species of *Astragalus* L. genus. Germination, juvenility, gene, generative states of middle age, elderly generative, senile and subsenile states of chrysanthemum beans (*Astragalus falcatus*), sweet-leaved beans (*A.glycyphyllos*) and lip beans (*A.kubensis*) of *Astragalus* genus have been established in studying of the full life

[13] Gurbanov, E.M., Mammadova, Z.J. Ecological-geobotanical map of some phytocenoses formed by legumes in the natural vegetation of Azerbaijan [Map] / - Baku, Copyright Agency of the Republic of Azerbaijan. Certificate of registration of the work. –№7462. -2013.

cycle[14]. The Development of juvenile individuals of *A.falcatus* was normal in Gakh, Sharur, Dashkasan districts. No juveniles were found in the sample plots in Gakh (I CP) and Dashkasan (III CP) districts in 2009 and in Sharur (II CP) districts in 2007. The maximum development of vegetative shoots was observed in 2008 in the state of virginal age, I CP. A large number of dead individuals were found in the first CP in 2009 (ss + s = 9) during the drought.

CP II in 2008 (Δ-ω = 0.47-0.71), in CP III in 2011 the mature type (Δ-ω=0,46-0,73), while others were transitional-type cenopopulations on the basis of age and efficiency index by assessing the cenopopulations of the *Astragalus falcatus* species (Table 2).

***Note: Age and quantity spectrum of cenopopulations of all studied species for 2007-2017 are given in the tables in the dissertation.***

Table 2.

Assessment of cenopopulations of *Astragalus falcatus* Lam. species

| CP | Ont. / Periods | I CP | | | II CP | | | III CP | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2007 | 2008 | 2009 | 2007 | 2008 | 2009 | 2009 | 2010 | 2011 |
| Growth phases of ontogeny, in% | j | 4,4 | 6,5 | - | - | 2,8 | 4,8 | - | 6,4 | 6,1 |
| | im | 6,7 | 6,5 | 4,5 | 7,3 | 5,7 | 7,1 | 7,5 | 6,4 | - |
| | v | 11,1 | 11,5 | 9,1 | 12,1 | 11,4 | 11,9 | 12,5 | 12,9 | 12,1 |
| | $g_1$ | 20 | 19,7 | 22,7 | 17 | 22,8 | 21,4 | 22,5 | 22,6 | 21,2 |
| | $g_2$ | 24,4 | 21,3 | 22,7 | 24,4 | 25,7 | 26,2 | 20 | 22,6 | 27,2 |
| | $g_3$ | 24,4 | 21,3 | 20,4 | 21,9 | 22,8 | 19 | 20 | 19,3 | 27,2 |
| | ss | 4,4 | 6,5 | 11,4 | 9,7 | 8,6 | - | 10 | 6,4 | 3 |
| | s | 4,4 | 6,5 | 9,1 | 7,3 | - | 9,5 | 7,5 | 3,2 | 3 |
| Index | $İ_r$ | 0,32 | 0,39 | 0,21 | 0,31 | 0,28 | 0,36 | 0,32 | 0,40 | 0,24 |
| | $İ_i$ | 0,29 | 0,32 | 0,16 | 0,24 | 0,25 | 0,31 | 0,25 | 0,35 | 0,22 |
| | Δ | 0,48 | 0,48 | 0,52 | 0,50 | 0,47 | 0,47 | 0,51 | 0,45 | 0,46 |
| | ω | 0,68 | 0,64 | 0,67 | 0,67 | 0,71 | 0,66 | 0,65 | 0,65 | 0,73 |
| Type of CP | Transite | + | + | + | + | | + | + | + | |
| | Mature | | | | | + | | | | + |

[14]Mammadova, Z.C. Study of age spectra of legumes (*Astragalus* L.) and sweet beans (*Astragalus falcata* Lam.) of the *Astragalus* L.genus // -Baku: Science, Scientific works of the Institute of Botany of ANAS. -2009. -XXIX vol., -p.346-348.

Cenopopulations of *Astragalus glycyphyllos* species were assessed in Togana massif of Goygol district, Nakhchivan AR, in the territory of Turyanchay Reserve in Gabala district. Age conditions of ontogeny were monitored in 2011-2013.

Only in the *Caraganetum* formation group (I CP) in the Togana massif of Goygol district in 2012, the cenopopulation type was of the growing type (Δ-ω = 0.33-0.64). This is due to the same amount of immature and virginal individuals (17.3%). Other populations were transitional (Table 3).

Table 3.

Assessment of cenopopulations of *Astragalus glycyphyllos* L. species

| CP | Ont. periods | I CP | | | II CP | | | III CP | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 |
| Growth phases of ontogeny, in% | j | 6,6 | - | 2,8 | 5,6 | 8,3 | 7,3 | - | - | 8,3 |
| | im | 10 | 17,3 | 8,6 | 9,4 | 8,3 | 7,3 | 8,3 | 10,4 | 11,7 |
| | v | 10 | 17,3 | 14,3 | 9,4 | 12,5 | 10,3 | 14,6 | 16,6 | 16,7 |
| | $g_1$ | 23,3 | 21,7 | 20 | 18,8 | 18,7 | 17,6 | 16,6 | 20,8 | 18,3 |
| | $g_2$ | 23,3 | 17,3 | 20 | 20,7 | 25 | 22 | 18,7 | 18,7 | 18,3 |
| | $g_3$ | 20 | 21,7 | 22,8 | 20,7 | 18,7 | 23,5 | 18,7 | 20,8 | 16,7 |
| | ss | 6,6 | 4,3 | 5,7 | 7,5 | 8,3 | 11,8 | 12,5 | 8,3 | 6,6 |
| | s | - | - | 5,7 | 7,5 | - | - | 10,4 | 4,1 | 3,3 |
| Index | $\dot{I}_r$ | 0,40 | 0,57 | 0,41 | 0,40 | 0,46 | 0,39 | 0,42 | 0,44 | 0,69 |
| | $\dot{I}_i$ | 0,36 | 0,53 | 0,35 | 0,32 | 0,41 | 0,33 | 0,29 | 0,37 | 0,58 |
| | Δ | 0,40 | 0,33 | 0,44 | 0,46 | 0,41 | 0,45 | 0,51 | 0,44 | 0,38 |
| | ω | 0,67 | 0,64 | 0,65 | 0,62 | 0,65 | 0,65 | 0,61 | 0,64 | 0,58 |
| CP type | Transite | + | | + | + | + | + | + | + | + |
| | Mature | | + | | | | | | | |

Severe grazing has been identified as a limiting factor for *A.glycyphyllos*. *A.glycyphyllos* is classified as "Extinct Susceptible" (VU) according to the threat category of the species). Therefore, permanent control over the species in that area is advisable. As the increase of protection measures for rare and endangered plants in the flora of Azerbaijan is one of the urgent problems of modern times, the cenopopulations of *Astragalus kubensis* in the territory of Guba district were studied (2015-2017 years), *A.kubensis* species was found in half populations during phytocenological studies.

The general index of individuals was not normal, more variability in ontogenetic conditions was observed in the *Hordeta-Trifolietum-Poaosum* and *Festuceta-Astragaletum-Juniperusosum* formations. In the ontogenesis of the species in the I CP juvenile in 2015, juvenile and immature individuals in 2017; juvenile and senile were not found in CP II in 2015, and the only juvenile in 2017. Juvenile individuals of the *Astragalus kubensis* species were found in I CP (2.8%) and II CP(1.8%) only in 2016 (Table 4).

Table 4.

Assessment of cenopopulations of *Astragalus kubensis* Grossh. species

| CP | CP type | Years | Ontogenetic age status in% | | | | | | | | Indexes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | j | im | v | $g_1$ | $g_2$ | $g_3$ | ss | s | $I_r$ | $I_i$ | Δ | ω |
| I CP | Transition | 2015 | - | 8,9 | 15,7 | 15,7 | 19,1 | 18 | 13,5 | 8,89 | 0,46 | 0,33 | 0,49 | 0,61 |
| | Transition | 2016 | 2,8 | 10 | 17,1 | 14,3 | 12,8 | 10 | 20 | 12,8 | 0,78 | 0,43 | 0,49 | 0,51 |
| | Old | 2017 | - | - | 18,9 | 10,8 | 5,4 | 21,6 | 24,3 | 18,9 | 0,5 | 0,23 | 0,63 | 0,52 |
| II CP | Transition | 2015 | - | 17,1 | 19,5 | 7,3 | 9,7 | 14,6 | 31,7 | - | 1,1 | 0,58 | 0,48 | 0,51 |
| | Old | 2016 | 1,8 | 5,4 | 9,1 | 12,7 | 20 | 14,5 | 23,6 | 12,7 | 0,34 | 0,19 | 0,58 | 0,59 |
| | Transition | 2017 | - | 10,6 | 17 | 8,5 | 8,5 | 19,1 | 19,1 | 17 | 0,76 | 0,38 | 0,52 | 0,50 |

Maximum development of virginal individuals was observed in the *Hordeta-Trifolietum-Poaosum* formation in 2017 (18.9%) and in the *Festuceta-Astragaletum-Juniperusosum* formation in 2015 (19.5%). Generative ($g_1+g_2+g_3$=52.8%) individuals predominated in CP I in 2015, and subsenile and senile individuals in 2017. Low growth rates were also observed in the *Formuceta-Astragaletum-Juniperusosum* formation. The predominance in the number of generative individuals was observed only in 2016 ($g_1$-12,7%; $g_2$-20%; $g_3$-14,5%). The number of subsenile (23.6%) and senile (12.7%) individuals was also high in the same year. This situation indicates that the species does not develop in the territory where is widespread.

The cenopopulation type was older (Δ-ω = 0.58-0,59) and other types of cenopopulation are transitional in the first CP of the *Astragalus kubensis* species in 2017 (Δ-ω = 0.63-0.52), in the second CP in 2016 as can be seen from Table 4. The maximum value of the efficiency index (ω = 0.61) was observed only in I CP in 2015. In the

following years, this figure was lower. Assessment is recommended that *A.kubensis* be classified as a "Critically Threatened Person" (CR) based on 10 years of observations and an IUCN 2001 Red List.

**5.2. Assessment of ontogenesis of cenopopulations of *Vicia sativa* L., *V.crocea* (Desf.) Fritsch, *V.alpestris* Stev., *V.sepium* L. species of *Vicia* L. genus.** Phytocenological research of *Vicia sativa* was carried out on 413 individuals in the relict forests of Astara, Lankaran (Hirkan National Park), Kurdamir districts.

Complete and incomplete ontogeny was observed in CP I, II and III of *Vicia sativa* species. Thus, juvenile individuals were not found in I CP in 2014, immature individuals in 2015, and an increase in the number of dead individuals (ss+s=9+7) was observed. No juvenile or immature individuals were found in CP II in 2014 either. The growth rate of individuals in 2015 was also low in CP III, and the decrease between $g_1$ and $g_3$ was found to be 50% ($g_1$ = 8; $g_3$ = 4). These results indicate that the cenosis is stunted and the condition of the population is deteriorating. The study of identified cenopopulations of *Vicia sativa* as young, old and transitional (Tab. 5).

Table 5.

Assessment of cenopopulations of *Vicia sativa* L. species

| | Ont. Periods | I CP | | | II CP | | | III CP | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2013 | 2014 | 2015 | 2013 | 2014 | 2015 | 2013 | 2014 | 2015 |
| Growth of ontogeny phases, in% of total | j | 6,1 | - | 8,8 | 9,7 | - | 17,1 | - | 12,8 | 13,8 |
| | im | 6,1 | 7,7 | - | 11,3 | - | 22,8 | 19,4 | 14,9 | - |
| | v | 10,8 | 9,2 | 17,6 | 9,7 | 12,5 | 22,8 | 16,7 | 17 | 13,8 |
| | $g_1$ | 16,9 | 15,4 | 26,5 | 16,1 | 22,5 | 11,4 | 22,2 | 17 | 27,6 |
| | $g_2$ | 23,1 | 21,5 | 11,8 | 17,7 | 20 | 14,3 | 19,4 | 19,1 | 13,8 |
| | $g_3$ | 27,7 | 21,5 | 11,8 | 17,7 | 20 | 11,4 | 16,7 | 14,9 | 13,8 |
| | ss | 9,2 | 13,8 | 5,9 | 11,3 | 15 | - | - | 4,2 | 10,3 |
| | s | - | 10,8 | 17,6 | 6,4 | 10 | - | 5,5 | - | 6,9 |
| İndex | $İ_r$ | 0,34 | 0,29 | 0,53 | 0,59 | 0,20 | 1,7 | 0,62 | 0,87 | 0,62 |
| | $İ_i$ | 0,30 | 0,20 | 0,36 | 0,44 | 0,14 | 1,7 | 0,56 | 0,81 | 0,48 |
| | Δ | 0,46 | 0,54 | 0,45 | 0,49 | 0,56 | 0,22 | 0,34 | 0,32 | 0,46 |
| | ω | 0,67 | 0,64 | 0,56 | 0,57 | 0,63 | 0,47 | 0,67 | 0,57 | 0,59 |
| CP type | Young | | | | | | + | | + | |
| | Transition | + | + | + | + | | | + | | + |
| | Old | | | | | + | | | | |

Juvenile and immature type of individuals in CP II in 2015 (Δ-ω = 0.22-0.47), in CP III in 2014 (Δ-ω = 0.32-0,57) as a result of the development. Aged type (Δ-ω = 0.56-0.63) was found in 2014 in CP II. The majority of the studied populations were transitional (Δ = 0.34-0.54; ω = 0.56-0.67). It should be noted that the decrease in the number of individuals in CP II and III is an indication of the decrease in *Vicia sativa* feed stocks.

