

REPUBLIC OF AZERBAIJAN

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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy in Biology

**BIOECOLOGICAL AND PHYTOCENOLOGICAL
FEATURES OF THE SPECIES OF THE FAMILY
ORCHIDACEAE JUSS. DISTRIBUTED IN THE FLORA OF
THE NAKHCHIVAN AUTONOMOUS REPUBLIC**

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INTRODUCTION

Relevance and degree of development of the topic. In modern times, the rapid growth of the world's population, ecological imbalances, declining biodiversity, increasing demand for important plants, study and conservation of biodiversity have become important issues. In terms of preventing the destruction of biodiversity, a number of international documents, state programs aimed at ensuring environmental protection in the Republic of Azerbaijan, relevant legislative acts pay special attention to the study and reliable protection of plant resources, especially the wild ancestors of cultivated plants¹. The study of plant cover at the level of a particular genus or species is important in solving the problem of studying, efficient use and protection of biodiversity².

The study, rational use, restoration and protection of natural resources has become an urgent problem in the development of the economy of the Nakhchivan Autonomous Republic and is one of the important issues of state importance. The studies conducted by us in recent years has shown that as a result of man's negative attitude to nature a number of species of flora of the autonomous republic become extinct and many become rare with a reduced areal. Due to the increase in settlements, construction of roads, expansion of arable lands and etc. plant resources are declining, their species composition is becoming sparse, as a result, valuable plant species are excluded from the flora³

The orchids (*Orchidaceae* Juss.) has a special place among the rare and endangered plants of the Nakhchivan flora. The orchids are very sensitive to anthropogenic influences, as well as plants adapted to different environmental conditions. The most striking feature of

¹ Əliyev, C.Ə. Bioloji müxtəliflik /C.Ə.Əliyev, Z.İ.Əkrərov, A.T.Məmmədov, – Bakı: Elm, – 2008. – s. 232.

² Natalya, V.I., Maxim P.S. Biodiversity databases in Russia: towards a national portal // Published NRC research press. Arctic Science, – 2017. –3, – p. 560-576.

³ Abutalıbov, M.H. Naxçıvan MR-də bitki örtüyü və onun xalq təsərrüfatı əhəmiyyəti / M.H.Abutalıbov, V.C.Hacıyev, Y.M.İsayev [və b.] // Naxçıvan MR-50, –Bakı: Elm, –1975. –s. 213-229.

orchids is their unusual shape and beautiful flowers. They are one of the leading directions in floriculture in many countries as an ornamental plant.

Representatives of the family *Orchidaceae* are one of the weaker components of phytocenoses due to their biological properties. Most representatives of the family are included in the regional Red Books and protected plants. In recent years, the systematics of the orchids has been studied in Azerbaijan (excluding the flora of Nakhchivan AR) by R. Heydarova, but has not been studied in detail in the Nakhchivan Autonomous Republic. Many species of the orchids are found in protected areas, where rare plants are also protected. For this reason, the study of species belonging to the family orchids in the Nakhchivan Autonomous Republic, the protection of endangered species, as well as the identification of research areas are one of the urgent issues. Due to the fact that many species of the family *Orchidaceae* belong to rare plants, it is important to study the individual species at the population level and clarify and organize specific conservation measures. It is known that over time, species formation process occurs, new species migrate from neighboring countries to the studied area. For this reason, it is very important to study the species belonging to the family *Orchidaceae* that are widespread in the region, to determine their species composition, useful species and natural resources. It is extremely important to conduct research in accordance with the changed conditions of anthropogenic and other influences, to develop practical proposals and recommendations for the collection, protection, effective and sustainable use of its gene pool.

Object and subject of research. Representatives of the family *Orchidaceae* distributed in the territory of the Nakhchivan Autonomous Republic were studied, species composition was clarified, as well as useful features were studied.

Aims and objectives of the research. The main purpose of the research is to develop an action plan to identify the species composition of the *Orchidaceae* family of the Nakhchivan Autonomous Republic, the patterns of their distribution, conduct an ecological and phytocenological analysis of life forms, estimate the

population, study bioecological features, their effective use and protection. To achieve our goal, the following tasks are planned to be performed:

- ✓ Clarification of taxonomic composition of family *Orchidaceae* distributed in the territory of Nakhchivan Autonomous Republic, preparation of abstract, compilation of new determining table of species belonging to the family;

- ✓ Systematic analysis of species of the family *Orchidaceae*, study of bioecological features (life forms, distribution patterns depending on altitude);

- ✓ Botanical-geographical analysis of the species included in the family;

- ✓ Modern typological and phytocenological study of species belonging to the family orchids in the vegetation types;

- ✓ Study of ways to effectively use and protect the orchids.

- ✓ Development of an action plan for revealing and protecting rare and endangered species.

Research methods. Classical and modern botanical floristic, systematic, areological, ecological, statistical methods were used in the development of materials, the species composition of the orchids was clarified, as well as their useful properties were studied. The flora of Azerbaijan, the synopsis of the flora of the Caucasus and The Euro + Med Plantbase Project. was used in the identification of species. IUCN (2019) 14 version was used to clarify the categories of rare and endangered plants according to hazard criteria.

The main provisions of the defense:

- The study of bioecological features, ecological groups of species belonging to the family *Orchidaceae*, determination of their participation in the formation of phytocenoses inhabited by species, the study of populations reveals the possibility of their adaptation to environmental conditions;

- The study and analysis of constant macro- and micromorphological diagnostic features of species of the family *Orchidaceae* is used to determine the status of taxa that have a disputable systematic position;

- The study of the development indicators of rare and endemic plants of the orchids is important for the development of scientifically based proposals for their effective use.

Scientific novelty of the research. For the first time, the species of the family *Orchidaceae* of the region were studied in detail and a synopsis of 21 species belonging to 8 genera of the family was prepared. Out of them, five species - *Dactylorhiza umbrosa* – Shadow orchid, *Neottia ovata* – Eggleaf twayblade, *Orchis simia* – Monkey orchid, *Gymnadenia conopsea* – Fragrant orchid, *Anacamptis pyramidalis* – Pyramidal orchid were shown for the first time for the flora of the region and their distribution in the area was determined by altitude zones.

