

Phytosenological features of ardijdag sparse juniper forest in the nakhchivan autonomous republic

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Abstract

Phytocenological features of juniper species in Ardijdag sparse juniper forest in Sharur district and their role presented in the article. According to the used literature and us researches, Gymnosperm plants in the territory of Nakhchivan AR are represented by 2 divisions, 2 classes, 3 rows, 3 families, 7 genera and 13 species, 7 of which belong to the cultural flora. According to the researches held in sparse juniper forests in the Ardijdag area, there were not found spices belonging to *Pinaceae* Adans. family, but 2 spices of *Juniperus* L. genera of *Cupressaceae* S.F. Gray family, and only one spice named *Ephedra aurantiaca* Takht. et Pachom. belonging to the *Ephedraceae* Dumort. family were determined. In phytocenoses of the sparse juniper forest *Juniperus polycarpus* C.Koch. species is edificatory, and the subdominant species is *Juniperus foetidissima* Willd. All formations and associations of phytocenoses in a rocky biotope were discovered and presented.

Keywords: gymnosperm, sparse juniper forest, association, phytocenoses, test area

Introduction

The Gymnosperms are divided into six sections: *Cycadophyta*, *Ginkgophyta*, *Gnetophyta*, *Pinophyta* (also known as *Coniferophyta*), *Pteridospermales* and *Cordaitales*, of which the last two plant divisions have already been perished. In the modern era, there are 4,651 species included into 12 families and 88 genera, of which 1,104 are generally accepted species. The families are as follows: *Araucariaceae*, *Cupressaceae*, *Cycadaceae*, *Ephedraceae*, *Ginkgoaceae*, *Gnetaceae*, *Pinaceae*, *Podocarpaceae*, *Sciadopityaceae*, *Taxaceae*, *Welwitschiaceae*, *Zamiaceae*. The largest group of plants with bare seeds are conifers (pine, cypress, juniper, etc.), and the smallest is Ginkgo found in China^[14].

The *Cupressaceae* family also includes *Taxodiaceae*, previously considered a separate family, since it has been shown that most of its biological characteristics are the same to those of the *Cupressaceae*. The only exception to the *Taxodiaceae* family is the genera *Sciadopitys*, which is genetically different from the *Cupressaceae* and has now formed the free *Sciadopityaceae* family. The *Cupressaceae* Bartlett family, also known as the conifers, is widespread throughout the world and includes a total of 130-140 species of juniper and trees with reddish-brown trunks belonging to 27-30 genera (17 monotypes). These are single-housed or (rarely) two-housed trees and shrubs up to 116 meters high. The bark of mature trees is usually orange-red or reddish-brown, with a firm texture, could be peeled along vertical stripes, but some species have smooth, spotted or hard square cracks.

Materials and Methods

The studies were conducted in 2018-2019 on the left bank of the Bagirsagdarasi River, located in Sharur watershed of the ridge of the Lesser Caucasus, in the territory of Ardijdag with an anticlinal structure, the height of which is 2034 m. In the relief of Ardijdag, located in Sharur region, a sharply divided dome-shaped hill was formed, and the right side of

the mountain stretches in the direction of the Arpachay river basin and connects to the river bank. A sparse juniper forest of Ardijdag was taken as a material for research and its phytocenological features were studied. In the course of studying the phenology and geobotanical classification of flora and vegetation generally accepted methods of I.N. Beideman^[5], Voronov A.G.^[6], Shennikov A.P.^[13] and other methodologies^[9, 10, 11] were used. In a systematic study, the materials "Flora of Azerbaijan"^[12], Grossheim A.A.^[4], Abstract of Caucasian flora^[8], Imkhanitskaya N.N.^[7], Talibov T.H., Valisoy A.N.^[2] Christenhusz M.J.^[14] and Robert P. Adams^[15] materials were taken as a basis. The height of the trees and distance among them were measured using a Tomshco TM-1000A laser device (3-1000M). Rare species, their protection and effective use have been mentioned in the used literature^[1, 3].

