

## THE STUDY OF ECOLOGICAL - COENOTIC PECULIARITIES OF RARE SPECIES, ON THE EXAMPLE FRAXINUSSOGDIANA

Abduova A.<sup>1\*</sup>, Satayev M.<sup>1</sup>, Esengeldi A.<sup>1</sup>, Batyrkhanova A.<sup>1</sup>, Kupriyanov A.<sup>2</sup>

<sup>1</sup>*M. Auezov South-Kazakhstan State University, Shymkent, Kazakhstan*

<sup>2</sup>*Kuzbass Botanical Garden Institute of Human Ecology "The Federal research center of coal and coal chemistry of Siberian branch of the Russian Academy of Sciences", Kemerovo, Russian Federation*

\*Corresponding author's e-mail: [aisulu.abduova@mail.ru](mailto:aisulu.abduova@mail.ru)

### ABSTRACT

Despite the serious efforts of the world community to preserve the plant resources of our planet, the study of ecological coenotic features of rare species continues to be very acute. According to experts, by the middle of the 21<sup>st</sup> century, the proportion of lost plant species on earth can reach 60% given that all plant species are unique and priceless; their disappearance not only deprives future generations of the legal right to life in the same biodiversity as previous ones, but also leads to catastrophic consequences on earth.

Therefore, the preservation of biodiversity on our planet is currently the most important international problem. In this article considering all the key aspects of the study of ecological-coenotic peculiarities of rare species, on the example fraxinussogdiana. Annual recreational load leads to a decline in the closeness of coeno population. In places be observed the displacement of species. The mowing and especially the use of slopes for summer pastures leads to a decrease in the recovery capacity and density of individuals per unit area. The most effective way to preserve the species is to protect it in its natural habitat with the allocation of reference sites with this species and control its environmental particularities. On the example of fraxinussogdiana, classified as one of the most valuable plant communities on earth, describes the extensive international and national experience of preserving the richest gene pool of this species.

**Key words:** ecological and coenotic peculiarities, the biodiversity of rare species, *fraxinussogdiana*

### INTRODUCTION

Despite the long history of floral research, the flora of the Boraldai mountains can not be considered well studied. Only recently was published a list of vascular plants protected areas Boraldaytau and additions to it [1]. Work on the study of the flora of certain types of vegetation in the Syrdarya Karatau has not been carried out to date.

*Materials and methods:* Floristic research were conducted in May-June 2019 by a complex team with the participation of specialists of M. Auezov South Kazakhstan State University, Syrdarya-Turkestan natural Park, Kuzbass Botanical garden "Federal research center of coal and coal chemistry of the Siberian branch of the Russian Academy of Sciences". In the course of the performance of work was recorded spring and summer aspect of vegetation cover. The survey of the territory of the natural Park began with the determination of the types of habitats and the list of the main plant formations of this territory. At the same time, field material was collected in accordance with the programme of field

research. Thus, were covered the whole complex of existing ecosystems and the maximum possible completeness of identification of plants inherent in this territory. The study of flora was carried out by the route method, in the process, which were collected and herboriste plants were made geobotanical descriptions in different habitats. Geobotanical descriptions were performed on all types of vegetation. The places of descriptions were fixed with the help of global positioning system devices (GPS). In total, 11 geobotanical descriptions of floristic formations with the participation of rare and endangered plants have been developed [1].

Materials were processed using software IBIS [2]. The herbarium was collected in the amount of 287 sheets, including ornamental and rare plants.

In determining the plants used determinant of plants in Central Asia (1983-1993) and the Flora of Kazakhstan (1957–1964) [3]. The main method of determining the plants was a relatively anatomical and morphological method.

The selection of reference areas was carried out by route method taking into account the richness of flora, the presence of decorative and rare plants.

## **RESULTS AND DISCUSSION**

Forests with the participation and domination Fraxinussogdiana on the territory of Syrdarya-Turkestan Regional natural Park occur exclusively in the floodplains of rivers in the mountainous part of the territory. In the cross-section of river valleys, forests massiv begin directly from the water's edge and extending along the flat surface of the floodplain, end abruptly at the base of the valley slope. The width of this strip is controlled by the floodplain geomorphology and ranges from 5 to 20 m. When you exit the mountain gorges on the foothills of the plain character of the river valley changes dramatically. Ash tree is present here only occasionally in the form of separate, single-standing trees. Up the valleys of the rivers ash rises to 800 meters above sea level meters, where there is a removable mode and a deep cut of the valley.