For the first time floristic-systematic, bioecological and botanical-geographical analysis of species of the family *Orchidaceae* was given in Nakhchivan AR.

Rare and endangered species were identified in the local flora, and recommendations were made for their protection. The status of endangered species were determined and a Red List was compiled. Suggestions and recommendations for the use of species were developed.

Theoretical and practical significance of the research. Systematics, taxonomy and bioecology of the family *Orchidaceae* distributed in the territory of Nakhchivan AR were studied, distribution area and ecological conditions of these species were determined, their morphological and taxonomic features were investigated. Information on the systematics, taxonomy and bioecology of the orchids can be taken into account in the compilation of the multi-volume “Flora of Azerbaijan”, “Determinant of Plants Azerbaijan” and III edition of the “Red Book” of the Republic of Azerbaijan on plants, regional flora and textbooks. Herbarium materials collected during the study were handed over to the Herbarium Fund (BAK) of the Institute of Botany of ANAS, which will allow the samples to be used by other researchers.

The species identified in the territory of Nakhchivan AR can be useful in agriculture, folk medicine, floriculture, preparation of ice

cream, meeting the needs of the autonomous republic for natural raw materials. The results of the research have been resolved in the form of a number of scientific provisions aimed at fulfilling the tasks arising from the “National Strategy and Action Plan for the Protection and Sustainable Use of Biological Diversity in the Republic of Azerbaijan” approved by the Decree of the President of the Republic of Azerbaijan, Ilham Aliyev dated March 24, 2006, No. 1368.

Approbation and application. Materials related to the dissertation were discussed at the International Scientific Conference “Development of Agriculture: Realities and Prospects” (May, 2015) in the Nakhchivan Branch of ANAS, the international scientific conference “Actual Problems of Modern Natural and Economic Sciences” (May, 2018), the international scientific-practical conference “Issues of modern scientific research” (October 2018), in the Conference of Young Scientists and Students “Innovations in Biology and Agriculture to Solve Global Challenges” (October 2018), the Department of Botany of Nakhchivan State University, the Scientific Council of the faculty and the Scientific seminar of the Institute of Botany of ANAS.

On the basis of research materials, 12 scientific articles, 4 conference materials reflecting the main provisions of the dissertation were published. Out of them, 6 articles and 1 conference material were published abroad.

Name of the organization where the dissertation work is carried out. The study was carried out at the Department of Botany of Nakhchivan State University

The volume of structural units of the dissertation. The dissertation is 170 pages consisting of an introduction, 6 chapters, results, proposals, literature with 179 titles (122 foreign) and appendices. The work is enriched with 13 tables (Appendix 1), 1 map, 25 figures (Appendix 33). The dissertation consists of a total of 197471 characters: title page and table of contents together - 1813 characters, introduction part - 9945 characters, Chapter I - 13617 characters, Chapter II - 23132 characters, Chapter III - 56110 characters, Chapter IV - 46299 characters, Chapter V - 22977

characters, Chapter VI – 19539 characters, conclusions – 2749 characters, practical proposals – 617 characters, list of abbreviations – 673 characters. The dissertation is completed with appendices and a list of abbreviations.

MAIN CONTENT OF THE WORK CHAPTER I. A REVIEW OF THE LITERATURE ON THE STUDY OF *ORCHIDACEAE* JUSS. – THE ORCHIDS FAMILY

The work carried out towards the study of orchids in the world and in our republic has been studied, comparatively analyzed and the obtained results have been widely explained in this section of the dissertation.

CHAPTER II. NATURAL GEOGRAPHICAL CONDITIONS OF THE NAKHCHIVAN AUTONOMOUS REPUBLIC, OBJECT AND METHODOLOGY OF RESEARCH

2.1. Natural-geographical conditions of the Nakhchivan Autonomous Republic. Nakhchivan AR is a typical mountainous region located in the south-west of the Lesser Caucasus. The total area of Nakhchivan AR is currently 5363km². The relief of Nakhchivan AR consists mainly of plains and mountainous parts.

Nakhchivan AR differs from other physical-geographical regions of Azerbaijan by its sharp continental climate. The main factors that create the climate here are the abundance of solar radiation, the complexity of the atmospheric cycle and with very different relief. In general, the difference between the minimum and maximum temperatures in the area is very sharp. The continental climate coefficient is more than 80 in the Araz plain. Such severe changes of thermal conditions during hot and cold periods lead to the formation of vegetation and soil cover typical of continental zones. Among other natural-geographical factors influencing the formation of vegetation in the area, detailed information on the amount of precipitation, thickness and durability of snow cover, possible evaporation, wind and water regime, soil diversity and structure is reflected in the dissertation.

2.2. Object and methodology of research. In order to study

orchids, more than 80 routes were made and herbarium material was collected during expeditions to different areas of the autonomous republic in 2014-2018. Herbarium materials related to the collected species were handed over to the Herbarium Funds of the Institute of Bioresources of the Nakhchivan Branch and the Institute of Botany of ANAS. On the expeditions indicators were determined using the Global Positioning System (GPS) device.

“Flora Azerbaijan”⁴ and many other determinants were used to identify the species, the “International Code of Botanical Nomenclature”⁵, A.M.Askerov’s “The plant world”⁶, “Abstract of Flora of the Caucasus”⁷ and other works were used to clarify the names and nomenclature changes.

During the research phenological observations were conducted with reference to “Method of phenological observations in botanical research”⁸, analysis of morphological features, geobotanical descriptions to “Methodology of field geobotanical research”⁹, rarity and endemism to “Narrow endemic and rare species of the natural flora of the Nakhichevan ASSR”¹⁰, A.M. Askerov¹¹. The protection

⁴ Флора Азербайджана: [в 8 томах] / ред. Д.И.Сосновский, И.И.Карягин—Баку: Изд-во АН Азерб. ССР. — т. II. — 1952. — 317с.

