IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Human Journals
**Research Article**
November 2020 Vol.:17, Issue:1


# Current State of Cenopopulations of *Albizia julibrissin* Species (Azerbaijan Republic)

IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

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**Submission:** 22 October 2020
**Accepted:** 28 October 2020
**Published:** 30 November 2020

HUMAN JOURNALS
**www.ijsrm.humanjournals.com**

**Keywords:** forest, formation, relic, dechromation, ecosystem

**ABSTRACT**

The ontogenesis of the *Albizia julibrissin* Durazz. species were assessed during the study of the current state of the species cenopopulations, while the germination and juvenile age conditions were found one by one in the study area. Low level of seed regeneration and further shrinkage of the species population in the near future has become clear under study this key indicator. Keep this tree plant under more control during the seed ripening season and to keep livestock away from the areas is recommended.

## INTRODUCTION

Definition of the woody plant species protected in our country and to clarify the reasons why these trees belong to the category of rare plants is one of the most important issues of modernity. The strategy for the protection of some areas of rare and endangered woody plant species in the flora of Azerbaijan has not been fully developed as shown in observations. Study at first the distribution of plants, population size, environmental requirements, the biology of reproductive organs, seed structure and quality, germination rate, root system, and subsequent stages of development is important. Very serious research has been conducted on the protection of plant species in the world flora, especially endemic of limited area in recent years. [1, 2, 3, 4, 5, 6, 7, 8]. At the same time, one of the primary goals of researchers is to determine which rare plants belong to the categories of threats accepted by international organizations, and then to focus the measures to be taken on these plants. For this purpose, assessment of the ontogensis of rare and relict of III periods *Albizia julibrissin* Durazz. species have been studied by us for the first time.

## MATERIALS AND METHODS

The object of the study was to assess the ontogenesis of cenopopulations of the rare and III periods relict plant species *Albizia julibrissin*. The research was conducted in the relict forest of the administrative territory of Lankaran and Astara districts, in the *Albizziaetum* formation group with the monodominance of legumes and perennial grasses formed under the plain forest belt, moist relict forests.

The assessment of cenopopulation of the *Albizia julibrissin* species carried out by methods of T.A.Rabotnov, A.A.Uranov, and their schools representative [9,10, 1, 12, 13, 14, 15].

Many methods were used to determine the species composition and structure of the *Albizziaetum* formation group, including ecological-geobotanical, systematic taxonomy of rare and endangered species, and the study of life forms during the geobotanical and fluorostatic studies [16, 17, 18, 19, 20].

100 $m^2$ of sample sites were constructed in the *Albizziaetum julibrissin* association and a general geobotanical description was conducted [18]. Modern techniques and computer technologies were used in addition to biological and morphological methods. Phenological observations were performed by the stationary method, measurements were made to identify images and various parameters in the course of the research [12]. Diagnostically significant

morphological features of *Albizia julibrissin* were systematically determined, comparing tree individuals to life form and height (a), pole diameter (b), trunk color (c), trunk surface (d), an umbrella shape (e), the color of the branches and shoots (f), the shape and size of the shoots (g), the size of the leaves (the length of the leaf stalk, the distance from the point where the stem joins the leaf stem to the stem, and the widest area and the length of stay (h), the shape of the fruit and determined by maturity (h), fruit color (x), size (q), shield (l), seed shape (m), seed color and size (n) and assessed viability [5]. The linear dimensions of fruits and seeds were measured by calipers with a barbell to the nearest 0.01mm. Determination of age of *Albizia julibrissin* began from taking anatomical incisions from the trunk in immature age.

The morphological condition of trees was assessed following methodological requirements, defoliation and dechromation were used as the main indicators of damage [5,12, 21]. The formation of forest phytocenoses has been identified according to their tiers and subsoil components. The tiers were classified according to their life forms. Also to study the cenopopulations of tree plants, to assess the ecological status of both natural forests and man-made ecosystems, formed forest phytocenoses [3, 21, 22].

## RESULTS AND DISCUSSION

Studies of cenopopulation were conducted in the *Albizziaetum* formation groups of meadow formation class with monodomination of legumes and perennial grasses in relict forest, plain forest belt vegetation, moist relict forests of administrative territory of Lankaran and Astara districts.