Results and Its Discussion

The research work carried out regarding the Gymnosperms in the Nakhchivan Autonomous Republic was generalized on the basis of materials collected during periodic expeditions organized in 2018-2020, to the territories starting from the Sadarak region up to Soyuqdag, Ordubad region. The study was conducted in the Ardijdag region of the Arpachay State Nature Reserve in the Sharur region. The article presents the researches held the Ardijdag sparse juniper forest in Sharur region and phytocenological characteristics of the Gymnosperms, especially juniper species, as well as the general features of the sparse juniper forests characteristic of this region are specified. As a result of research, in the sparse juniper forest of Ardijdag were discovered *Juniperus polycarpus* C.Koch and *Juniperus foetidissima* Willd. species belonging to the *Juniperus* L. genera of *Cupressaceae* S.F. Gray family, and only one species - *Ephedra aurantiaca* Takht. et Pachom. were found that belongs to *Ephedra* L. genera of *Ephedraceae* Dumort. family. A sparse juniper forest is located in this zone at an altitude of 850-1950 m above sea level and covers a large

rocky area. The phytocenological role of juniper species in sparse juniper forests, their ability to regenerate in natural conditions, their relationship with other plants, and their competitiveness were studied by the method of experimental fields. During the study by this method, phytocenological relationships in a small experimental field can be studied with complete accuracy. The experimental region is divided into regions where associations with the dominance of juniper species prevail. This association is a typical area of phytocenoses, which is almost homogenous and reflects the general characteristics of the phytocenoses. In the sparse juniper forest of Ardijdag, trees are generally represented by a small number of old trees, mostly middle-aged and young, with a distance between them of 5-10 m. The selected test area was assumed to be approximately $120 \times 70 = 8400 \text{ m}^2$ due to the rocky territory. The selected experimental area is the sparse juniper forest formed by the dominance of many seed (polysperma) species of juniper, and is located in the direction of the Arpachay river basin in Ardijdag. These forests are used both as summer and winter pastures. Since the forest is used as pasture, several juniper trees, felled and dried by shepherds could be found nearby. The area is rocky with sparse shrubs, and the forest on the slopes extends towards the Arpachay valley. Here, the many seed (polysperma) juniper, when mixed with other trees and shrubs, forms new groups. The dominant species of the area is *Juniperus polycarpus* C.Koch. - Many seed (Polysperma) junipers, and the subdominant species are *Pyrus salicifolia* Pall. - willow-leaved pear and *Amygdalus fenzliana* (Fritsch) Lipsky - almond phenyl. The density of tree trunks belonging to the dominant species in the test area was calculated according to the Kraft classification. First, trees were selected at the corners of an imaginary square, then

trees on the connecting line of these points, and then trees on the diagonal of the square and their diameters were measured. In this case, the measurement was carried out with a measuring fork at a height of 1.3 m from the ground. The measurement results are entered in the calculating table according to the Kraft classification. This classification allows us to study the effect of intraspecific competition and micro-conditions on development of the trees of the same aged, growth of their umbrella and trunk thickness. You can distinguish 5 classes at the same level. Trees that dominate and have a well-developed umbrella includes into the first class; in the second class the umbrella of trees is less developed than those that belong to the first; the group of trees the umbrella of which grows under the umbrella of trees of class I and II belongs to the third class; the fourth class lags behind in growth in height, and the fifth class includes dry, withered and very poorly developed trees. The height and distance between the trees were measured using Tomshco TM-1000A, a special laser device (3-1000M). In the table Many seed juniper trees in the test zone was calculated and estimated according to the classes, diameter of the trunks was measured and the average diameter was found. In this test zone, the tree with the smallest diameter is 8 cm and the tree with the largest diameter is 44 cm. To find the average diameter, the thickness steps of the trunk were multiplied by the number of trees, and the diameters were added and then divided by the number of trees. Due to the sparse forest cover, there are mainly dominated the trees of the II and III classes, but trees of classes I and V are also found. The density of the forest is 0.3. Although the average age of the trees is 119 years, there are also trees in this forest that reach a height of 12-14 m, a trunk diameter is 40-44 cm and their age is more than 200 years (Table 1).

Table 1: Taxonomic indicators of the tier of the sparse juniper forest Ardijdag

Tree plants	Height, m		Trunk diameter/sm		Average age	Bonitet	Density
	Average	Maxim	Average	Maxim.			
<i>Juniperus polycarpus</i> K. Koch	5,5	14	19	44	119	III	0,3
<i>Juniperus foetidissima</i> Willd.	4	10	14	40	90	III	0,1
<i>Pyrus salicifolia</i> Pall.	2	4,5	13	35	87	III	0,2