⁵Международный кодекс ботанической номенклатуры. Венский кодекс /Под Ред. Колл. —Санкт-Петербург: Товарищество научных изданий КМК, — 2009. — 281 с.

⁶Əsgərov, A.M. Azərbaycanın bitki aləmi (Ali bitkilər-Embryophyta) /A.M.Əsgərov, —Bakı: TEAS Press Nəşriyyat evi, —2016. —444 s.

⁷Конспект флоры Кавказа [В 3-х т.] / Под. Ред. Ю.Л. Меницкий, Т.Н. Попова. —СПб.: С.-Петербур. ун-та, —Т. 2. —2006.—466 с.

⁸Бейдеман, И.Н. Методика фенологических наблюдений при геоботанических исследованиях /И.Н.Бейдеман, — М.-Л.: АН СССР, — 1954. — 128 с

⁹Методика полевых геоботанических исследований / Под Ред. Колл. —М.-Л.: АН СССР, —1938. —214 с

¹⁰Ахундов, Г.Ф., Гогина, Е.Е., Прилипко, Л.И. Узкоэндемные и редкие виды природной флоры Нахичеванской АССР // Бюлл. ГБС, — 1978, — вып. 107, — с. 54-62.

¹¹ Əsgərov, A.M. Azərbaycan florasının subendəmləri // -Bakı: AMEA Xəbərləri, biol. və tibb e.b.,—2014. —№1, —s.81-91

status of rare species is determined according to the IUCN “Red List”¹² categories.

The life forms of plants were determined according to C.Raunkier and I.G.Serebryakov¹³ and the distribution patterns of plants in the belts and their role in the vegetation type were studied on the basis of research conducted by V.V. Alekhine¹⁴ and others

The works of R.D. Yaroshenko¹⁵ and other researchers were used in the classification of vegetation based on the ecological-phytocenological, dominance principles.

The schemes of N.N.Portenier’s¹⁶ and others were used as a basis in determining the geographical elements of the species.

The structure of the coenopopulation of the species studied was conducted on the basis of T.A.Rabotnov’s¹⁷ methods.

CHAPTER III. SYSTEMATIC ANALYSIS OF THE FAMILY *ORCHIDACEAE* IN THE FLORA OF NAKHCHIVAN AR

3.1. Taxonomic spectrum of orchids. Based on the literature, materials in the herbarium fund and conducted studies, it was determined that 21 species of orchids in 8 genera were distributed in the territory of the autonomous republic and a taxonomic spectrum was compiled.

¹²IUCN Standards and Petitions Committee. Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee.–2019.

URL:<http://www.iucnredlist.org/documents/RedListGuidelines.pdf>

¹³Серебряков, И.Г. Жизненные формы высших растений и их изучение / И.Г.Серебряков, В кн.: полевая геоботаника, –М.Л.:изд.во –т. 3, –1964.– с. 530.

¹⁴Алехин, В.В. География растений (основы фитогеографии, экологии и геоботаники)/ В.В. Алехин, – Москва: Учпедгиз, – 1950, – 420 с.

¹⁵Ярошенко, П.Д. Геоботаника / П.Д. Ярошенко, – Москва: изд.во, –1969. –198с.

¹⁶Портениер, Н.Н. Флора и ботаническая география Северного Кавказа / Н.Н.Портениер, –М.: Изд-во –2012. –293 с.

¹⁷Работнов, Т.А. Жизненный цикл многолетних травянистых растений в луговых ценозах // Тр. Бот.ин-та АН СССР. Сер. 3: Геоботаника. – М.;Л.: Изд-во АН СССР, –1950. –Вып. 6, – С. 179 –196.

3.2. Systematics of the orchids. As a result of the studies, the taxonomic structure of the orchids (*Orchidaceae* Juss.) was updated, new species were found in the area and a new key was developed.

3.3. Distribution of orchids along altitude zones. The distribution of vegetation types in the Autonomous Republic, in accordance with the law of zoning, changes vertically from the plains to the highlands due to changes in environmental conditions. When determining the species by altitude, 6 vertical belts, which differ from each other in physical-geographical and ecological conditions were taken, the heights of their distribution were specified and the distribution patterns of orchids were studied (Fig. 1).

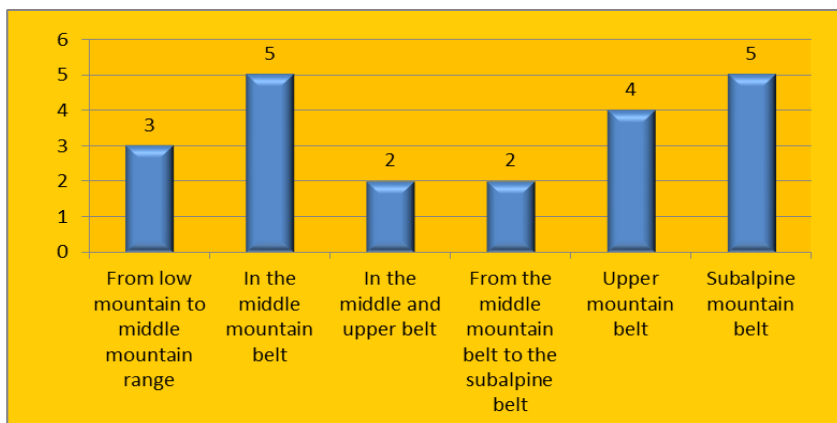


Figure 1. Distribution of orchids along belts

In the territory of the Autonomous Republic, three species of orchids are distributed from the lower mountain range to the middle mountain range, five species on the middle mountain belt, two species from medium to high mountain range, four species from the middle mountain belt to the subalpine belt, on a high mountain belt, five species in subalpine meadows.

3.4.1. Botanical-geographical analysis and ecological groups of orchids. In modern times, the study of the genesis of species and ways of formation, habitat types of species, as well as geographical and genetic elements of plants are a topical issue. The habitat types of the species reflect the relationship between the flora of the region studied and the flora of the large areas surrounding the region,

leading to the study of the migration routes of the species from a historical point of view.