*Albizia julibrissin* is found in the mountainous part of Lankaran and Lankaran lowland in Azerbaijan (Lankaran district - Burjali and Seyidaturba villages; Astara district - Shuvi village) [16]. *Albizzia julibrissin* Durazz. species is a medium-sized tree by 18-20 m in height. The leaves are alternately arranged, double-paired, 18-20 (25) cm long. The flowers are formed by a group of head-shaped flowers (Figure 1). The stamens are numerous long (30-35 mm) and thin filaments. The dust is small, four-chambered. The teeth are single, linear-columnar, and the mouth is small. The beans are flat, linear, open by 2 caps, 11-13 seeds, by 10-20 cm long, 8cm wide, and the seeds are elongated, flat, brown, 7(8-9)-10 mm long, 4(4.5)mm width. Blooms in June-July. Pollination is entomophilic. Legumes ripen in October-November. Propagated by seeds and shoots [16, 17, 18].

This species in the wild forms adapted to the humid subtropical climate. Such a climate is

typical for the Lankaran region. The plant grows especially well on the steep slopes and heavy clay soils and grows and develops very well on washed soils close to running water in the Lankaran zone. Partially mixed with Hirkan forests in the lower mountain range, in very small areas. The plant is spread in the foothills of the Lankaran mountains, on the eastern slopes, on the slopes with yellow soil, up to 300-400m above sea level [23]. The plant does not grow poorly on light, rocky soils of slopes. But it does not grow in swampy places. This species has adapted to living in drier conditions, gaining several features such as drought tolerance due to climate change.

*Albizzia julibriss* - an ancient or relict plant of the third period, which is considered an endemic species, is also found in the Hirkan-type forests around the Caspian Sea. Thus, *Albizzia julibris* is uniquely distributed in the forests of Lankaran and Astara districts (up to 600 m above sea level) in the mountain forests of the lower mountain range [24].

*Albizziaetum* formation group includes the *Albizziaetum julibrissin* association as shown in studies of cenopopulation. The species composition and structure of the formation are reflected in Table 1. This species as a monodominant of the phytocenosis is the main edificator species in the lowland forests at an altitude of 300-400m above sea level.

**Figure No. 1:** *Albizzia julibrissin* Durazz.

**Table No. 1:** Species composition and structure of the *Albizziaetum julibrissin* association

| № | Names of biomorph species | Ecol. groups | Abundance (by ball) | Average height (by cm) | Phenological phases |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| | *Trees* | | | | |
| 1. | *Albizzia julibrissin* Durazz. | mesophyte | 3-4 | I (20) | flow. |
| 2. | *Quercus castanaeifolia* C.A.Mey. | mesophyte | 1-2 | I (30) | flow. |
| 3. | *Parrotia persica* (DC.) C.A.Mey. | mesophyte | 1-2 | I (25) | fruiting |
| 4. | *Carpinus betulus* L. | mesophyte | 1 | I (18) | fruiting |
| 5. | *Gleditsia caspia* Desf. | mesophyte | 1 | I (16) | fruiting |
| 6. | *Ficus carica* L. | mesoxerophyte | 1 | I (15) | flow. |
| 7. | *Alnus barbata* C.A.Mey | mesophyte | 1 | I (14) | veget. |
| 8. | *Sorbus torminalis* (L.) Crantz. | mesophyte | 1 | I(13) | flow. |
| 9. | *Pyrus hyrcana* Fed. | mesoxerophyte | 1 | I (8) | flow. |
| | *Bushes* | | | | |
| 10. | *Prunus divaricata subsp. caspica* Browiez. | mesophyte | 1-2 | II (12) | flow. |
| 11. | *Rubus candicans* Weihe | xerophyte | 1-2 | II (10) | flow. |
| 12. | *Mespilus germanica* L. | mesoxerophyte | 1-2 | II (8) | flow.., fruiting |
| 13. | *Grataegus laganeria* Fisch.et C.A.Mey | mesoxerophyte | 1-2 | II (7) | flow. |
| 14. | *Rosa marsiliana* Sosn. | xerophyte | 1-2 | II (1) | fruiting |
| 15. | *Malus orientalis* Uğlitzk. | mesoxerophyte | 1 | II (6) | flow. |
| 16. | *Euonymus latifolia* (L.)Mill. | mesoxerophyte | 1 | II (5) | flow. |
| 17. | *Swida meyeri* (Pojark.) Sojak. | xerophyte | 1 | II (2) | flow. |
| 18. | *Cotanaster krasnowii* Poyark | xerophyte | 1 | II (1) | fruiting |
| | *Convolvulus* | | | | |
| 19. | *Humulus lupulus* L. | mesophyte | 1-2 | III (80) | veget. |
| | *Perennial grasses* | | | | |
| 20. | *Lathyrus miniatus* Bieb. ex Stev. | mesophyte | 1-2 | III (30) | bean ripening |
| 21. | *Lotus tenuis* Waldst. et Kit. ex Willd. | mesophyte | 1-2 | III (25) | flow. |
| 22. | *Vicia cassubica* L. | mesophyte | 1 | III (60) | flow. |
| 23. | *Briza media* L. | mesophyte | 1 | III (15) | flow. |
| 24. | *Phleum pratensis* L. | mesophyte | 1 | III (10) | flow. |
| The overall project coverage is 70-90%. | | | | | |