Besides, there are 4 dry junipers of 1.2-1.5 m high, 2 many seed (polysperma) junipers up to 0.5 m high and 5 pear seedlings up to 1 m high under the tree tier cover. The density of the forest floor is equal to 0.4. The shrub species as *Pistacia mutica* Fisch.et C.A. Mey., *Amygdalus fenzliana* (Fritsch) Lipsky, *Pyrus salicifolia* Pall., *Crataegus pentagyna* Waldst. et Kit., *Euonymus euopaea* L., *Berberis vulgaris* L., *Rosa canina* L., *Rhamnus cathartica* L., *Lonicera iberica* Bieb., *Ephedra aurantiaca* Takht. et Pachom. are also found in the area close to the territory of Many seed (polysperm) juniper trees. The species *Atraphaxis spinosa* L., *Cerasus incana* (Pall.) Spach, *Zygophyllum atriplicoides* Fisch.et C.A. Mey, *Astracantha oleifolia* (DC.) Podlech, *Astragalus candolleanus* Boiss. growing in the remaining zone between trees and shrubs also play an important role in the phytocenoses. The following tables show the elevation due to the tier, viability, and phenophase of the genera and species that make up the forest floor. When we say "species viability", we mean the level of development of this species in the phytocenoses. To do this, A.G. Voronov's life scale was used. According to this scale, plants are divided into 4 groups according to their development in the phytocenoses:

1. Species, having a full period of development in the studied phytocenoses, normal development and bearing fruits - 3a;
2. Although the species goes through all stages of development, it does not reach its normal size - 3b;
3. The species is well developed vegetative, but does not bear fruit - 2;
4. The species does not bear fruit and is poorly developed vegetative.

According to this scale, the species that make up forest foot of the Ardijdag sparse juniper forest, apparently, relate mainly to indicators 3a and 3b (table 2).

Under the forest floor, it is mainly composed of the remains of grasses and dried branches with scaly leaves of juniper trees. Therefore, it is thin and soft. Bedding was not registered in open areas. The topsoil is formed by the lower tier semi-shrubs, bushes, grass cover and moss-lichen background. On this territory the following species of semi-shrubs are widely spread: *Artemisia absinthium* L., *Acantholimon bracteatum* (Girard) Boiss., *Thymus collinus* Bieb., *Astracantha aurea* (Willd.) Podlech, *Astragalus macrostachys* DC., *Atriplex turcomanica* Boiss. The basis of

the grass cover is dry steppe vegetation, consisting of grains and various herbs. In particular, the formation of *Stipaeta capillosum* predominates here, but in addition to this plant, *Stipa capillata* L., *S. karjaginii* S.G. Mussajev et Sadychov, *Elytrigia heidemaniae* Tzvel., *Bromus arvensis* L., *B. tzvelevii* S.G. Mussajev, *Avena persica* Steud., *Aegilops cylindrica* Host, *Stachys fomini* Sosn, *S. inflata* Benth., *Nepeta noraschenica* Grossh., *N. meyeri* Benth., *Pedicularis sibthorpii* Boiss., *P. caucasica* Bieb., *Phleum montanum*

C.Koch, *Phlomis pungens* Willd., *Ferula szowitsiana* DC., *Eryngium campestre* L., *Alchemilla grossheimii* Juz., *Achillea tenuifolia* Lam., *Tanacetum millefolium* (L.) Tzvel., *Íris imbricata* Lindl., *Í. lycotis* Woronow, *Tulipa biflora* Pall., *T. florenskyi* Woronow, *Hypericum perforatum* L., *Dianthus crinitus* Smith, *Rumex acetosa* L., *Campanula tridentata* Scheab., *Centaurea cyanus* L., *Caccinia macranthera* (Banks et Soland.) Brand, *Galium aparine* L. and others were found.

Table 2: Description of the forest floor in the test area of the Ardijdag sparse juniper forest

Species	Ties	Height, m	Viability	Phenophase
<i>Juniperus polycarpus</i> K. Koch	II	2-2,5	3a	Three-year-old fruits have already fallen, and two-year-olds have not yet ripened
<i>Juniperus foetidissima</i> Willd.	II	1,5-2	3a	Three-year-old fruits have already fallen, and two-year-olds have not yet ripened
<i>Pyrus salicifolia</i> Pall.	II	1,5-2	3a-3b	The fruit is not fully ripe
<i>Berberis iberica</i> Fisch. ex DC.	II-III	1	3a	The fruit is not fully ripe
<i>Cerasus microcarpa</i> (C.A. Mey.) Boiss.	II	1-1,2	3a	The fruit is not fully ripe
<i>Ephedra aurantiaca</i> Pachom.	III	0,5	3a	The fruit ripe and fallen
<i>Rosa canina</i> L.	II	0,7-1,5	3a	The fruit is not fully ripe