According to the studies, it was found that orchids belong to different habitat types, which allows to determine the migration routes of the species to the area. In order to clarify the genesis and ways of formation of orchids in Nakhchivan AR, the species were grouped according to geographical elements, ecological analysis was carried out according to the attitude to moisture (Table 1).

Table 1

Ecological groups and geographical types of the orchids

| No. | Species | Ecological groups | Geographical types |
|-----|--------------------------------|-------------------|-----------------------|
| 1 | 2 | 3 | 4 |
| 1 | <i>Epipactis microphylla</i> | Mesophyte | Europe |
| 2 | <i>Epipactis palustris</i> | Mesophyte | Paleoarctic |
| 3 | <i>Epipactis veratrifolia</i> | Mesophyte | Iran-Turan |
| 4 | <i>Neottia ovata</i> | Mesophyte | Eurosiberia |
| 5 | <i>Platanthera chlorantha</i> | Mesoxerophyte | Paleoarctic |
| 6 | <i>Dactylorhiza euxina</i> | Mesophyte | Caucasus |
| 7 | <i>Dactylorhiza salina</i> | Mesophyte | Iran-Turan |
| 8 | <i>Dactylorhiza iberica</i> | Mesophyte | Ancient Mediterranean |
| 9 | <i>Dactylorhiza romana</i> | Mesophyte | Iran-Turan |
| 10 | <i>Dactylorhiza umbrosa</i> | Mesophyte | Caucasus |
| 11 | <i>Dactylorhiza urvilleana</i> | Mesophyte | SubCaucasus |
| 12 | <i>Dactylorhiza osmanica</i> | Mesoxerophyte | Iran-Turan |
| 13 | <i>Anacamptis coriophora</i> | Mesophyte | Ancient Mediterranean |
| 14 | <i>Anacamptis laxiflora</i> | Mesophyte | Iran-Turan |
| 15 | <i>Anacamptis palustris</i> | Mesophyte | SubMediterranean |
| 16 | <i>Anacamptis pyramidalis</i> | Mesophyte | Mediterranean |
| 17 | <i>Orchis mascula</i> | Mesophyte | Paleoarctic |
| 18 | <i>Orchis punctulata</i> | Mesoxerophyte | Ancient Mediterranean |
| 19 | <i>Orchis simia</i> | Mesophyte | SubMediterranean |
| 20 | <i>Ophrys apifera</i> | Mesoxerophyte | Iran-Turan |
| 21 | <i>Gymnadenia conopsea</i> | Mesophyte | Paleoarctic |

Orchids are mesophytes and mesoxerophytes in their attitude and need for moisture. Mesophytes have an intermediate position between hydrophytes and xerophytes. Mesophytic plants are mainly forest, shrub, subalpine, alpine, subnival and nival belt plants. These

plants are the founders of forest edge, subalpine and alpine meadow phytocenoses, some of which act as edificators of phytocenoses.

CHAPTER IV. BIOMORPHOLOGICAL ANALYSIS OF ORCHIDS, ONTOGENETIC, MORPHOMETRIC FEATURES OF SOME COENOPOPULATIONS AND THEIR PROTECTION

4.1. Biomorphological features. They are characterized by morphological features of plants, their life forms, anatomical structure of the stem and leaves, features of cover with tiny hairs, structure and ways of dehiscence of seeds. Analysis of traits gives an idea of the amplitude, rarity of variability, homology and parallelism of phylogenetic lines in the system of kinship, as well as the nature of adaptive specializations. This, in turn, allows to differentiate the taxonomic and diagnostic significance of traits, to improve the traditional comparative-morphological method on their biodiversity materials.

4.1.1. Biomorphological analysis of life forms of orchids. According to studies, it became clear that the orchids in Nakhchivan AR can be divided into the following biomorphological types: *rhizome (short rhizome)*, *stolon-shaped - rhizome*, *tuberidiums*. Rosette-shaped and non-rosette-shaped forms are also encountered within each type.

Rhizome species are mainly rosetteless forms, which also have strong roots. Strong rosette-shaped tuberidiums are found in species belonging to the genus *Orchis*, *Dactylorhiza* (meadow-stolon, creeping rhizome -stolon).

The formation of short rhizomes of the orchid family is found in species belonging to the genus *Epipactis* and *Neottia*. Individuals of *Epipactis microphylla*, *Neottia ovata* are characterized by plagiotropic or numerous roots and have short rhizomes that penetrate deep into the soil (up to 40 cm).

One species – *Epipactis palustris* belong to stolon-shaped-rhizome form. It has long internode, creeping, thin stolon-shaped rhizome. *Epipactis palustris* has long rhizome and belongs to the green form in summer.

Tuberidium orchids are more common in the district (species of genera *Orchis*, *Ophrys*, *Platanthera*, *Dactylorhiza*). They are distributed in various types of forests, mountain-xerophytic steppes and mountain meadows in the region. The species of the genus *Anacamptis*, *Orchis*, *Ophrys* have adapted to withstand prolonged drought (up to 3 months) in some parts of Nakhchivan AR. Some species grow on very dry gravelly soils (*Ophrys apifera*, *Orchis punctulata* etc.).

4.1.2. Morphometric features of orchids. Observations in the condition of the Nakhchivan Autonomous Republic were conducted from 2014 to 2018. The species *Orchis mascula*, *Dactylorhiza umbrosa*, *Dactylorhiza romana*, *Anacamptis coriophora* were selected as the object of research and morphometric indicators of each species were studied at different ages. In the evolutionary process, in addition to the specific features of the representatives of the orchid family, a system of formation and distribution characteristics have been developed.

Significant variations in the length of flowers and fruits, inflorescence were recorded in all species of orchids studied (Table 2).