CP of *Vicia crocea* was comparatively studied in xerophyte sparse forest (I CP) and semi-desert (II CP) vegetation types in Gabala district in 2014-2016, ontogeny was observed for 3 years, age conditions were noted (Tab. 6).

Table 6.

Assessment of cenopopulations of *Vicia crocea* (Desf.) Fritsch species

| CP | Ont. / Periods | I CP | | | II CP | | |
|---|---|---|---|---|---|---|---|
| | | 2014 | 2015 | 2016 | 2014 | 2015 | 2016 |
| Growth of ontogeny phases, in% of total | j | - | 6,7 | 5,3 | - | 3,1 | - |
| | im | 6,4 | 13,3 | - | 6,3 | 9,2 | - |
| | v | 8,6 | 14,2 | 10,6 | 12,7 | 10,8 | 13 |
| | $g_1$ | 20,4 | 16,7 | 18,7 | 25,4 | 26,1 | 19,6 |
| | $g_2$ | 27,9 | 18,3 | 22,7 | 19 | 13,8 | 15,2 |
| | $g_3$ | 25,8 | 18,3 | 16 | 14,3 | 13,8 | 13 |
| | ss | 10,7 | 12,5 | 14,7 | 12,7 | 12,3 | 19,6 |
| | s | - | - | 12 | 9,5 | 10,8 | 19,6 |
| Indexes | $İ_r$ | 0,20 | 0,64 | 0,28 | 0,32 | 0,43 | 0,27 |
| | $İ_i$ | 0,18 | 0,52 | 0,19 | 0,23 | 0,30 | 0,15 |
| | Δ | 0,49 | 0,61 | 0,54 | 0,49 | 0,47 | 0,60 |
| | ω | 0,73 | 0,91 | 0,63 | 0,64 | 0,59 | 0,58 |
| CP type | Aging | | | | | | + |
| | Transition | | | + | + | + | |
| | Mature | + | + | | | | |

Development of *V.crocea* is high in the *Caraganeta-Pistacetum-Juniperusosum* formation group (I CP) based on biomorphological evidence. Although the number of individuals in the *Artemisietum-Caraganosum* (II CP) formation was high in the young generative

age group in 2014-2016, in the middle-aged generative age group ($g_2$=19-13.8%) and in the adult generative age group in 2015-2016 ($g_3$=13.8%;13%) the development of individuals decreased with age. The absence of juvenile and immature individuals in 2016, and the increase in the share of the development of individuals in the subsenile and senile age are the main indicators of the low status of the population.Types of cenopopulations were identified based on age and efficacy indices (Table 6). No young populations were found. The transition type (Δ-ω = 0.49-0.64; Δ- ω = 0.47-0.59) CP I in 2016 (Δ-ω = 0.54-0.63) and in CP II in 2014-2015, matured in CP I in 2014-2015 (Δ-ω = 0.49-0.73; Δ- ω = 0.61-0.91), there were cenopopulations of the aging type (Δ-ω = 0.60-0.58) in II CP in 2016.

The *Vicia crocea* is classified as "Nearly Dangerous" (NT). Number of generative individuals in the population has decreased, but not in large populations have shown studies. This is due to the fact that the species is exposed to anthropogenic influences and is used as a very valuable fodder plant in livestock.

Cenopopulation studies of *Vicia sepium* species were conducted in 2012-2014 in different formation groups in Gadabay and Guba districts (Table 7).

Table 7.

Assessment of cenopopulations of *Vicia sepium* L. species

| CP | Ont. periods | I CP | | | II CP | | | III CP | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2012 | 2013 | 2014 | 2012 | 2013 | 2014 | 2012 | 2013 | 2014 |
| Growth of ontogeny phases, in% of total | j | - | 14,3 | 9,5 | 6,9 | 6,8 | - | - | - | - |
| | im | 10,4 | - | 14,3 | - | 8,2 | 10,8 | - | 8,5 | - |
| | v | 8,3 | - | 16,7 | 10,3 | 10,9 | 12,2 | 11,9 | 17 | 21,9 |
| | $g_1$ | 16,7 | 25 | 14,3 | 19 | 16,4 | 18,9 | 23,7 | 12,8 | 25 |
| | $g_2$ | 18,7 | 21,4 | 11,9 | 27,6 | 23,3 | 21,6 | 23,7 | 10,6 | 12,5 |
| | $g_3$ | 18,7 | 17,8 | - | 24,1 | 23,3 | 18,9 | 20,3 | 19,1 | 12,5 |
| | ss | 14,6 | 21,4 | 19 | 12,1 | 10,9 | 9,4 | 13,5 | 19,1 | 12,5 |
| | s | 12,5 | - | 14,3 | - | - | 8,1 | 6,8 | 12,8 | 15,6 |
| Indexes | $İ_r$ | 0,35 | 0,22 | 1,5 | 0,24 | 0,41 | 0,39 | 0,17 | 0,60 | 0,44 |
| | $İ_i$ | 0,23 | 0,17 | 0,68 | 0,21 | 0,35 | 0,30 | 0,13 | 0,34 | 0,28 |
| | Δ | 0,54 | 0,49 | 0,42 | 0,48 | 0,44 | 0,48 | 0,53 | 0,58 | 0,50 |
| | ω | 0,60 | 0,65 | 0,44 | 0,71 | 0,66 | 0,64 | 0,71 | 0,55 | 0,63 |
| CP type | Mature | | | | + | | | + | | |
| | Transition | + | + | + | | + | + | | | + |

The ontogenetic development of *V.sepium* species in I CP (*Bromopsiseta-Poaetum-Trifoliosum*) and II CP (*Festuceta-Astragaletum-Juniperusosum*) was very quiet, no acute disturbances were observed. However, the reproductive capacity of the species was low (12.5-19.1%) in CP III (*Festucetum-Onobrychisosum*) in the territory of Guba district in 2013-2014. Almost all senile and subsenile individuals predominated.

The cenopopulation types of *Vicia sepium* type were mature in CP II and CP III in 2012 (Δ-ω = 0.48-0.71; Δ- ω = 0.53-0.71), while others and the transition (Δ-ω = 0.54-0.60; Δ- ω = 0.49-0.65; Δ-ω = 0.42-0.44; Δ-ω = 0.44-0.66 ; Δ-ω = 0,48-0,64; Δ-ω = 0,50-0,63) as can be seen from Table 7.

*V.sepium* is an important forage plant was determined in the mentioned areas, taking into account the possibility of creating high-yielding and high-quality hayfields and considering it as one of the main tasks in agriculture as have conducted result of research.

Cenopopulation studies of *Vicia alpestris* species were carried out in the Greater Caucasus in 2011-2013: I CP (Gakh district) and II CP (Oguz district) of alpine vegetation type, and III CP (Oguz district) of alpine carpet vegetation type (Table 8).

Table 8.

Assessment of cenopopulations of *Vicia alpestris* Stev. species

| CP | Ont. periods | I CP | | | II CP | | | III CP | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 |
| Growth of ontogeny phases, in% of total | j | - | 3 | 11,1 | 4,1 | - | - | 2,6 | - | 12,5 |
| | im | 16 | 15,1 | - | 8,2 | 10,4 | 10 | 7,9 | 9,3 | - |
| | v | 8 | 18,2 | - | - | 14,6 | 15 | 7,9 | 9,3 | 12,5 |
| | $g_1$ | 16 | 18,2 | 22,2 | 20,4 | 16,7 | 25 | 21 | 20,9 | 18,7 |
| | $g_2$ | 12 | 6,1 | 22,2 | 20,4 | 18,7 | 20 | 13,1 | 18,6 | 15,6 |
| | $g_3$ | 8 | 6,1 | 16,7 | 16,3 | 16,7 | 20 | 13,1 | 16,3 | 12,5 |
| | ss | 20 | 18,2 | 27,8 | 16,3 | 12,5 | 10 | 15,8 | 16,3 | 15,6 |
| | s | 20 | 15,1 | - | 14,3 | 10,4 | - | 18,4 | 9,3 | 12,5 |
| Index | $İ_r$ | 0,67 | 1,2 | 0,18 | 0,21 | 0,48 | 0,38 | 0,39 | 0,33 | 0,53 |
| | $İ_i$ | 0,31 | 0,57 | 0,12 | 0,14 | 0,30 | 0,33 | 0,23 | 0,23 | 0,33 |
| | Δ | 0,54 | 0,43 | 0,67 | 0,59 | 0,49 | 0,42 | 0,55 | 0,51 | 0,49 |
| | ω | 0,49 | 0,46 | 0,65 | 0,61 | 0,60 | 0,68 | 0,55 | 0,62 | 0,42 |
| CP type | Aging | | | + | + | | | | | |
| | Transition | + | + | | | + | + | + | + | + |

The occurrence of aging (in CP I in 2013; in CP II in 2011) and transitional populations and the absence of young populations, will lead to a further decline in individuals in the near future. The maximum efficiency index (ω = 0.68) in transitional cenopopulations was observed in 2013 in CP II. *V.alpestris* was assessed according to the IUCN Red List according to the threat category and was classified as "Endangered" (EN) as can be seen from Table 8 [15].

**5.3.Assessment of the ontogenesis of cenopopulations of some legumes with new distribution areas in the flora of Azerbaijan.**

Assessment of CP ontogenesis of *Trifolium caucasicum*, a new habitat for the northwestern and western part of the southern slope of the Greater Caucasus was studied in 2007-2009 in the *Chrysospisetum elizabethae – Alchemillosum sericea* association in the Zagatala district, in 2007 juvenile (5) the normal development of individuals (8), the absence of subsenile and senile individuals, the mass formation of young individuals, high seed productivity, and the new distribution of the species within that phytocenosis. Subsenile and senile individuals were also found (ss=6 in 2008; ss+s=15 in 2009) in 2008-2009. This is an indication of the weak development of the population in the following years. The age and efficiency indices of cenopopulation were determined (Tab.9) based on the obtained results.

Table 9.

Assessment of cenopopulations of *Trifolium caucasicum* Tausch species

| CP type | Years | Ontogenetic age status in% | | | | | | | | Indexes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | j | im | v | $g_1$ | $g_2$ | $g_3$ | ss | s | $İ_b$ | $İ_ə$ | Δ | ω |
| Growing up | 2007 | 8,9 | 14,3 | 16,1 | 16,1 | 25 | 19,6 | - | - | 0,65 | 0,65 | 0,34 | 0,63 |
| Growing up | 2008 | - | 13,5 | 18,6 | 23,7 | 16,9 | 16,9 | 10,2 | - | 0,56 | 0,47 | 0,28 | 0,63 |
| Transition | 2009 | - | 7,7 | 11,5 | 21,8 | 20,5 | 19,2 | 9 | 10,2 | 0,31 | 0,24 | 0,50 | 0,64 |

Cenopopulations were of the mature type in 2007-2008 (Δ-ω =

[15]Mammadova, Z.J. Assessment of the current situation of populations of *Vicia sativa* L. species in different regions of Azerbaijan //Internati.Jour.of Botany Studies, - 2020. –V. 5, -Issue 6, - p. 19-22.

0.34-0.63; Δ-ω = 0.28-0.63), and the transitional type (Δ-ω = 0.50-0.64) in 2009 was determined. Taking into account the direct observations and the influence of anthropogenic and zoogenic factors, the *T.caucasicum* species was classified as "Less endangered" (LC).

*Astragalus aduncus* also has been recorded as a new distribution area for the Lesser Caucasus Mountains. Cenopopulation surveys were conducted in 2009-2013 in the summer pastures of Dashkesan districts on the banks of the Daligoshgar River in the *Phleumetum pratense - Amoriosum ambigua* association (Tab. 10). Species were found in all individuals except senile individuals in 2009.

As a result of the beginning of a new cycle, a rapid increase in the number of juvenile and immature individuals was observed in the study area of *A.aduncus* species. However, in subsequent research years, overgrazing in the cenopopulations of the *Astragalus aduncus* species, as a result of anthropogenic influences, a gradual predominance of subsenile individuals (ss, s = 48.5% maximum in 2013). Juvenile and immature individuals were not encountered at all, subsenile and senile individuals reaching 42% in 2012. The maximum number of generative individuals was observed in 2011 ($g_1$-$g_3$ = 58.5%) and the minimum number ($g_1$-$g_3$=34.2%) was observed in 2013. In general, below-normal seedling numbers have led to population extinction.

Table 10.

Assessment of cenopopulations of *Astragalus aduncus* Willd. species

| Years | CP type | Ontogenetic age status in% | | | | | Indexes | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | j | im | v | $g_1$-$g_3$ | ss, s | $İ_r$ | $İ_i$ | Δ | ω |
| 2009 | Young | 14,3 | 14,3 | 17,8 | 39,3 | 14,3 | 1,2 | 0,87 | 0,35 | 0,51 |
| 2010 | Transition | - | 20 | 17,1 | 37,1 | 25,7 | 0 | 0,59 | 0,44 | 0,51 |
| 2011 | Aging | 13,8 | - | - | 58,5 | 27,6 | 0,23 | 0,16 | 0,56 | 0,61 |
| 2012 | Old | - | - | 14 | 44 | 42 | 0,32 | 0,16 | 0,61 | 0,58 |
| 2013 | Old | - | 17,1 | - | 34,2 | 48,5 | 0,5 | 0,21 | 0,62 | 0,47 |

The highest efficiency (ω = 0.61) was observed in 2011. In the same year, the number of generative individuals was 58.5%. The types of cenopopulation are young in 2009 (Δ-ω = 0.35-0.51),

transition in 2010 (Δ-ω = 0.44-0.51), and in 2011 (Δ-ω = 0.56-0.61), and in 2012-2013 was of the older type (Δ-ω = 0.61-0.58; Δ- ω = 0.62-0.47).