The species composition of this association was recorded in the relict forest of the administrative territory of Lankaran and Astara districts [25]. The legume tree as a monodominant of the phytocenosis is the main edificator species in the lowland forests at an altitude of 300-400 m above sea level.

The species composition of the association represented by 24 species. 9 species of trees on the first floor of this phytocenosis; 10 species of shrubs and convolvulus on the second floor; *Lathyrus miniatus* Bieb. ex Stev., *Lotus tenuis* Waldst. et Kit. ex Willd., *Vicia cassubica* L., *Briza media* L., *Phleum pratensis* L. and etc. mesophyte perennial grasses - on the third floor have been found. The average height of grass cover is 10-30 cm. The height of the *Albizzia julibriss* species found here by 15-20m height. The total project cover is 70-90% and is found in the form of small forest "spots".

From 24 species found in the association - 9 species (37.5%) are trees, 9 species (37.5%) are shrubs, 5 species (20.8%) are perennial grasses, and 1 species (4.2%) are convolvulus according to the biomorphological analysis. 14 species (58.3%) of the same number of species belong to mesophytes, 6 species (25.0%) to mesoxerophytes and 4 species to xerophytes (16.7%) according to ecological groups.

*Albizzia julibrissin* is a major component of lowland forests. Forme groups with *Ficus carica* L., *Quercus castanaeifolia* C.A.Mey., *Parrotia persica (*DC.) C.A.Mey. and *Carpinus betulus* L. included in the “Red Book” of the Azerbaijan Republic. Age of trees and reaction on environmental factors have been determined in immature age of tree under taking anatomical sections from the trunk. The deterioration of growth conditions, the following changes are observed in most tree species as known: 1) Defoliation - a decrease in the density of the umbrella and the loss of leaves; 2) Loss of the natural color of the umbrella. This process continues until the cessation of life activities.

The morphological condition of the trees was assessed following the methodological requirements during the research. Defoliation and dechromation were used as the main indicators of damage. Defoliation assessment was determined for 5 classes of leaf loss. *Albizia julibriss* tree of different ages from 5 to 15 was taken as a model plant. Observations were made every 10 days from the first decade of March to the first decade of December. Phenological observations were made every two days during the period of intensive growth and development of plants. The following phases of the seasonal development period were identified during the observations.

Surface seedlings were observed in early spring under natural conditions. So the seed coat remains under the soil, but the leaves released from it come to the surface under seed germination. Subcutaneous length of seedlings 25-30 mm and the width is 1-1.7mm. Embryonic roots grow deep into the soil. The kernel leaves are low weight, light green, up to 4-9. These leaves begin to carry out the process of photosynthesis. The height of the seedling is 25-30 mm and the width is 0.7 cm. The kernel leaves are destroyed in winter. The height of the seedling reached 45-50 mm under favorable conditions. The leaves look like juvenile leaves in this case. The root grew better and deeper after the winter of the first year.

The trunk and umbrella of the of *Albizia julibrissin* tree begin to form at the immature age (Table 2). Up to 25 additional roots develop in the root system and spread horizontally in the soil. This stage divides into two subgroups: im1 and im2. Trees with the trunk are 15-35cm height and 5-12cm wide in the first subgroup. The average age lasts up to 5 years. Development is faster in the second stage. The height of the trunk is 50-90cm and the width is 35-60cm. The development period of this stage lasts up to 6 years.