Table 2

The size of the fruit in the orchids

| Species | The length of the fruit, mm | | | | The width of the fruit, mm | | | |
|------------------------------|-----------------------------|----------------|----------------|----------------|----------------------------|---------------|---------------|---------------|
| | low | middle | high | Mean value | low | middle | high | Mean value |
| <i>Orchis mascula</i> | 15,24± 0,32 | 13,21± 0,34 | 11,55± 0,32 | 13,13± 0,33 | 4,26± 0,24 | 4,01± 0,11 | 3,10± 0,18 | 3,79± 0,18 |
| <i>Dactylorhiza umbrosa</i> | 16,20± 0,12 | 14,16± 0,33 | 13,12± 0,24 | 14,49± 0,23 | 4,99± 0,11 | 4,02± 0,12 | 3,96± 0,23 | 4,32± 0,15 |
| <i>Dactylorhiza romana</i> | 9,24± 0,10 | 8,76± 0,22 | 7,98± 0,14 | 8,66± 0,15 | 3,28± 0,06 | 2,82± 0,07 | 2,11± 0,16 | 2,74± 0,10 |
| <i>Anacamptis coriophora</i> | 9,62± 0,16 | 7,68± 0,11 | 6,12± 0,08 | 7,80± 0,12 | 3,22± 0,12 | 2,46± 0,08 | 2,02± 0,07 | 2,57± 0,37 |

4.1.3. Ontogenetic features. During the study, 6 natural populations of Roman orchids were observed in Shahbuz, Ordubad, Julfa and Kangarli districts, and the phytocenological structure of each population was studied and all individuals related to the development phase of ontogeny were calculated.¹⁸ Thus, the project cover around Bichanak village of Shahbuz district is 80%, but in other regions it reaches 60-75% (Table 3).

Table 3

Plant associations formed by the species *Dactylorhiza romana* (Sebast.) Soo

| No. | Distribution districts | <i>Dactylorhiza romana</i> (Sebast.) Soo is typical for each of the associations (key elements are listed in the table) | Project cover (%) | Abundance of species <i>Dactylorhiza romana</i> (Sebast.) Soo ¹ |
|-----|------------------------------------|---|-------------------|--|
| 1 | Shahbuz district, Kechili village | <i>Dactylorhiza romana</i> + <i>Muscari neglectum</i> | 70 | cop ₃ |
| 2 | Shahbuz district, Bichanak village | <i>Dactylorhiza romana</i> + <i>Trifolium rubens</i> | 80 | cop ₃ |
| 3 | Julfa district, Boyahmad village | <i>Dactylorhiza romana</i> + <i>Muscari neglectum</i> | 60 | cop ₁ |
| 4 | Julfa district, Khazina Valley | <i>Dactylorhiza romana</i> + <i>Alchemilla vulgaris</i> | 70 | cop ₂ |
| 5 | Ordubad district, Pazmari village | <i>Dactylorhiza romana</i> + <i>Muscari neglectum</i> | 75 | cop ₂ |
| 6 | Kangarli district, Garagush | <i>Dactylorhiza romana</i> + <i>Trifolium rubens</i> | 65 | sp |

In each area (cp) the age and the type of coenopopulation of the Roman orchid species were determined. To determine the integral number of the demographic structure, plant age and efficiency ratio

¹⁸Salmanova, R.K. Ecological-phytosenological features of tuberous orchids spread in the territory of the Nakhchivan Autonomous Republic //–India: International Journal of Botany Studies, –2020. – (5) 4, – p. 62-65.

were calculated, and the base spectrum was determined. It was found that all populations are developing in 2017-2018¹⁹ (Fig.2).

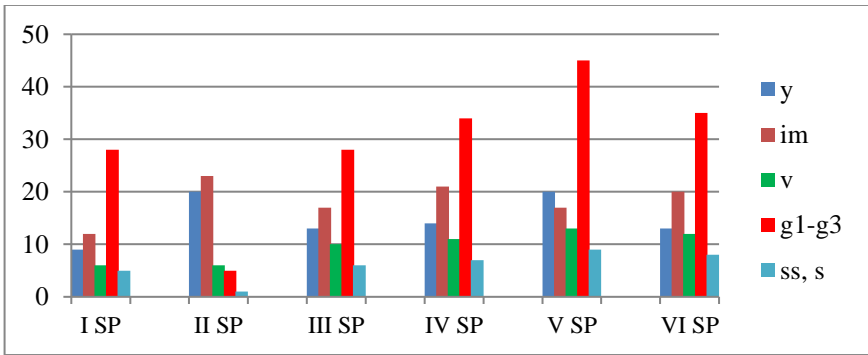


Figure 2. Age and quantity spectra of coenopopulations in phytocenoses where *Dactylorhiza romana* (Sebast.) Soo species is distributed, 2017 (in%)

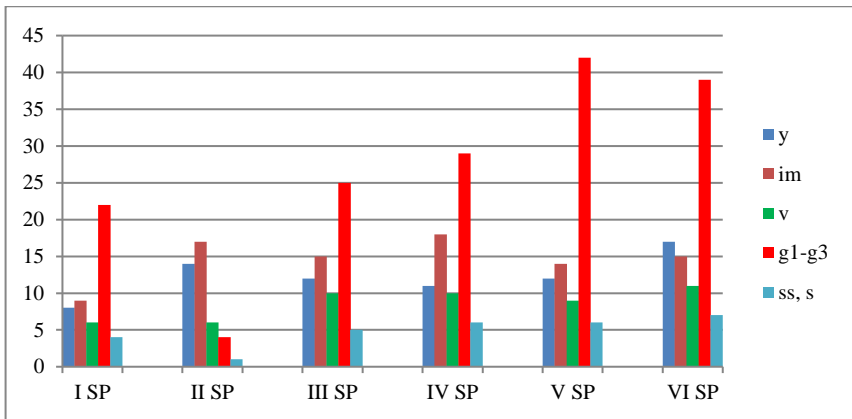


Figure 3. Ontogenetic status of coenopopulations in the phytocenoses where the species *Dactylorhiza romana* (Sebast.) Soo is distributed, 2018

¹⁹ Salmanova, R.K. *Dactylorhiza romana* (Sebast.) Soo növünün populyasiyalarının qiymətləndirilməsi // - Naxçıvan: Tusi, AMEA Naxçıvan bölməsi, xəbərlər jurnalı, “Təbiət və texniki elmlər seriyası” –2018. –№ 4(14), – s. 187-192.