50% decrease was observed over 10 years ($A_1$abc) according to the assessment criteria of rare and endangered species. As a result of cenopopulation studies localization (B1, B2, C1) conducted in the *Phleumetum-Amoriosum* formation for 5 years, according to the decrease in seed reproduction and encounter distance *A.aduncus* species was classified as "Endangered".

One of the species identified in the study as a new range is the glandular black clover (*Medicago glutinosa*). Assessment of *M.glutinosa* species cenopopulations was spent in 2013-2015 by the *Viciaetum pannonica-Festucosum rupicola* association in the mountain forest-meadow lands of Astara district, located in the mountainous part of Lankaran district. All age conditions of ontogeny, including subsenile and senile age conditions were observed during cenopopulation studies (Table 11).

Table 11.

Assessment of cenopopulations of *Medicago glutinosa* Bieb. species

| CP type | Years | Ontogenetic age status in% | | | | | | | | Indexes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | j | im | v | $g_1$ | $g_2$ | $g_3$ | ss | s | $İ_r$ | $İ_i$ | Δ | ω |
| Young | 2013 | 10,5 | 11,8 | 21 | 22,4 | 19,7 | 14,5 | - | - | 0,77 | 0,77 | 0,30 | 0,60 |
| Transition | 2014 | 11,1 | 13,6 | 14,8 | 17,3 | 17,3 | 16 | 9,9 | - | 0,78 | 0,65 | 0,36 | 0,57 |
| Young | 2015 | 10,1 | 20,3 | 17,4 | 17,4 | 14,5 | 11,6 | 2,9 | 5,8 | 1,1 | 0,92 | 0,31 | 0,51 |

The types of cenopopulations in 2013 (Δ-ω = 0.30-0.60) and in 2015 were young (Δ-ω = 0.31-0.51), and were transitional in 2014 (Δ-ω = 0.36-0.57). *M.glutinosa* was rated according to the IUCN hazard category and referred to the "Less Threatened" (LC) as can be seen from Table 11.

**5.4. Assessment of ontogenesis of cenopopulations of some leguminous shrubs and trees found in the flora of Azerbaijan.** Cenopopulations of *Caragana grandiflora* species of *Caragana* genus from leguminous shrubs during the study of *Caraganetum* in Ordubad districts in 2014-2018; the assessment was spent in the *Caraganeta-Pistacetum-Juniperusosum* formation group (CP II, 2016-2017) in the Gabala district. During the development of partial

shrubs in the ontogenesis of the *Caragana grandiflora* species, virginal (v), young generative and virginal ($g_1$ and $g_1v$), middle-aged generative and virginal ($g_2$ and $g_2v$), old generative and virginal ($g_3$ and $g_3v$), subsenile (ss) and senile (s) age periods and age conditions were monitored.

The succession process took place in 5 stages according to the development cycle of *Caragana grandiflora*. The normal development of the ontogeny of the species *C.grandiflora* was observed in the *Caraganetum* formation group (I CP) found in the Ordubad district (Tab. 12). The number of generative individuals reached a maximum (g1 = 16.7%) in the flowering stage only in 2016 in CP II in *Caraganeta-Pistacetum-Juniperusosum* formation group. In general, the presence of low-grade cenopopulation in the partial shrubs of *C.grandiflora* is associated with a decrease in the number.

Table 12.

Assessment of cenopopulations of *Caragana grandiflora* (Bieb.) DC. species

| CPP | CP type | Years | Ontogenetic age status in% | | | | | | | | Indexes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | j | im | v | $g_1$ | $g_2$ | $g_3$ | ss | s | $I_r$ | $I_i$ | Δ | ω |
| I CP | Old | 2014 | 1,5 | - | 17,9 | 14,9 | 13,4 | 11,9 | 22,4 | 17,9 | 0,48 | 0,24 | 0,60 | 0,54 |
| | Transition | 2015 | - | - | 26,2 | 14,9 | 11,5 | 8,2 | 21,3 | 14,9 | 0,76 | 0,37 | 0,53 | 0,58 |
| II CP | Old | 2016 | - | - | 18,5 | 16,7 | 14,8 | 11,1 | 22,2 | 16,7 | 0,43 | 0,23 | 0,58 | 0,57 |
| | Old | 2017 | - | - | 19,2 | 15,4 | 13,5 | 9,6 | 21,1 | 21,1 | 0,49 | 0,24 | 0,59 | 0,54 |

Cenopopulations of the *Caragana grandiflora*, only I CP in the *Caraganetum* formation group was transitional in 2015 (Δ-ω = 00.53-0.58). Other types of cenopopulations were older: I CP in 2014 Δ-ω = 0.60-0.54; II CP in 2016 Δ-0,5 = 0,58-0,57, in 2017 Δ-ω = 0,59-0,54. indicates that it is in danger of extinction. This type is classified as a "Critical Threat Threat" (CR) of IUCN.

Cenopopulation of the species of Lankaran rose (*Albizia julibrissin*), a rare and relict plant of the III period have studied by us for the first time. Cenopopulation studies were carried out in the relict forest in the administrative territory of Lankaran and Astara districts, in the meadow formation group (*Albizziaetum*) with the monodominance of legumes and perennial grasses formed under the

wet relict forests of the plain forest belt (Tab.13).

Table 13.

Linear relationships between elements of the ontogenetic age status of *Albizia julibrissin* L.

| Signs | Tree height (cm) | Trunk diameter (cm) | Tree age | Inflorescence diameter (m) |
|---|---|---|---|---|
| Tree height (cm) | 1 | - | - | - |
| Trunk diameter (cm) | $0.958^{**}$ | 1 | - | - |
| Tree age | $0.537^{n.s}$ | $0.577^{n.s}$ | 1 | - |
| Inflorescence diameter (m) | $0.976^{**}$ | $0.962^{**}$ | $0.384^{n.s.}$ | 1 |

Note: 1. ** P <0.01 reliability rate; 2. * P <0.05 degree of reliability; 3. n.s = degree of insecurity

Under natural conditions, seedlings were found in early spring. Anatomical incisions were taken from the trunk to determine the age of the *A.julibrissin* species from immature age. At the age of virginal, the trunk of the tree is fully developed. Sympodial branching occurred in young generative trees ($g_1$), the process of seed formation was observed at the maximum level during middle-aged generative age. The sympodial branches swayed relatively low, due to the weakening of physiological processes in the old generative tree.

At this time, the process of death was observed in large branches. Determine the age of the tree and its reaction to environmental factors as possible as a result. Defoliation assessment was determined for 5 classes of leaf loss.

Linear relationships between tree height, trunk diameter, inflorescence diameter, and age in the ontogenetic age of *A. julibrissin* species and for defoliation and dechromation in the cenopopulation of the species has been assessed, and statistical analysis has shown that environmental factors do not have a limiting

effect have been investigated[16] as shown from table 13. Thus, no matter how different the change of climatic factors in different years the diameter of the inflorescence and the diameter of the trunk developed in parallel. The *A.julibrissin* species had a weak reaction to drought in the dry years - 2008 and 2012 became clear during the study of the annual rings of the trunk. Statistical analysis can also be used to introduce the plant to new climatic conditions in the future.

The germination and juvenile age conditions of *A.julibrissin* species were found one by one conducted by us as a result of cenopopulation studies. This is a key indicator of the low level of seed regeneration and further shrinkage of the species population in the near future. Therefore, keep this tree plant under more control during the seed ripening season and keeping livestock away from the areas where species founded is recommended.

## CHAPTER VI. ASSESSMENT OF DEVELOPMENT DYNAMICS AND LIFE OF CENOPOPULATIONS OF OF DIFFERENT LIFE FORMS OF SOME LEGUME PLANTS AZERBAIJAN

The phytocenoses found in plant species are not a random combination of the species that make them up, but a naturally related dynamic system that has evolved dynamically over centuries and millennia. Variations in this system occur as a result of changes in plant abundance, density, regeneration, as well as the nature of phytocenoses. In response to various stressors, the quality of individuals' cenopopulation elements changes and causes a chain reaction of the plant's age.

**6.1 Dynamics of development of cenopopulations of various life forms of some legumes in Azerbaijan.** Species have different dynamics due to the development of age spectra in the cenopopulation.

The majority of the leguminous (*Astragalus falcatus*) populations

[16]Mammadova, Z.J. Current state of cenopopulations of *Albizia julibrissin* species *(Azerbaijan Republic)* //International Journal of Science and Research Methodology (Ijsrm.Human, ISSN: 2454-2008. SJIF Impact Factor: 6.418), -2020. -Vol. 17 (1), -p.70-80.

of leguminous plants in the study areas were full members. Maximum recovery index ($I_r$=0.40) in the summer pasture of Dashkesan district in the North part of Goshgar mountain in the *Alchemileta-Amorietum-Anthyllisosum* formation group (III CP) in 2010, the minimum recovery index ($I_r$=0, 21) was observed in 2009 in the *Trifolietum-Nardosum* formation group (I CP) in Gakh districts. Monitoring of the minimum recovery intensity in the Gakh district is associated with the low level of development of vegetative individuals (im+v=13.6%). This, of course, leads to a low level of development of the species in the future in the cenosis. Therefore, organize systematic grazing in the area is recommended.

Change in the population wave was observed, which was due to the fragmentation of the age spectrum during the study. The generative period is longer because the pre-generative and post-generative periods are dynamic in terms of the rate of cenopopulation development (Diag. 2).

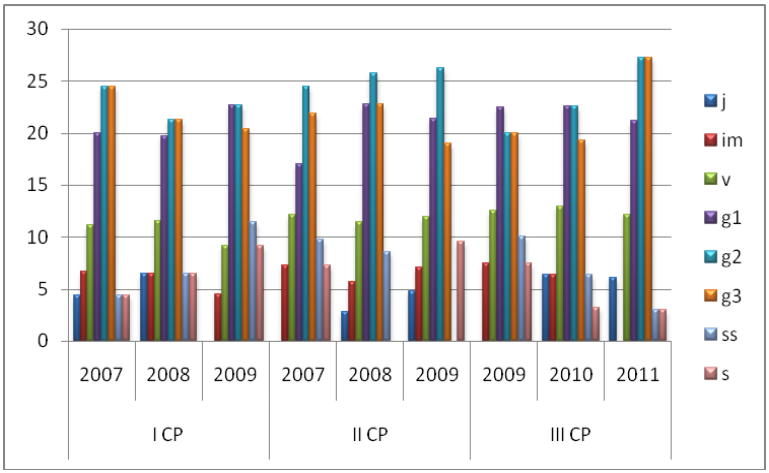


Diagram 2. Development dynamics for *Astragalus falcatus* Lam species in different plant groups in 2007-2011 years.

As we move from north to south the size of the organs decreases as a result of the arid climate. In the studied populations, the highest density of *A.falcatus* was D=1.22 in the *Trifolietum-Nardosum* formation group (I CP) in 2008 (50 $m^2$ sample area). Despite the

high density, the recovery index was $I_r$=0.39. This is due to the weakening of development as a result of increasing density.

The dynamics of cenopopulations of the *Astragalus glycyphyllus* species were observed in 3 different plant types. An increase in subsenile individuals in 2013 (11.8%) in the *Thymetum kotschyanus-Astragalosum falcatus* formation group as a result of which the population wave changed more in the following years (Diag. 3).

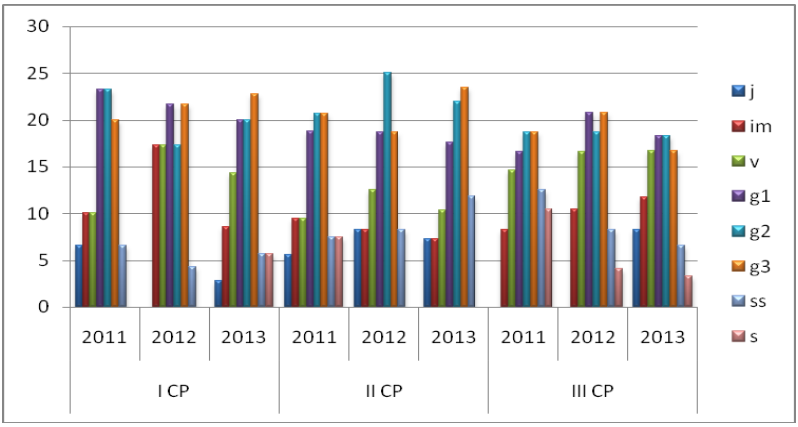


Diagram 3. Development dynamics of *Astragalus glycyphyllos* L. species in different plant groups in 2011-2013 years

Although the lack of favorable conditions for the plant led to a further decline in the number of generative individuals, other populations were normal. The maximum recovery index ($I_r$=0.69) was observed in 2013 in the *Caraganeta-Pistacetum-Juniperusosum* formation group (III CP). Reversible changes were observed in this cenopopulation. The succession of individuals during development is cyclical.The highest density was D=1.36 in 2013 in the T*hymetum kotschyanus-Astragalosum falcatus* association (II CP) was found in the mountain-brown soils of Nakhchivan AR. This is due to the fact that the climatic conditions are optimal for plant development.