The projective glass cover is 40%. In sparse forests, the grass cover forms 2 tiers. The first tier includes plants up to 30-70 cm height, the second tier up to 30 cm. Moss and lichen species form a layer of 5 cm high. These plants are found in the lower, large branches, trunks of the trees and in soil. When studying the growing conditions of juniper species, it became clear that the presence of mosses in the soil is important for the acquisition of seedlings of these plants and their development to normal plant levels. Even looking at the conditions of juniper seedlings growing on the rocky area, it was found that they grow in moss rot on the rock or on pieces of stones in almost groundless conditions. The following species of moss were found under the umbrellas of juniper trees: *Dicranum scoparium* - this species is mainly characteristic of forest lands. At an altitude of 1800 m above sea level, this species, characteristic of well-lit and sparse forest areas, also formed a greenish-yellow cover in Ardijdag sparse juniper forest. Surface species of xerophytic mosses have also been found in the area, and the species *Trichostomum crispulum* forms pillows on a rocky substrate covered with soil. The humus layer of the soil includes *Saelania glascenscens*, *Fissidens grandifrons*, *Encalypta streptocarpa*, *Eucladium verticillatum*, *Phascum cuspidatum*, *Pottia bryoides*, as well as *Grimmia ovalis*, *Racomitrium microcarpum*, representatives of the genus *Crimmia*. Species *Tortella inclinata* and *Mnium marginatum* have also been found in the topsoil around the trunks where the trees stop growing. Epiphytes and epixyl mosses are spread on the trunks of trees, especially on juniper trees. These include the following species: *Distichum capillaceum*, *Dicranella serviculata*, *Dicranum polysetum*, *Pseudobryum cinclidoides*, *Campylium chrysophyllum*. Some species of lichen have also been found on tree trunks (epiphytes) and under their umbrellas. *Arthonia radiata*, *Opegrapha saxatilis*, *Pyrenula nitida* are epiphytes species, and

Endopyrenium krylovinatum, *Peltigera aphosa*, *Peltigera venosa*, *Collema polycarpon* are the species found under umbrellas.

Test area №2 (05.VII.2019). The area is located in the direction of the western zone of Ardijdag at an altitude of 1200-1600 m above sea level. Owing to the rocky area, the area is approximately 65 x 25 = 1625m². The soil is of mountain-forest character, light brown, carbonated. Tree tier: Composition 9Jun., 1Pyr., + Pis. The exact number of trees in the test area was calculated. The number of juniper trees is 27, mainly young trees. One old juniper tree was registered in the test area. The average age of other trees is 80-90 years. 25 of the 27 juniper trees are juniper polycarpus and two are foetid junipers. In addition to these species, the shrubs as *Pyrus salicifolia* Pall., *Pistacia mutica* C.A. Mey., *Amygdalus fenzliana* Lipsky, *Ephedra aurantiaca* Pachom., *Cerasus microcarpa* (C.A. Mey.) Boiss., *Berberis iberica* Fisch. ex DC., *Zygophyllum atriplicoides* Fisch. et C.A. Mey., *Atraphaxis angustifolia* Jaub. et Spach, *Reaumuria persica* (Boiss.) Boiss., *Capparis spinosa* L., *Rosa canina* L. were registered. Their number was 25. The wood cover in this area includes 2 eastern oak-trees - *Quercus macranthera* Fisch. et C.A. Mey ex Hohen. It should be noted that in addition to the nature of the relief of the test area, due to the severe drought of recent years, not only xerophytic junipers, but also other trees and shrubs were severely affected (Table 3). Under the cover of the tree layer, juniper polycarpus (height 2-2.5 m, average trunk diameter 6.5 cm, 15 pieces), foetid juniper (height 2 m, average trunk diameter 4 cm, 2 pieces), willow-leaf pear (height 1.5 m, average trunk diameter 3 cm, 2 pieces) were found. It should be noted that sparse forests are not satisfactory due to the level of natural regeneration. Thus, very few juniper seedlings were found under tree umbrellas, and 3-4 juniper seedlings in open areas between trees.

Table 3: Taxonomic indicators of the tree tier in the test area №2

Tree species	Height, m		Trunk diameter, sm		Average age	Bonitet	Density
	Average	Maximal	Average	Maximal			
<i>Juniperus polycarpus</i> K. Koch	4	8	14	40	85	III	0,4
<i>Juniperus foetidissima</i> Willd.	3,5	4	10	25	77	III	0,1
<i>Pistacia mutica</i> C.A. Mey.	2,5	3,5	10	15	75	III	0,1
<i>Pyrus salicifolia</i> Pall.	2,5	4	10	30	80	III	0,2
<i>Quercus macranthera</i> Fisch. et C.A. Mey. ex Hohen	3	4	20	30	12	III	0,1

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