According to the results of the study in both two years II CP type is young ($\Delta=0,09-0,12$; $\omega=0,23-0,25$), in 2017 IV, V and VI CP type is mature ($\Delta=0,23-0,25$; $\omega=0,49-0,51$). The recovery ability of populations was observed in minimum III population in 2018 and maximum in II population in 2017. In 2018 this was recorded in a small number (24 individuals). The studied coenopopulations had the most variable vegetative organs and immature plants (10 to 14 and 12 to 16, respectively). The height and development of species *Dactylorhiza romana* (Sebast.) Soo are negatively affected by haying and grazing by cattle (Fig. 3).

It is clear from the figure that the age and quantity spectra of the *Dactylorhiza romana* (Sebast.) Soo species are mostly observed in the g1-g3 periods of populations V and VI. The lowest results were observed in the ss period of all populations.

4.2. Collection and protection of the gene pool of the studied species. Seven species of orchids-*Epipactis palustris*, *E.veratrifolia*, *Platanthera chlorantha*, *Orchis mascula*, *Ophrys oestifera*, *O.apifera*, *Dactylorhiza flavescens* were included in the “Red Book” of Nakhchivan AR²⁰. As a result of our studies, it was determined that 4 species of orchids are in danger of extinction in the region. It should also be noted that we have identified new habitats for these species. It was recommended that they be included in the future “Red Book” of the Nakhchivan Autonomous Republic. These species have been identified in full accordance with the IUCN categories and the dissertation describes the current situation of orchids at threat:

1. *Neottia ovata* -VU A2ab+B2a(ii,iii.iv); D1.
2. *Epipactis microphylla* -EN B2ab (ii, iii, iv).
3. *Dactylorhiza iberica* -VUA2c+3c.
4. *Orchis simia* – LC.

Thus, in growing areas of species with gradually narrowing habitats, the biology of which is poorly studied and endangered, it is

²⁰Talıbov, T. H. Naxçıvan Muxtar Respublikasının Qırmızı Kitabı (Ali sporlu, çılpaqtoxumlu və örtülütoxumlu bitkilər) /T.H.Talıbov, Ə.Ş.İbrahimov, – Naxçıvan: Əcəmi – 2010. – 677 s.

necessary to control populations and declare their habitats as nature reserves and small sanctuaries.

CHAPTER V. THE ROLE OF PLANTS OF THE FAMILY *ORCHIDACEAE* JUSS. IN PHYTOCENOSES AND THE RESERVE OF SOME PRIORITY SPECIES

5.1. Shrubs and forest area. Shrub vegetation spread at altitudes of 1200-3200 m, rising to the borders of the subalpine and alpine belt. More typical shrubs, meadow-shrubs is located in Garatorpaglar of Sadarak district, Ardicdag of Sharur district, Lizbirt gorge, Garagush mountain of Babek district, Nursu, Kuku, Agbulag, Gomur, Kechili, Kulus villages of Shahbuz district, around Kukudag, Kechaldag, Ganligol, Khazinadara, Haramı, Koreymar of Julfa district, around Paraga, Tivi, Nasirvaz, Nurgut, Mazra and other villages of Ordubad district.

Forest vegetation forms a carpet at an altitude of 1500-2700 m above sea level. Xerophytization is more common in dry forest meadows, and grass cover is sparse. In intraforest mesophyte meadows soils are fertile, moist, and rich in humus and they create conditions for the formation of denser and taller vegetation. In these mesophytic meadows, along with typical meadow plants, the conditions created by plant species from neighboring groupings (forests, steppes and swamps) lead to a greater or lesser degree of plant diversity. Sedge and grass plants dominate in in the cenoses. In forest edges and meadows in intraforests species included in the genus *Dactylorhiza*, *Orchis* and *Anacamptis* are more common. Besides, the composition of cenosis includes species such as *Platanthera chlorantha* (Custer) Rchb., *Anacamptis palustris* (Jacq.) R.M.Bateman, Pridgeon & M.W.Chase, *Ranunculus polyanthemus* L., *Potentilla argentea* L., *Filipendula ulmaria* (L.) Maxim, *Geum rivale* L., *Inula auriculata* Boiss. & Balanca, *Plantago lanceolata* L., *Rumex acetosa* L., *Origanum vulgare* L., *Galium verum* L., *Leopoldia caucasica* (Griseb.) Losinsk., *Allium cardiostemon* Fisch. & C.A.Mey. and etc. along with species such as *Carex tristis* Bieb.,

C. divulsa subsp. *leersii* (Kneuck.) W.Koch, *C.melanostachya* Willd., *Agrostis vinealis* subsp. *planifolia* (K.Koch) Tzvelev, *A.capillaris* L., *Arrenatherum elatius* (L.) C. Presl. & J.Presl., *Poa nemoralis* L²¹.

5.2. Distribution in steppe vegetation. The steppe vegetation generally covers a large area at an altitude of 1500-2400 m and loses its zonality in the form of clearings in the subalpine and alpine zone, while forming a zoning. The composition of formations in the steppes from grasses also includes plant species such as *Festuca sclerophylla* Boiss. ex Bisch., *Stipa hohenackeriana* Trin.& Rupr., *S.holosericea* Trin.& Rupr., *S.lessingiana* Trin. & Rupr., *Koeleria bitzenachica* (Tzvel.) Tzvel., *K. albovii* Domin, *Bromopsis variegata* (Bieb.) Holub., *Dactylis glomerata* L., *Phleum phleoides* Karst, *Poa bulbosa* L., *P.pratensis*, *Trisetum rigidum* Schult. etc. In steppes dominated by the grass family, especially on the edges of gorges with steppe vegetation consisting of forbs-fescue associations and in the density of dead plants in non-grazed areas, the grasses form thick turf cover.