Short-term fluctuations were observed in the development dynamics of *Astragalus aduncus*. The structure of the species and the intensity of ontogenetic processes differed from the influence of specific conditions in the studied plant grouping *Phleumetum*

*pratense - Amoriosum ambigua* (Diag. 4).

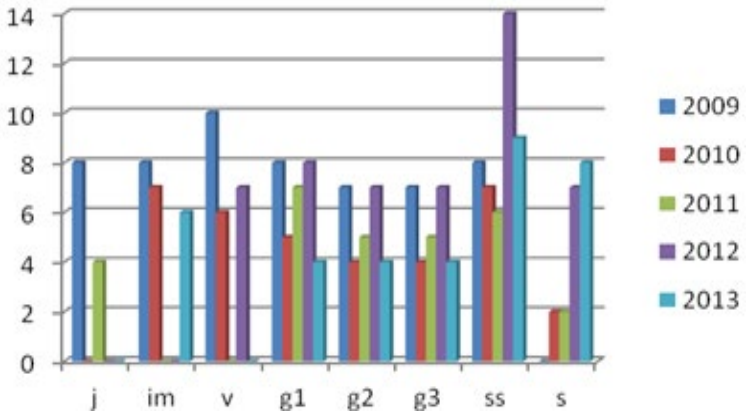


Diagram 4. Development dynamics of *Astragalus aduncus* Willd. species in the *Phleumetum pratense - Amoriosum ambigua* association

At the same time, the influence of grouping factors and environmental conditions on *A.aduncus* species was differentiated on the basis of the relationship between the formation and destruction of new shoots, ramet. The recovery intensity was equal to $I_r$=0 in 2010. There is a fragmentation of the age spectrum as a result of changes in environmental conditionsin 2012.

The cenopopulation of the development dynamics of the rare, priority endemic species of Azerbaijan -*Astragalus kubensis* was not the same in the studied *Hordeta-Trifolietum-Poaosum* (I CP) and *Festuceta-Astragaletum-Juniperusosum* (II CP) formations (Diag. 5). Thus, individuals of the *A.kubensis* species appeared in small numbers, scattered (in 2015 and 2017) in the *Festuceta-Astragaletum-Juniperusosum* formation. New population waves emerged as a result of the subsequent development of the cenopopulation, which over time shifted to the older part of the cenopopulation, when recovery began in CP II, in 2016. As a result, reversible wave fluctuations were observed.

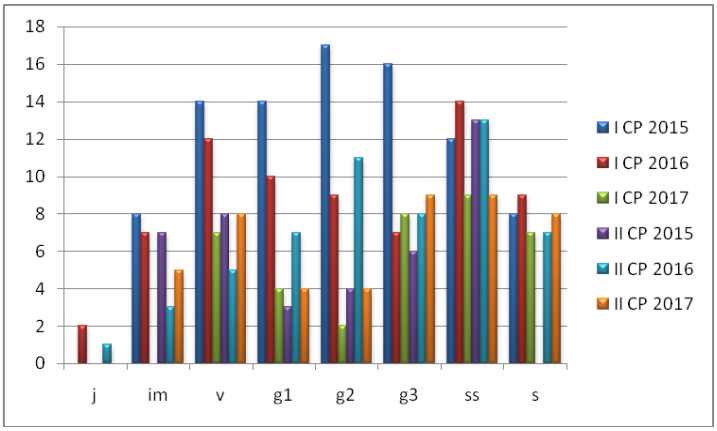


Diagram 5. Development dynamics of *Astragalus kubensis* Grossh. species in the *Hordeta-Trifolietum-Poaosum* (I CP) and in *Festuceta-Astracanthetum-Juniperusosum* (II CP) formations

As can be seen from the diagram, gradual deterioration of the situation of cenopopulation the I CP (*Hordeta-Trifolietum-Poaosum* formation) in 2015-2016and a further fragmentation of population waves in 2017 have been observed. No juvenile or immature individuals were found in the development dynamics, 5.4% of middle-aged generative individuals, 24.3% of subsenile individuals, and 18.9% of senile individuals. The maximum value of the recovery index was $I_r$=0.78 in CP I in 2016, and the maximum density was D=1.7 in 2015. Irreversible fluctuation variations were observed in the dynamics of *A.kubensis* species. This accelerates syngenetic processes in the future as a result of endogenetic changes in the *Festuceta-Astracanthetum-Juniperusosum* formation (II CP). *Festuceta-Astracanthetum-Juniperusosum* formation (II CP) can be replaced by another phytocenosis as a result.

The cenopopulations of leguminous species *Vicia sativa*, *V.sepium*, *V.crocea* and *V.alpestris* were studied and their development dynamics were observed during the research years.

Further changes in the population waves of the *Vicia sativa* species were observed in the relict forests of Lankaran, in the *Viciaetum cassubica* association (II CP) (Diag. 6).

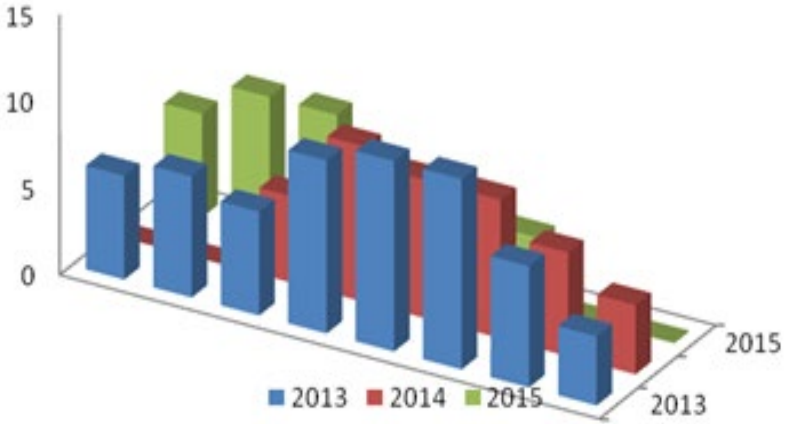


Diagram 6. Dynamics of development of the *Viciaetum cassubica* association of the *V.sativa* L. species

The density of cenopopulations decreased, the number of young in Populations were observed in 2013-2014 with normal fluctuations, and in 2015 with sharp fluctuations in this association. As a result of the displacement of the population wave, the age spectrum was fragmented, resulting in an incomplete population. This is due to the instability of the cenopopulation indicators in the study area and the result of the compression of the species during competition.

dividuals decreased, and the number of older individuals increased as a result of intensive grazing. Succession variability can occur if timely measures are not taken. One-way irreversible variables are very dangerous for the *Vicia sativa* species.

Maximum recovery index ($I_r$=0,87) in the territory of Kurdamir district, in the *Lagonychieta - Alhagietum-Cynodonosum* formation III CP in 2014, and the maximum density (D = 1.3) I CP was observed in 2013-2014.

The abundance of young generative individuals in the populations of *V.sepium* species in the *Festuceta-Astragaletum-Juniperusosum* formations (II CP), on the one hand, ensures the transition of the plant to the young generative state, on the other hand, the long-term continuation of this age (Diag. 7).

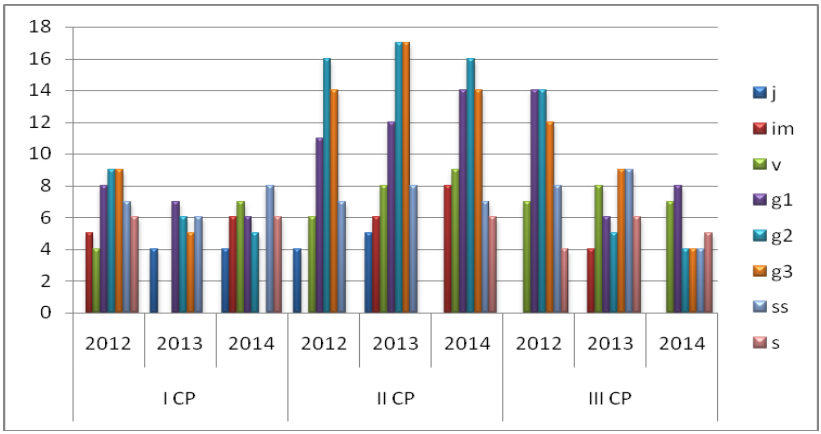

Diagram 7. The dynamics of development of *Vicia sepium* L. species in different plant groups for 2012-2014 years

The amount of senile plants in the population is low due to the high number of juvenile and immature individuals in the area. This indicates that the development in the area will be normal in next season. The population was divided, the invasive type of population was observed and an unequal situation was revealedin the *Festucetum-Onobrychisosum* formation (III CP) in the Guba district. The maximum recovery intensity ($I_r$=1.5) of *V.sepium* was observed in I CP in 2014, and the minimum recovery intensity ($I_r$=0.17) was observed in III CP in 2012. The dynamics of development of the *Vicia crocea* species were observed in two formations, no fragmentation was observed in the populations. The maximum recovery intensity ($I_r$=0.64) in the *Caraganeta-Pistacetum-Juniperusosum* formation ($I_r$=0.64) in the Turyanchay Reserve in 2015, and the minimum recovery intensity ($I_r$ = 0.20) in the same formation in 2014 were observed (Diag.8). The reason for such a rapid development of the species during the year was the creation of optimal climatic conditions. It should be noted that the summer of 2014 was dry. The biological characteristics of the base spectrum show that the reason for such a rapid change in populations depends on the course of external reactions.

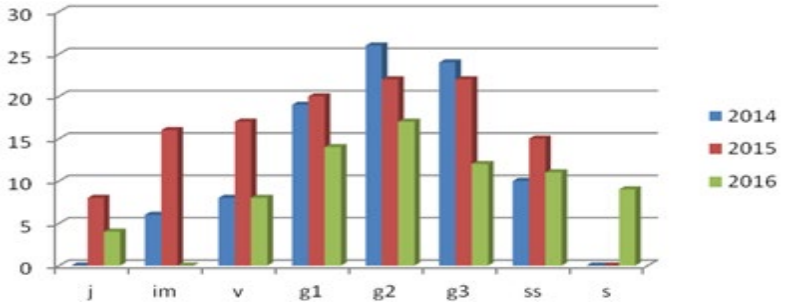


Diagram 8. Development dynamics in the *Caraganeta-Pistacetum-Juniperusosum* formation of *Vicia crocea* (Desf.) Fritsch

All cenopopulations of the *Vicia alpestris* species have undergone fluctuations. Incomplete cenopopulations have formed as a result of age-inequality. Incomplete cenopopulations have formed as a result of age-inequality. As recovery began, new population waves emerged as a result of the subsequent development of the cenopopulation, which over time shifted to the older part of the cenopopulation. Such wavy fluctuations were observed in the formation of *Trifolietum-Nardosu* (I CP) in the Gakh district which was caused by trampling and damage. The dynamics of cenopopulation of *Trifolium caucasicum* species was observed in *Chrysospisetum elizabethae - Alchemillosum sericea* association in the new distribution area in Zagatala districts (Diag.9). Latent fluctuations were observed within the phytocenosis in association of *T.caucasicum* species, favorable conditions were created, and the populations were normal.

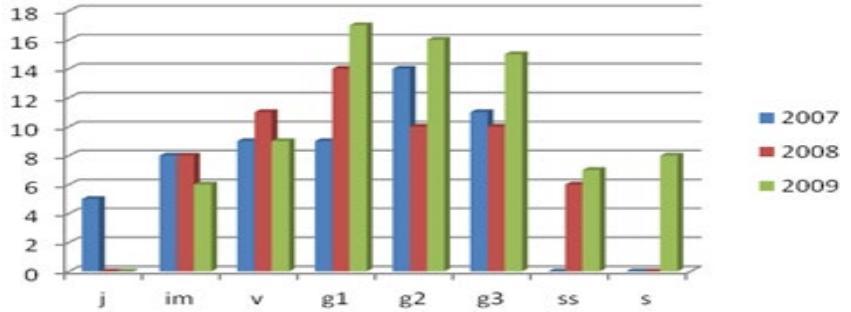


Diagram 9. Dynamics of development of *Trifolium caucasicum* Tauschna in *Chrysospisetum elizabethae-Alchemillosum sericea* association

Although the density of shoots was D = 1.12-1.56 in non-grazing conditions was found in individuals in the cenosis. Maximum recovery intensity $I_r$=0.65 was observed in 2007. Compared to other plant groups where the species is widespread, the lifespan of all age conditions in mountain meadows has increased.

The cenopopulations of the *Medicago glutinosa* species were also normal and fragmented. The dynamics of the cenopopulation of this species have been followed in *Viciaetum pannonica-Festucosum rupicola* assossiation of *Thymuseta-Vicioetum-Festucosum* formation in the new distribution area - mountainous part of Lankaran (Diag.10).