**Table No. 2:** Ontogenetic age condition of the *Albizia julibrissin* Durazz. species

| Age conditions | Tree height (cm) | Trunk diameter (cm) | Age | Umbrella diameter (m) |
|---|---|---|---|---|
| Juvenile | 3 | 0,7 | 1 | 0,5 |
| Immature | 70 | 8 | 6 | 3 |
| Virginil | 170 | 40 | 8 | 10 |
| Young generative | 180 | 60 | 10 | 12 |
| Middle-aged generative | 180 | 55 | 11 | 12 |
| Old generative | 160 | 50 | 30 | 8 |

*Albizia julibrissin* completes the full development of the tree trunk at the virginil age. The duration of this age condition can last from 5 to 10 years, with two subgroups identified during development ($v_1$ and $v_2$). The lifespan is short in the $V_1$ age. The tree blooms is fully formed to bear fruit in the $V_2$ age. Monopodial branching is observed and the diameter of the umbrella increases by 2-3 times in this case. The average age is 11 years.

Flowering and fruiting occur during the generative age periods. Additional roots formed at this age are clearly distinguished, growing horizontally in the soil to a depth of 2 m and in the

vertical direction. The roots grow up to 3-5 m in length during the generative age.

Sympodial branching occurs in young generative trees ($g_1$). More variability is observed as a result of active development in the young generative of *Albizia julibrissin* species. Flowering occurs from the 10 years age. The length of the flowering period can last up to 50 years. The following morphological variations were observed in the *Albizia julibrissin* species during the study: 1) the average height of the tree in the cenosis was 12-18m; 2) the diameter of the tree was 35-45cm during the initial development period; 3) the number of side branches changed between 8-12; 4) the total diameter of the trunk was equal to 75 cm; 5) fallen branches of the tree up to 10 m high; 6) the maximum size of the leaves with double feathers was 18-22 cm.

The process of seed formation in the *Albizia julibrissin* species was observed at the maximum level during the middle-aged generative age. The central trunk was completely lost due to the side branches, and the weak branches were destroyed. The complete failure of the small branches also coincides with the change of the periderm cover. The number of small branches growing on the newly formed branches is 7-9. Upward growth stops. The overall size of the umbrella begins to decline.

The sympodial branches swing relatively downward an older generative tree. This is due to the weakening of physiological processes. Large branches are already in the process of extinction. The average height is 15-16 m, the diameter is 45-50 cm. In this case, the tree can live up to 20 years. The study determined the existence of a correlation between the ontogenetic age status of the *Albizia julibrissin* species using the SPSS-statistical program (Table 3).

**Table No. 3:** Linear dependences between the elements of the ontogenetic age state of the *Albizia julibrissin* Durazz. species

| Features | Height of tree (cm) | The diameter of trunk (cm) | Age | The diameter of the umbrella (m) |
|---|---|---|---|---|
| Height of tree (cm) | Diameter of trunk (cm) | - | - | - |
| Diameter of trunk (cm) | $0.958^{**}$ | 1 | - | - |
| The age of the tree | $0.537^{n.s}$ | $0.577^{n.s}$ | 1 | - |
| Diameter of umbrella (m) | $0.976^{**}$ | $0.962^{**}$ | $0.384^{n.s.}$ | 1 |

Note:: 1. $^{**}$ P<0.01 reliability rate; 2. $^{*}$ P<0.05 reliability rate; 3. $n.s^{=}$ insecurity rate

Linear relationships between tree height, trunk diameter, umbrella diameter, and age in the ontogenetic age of *Albizia julibrissin* have been investigated (Table 3). *Albizia julibrissin* trees distributed in Lankaran have a normal growing environment determined in results. The lack of a correlation between the height and age of the trees indicates that the area is densely forested. Correlation between the height of the tree and the diameter of the umbrella, the diameter of the trunk, and the diameter of the umbrella was observed. These characteristics indicate that the species is developing following the ecological parameters of the areal.

Evaluation of defoliation and dechromation in the cenopopulation of *Albizia julibrissin* species was carried out and statistical analysis proved that environmental factors do not have a limiting effect. Thus, no matter how different the change of climatic factors in different years. The diameter of the umbrella and the diameter of the trunk developed in parallel. *Albizia julibriss* species had a weak response to drought was showed examination of the annual rings of the trunk in the drought of 2008 and 2012 years. Statistical analysis can also be used to introduce the plant to new climatic conditions in the future.

The category and status of the *Albizia julibrissin* species according to the IUCN Red List of Azerbaijan includes in the EN category "Endangered" [16]. The germination and juvenile age conditions of *Albizia julibrissin* were isolated as a result of our 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. So, keep this tree under more control during the seed ripening season and to keep livestock away from the areas are recommended.

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