Although xerophytic cenoses grow in arid conditions, these plants complete their development very quickly in accordance with the ecological conditions.

5.3. Subalpine meadows. Starting from the upper boundary of the forest and extending along the wet slopes to the lower boundary of the alpine belt, subalpine meadows form wide and narrow strips. In the Agabba and Jamalgala areas above the Kechili village, in Zorbulag, Khazinadere, and Dikbash areas of the Batabat plateau, species such as *Ophrys apifera*, *Dactylorhiza romana* (Sebast.) Soo, *D.umbrosa*, *D.osmanica*, *Platanthera chlorantha* form groupings with different plants, especially with mesophytes such as *Muscari neglectum* Guss, *Alchemilla vulgaris*, *Chaerophylleta aureum*, *Deschampsia caespitosa* (L.) P. Beauv., *Pastinaca armena* Fisch. &

²¹Салманова, Р.К. Распространение видов семейства Orchidaceae Juss. в кустраниковой и лесной растительности Нахичеванской Автономной Республики // Нижневартовск: Бюллетень науки и практики, научный электронный журнал. 2020. –№ 9 (6) – с.62-68.

C.A.Mey., *Cephalaria procera* Fisch. & Avé-Lall., *C.armeniaca* Bordz., *Bromopsis variegata* (M.Bieb.) Holub, *Poa pratensis* L., *P. nemoralis* L., *Potentilla argaea* Boiss. & Balansa, *Ranunculus caucasicus* M.Bieb., *R. meyerianus* Rupr., *Poa bulbosa* L., *P. pratensis* L., *Potentilla argentea* L., *Filipendula ulmaria*, *Inula auriculata* Boiss. & Balansa, *Phleum phleoides* (L.) H. Karst., *P. pretense*, *Festuca valesiaca* Gaudin, *Dactylis glomerata* L., paxlalılardan *Lotus tenuis* Willd., *L. pratensis*, *Lathyrus chloranthys* Boiss., *L.aphaca* L. and cover large areas.

5.4. High mountain meadows. High mountain meadows cover the areas of the Nakhchivan Autonomous Republic at an altitude of 2350-3000 m above sea level. Main turf-forming plants of high mountain meadows are plants such as *Orchis mascula*, *O.simia*, *Anacamptis coriophora*, *A.palustris*, *Epipactis palustris*, *E.veratrifolia*, *E.microphylla*, *Carex tristis*, *C. huetiana*, *Festuca valesiaca*, *Alchemilla sericea*, *A.venosa*, *A. amicta*. In higher areas plants such as *Festuca valesiaca*, *Carex tristis*, *C.huetiana* dominate in short lichen-carex associations. Main turf-forming plants at the edge of spring waters of high mountain belt include some species from the genus *Carex*, as well as plant species such as *Primula auriculata* Lam., *Epilobium gemmascens* C.A. Mey., *Cardamine uliginosa* Bieb., *E.subalgidum* Hausskn. and etc. *Orchis mascula* and *Epipactis palustris* are predominant in the highlands.

CHAPTER VI. POSSIBILITIES OF USE AND INTRODUCTION OF ORCHIDS IN FOLK MEDICINE

6.1. Possibilities of use of orchids in folk medicine

From ancient times, orchids have been used in folk medicine. The drink made from their tubers, in other words, the ground form of dried tubers, is known as salep. Due to the large amount of mucus, pectin compounds and starch in the tubers of orchids, it has a strong protective effect on the gastrointestinal tract and successfully treats gastritis, ulcers, dysentery, food or toxic poisoning.

In modern times, medicines made from orchids have “covering, binding, anti-inflammatory effects”. The dissertation explains in

detail the intended use and dosage of orchids for therapeutic purposes, various methods of application.

6.2. Introduction of some species included in the family.

Planting materials of the family *Orchidaceae* Juss. collected from different regions of Nakhchivan Autonomous Republic were introduced in the Botanical Garden of the Institute of Bioresources of Nakhchivan Branch of ANAS. Introduction was carried out vegetatively, 6 species were planted by this method.

Table 4
Flowering of introduced species in *ex situ* and *in situ* conditions

| № | Species | <i>Ex situ</i> | | | | <i>In situ</i> | | | |
|---|--------------------------------|----------------|-------|-----------------|------------------------|----------------|-------|-----------------|------------------------|
| | | Flowering | | | | Flowering | | | |
| | | start | end | Duration (days) | The life of the flower | start | end | Duration (days) | The life of the flower |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | <i>Dactylorhiza umbrosa</i> | 21.04 | 23.05 | 33 | 12-18 | 05.05 | 05.06 | 31 | 11-17 |
| 2 | <i>Dactylorhiza iberica</i> | 28.04 | 29.05 | 32 | 11-18 | 10.06 | 11.07 | 31 | 10-16 |
| 3 | <i>Dactylorhiza romana</i> | 18.04 | 20.05 | 33 | 12-17 | 05.05 | 04.06 | 30 | 10-17 |
| 4 | <i>Dactylorhiza urvilleana</i> | 22.04 | 23.05 | 32 | 11-16 | 12.05 | 11.06 | 30 | 10-18 |
| 5 | <i>Orchis mascula</i> | 18.04 | 22.05 | 35 | 12-18 | 04.05 | 07.06 | 34 | 12-18 |
| 6 | <i>Anacamptis coriophora</i> | 28.04 | 29.05 | 33 | 11-18 | 19.05 | 20.06 | 32 | 12-19 |
| 7 | <i>Anacamptis palustris</i> | 20.04 | 22.05 | 34 | 12-18 | 03.05 | 03.06 | 31 | 11-17 |

Regular monitoring and phenological observations were made on these plants, and their germination, flowering and seeding

characteristics were studied. Monitoring was conducted both in the introduced areas and in nature (Table 4).

When comparing the plants *ex situ* condition with the plants *in situ* conditions in terms of fruiting ability, *Dactylorhiza urvilleana* was found to have the lowest (28.5%) and *Dactylorhiza romana* - (40%) and *Anacamptis coriophora* (40%) the highest fruit retaining ability in nature. Other species took an intermediate position (Table 5).