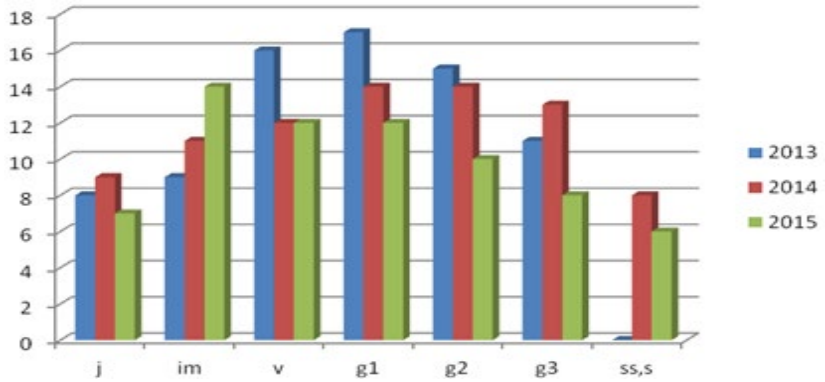


Diagram 10. The dynamics of development of *Medicago glutinosa* Bieb. in the new distribution area of the species for 2013-2015.

Recovery intensity increased to $I_r$=1.1. The observation of two peaks in the development dynamics in 2013 led to an increase in density. This is due to the long growing season in the plant group. Such deviations are among the factors that hinder the future development of the species, resulting in latent fluctuations. Therefore, long-term monitoring should be carried out in the area.

New individuals of the cenopopulation were observed in the *Caragana grandiflora* formation group (*Caraganetum*) with the onset of a new invasive cycle in 2014 (Diag.11).

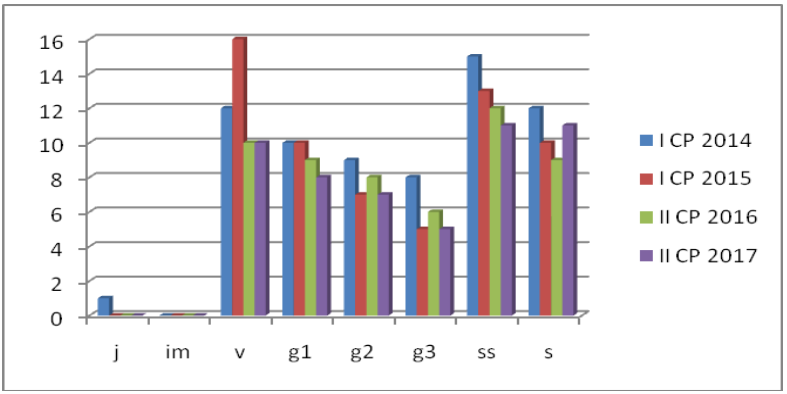

Diagram 11. Development dynamics of the *Caragana grandiflora* (Bieb.) DC. cenopopulation in which the species is widespread

The maximum recovery index of this species ($I_r$=0.76) was found in I CP in 2015. At the same time, with the increase in density, the extinction in the cenopopulation has increased. As a result of the dynamic development of young individuals, mature populations have emerged. The dynamics and strategy of the young plant reflect the ecological adaptation of the species. *C.grandiflora* is characterized by an increase in density in the early stages of development, followed by a sharp decline.

The dynamics of the development of the cenopopulation of leguminous species of *Albizia julibrissin* was observed in the *Albizziaetum julibrissin* association and this development was not considered satisfactory during the study. This is because species defoliation has been observed in middle-aged and older generative age conditions. This is due to diseases, various environmental influences and the weakening of physiological processes. Over the years, the number of leaves has decreased and the natural color of the inflorescence has gradually lost.

**6.2.Assessment of the viability of cenopopulations of different life forms of some legumes in Azerbaijan.** Vitality refers to the degree to which a species develops in the cenosis. Life expectancy is a common indicator of the development of cenopopulation. Normal life development was observed in the studied populations of legumes

*Astragalus falcatus* and *A.glycyphyllos*[17].

However, in the new distribution area of *A.aduncus* species in the summer pastures of Dashkesan districts, different types of life were found in the *Phleumetum pratense - Amoriosum ambigua* association (Tab.14).

Table 14.

Vitality in the *Phleumetum pratense – Amoriosum ambigua* association of *Astragalus aduncus* species

| Years | Percentage (%) of individuals in CP | | | $İ_Q$ | Q | Vitalityof CP |
|---|---|---|---|---|---|---|
| | a | b | c | | | |
| 2009 | 46 | 39 | 14 | 3 | 42 | Being developed |
| 2010 | 37 | 37 | 26 | 1,4 | 37 | Being developed |
| 2011 | 58 | 14 | 28 | 1,3 | 36 | Being developed |
| 2012 | 44 | 12 | 42 | 0,7 | 28 | Crisis situation |
| 2013 | 34 | 17 | 48 | 0,5 | 10 | Crisis situation |

The viability of cenopopulations of *A.aduncus* species was developing in 2009-2011, and in a crisis situation in 2012-2013. The population type is generative according to Yu.A. Zlobin [18]. According to the standard of living, low and medium populations were also observed. Because the summer pastures of Dashkesan district are very sensitive to external influences, the effects are sometimes catastrophic. As a result, the cycle of *A. aduncus* on the slopes of the succession process ends with degradation in the cenosis. This phenomenon is cyclical on eroded slopes.

Assessment of the viability of the rare *Astragalus kubensis* species are shown in Table 15 below. Vital activity in the *Hordeta-Trifolietum-Poaosum* was identified in 2015, in equilibrium in 2016, and in crisis in 2017. Vitality in the *Festuceta-Astragaletum-Juniperusosum* formation was observed in 2015, which was

[17]Mammadova, Z.J. Characteristics of the *Astragalus* L.genus and the study of some species of the genus at the level of cenopopulation //- Baku: Elm, Scientific works of the Institute of Botany of ANAS, - 2007. – Volume XXVII, -p.95-97.

[18] Zlobin, Yu.A. Rare plant species: floristic, phytocenotic and population approach // Journal of General Biology, -2011. -vol.72, -№ 6, -p. 422-435.

developing, and in 2016 and 2017, which was in crisis.

Table 15.

Assessment of the viability of the *Astragalus kubensis* Grossh. species

| CP | Years | Percentage (%) of individuals in CP | | | $İ_Q$ | Q | Vitalityof CP |
|---|---|---|---|---|---|---|---|
| | | a | b | c | | | |
| I CP | 2015 | 36 | 25 | 22 | 1,4 | 30 | Being developed |
| | 2016 | 37 | 30 | 33 | 1 | 33 | Being in balance |
| | 2017 | 37 | 19 | 44 | 0,6 | 28 | Crisis situation |
| II CP | 2015 | 31 | 37 | 32 | 1 | 34 | Being developed |
| | 2016 | 47 | 16 | 36 | 0,8 | 31 | Crisis situation |
| | 2017 | 36 | 13 | 36 | 0,7 | 24 | Crisis situation |

Assessment of the viability of the *Vicia sativa* species is shown in Table 16. Individuals in all populations were characterized by an average rate of development as clear from the table.

Table 16.

Assessment of the viability of the *Vicia sativa* L.species

| CP | Years | Percentage (%) of individuals in CP | | | $İ_Q$ | Q | Vitalityof CP |
|---|---|---|---|---|---|---|---|
| | | a | b | c | | | |
| I CP | 2013 | 70 | 23 | 9 | 5,1 | 18,6 | Being developed |
| | 2014 | 58,4 | 16,9 | 24,6 | 1,5 | 38 | Being developed |
| | 2015 | 50,1 | 26,4 | 23,5 | 1,6 | 38,2 | Being developed |
| II CP | 2013 | 51 | 30,7 | 17,7 | 2,3 | 41 | Being developed |
| | 2014 | 62,5 | 12,5 | 35 | 1 | 37 | Being developed |
| | 2015 | 37,1 | 62,7 | 0 | 50 | 50 | Being developed |
| III CP | 2013 | 55 | 27,6 | 17 | 2,4 | 41 | Being developed |
| | 2014 | 45 | 51 | 4,2 | 10,6 | 48 | Being developed |
| | 2015 | 55 | 27,6 | 17,2 | 2,4 | 41 | Being developed |

Violations were observed only in the *Viciaetum cassubica* association in Lankaran in 2015, and in the *Lagonychieta-Alhagietum-Cynodonosum* association in the Kurdamir district in 2014. These

populations were vegetative according to the classification of Yu.A. Zlobin. This indicates the vegetative recovery of populations in the same year.

The viability of cenopopulation in *V.crocea, V.sepium, V.alpestris* species also were studied. The development of most populations was moderate in *V.alpestris*, acute disturbances were observed in the *Trifolietum-Nardosum* formation in the territory of Gakh district (I CP), which was assessed by the viability in a crisis situation. The number of deaths in this cenopopulation reached 40% in 2011.

Assessment of the viability *Chrysospisetum elizabethae - Alchemillosum sericea* association of *Trifolium caucasicum* in the Zagatala district based on the results of cenopopulation studies in 2013-2015 have been shown in table 17.

The type of cenopopulation viability has been "evolving" for 3 years. Vitality was generative in 2013-2014, and was vegetative in 2015. The normal viability of the cenopopulation indicates that the *Chrysospisetum elizabethae-Alchemillosum sericea* association is favorable for the *T.caucasicum* species.

Table 17.

Assessment of the viability of the *Trifolium caucasicum* Tausch. species

| CP | Years | Percentage (%) of individuals in CP | | | $İ_Q$ | Q | Vitalityof CP |
|---|---|---|---|---|---|---|---|
| | | a | b | c | | | |
| I CP | 2013 | 61 | 39 | - | 50 | 50 | Being developed |
| | 2014 | 58 | 32 | 10 | 4,5 | 45 | Being developed |
| | 2015 | 19 | 62 | 19 | 2,1 | 40,5 | Being developed |

The viability of the *Medicago glutinosa* species was also assessed. Viability was vegetative in 2013 and 2015, and generative in 2014 in areas with widespread *of Medicago glutinosa*, including the new distribution area *Viciaetum pannonica-Festucosum rupicola* association (Astara district). No crisis situation was observed.

The viability of each individual of the *Caragana grandiflora* species is characterized by an ascending curve in ontogeny and is directed to the shield branch of ontogeny, while the inconsistency

decreases. The cenopopulation of the species is dominated by individuals with a moderate level of vitality. One group of them undergoes complete ontogeny, while the other does not undergo a certain part of the age condition. As a result, plants with low viability quickly become senile in ontogeny.

The process of extinction was accelerated with the beginning of the second peace period in the *Caraganeta-Pistacetum-Juniperusosum* formation group of *C.grandiflora* in the Gabala district. In general, environmental conditions increase the ontogenetic adaptation of the species, increase its ecological sustainability. The development of individuals of the *C.grandiflora* species was low in CP I and II, assessed by the life in crisis (Tab.18).

Reason for the extinction of the species is the rapid aging of the population during the drought years (2016-2017) was found. It should also be noted that a wide range of negative changes in fluctuations will prevent the species from taking a strong position among other populations in the future. Therefore, constant control and monitoring of *C.grandiflora* in the Gabala district is important to carry out.

Table 18.

Assessment of the viability of the *Caragana grandiflora* (Bieb.) DC. species

| CP | Years | Percentage (%) of individuals in CP | | | $İ_Q$ | Q | Vitality of CP |
|---|---|---|---|---|---|---|---|
| | | a | b | c | | | |
| I CP | 2014 | 40 | 19 | 41 | 0,72 | 29,5 | Crisis situation |
| | 2015 | 35 | 27 | 36 | 0,86 | 31 | Crisis situation |
| II CP | 2016 | 43 | 19 | 39 | 0,79 | 31 | Crisis situation |
| | 2017 | 38 | 19 | 42 | 0,68 | 28,5 | Crisis situation |

The viability of the *Albizia julibrissin* species was assessed for the general condition of the tree, the degree of damage and dechromation of the inflorescences in 3 sample plots in the *Albizziaetum* formation group, and the following results were obtained (Tab.19).

Table 19.

Assessment of the viability of the A*lbizia julibrissin* Durazz. species

| The condition of the tree | I | II | III |
|---|---|---|---|
| Healthy | 2 | 6 | 2 |
| Weakened | 3 | 4 | 3 |
| Sharply weakened | 8 | 7 | 6 |
| Dried | 7 | 4 | 6 |
| Σ | 20 | 21 | 17 |
| Vitality $L_N$ | 38 | 56 | 40 |

Sharply weakened vitality was observed in the I and III sample sites, and a weakened vitality was observed in the II sample sites as can be seen from the table. Thus, due to the defoliation of the tree, the weakened viability varied between Ln = 56%, and the sharply weakened viability varied between Ln = 38-40%. So the reason for monitoring this vitality is that the number of severely weakened and dried trees (more than 50%) in all sample plots is higher than the total number of trees and indicates that the current and future condition of the species is unsatisfactory.

Study of the dynamics of development and assessment of the viability of cenopopulations of different life forms of some legumes of Azerbaijan allows making predictions about the future of the population of each species can be concluded from the research.

## CHAPTER VII. PRODUCTIVITY OF CENOPOPULATIONS OF SOME LEGUME PLANTS IN AZERBAIJAN

In addition to the composition, structure, and sustainability of the cenoses, the reproductive development of the leguminous plants was studied in order to preserve them in the plant groups where the legumes were studied.

**7.1. Productivity of cenopopulations of some studied legumes.** At the same time assessing the cenopopulations of *V.sativa* species, and their productivity was also studied. The elements of wet and dry mass were also highalong with the elements of productivity in the *Thymuseta-Viciaetum-Festucosum* formation group (I CP) of *V.sativa* species. Such a high productivity rate in CP I indicates is

possible to supply fodder in the future. The productivity of legumes decreased from 8.8 g/m$^2$ to 5.1 g/ m$^2$in the *Phleumetum pratense-Amoriosum ambigua* association, where *A.aduncus* is found, in 2013. The highest value of the plant in the wet mass in the formation was 19 cents/ha in 2009 and 8.9 cents/ha in the dry mass.

**7.2.Germination energy of seeds of some legumes and seed reserve in the soil.** Germination energy of *Vicia* genus (*Vicia sativa, V.crocea*, *V.alpestris*, *V.sepium)* was studied in the studied species at the cenopopulation level. *V.alpestris* had low germination energy but high germination density. Thus, while other species produced 15.9% (95:6) seedlings per day, 31.7% (95:3) seedlings were obtained from *V.alpestris*.

The development of tissue seedlings according to the depth of the soil was studied on the seeds of the introduced *Vicia sativa, V.crocea, V.alpestris, V.sepium*, and *Medicago glutinosa* species (Diag. 12). Seed materials are well cleaned and sorted. Class 1-2 seeds with 98-99% purity and 95-97% germination were taken for sowing.

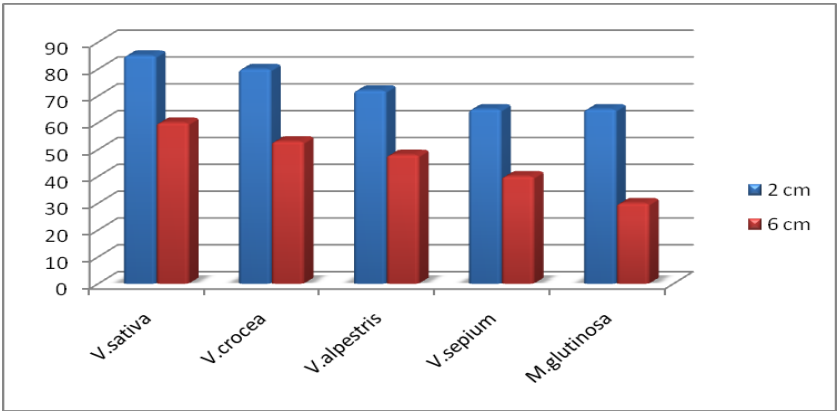


Diagram 12. The scheme of development of tissues according to the depth of the soil of some introduced legumes of some species of the *Vicia* L. and *Medicago* L. genus

The lowest quality seedlings of *Astragalus glycyphyllos* species were found in mixed xerophytic shrubs in Togana massif of Goygol district due to excessive degradation of the area. However, the

maximum (8.3%) development of seedlings for *A.glycyphyllos* was observed in the *Thymetum kotschyanus-Astragalosum falcatus* association

**7.3. Seed productivity of some studied legumes.** Correlations between the productivity elements of studied legumes for cenopopulations were determined (Tab. 20).

Table 20

Correlation between productivity elements

| Elements | Total number of trunks | Number of generative trunks | The height of the plant | Number of flowers | The mass of the seed in the generative stem |
|---|---|---|---|---|---|
| Total number of trunks | 1 | - | - | - | - |
| Number of generative trunks | $0.947^{**}$ | 1 | - | - | - |
| The height of the plant | $-0.412^{n.s}$ | $0.222^{n.s}$ | 1 | - | - |
| Number of flowers | $0.784^{n.s}$ | $-0.042^{n.s}$ | $0.379^{n.s}$ | 1 | - |
| The mass of the seed in the generative stem | $0.093^{n.s}$ | $0.906^{n.s}$ | $0.443^{n.s}$ | $0.956^{**}$ | 1 |

Correlation relationships in the studied species were normal. Among the elements of productivity, the highest degree of reliability was between the total number of stems and the number of generative stems and the number of flowers and the mass of seeds in the generative stem.

This feature indicates the ability of the studied plants to produce high yields under favorable conditions. A negative correlation was observed between the total number of stems and plant height, the number of generative stems and the number of flowers was observed in aduncus (Km = 0.43) species[19].

[19]Mammadova, Z.J. Seed productivity of some leguminous plants studied at the level of cenopopulations in the Republic of Azerbaijan // Bulletin of Science and Practice (https: // doi.org/ 10. 33619 / 2414-2948 / 53/06). -2020. -T.6, -No.4, -p.58-65.

## CHAPTER VIII. EFFECTIVE USE AND PROTECTION OF LEGUME PLANTS IN AZERBAIJAN

Legumes occupy a special place in the plant world due to their many positive qualities, after the nutritious representatives of cereals. Legumes have a great scientific and practical importance in the development of animal husbandry in agriculture, the creation of an abundant fodder base, the improvement of summer and winter pastures, the enrichment of arable lands with nitrogen. Economic importance in phytocenoses of *Astragalus glycyphyllos, A.falcatus, A.kubensis, A.aduncus, Vicia sativa, V.crocea, V.alpestris, V.sepium, Trifolium caucasicum, Medicago glutinosa, Caragana grandiflora* and *Albizia julibrissin* has also been identified. These plants can be used as fodder crops after seeding to protect their reserves[20]. Prevent their extinction and destruction by collecting seeds and increasing the number of farms is also possible.

Criteria were used to assess the rarity status of rare species among legumes during cenopopulation studies by IUCN's Red List Criteria, and criteria A, B, C, D were used to assess the risk category. *Astragalus glycyphyllos* has been identified as “Extremely Endangered” (VU), *A.aduncus* and *Vicia alpestris* as “Endangered” (EN), *Astragalus kubensis* and *Caragana grandiflora* as “Critically Endangered” (CR). The *Vicia crocea* species is classified as "Nearly Dangerous" (NT), and the *Trifolium caucasicum* and *Medicago glutinosa* species are classified as "Less Dangerous" (LC). In order to increase the number of these representatives, to prevent their extinction, fully protect the areas where they live and to establish a sanctuary in those areas is necessary.

The current condition of the areas where *V.sativa* is distributed in the meadow-grass vegetation type is unsatisfactory was determined during the cenopopulation studies. Pastures in the area are in 3rd-degree degradation state. Therefore, if timely protection measures are not taken, in the future these areas will become unsuitable for the

[20] Gurbanov, E.M., Mammadova, Z.J., Asadova, K.A. Phytocenosis Created by Leguminous Plants at Mil Steppe of Azerbaijan and Their Agricultural Importance //Pelagia Research Library Asian Journal of Plant Science and Research, ISSN:2249-7412 CODEN (USA): AJPSKY, -2019. -9(2), -p.1-5.

fodder base. Graze legally in order to strengthen the fodder bases in the pastures found in Oguz and Gakh districts is recommended, where the cenopulation study of *V.sepium* species is conducted.

Result of spontaneous grazing of cattle in the areas where *Astragalus glycyphyllos, A.aduncus* and *Vicia alpestris* are widespread, many areas of steppe and alpine meadow pastures of the Azerbaijani flora are also degraded to 3-4 degrees have shown studies. An increase in desertification in the Caspian region and the Kur-Araz lowlands is one of the factors leading to a sharp negative change in biodiversity was also found.

*Medicago glutinosa* species is in danger of extinction due to inefficient use of plant-type phytocenoses and lack of improvement measures, degraded soil vegetation in summer pastures, many useful fodder plants, as well as endemic, rare and endangered species and conditions for ecological imbalances. Therefore, in order to prevent the continuation of such negative processes, a system of phytoecological measures has been developed on a scientific basis.

For the protection of rare and endangered plants listed in the "Red Book" as a recommendation to the farm, large-scale cultivation of legumes studied at the level of cenopulation will significantly improve the fodder base in the country, can be used in the development of beekeeping as drought-tolerant plants. There can be widely used in the restoration of fodder reserves in desert areas, in the enrichment of soil with nitrogen, and against erosion.

Our research at the cenopopulation level also allows us to investigate the causes of extinction, to determine at what stage of development this process began, to eliminate or reduce it.

## CONCLUSION

1. The flora conspectus of the number of legumes distributed in the territory of the Azerbaijan Republic was prepared, the distribution of 460 species into 3 families, 70 genus was clarified, 13 species belonged to the *Cesalpiniacea* family, 7 species belonged to the *Mimosaceae* family, 440 species belonged to the *Fabacea* family, their life forms, endemicity and relict, geographical and habitat types, ecological groups have been reworked on the basis on

the basis of the researches and modern classifications and literature.

2. The dominance and phytoecological principles of many ecosystem engineer (edifiers) legumes were accepted as the main criteria for the preparation of a modern classification of phytocenoses on the basis of geobotanical descriptions recorded during our field research in the natural plant ecosystem of Azerbaijan. 79 formation groups and 126 associations and 18 new habitats have been identified.

3.Phytocenoses formed by some rare and endangered leguminous trees and perennial grasses forming a humid plain forest belt for the first time were studied and a classification scheme was developed based on ecological-geobotanical researches. Phytocenoses formed by some rare and endangered species of legumes consists of 1 type, 1 formation class, 5 formation groups and 5 associations was determined.

4. "Ecological-geobotanical map of some phytocenoses formed by legumes in the natural vegetation of Azerbaijan" at the level of formation classes were compiled at 1: 500000 scale on the basis of the classification scheme of phytocenoses formed mainly by legumes in the natural vegetation of Azerbaijan developed by us for the first time.

5.The structure of the ontogenesis of the *Astragalus glycyphyllos* L., *A.falcatus* Lam., *A.kubensis* Grossh., *A.aduncus* Willd., *Vicia sativa* L., *V.crocea* (Desf.) Fritsch, *V.alpestris* Stev., *V.sepium* L., *Trifolium caucasicum* Tausch, *Medicago glutinosa* Bieb., *Caragana grandiflora* (Bieb.) DC., *Albizia julibrissin* L. species was determined, the cenopopulations were assessed, the types of young, transitional, mature, mature, elderly cenopopulations were identified and a protection strategy was developed.

6.The developmental dynamics of legumes studied at the cenopopulation level were studied, and short-term, wavy, reversible and irreversible fluctuations occur in population waves as a result of changes in environmental conditions were determined. Thus, the age spectrum of *Astragalus falcatus*, *A.aduncus, A.kubensis, Vicia alpestris, V.sativa, Caragana grandiflora* and *Albizia julibrissin* species is fragmented and incomplete populations are formed.

7.The viability of the studied legumes at the cenopopulation level was assessed, different life types (developing, in balance, in crisis) were identified and viability of the studied species depends on the degree of development of the cenoses encountered was determined.

8.The productivity of cenopopulations of these species was studied, correlations between fertility elements were determined, the highest indicator of seed productivity was *Trifolium caucasicum* Tausch. species (Km = 0.80), while the lowest index is *Astragalus glycyphyllos* L. (Km = 0.43) and *A.aduncus* Willd. (Km = 0.43). The productivity of wet and dry mass of cenopopulations, the highest value was in *Vicia sativa* L. (7.8 cents/hectare), the lowest value was in *Astragalus aduncus* Willd. (2.1 cents/hectare).

9.*Astragalus glycyphyllos* L. is a species susceptible to extinction (VU), *A.aduncus* Willd., *Vicia alpestris* Stev. species "Endangered" (EN), *Astragalus kubensis* Grossh. and *Caragana grandiflora* (Bieb.) DC. species *Vicia crocea* (Desf.) Fritsch (NT), *Trifolium caucasicum* Tausch and *Medicago glutinosa* Bieb. species have been shown to be less endangered (LC) has been determined based on cenopopulation studies.

10.Ways to effectively use legumes in Azerbaijan were identified during the study, a protection strategy was developed and the results of our research were presented to the State Committee for Property Affairs, the Department of Landscaping of the Baku City Executive Power, as well as the Ministry of Ecology and Natural Resources of Azerbaijan Republic.

## RECOMMENDATIONS

1.Create high-yielding and high-quality hayfields, which is important in agriculture and livestock development is possible by cultivating some legume species studied at the cenopopulation level.

2.Significant results can be achieved in the prevention of food security by studying legumes at the cenopopulation level, which are second only to grains in terms of nutrition and feed in the vegetation of Azerbaijan.

3.Cultivation of legumes on a large scale on a rotating basis with other crops will improve the fodder base in the country, mainly from

the phytocenoses formed by legumes, crops and hayfields, as well as high-quality crops from summer and winter pastures.

4.Legumes as drought-resistant plants can be widely used in desert areas to restore fodder reserves, enrich the soil with nitrogen, prevent erosion, develop beekeeping because they are beekeeping plants, plant ornamental plants in cities and villages, and have medicinal and industrial properties.

5.The study of legumes at the cenopopulation level for the implementation of the "Problem of efficient use and protection of flora on a biological basis" in the territory of the Azerbaijan Republic also plays an important role in the protection and conservation of called rare plants in "Red Book".

**The main content of the dissertation is set out in the following publications:**


1.Məmmədova, Z.C. Paxlalılar *(Fabaceae* Lindl.) fəsiləsinin təsərrüfat əhəmiyyətli bəzi nümayəndələri //-Bakı: AMEA Botanika institutunun elmi əsərləri, Akademik V.C.Hacıyevin anadan olmasının 75, elmi-pedaqoji fəaliyyətinin 55 illik yubileyinə həsr olunmuş kitab. İSBN 5-8066-1647-9. -2004. -XXV cild.- s.210-212.