Table 5

Fruiting ability of introduced species *in ex-situ* and *in-situ* conditions

| №. | Species | <i>Ex situ</i> | | | | <i>In situ</i> | | | |
|----|--------------------------------|--|---------------------|------|---------------------|--|---------------------|------|---------------------|
| | | The number of opening flowers on the plant | The amount of fruit | | Fruit ripening time | The number of opening flowers on the plant | The amount of fruit | | Fruit ripening time |
| | | | piece | In % | | | piece | In % | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | <i>Dactylorhiza umbrosa</i> | 40 | 16 | 35,6 | 28.05 | 50 | 18 | 36 | 08.06 |
| 2 | <i>Dactylorhiza iberica</i> | 28 | 10 | 35,7 | 01.06 | 36 | 14 | 38,8 | 08.07 |
| 3 | <i>Dactylorhiza romana</i> | 35 | 12 | 40 | 26.05 | 40 | 16 | 40 | 06.06 |
| 4 | <i>Dactylorhiza urvilleana</i> | 35 | 10 | 28,5 | 28.05 | 45 | 18 | 40 | 06.06 |
| 5 | <i>Orchis mascula</i> | 40 | 12 | 26,6 | 30.05 | 45 | 14 | 31,1 | 04.06 |
| 6 | <i>Anacamptis coriophora</i> | 20 | 8 | 40 | 02.06 | 30 | 14 | 46,6 | 15.06 |
| 7 | <i>Anacamptis palustris</i> | 35 | 12 | 34,3 | 30.05 | 40 | 14 | 35 | 05.06 |

CONCLUSIONS

1. As a result of the studies, for the first time, the species of the *Orchidaceae* family of the region were studied, a taxonomic spectrum of 21 species belonging to 8 genera of the family was prepared, and a new determining table of genera and species was compiled.

2. Five species - *Dactylorhiza umbrosa* – shadow orchid, *Neottia ovata* – eggleaf twayblade, *Orchis simia* – monkey orchid, *Anacamptis pyramidalis* – pyramidal orchid, *Gymnadenia conopsea* – fragrant orchid - belonging to the family *Orchidaceae* distributed in the flora of Nakhchivan was given for the first time for the flora of this region.

3. According to the results of the assessment of populations of *Dactylorhiza romana* species, in both years II CP type is young ($\Delta=0,09-0,12$; $\omega=0,23-0,25$), in 2017 IV, V and VI CP types are mature ($\Delta=0,23-0,25$; $\omega=0,49-0,51$). The recovery ability of population was observed in a minimum of II population in 2018 and a maximum of V population in 2017.

4. It was found that the areal of 4 species of orchids (*Neottia ovata*, *Epipactis microphylla*, *Dactylorhiza iberica*, *Orchis simia*) has narrowed and is in danger of extinction. Inefficient use of lands and environmental factors were shown as the reasons for the extinction of these species.

5. The study of life forms showed that orchids are divided into 3 biomorphological types: rhizomes, stolon-shaped-rhizomes and tuberidium. It was found that tuberidium species predominate, representing 85.7% of the total species (18 species), stolon-shaped-rhizomes 9.5% (2 species), and rhizomes are represented by a one species and is monotypic.

6. Based on the analysis of the *Orchidaceae* family by ecological groups, mesophytic ecological group with 17 species (80.95%) dominate in the flora of Nakhchivan AR according to water regime. Mesoxerophytes belonging to transient ecological groups are represented by 4 species (19.05%).

7. The orchid species distributed in the territory of Nakhchivan AR form various groupings in meadow shrub cenoses (*Neottia ovata*, *Dactylorhiza umbrosa*, *Orchis simia*), in forest edge and intraforest meadows (*Platanthera chlorantha*, *Anacamptis palustris*, *Dactylorhiza salina*, *D.urvilleana*, *Orchis mascula*, *Epipactis palustris*), in high mountain meadows (*Orchis mascula*, *O.simia*, *Anacamptis coriophora*, *A. palustris*, *Epipactis palustris*, *E.veratrifolia*, *E.microphylla*), in subalpine meadows (*Ophrys apifera*, *Dactylorhiza romana*, *D.umbrosa*, *D.osmanica*, *Platanthera chlorantha*), steppe vegetation (*Platanthera chlorantha*, *Orshis mascula*).

8. For the first time, flowering and fruiting features of the orchids were studied *ex situ* and *in situ* condition. It was found that in *ex situ* condition the longest flowering period is determined in *Orchis mascula* (35 days), the shortest - *Dactylorhiza iberica*, *D. urvilliana* species (32 days), fruiting features are most common in the species *Dactylorhiza romana* (40%) and *Anacamptis coriophora* (40%), and the least common in the species *Orchis mascula* (26.6%). *In situ* condition the longest flowering period is observed in *Ochis mascula* (34 days), the shortest in *Dactylorhiza romana*, *D. urvilliana* (30 days), fruiting features the most in *Anacamptis coriophora* (46.6%), the least *Anacamptis palustiris* (35%) species.

PRACTICAL PROPOSALS

1. Due to the depletion of reserves of *Neottia ovata*, *Epipactis microphylla*, *Dactylorhiza iberica*, *Orchis simia* species, it is recommended to include them in the new edition of the “Red Book” of the Nakhchivan Autonomous Republic.

2. It is important to introduce and propagate orchids in the cultural flora to meet domestic and foreign demand and strengthen trade turnover.

3. It is recommended to inform pupils and students about the protection of these species in additional classes in educational institutions, to hang information boards in the settlements close to their distribution areas, to carry out awareness-raising activities among the population.

List of published scientific works related to the dissertation:

1. Salmanova, R.K. Naxçıvan Muxtar Respublikası ərazisində Səhləbkimilər fəsiləsinin öyrənilmə tarixi//– Naxçıvan: Naxçıvan Dövlət Universitetinin «Elmi əsərlər» jurnalı–2014. – № 8(64),– s. 28-31.
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