2.Məmmədova, Z.C. Böyük Qafqazın Quba rayonu və Samur-Dəvəçi ovalığında yayılmış paxladən (*Astragalus* L.) cinsinin növləri //–Bakı:Bakı universiteti nəşriyyatı, Bakı Universitetinin Xəbərləri (Təbiət elmləri seriyası), İSSN 1609-0586. -Bakı, -2004. -№ 4. - s.85-89.

3.Məmmədova, Z.C. Azərbaycanın paxlalı bitkilərinin təbii şəraitdə yayılması və əhəmiyyəti //–Bakı:Elm, AMEA Botanika Institu. elmi əsərləri. -2006.- 226-228 s.

4.Mammadova, Z.J. Biodiversity of the species belonging to Trigonella L. //International Conference on Environment. -Near East University, -Nicosia-Northern Cyprus, - 2007.- p. 545-551.

5.Məmmədova, Z.C. Yüksək dağ bitkiliyinin fitosenozunun əmələ gəlməsində yonca (Trifolium L.) cinsinin əhəmiyyəti //Bakı Dövlət Universitetinin Biologiya fakültəsində «Tətbiqi biologiyanın problemləri» mövzusunda Respublika elmi konfransının materialları. -Bakı, -2007. -s.175-176.

6.Mammadova, Z.J. Bioecological properties of the species with economic importance belonging to Trigonella L. //International ecoenergy academy scientific-manufacturing association “Gunesh”. Prosiding of the ninth Baku International congress “Energy, ecology, economy”, -Baku: -7-9

June, - 2007. -p.306-310.

7.Mammadova, Z.J. Study of some species of *Vicia* L. genus on the senopopulation level //International symposium 7th plant life of South West Asia (7th PloSWA). -Turkey- Anadolu (Eskisheher): Anadolu University, - 25-29 June, -2007, -p.112.

8.Məmmədova, Z.C. Paxlakimilər (*Fabaceae* Lindl.) fəsiləsinin nəsli kəsilməkdə olan bəzi nümayəndələri //Gəncə Dövlət Universitetinin Biokimyəvi nəzəriyyələrin aktual problemləri. Elmi praktik konfransın materialları. -Gəncə: - 2007. -s.175-178

9.Məmmədova, Z.C. Paxladən (*Astraqalus* L.) cinsinin xarakter xüsusiyyətləri və cinsin bəzi növlərinin senopopulyasiya səviyyəsində tədqiq edilməsi//- Bakı:Elm, AMEA-nın Botanika institutunun elmi əsərləri.- 2007. -XXVII cild, -s.95-97.

10.Мамедова, З.Дж. Биологические особенности некоторых видов Vicia L. распространенных на территории Азербайджанской республики //Актуальные проблемы биоэкологии. Сборник материалов. Международной научно-практической конференции. –Москва: -2008. -ст.167-169.

11.Мамедова, З.Дж. Бобовые-как ценные растения для озеленительных работ. Интродукция нетрадиционных и редких растений //Материалы VIII Международной научно- методической конференции Мичуринск-наукоград, -РФ, -2008. -Том III, -с.188-190.

12.Məmmədova, Z.C. Paxladən (*Astragalus* L.) cinsinin şirinyarpaq paxladən (*Astragalus glycyphyllus* L.) və çinmeyvə paxladən (*Astragalus falcata* Lam.) növlərinin yaş spektrlərinin öyrənilməsi //-Bakı:Elm, AMEA Botanika institutunun elmi əsərləri. -2009. -XXIX cild. -s.346-348.

13.Məmmədova, Z.C.Yüksək yem əhəmiyyətinə malik lərgə (Vicia L.) cinsinin bəzi növləri // -Gəncə:Elm, Azərbaycan Milli Elmlər Akademiyası. Gəncə Regional Elmi Mərkəz. -2009.-s.22-25.

14.Məmmədova, Z.C. Kimyəvi tərkibinə görə yüksək qidalılığa malik lərgə (Vicia L.) cinsinin bəzi növləri //Bakı Dövlət Universitetinin 90 illik yubileyinə həsr olunmuş» Biologiyada elmi naliyyətlər» mövzusunda Respublika elmi konfransının materialları. -Bakı:Bakı Universiteti, -2009.-s.190-191.

15.Məmmədova, Z.C. Əkin (*Vicia sativa* L.) və narıncı (*V. crocea* Desf.) lərgə növlərinin yaş dövrlərinin öyrənilməsi //Bakı Dövlət Universitetinin 90 illik yubileyinə həsr olunmuş Beynəlxalq elmi konfransının materialları. Təbiət elmləri seriyası, -Bakı:Bakı Universiteti, -2009. -s.451

16.Məmmədova, Z.C., A.D.Hüseynova, Ş.N.Mirzəyeva. Azərbaycanın Qərb bölgəsinin bozqırlarında rast gəlinən paxlalı bitkilər //Əməkdar elm xadimi, akademik Abdulla Qarayevin anadan olmasının 100 illik yubileyinə həsr olunmuş «XXI əsrdə Biologiyanın aktual problemləri» mövzusunda elmi

konfransın materialları. -Bakı:Bakı Universiteti, -2010. -s.281-283.

17.Məmmədova, Z.C. Qalaaltı bölgəsinin bitkilik tiplərində rast gəlinən paxlalı bitkiləri //-Bakı:«Təhsil» Elm, AMEA Botanika institutunun elmi əsərləri, -2010. -XXX cild. -s.22-25.

18.Мамедова, З.Дж., Гурбанов, Э.М., Гусейнова, А.Д. Улучщение сенокосов с участием бобовых на Азербайджане. Интродукция нетрадиционных редких растений //Материалы IX Международной научно-методической конференции. Мичуринск-наукоград. РФ. -2010. -Том I. -с.306-308.

19.Məmmədova, Z.C. Əkin lərgəsi (Vicia sativa L.), narıncı lərgə (V.croceae Desf.), dağ lərgəsi (V.alpestris Stev.) və çəpər lərgəsi (V.sepium L.) növlərinin yaş spektrlərinin öyrənilməsi //Beynəlxalq konfrans. Botanika bağlarının müasir mərhələdə təbii mühafizəsi. AMEA, Biologiya Elmlər Bölməsi, Mərdəkan Dendrarisi. –Bakı:Elm, -2010. -s.46-49.

20.Məmmədova, Z.C. Azərbaycanın müxtəlif qurşaqlarında rast gəlinən paxlalı bitkilər və onlardan səmərəli istifadə//-Bakı:Elm, AMEA Botanika institutunun elmi əsərləri, İSSN 2223-1617. -2011. -XXXI cild, -s.121-124.

21.Məmmədova, Z.C., Qurbanov, E.M. Azərbaycan respublikasının yaşıllaşdırılmasında ekoloji streslərə adaptasiya oluna bilən paxlalı bitkilər //AMEA-nın Naxçıvan bölməsinin xəbərləri. Təbiət və texniki elmlər seriyası. İSSN 2218-4791. Naxçıvan: Tusi,-2011.- Cild 7, -№ 4.- s.86-90.

22.Məmmədova, Z.C. Əkin lərgəsi (Vicia sativa L.), narıncı lərgə (V.crocea Desf.), dağ lərgəsi (V.alpestris Stev.) və çəpər lərgəsi (V.sepium L.) növlərinin senopopulyasiyasında fərdlərin həyatiliyinin öyrənilməsi //-Gəncə:Azərbaycan Milli Elmlər Akademiyası Gəncə Regional Elmi Mərkəzin ”Xəbərlər məcmuəsi”, -2011.- №46, -s.12-14.

23.Qurbanov, E.M., Məmmədova, Z.C., Abşeron yarımadasının səhra və yarımsəhra bitkiliyində paxlalı bitkilərin əmələ gətirdiyi fitosenozlar // «Biokimyəvi nəzəriyyələrin aktual problemləri» II Beynəlxalq konfransı. -Gəncə, -2011.-s.13-15.

24.Qurbanov, E.M. Lənkəranın dağlıq hissəsinin (Lerik rayonu ərazisində) bitkiliyinin fitosenoloji xüsusiyyətləri və əhəmiyyəti / E.M.Qurbanov, S.S.Aslanova, M.T.Cabbarov [və s.] //Bakı Universitetinin xəbərləri (Təbiət elmləri seriyası), İSSN 1609-0586. –Bakı: Bakı universiteti, -2011.-№4,- s.47-54.

25.Məmmədova, Z.C. Alazan-Ağrıçay vadisinin alp bitkiliyinin fitosenoloji xüsusiyyətləri və onun ekosisteminin qorunması // -Bakı: Elm, AMEA Botanika İnstitutunun Elmi əsərləri, -2012.-XXXII cild, -s. 236-239.

26.Məmmədova, Z.C., Qurbanov, E.M. Alp çəmənlər və alp xalılar bitkilik tipində bəzi paxlalı bitkilərin əmələ gətirdiyi fitosenozlar //Akademik Həsən Əliyevin 105 illik yubileyinə həsr olunmuş «Ekologiya, təbiət və cəmiyyət problemləri» mövzusunda II Beynəlxalq elmi konfransın materialları.-

Bakı, -2012,- s.372.

27.Məmmədova, Z.C. Azərbaycanin alp çəmənləri bitkilik tipində rast gəlinən taxıllı-paxlalı formasiya sinfi //-Gəncə:Elm, Azərbaycan Milli Elmlər Akademiyası Gəncə Regional Elmi Mərkəzin "Xəbərlər məcmuəsi İJBN 5-8066-1638-4. -2012.- №50.-s.20-24.

28.Məmmədova, Z.C. Böyük Qafqazın alp çəmənlərinin cənub yamaclarında ağbığlı-çəmən yoncalı-topallıq *(Nardeta-Trifolietum-Festucosum)* formasiyasının geobotaniki tədqiqi //-Bakı:Bakı universiteti, Bakı Universitetinin xəbərləri (Təbiət elmləri seriyası) İSSN 1609-0586. –2013. -№1, -s.35-39.

29.Məmmədova, Z.C., Qurbanov, E.M. Böyük Qafqaz (Azərbaycan) ərazisində paxlalı bitkilərin dominantlığı ilə rast gələn subalp bitkiliyi //Bakı Universitetinin xəbərləri (Təbiət elmləri seriyası), İSSN 1609-0586. -Bakı:Bakı universiteti, -2013. -№3, -s.55-64.

30.Məmmədova, Z.C., Qurbanov, E.M. Kiçik Qafqazın subalp qurşağında paxlalı bitkilərin əmələ gətirdiyi fitosenozlar //AMEA Mikrobiologiya Institutunun elmi əsərləri. ISSN2224-0683. -Bakı, -2013. -Cild 11, -№1, -s.241-248.

31.Məmmədova, Z.C. Azərbaycan respubllikası ərazisində yayılmış paxlakimilər fəsiləsinin nadir və məhvolma təhlükəsində olan bəzi növlərinin təsərrüfat əhəmiyyəti //-Bakı: AMEA Mikrobiologiya institutunun elmi əsərləri. ISSN2224-0683. -2013.-Cild 11, -№2. -s.124-127.

32.Mammadova, Z.J., Gurbanov, E.M. Phytochemical Composition Of Some *Vicia* L. genus Species //International Caucasian Forestry Symposium. -Artvin-Turkey, -2013. -p.1068-1071.

33.Qurbanov, E.M., Məmmədova, Z.C. Azərbaycanın təbii bitkiliyində paxlakimilərin əmələ gətirdiyi bəzi fitosenozların ekoloji-geobotaniki xəritəsi [Xəritə] /-Bakı, Azərbaycan Respublikası müəllif hüquqları agentliyi. Əsərin qeydiyyatı haqqında şəhadətnamə. -№7462. -2013.

34.Məmmədova, Z.C., Qurbanov, E.M. Böyük Qafqazın cənub-qərbində (Azərbaycan ərazisində) rast gəlinən müxtəlifotlu-paxlalı və paxlalı-taxıllı-müxtəlifotlu subalp çəmən formasiya siniflərinin fitosenoloji quruluşu //Journal of Qafqaz University. Chemistry and Biology. An international Journal. ISSN 2310-905X. Qafqaz University, - 2014. -Volume 2, -Number 2. -p.134-138.

35.Məmmədova, Z.C., Qurbanov, E.M. Paxlakimilərdən formalaşan müxtəlif dağ çəmən bitkiliyində rast gəlinən fitosenozlar və onların tərkibindəki endemik paxlalı bitkilərin qorunması //Pedaqoji Universitet xəbərləri. Təbiət, humanitar və pedaqoji-psixoloji elmlər bölməsi. –Bakı:Azərbaycan Dövlət Pedaqoji Universiteti nəşriyyatı. -2014. - №2, -s.73-81.

36.Məmmədova, Z.C., Qurbanov, E.M. Rütubətli düzən meşə qurşağı bitkiliyində paxlalı bitkilərin əmələ gətirdiyi fitosenozlar və onların qorunması //AMEA-nın Naxçıvan bölməsinin xəbərləri. Təbiət və texniki elmlər seriyası. İSSN 2218-4791. -Naxçıvan: Tusi, -2014. -cild 10, - № 4,- s.58-64.

37.Мамедова, З.Дж. Некоторые редкие и исчезающие бобовые растения и пути их охраны//-Москва: Вестник МГОУ, серия «Естественные науки», ISSN 2072-8352. Издательство МГОУ. -2014. -№5. - с.32-36.

38.Məmmədova, Z.C. Azərbaycanın bozqırlaşmış çəmənlərində paxlalı bitkilərin əmələ gətirdiyi fitosenozların əhəmiyyəti //-Bakı:Tərəqqi nəşriyyatı, Azərbaycan Aqrar Elmi. Azərbaycan Aqrar Elmi. Azərbaycan Respublikası kənd təsərrüfatı nazirliyinin elmi-nəzəri jurnalı, İSSN -76419. -2014. -№ 2. - s.40-44.

39.Məmmədova, Z.C. Paxlakimilərdən səmərəli istifadə edilmə və genofondun mühafizə olunma yolları //BDU-nun Biologiya fakültəsinin 80 illik yubileyinə həsr olunmuş "Ekspremental biologiyanın inkişaf perspektivləri» mövzusunda Respublika elmi konfransının materialları. – Bakı:Bakı Universiteti, - 2014. -s. 240.

40.Məmmədova, Z.C. Azərbaycanın qərb bölgəsinin bozqırlarında rast gəlinən paxlalı bitkilərin yem bazasının möhkəmləndirilməsində rolu //Heydər Əliyevin anadan olmasının 92-ci ildönümünə həsr olunmuş Müasir Biologiya və kimyanın aktual problemləri elmi-praktik konfrans. -Gəncə: Gəncə Dövlət universitetinin nəşriyyatı -2015. -I hissə. -s.64-65.

41.Mammadova, Z.J., Gurbanov, E.M. Legumes of the xerophytic forest vegetation in Azerbaijan //Journal of ecology of Health and Environment. An International Journal. İSSN2090-9497. -USA**,** New York: Natural Sciences Publishing, -2015. -Vol.3, -№3. -P.77-79.

42.Məmmədova, Z.C., Qurbanov, E.M. Azərbaycanın arid seyrək meşəliyinin paxlalı bitkiləri //Bakı Universitetinin xəbərləri (Təbiət elmləri seriyası) İSSN 1609-0586. –Bakı: Bakı universiteti, -2015. -№4,- s.66-71.

43.Mammadova, Z.J., Gurbanov, E.M. Legumes with new areas of distribution determined in the flora of Azerbaijan //Jokull journal (ISSN: 0449-0576). -Iceland, -Jan.2016. -Volume. 66, -Issue 1, -p.16-23.

44.Məmmədova, Z.C., Qurbanov, E.M. Azərbaycanın interzonal bitki örtüyündə rast gəlinən yarımkolcuqlu-paxlalı-taxilotlu çala-çəmən fitosenozları //Müasir kimya və biologiyanın aktual problemləri. Ümummilli lider Heydər Əliyevin anadan olmasının 93-cü ildönümünə həsr olumuş Beynəlxalq elmi konfrans. - Gəncə:Gəncə Dövlət universiteti, -2016. -s.23-27.

45.Mammadova, Z.J., Gurbanov, E.M. Evaluation of coenopopulations of the species of Vicia sativa L., V.croceae Desf., V.alpestris Stev. and V.sepium L. of Vicia L. genus //Symposium on Euroasian Biodiversity (SEAB-2016). – Antalya (Turkey), -23-27 may 2016.- p.247.

46.Məmmədova, Z.C., Qurbanov, E.M. Yarımsəhra və şorangəli səhra bitkilik tiplərində paxlalı bitkilərin üstünlüyü ilə qeydə alınmış fitosenozlar //Azərbaycan Aqrar elmi. Azərbaycan Respublikası kənd təsərrüfatı nazirliyinin Elmi- Nəzəri jurnalı. İSSN -76419. -Bakı:Tərəqqi. -2016. -№ 1, -s.67-72.

47.Мамедова, З.Дж., Гурбанов, Э.М. Бобовые фитоценозы, распространенные в кустарниковой растительности нагорно-ксерофитного и горно-степного пояса //Вестник МГОУ, серия «Естественные науки», ISSN 2072-8352. -Москва:МГОУ, -2016. –т. 12, - №2, -с.24-33.

48.Məmmədova, Z.C., Qurbanov, E.M. Ağzıbir göllləri ətrafının subataqlıq bitkilik tipində *Alhagietum-Phragmitosum* formasiyasının növ tərkibi //AMEA-nın Naxçıvan bölməsi. Xəbərlər. Təbiət və texniki elmlər seriyası. İSSN 2218-4791. -Naxçıvan:Tusi, -2016. -cild 12, - № 2,- s.58-63.

49.Məmmədova, Z.C., Qurbanov, E.M., Hüseynova, H.Z. Azərbaycanın dənizkənarı qumlu səhra və psammofit-litoral bitkilik tiplərində paxlalı fitosenozların əhəmiyyəti // Journal of Qafqaz University. Chemistry and Biology. An international Journal. ISSN 2310-905X. –Bakı: Qafqaz University. -2016. -Vol.1, -Num.1. -s.38-46.

50.Mammadova, Z.J. Influence of ecological factors to *Astragalus glycyphyllys* L. and *Astragalus falcata* Lam. species which evoluated at senopopulation level. //International Conference. Innovative Approaches to conservation of Biodiversity dedicated to the 80 Anniversary of the Institute of Botany, Azerbaijan National Academy of Sciences (ANAS).. –Baku:CBS Polycraphic production, -October 2-4, -2016.-p.84.

51.Mammadova, Z.J., Gurbanov, E.M., Asadova, K.A. Leguminous phytocenosis distributed in hole-meadow vegetation of Azerbaijan and their agricultural importance //European Academic Rescarch. -Bucharest (Romania), -April, 2017, -Vol.V, -İssue 1, -p.580-594

52.Gurbanov, E.M., Mammadova, Z.J., Asadova, K.A. Phytocenological structure of the perennial wheaty-leguminous grassy hole-meadow vegetation distributed at Mil steppe of Azerbaijan. The 3rd International Symposium on Euroasian biodiversity. Belarusian State University. –Minsk (Belarus), - 2017.-p.661.

53.Mammadova, Z.J., Gurbanov, E.M. Studying of the vitality of individuals at cenopopulation of *Astragalus glycyphyllys* L. and *Astragalus falcata* Lam. species of *Astragalus* L. genus //Jokull journal (ISSN: 0449-0576). –Iceland: , -2017. -Volume 67, -Issue 7. -p.2-6.

54.Məmmədova, Z.C., Qurbanov, E.M., Əsədova, K.A. Azərbaycanın Mil düzündə paxlalı bitkilərin üstünlüyü ilə rast gəlinən fitosenozlara iqlim dəyişikliklərinin təsiri. İqlim dəyişkənliyinin bitki biomüxtəlifliyinə təsiri //Beynəlxalq elmi konfransı. Məruzələr toplusu. AMEA Biologiya və Tibb elmləri bölməsi AMEA Dendrologiya İnstitutu, -Bakı:Elm, RNPM nəşriyyatı,

- 2017. -s.463-464.

55.Məmmədova, Z.C. Xostək (*Caragana* Fabr.) cinsinin *Caragana grandiflora* (Bieb.) DC. növünün senopopulyasiyalarının qiymətləndirilməsi //Ümummilli lider Heydər Əliyevin anadan olmasının 95-ci ildönümünə həsr olumuş "Müasir təbiət və iqtisad elmlərinin aktual problemləri" Beynəlxalq elmi konfransı, -Gəncə:Gəncə Dövlət universiteti nəşriyyatı, -2018.- II hissə, -s.88-90.

56.Məmmədova, Z.C., Qurbanov, E.M. *Trifolium caucasicum* Tausch növünün senopopulyasiyalarının həyatiliyinin qiymətləndirilməsi //AMEA Botanika İnstitutu və Azərbaycan Botaniklər cəmiyyətinin akademik Vahid Cəlal oğlu Hacıyevin 90 illiyinə həsr edilmiş konfrans materialları, -Bakı: Red N Line nəşriyyatı, - 20-21 iyun 2018. -s.267-269.

57.Мамедова, З.Дж., Гурбанов, Э.М., Гусейнова, Х. Бобовые растения, адаптированные экологическим стрессам в озеленении прикаспийского побережья Азербайджанской Республики //Министерство образования и науки Российской Федерации. Экология городской среды: История, современность и перспективы. Сборник статей Всероссийской научно-практической конференции с международным участием. ISBN 978-5-9926-1108-3, -Астрахан: «Астраханский университет», -25-26 октября., 2018 г. -с.128-131

58.Məmmədova, Z.C., Gurbanov, E.M. Studying of germinative energy in species of *Vicia* L. genus analysed on senopopulation level //AMEA Botanika İnstitutu və Azərbaycan Botaniklər cəmiyyəti. Akademik V.İ.Ulyanişevin 120 illiyinə həsr edilmiş simpozium. Bakı: CBS Polycraphic production, -2018.- s.57.

59.Gurbanov, E.M., Məmmədova, Z.C., Asadova, K.A. Phytocenosis Created by Leguminous Plants at Mil Steppe of Azerbaijan and Their Agricultural Importance //Pelagia Research Library Asian Journal of Plant Science and Research, ISSN:2249-7412 CODEN (USA): AJPSKY, -2019. -9(2), -p.1-5.

60.Qurbanov, E.M., Məmmədova, Z.C. Azərbaycanın Xəzər sahili bitkiliyində rast gəlinən paxlalı bitkilər və onların təsərrüfat əhəmiyyəti //Həyat elmləri və biotibb jurnalı. İSSN: 2078-3388. Bakı: AMEA tərəfindən nəşr olunur. -2019. -Cild 1 (74), -№.2, - s.33-41

61.Məmmədova, Z.C. Albizia julibrissin Durazz. növünün senopopulyasiyalarının həyatiliyinin qiymətləndirilməsi //Akademik A.A.Qrossheymin 130-cu ildönümünə həsr olunmuş Gənc alim və tədqiqatçıların "Müasir Botanikada innovasiya və ənənələr" mövzusunda konfransın tezisləri. Bakı: AMEA Botanika institutu və Azərbaycan Botaniklər cəmiyyətinin nəşri, -20 dekabr 2019. -s.37.

62.Мамедова, З.Дж. Семенная продуктивность некоторых бобовых растений, исследуемых на уровне ценопопуляций в Азербайджанской

Республике //Бюллетень науки и практики (https: // doi.org/ 10. 33619 /2414-2948 /53/06). -2020. -T.6, -№4, -c.58-65.

63.Məmmədova, Z.C. Senopopulyasiya səviyyəsində tədqiq olunan bəzi paxlalı bitkilərin yem bazasının möhkəmləndirilməsində rolu //-Bakı: "Müəllim" nəşriyyatı, Əkinçilik Elmi-Tədqiqat İnstitutunun Elmi Əsərləri Məcmuəsi (ISSN2664-4037), -2020.- Cild 2 (31), -№1, - s.55-60.

64.Mammadova, Z.J. Assessment of the current situation of populations of *Vicia sativa* L. species in different regions of Azerbaijan //International Journal of Botany Studies (ISSN: 2455-541X; Impact Factor: RJIF 5.12), -2020. -Volume 5, -Issue 6, - p. 19-22

65.Mammadova, Z.J. Current state of cenopopulations of *Albizia julibrissin* species *(Azerbaijan Republic)* //International Journal of Science and Research Methodology (Ijsrm.Human, ISSN: 2454-2008. SJIF Impact Factor: 6.418), -November 2020. -Vol. 17 (1), -p.70-80.

66.Мамедова, З.Дж. Оценка онтогенеза *Vicia alpestris* Steven в ценопопуляциях на территории Азербайджана // Бюллетень науки и практики. - 2021. - Т. 7. - №2. - с. 45-51. https: //doi.org/10.33619/2414-2948/63/03

67.Mammadova, Z.J. Assessment of cenopopulations of some economically important species of the *Astragalus* L. genus distributed in Azerbaijan. Biodiversity Journal, 2021,12 (2): 361–368 https://doi.org/10.31396/

68. Мамедова, З.Дж. Оценка ценопопуляций ценного кормового растения *Vicia crocea* (Desf.) Fritsch на Южном Кавказе (Азербайджанская Республика). Аграрная наука. Т.348. №4 с.52-60.https://doi.org/10.32634/0869-8155-2021-348-4-52-60

69. Mammadova, Z.J. Assessment of the populations of the species *Medicago glutinosa* Bieb. in the flora of Azerbaijan. International Journal of Botany Studies. ISSN: 2455-541X; Impact Factor: RJIF 8 Volume 6; Issue 6; 2021; Page No. 1188-1191

70.Мамедова, З.Дж. Динамика развития ценопопуляций *Albizzia julibrissin* Durazz., встречающихся в Азербайджане //Бюллетень науки и практики (https: // doi.org/ 10. 33619 /2414-2948 /74/06). -2022. -T.8, -№1, -c.50-55.

The defense will be held on 14 june 2022 at $11^{00}$ at the meeting of the Dissertation Council ED 1.26 of Supreme Attestation Commission under the President of the Republic of Azerbaijan operating at the Institute of Botany of ANAS

Address: AZ 1004, Baku, Badamdar shosse, 40.

Dissertation is accessible at the library of the Institute of Botany of ANAS.

Electronic version of dissertation and its abstract are available on the official website of the Institute of Botany of ANAS.

Abstract was sent to the required addresses on 12 may 2022.

Signed for print:12.05.2022

Paper format: A5

Volume:71341

Number of hard copies: 30