Forest medium density (0.4 – 0.6) the height of the tree stand from 20 to 24 m with a trunk diameter 24-34 (44) cm. The main dominants of the tree stand Fraxinussogdiana with the participation single part of other types of trees. Occasionally dominance in the tree stand passes to *Acersemenovii* or *Morusalba*. Ash tree, especially large-sized instance, is presented in the form of a multi-barrel tree, which arose as a result of cutting down the main trunk and the subsequent resumption of the coppice shoots. And meets the successful seed regeneration of ash tree. The undergrowth of bushes from individual to medium density (0,4-0,6). In the latter case, *Rubus caesius* is formed. The grass cover closed (total projective cover 80-100%) tall (80-150 cm). Individual ekzemple of generative shoots of herbs reach a height of 250-350 cm (*Coniummaculatum*, *Ligulariamacrophylla*). Ground moss cover is absent. The species composition of the herbage varies widely depending on the substrate and the mode of seeding. In mature forests on a gravelly-stony substrate with a pronounced micro relief of the soil surface, the species diversity of the herbage is 40-50 species per 100 m<sup>2</sup>, while in the ripening stands on a fine-grained, often poured substrate with a flat micro relief of the soil surface, the number of species of grass is reduced to 10 per 100 m<sup>2</sup>. In the latter case, the dominant grasses are annual grasses (*Anisanthasterilis*, *Impatiensparviflora*). Since river valleys are the main corridors of migration of people and domestic animals, all surveyed forest areas bear traces of the past intense anthropogenic impact in the form of traces of fires, spontaneous felling and grazing. Past anthropogenic impacts explains a large proportion of participation in the herbage of meadow and weed species, as well as the frequent occurrence of high-grass secondary meadows between forests massive.

Despite the long history of floristic research, the flora of the Boraldai mountains can not be considered well studied. Only recently was published a list of vascular plants protected areas Boraldaytau and additions to it [4]. The work on the study of the flora of certain types of vegetation in the Syrdarya Karatau has not been carried out to date.

Coenoflora of ash forests includes 186 species belonging to 44 families and 138 genera. On R. V. Camelina [5] flora of the Syr-Darya Karatau has 1666 species, and the flora Boraldai mountains is estimated at about 800 species, also coenoflora of ash forest comprises almost a quarter of the cumulative flora Boraldai range, despite the small area occupied by these communities.

The greatest activity on B. A. Yurtsev have six types of coenoflora belonging to different tiers of communities. In the tree layer is expected *Fraxinus sogdiana* in shrub - *Rubus caesius* and herbal – *Ligulariamacrophylla* and *Poa bulbosa* as representatives of savannoids meadow view *Poa pratensis* and weed annual *Galium aparine*. Besides these, occasionally in considerable abundance in the herbage *Acer semenovii* *Morus alba*, and in the grass layer *Cousinia umbrosa*, *Astragalus sieversianus* and a number of annuals (*Anisanthasterilis*, *Impatiens parviflora*, *Galium spurium*).

Only 24 species of coenoflora have a prevalence of more than 50% in 17 surveyed communities. Of these, special mention should be *Aegopodium tadjikorum*, *Alliaria petiolata* and *Brachypodium sylvaticum* – species of immoral nature, limited in its spread to the Boraldai mountains only ash floodplain forests. The immoral forest nature of these species and the narrow ecological amplitude in the studied area allow us to consider them as the most ancient indigenous component of ash forests. Also high constancy is characterized by some meadow (*Poa pratensis*, *Festuca pratensis*) and weed (*Conium maculatum*, *Arctium leiospermum*) species found only in floodplain forests. The high resistance of these species is probably due to long and intense anthropogenic forcing and possible drift with peoples and domestic animals.

The seeds *F. sogdiana* ripen in late August. Seeds have an endogenous dormancy and germinate in the year after the fall. On average, in mid-April along the water's edge there is a fairly large number of shoots up to 1 piece/m<sup>2</sup>.

Germination above ground. The first appears root, then there is an intense stretching of hypocotyl, release and staining of cotyledons in green. Cotyledons are oblong blunt. They exist for a month before the appearance of real leaves. The first real leaf is solid, sharp-toothed.

The juvenile age state (j) is characterized by a simpler morphology of the leaf. At this age, the leaves are whole and only 3-4 leaves become triangular lobed. In the juvenile state, depending on environmental conditions, ash may remain 2-3 years. During this time, the taproot develops.

The immature state (im) begins with the intensive growth of shoots and the formation of lateral axes and ends with the formation of a full-fledged undergrowth. Occurs a sequential complication of the leaf blades once [odd-pinnate](#), twice [odd-pinnate](#), three times [odd-pinnate](#). But the leaves are small and much inferior in size to adults individuals. The root system is branched, as the main root dies, it is replaced by lateral roots, departing from the hypocotyl or plagiotropically located part of the shoot, located underground. In this state, the plants are not more than 3-5 years.

Virginillo condition starts with increasing order of branching shoots – formation of crown and ends with the first flowering. The crown of plants at this age is sharply pyramidal, the bark is smooth, not fractured, greenish-gray (Picture. 1a). For this state is characterized by the appearance of vegetative shoots from xylorhiza (Picture. 2).

Depending on the environmental conditions in the virginal state of the individual may be indefinitely, forming vegetative clones of xylorizome. (Celerity – underground woody rhizomes produced in some tree species).

In favorable conditions formed a young tree with a branching of 4 – 6 orders, the trunk is 1.3 – 1.5 m, the crown is elongated ovoid. With age, the order of branching increases, the crown becomes oval, the size of the trunk increases to 2 – 3 m first formed a smooth bark by the end of the age state – a slightly cracked crust. The root system is branched, the number colorizing shoots an average of 2 – 3. The period continues from 6 to 20 years. The diameter of the trunk in this state on average 8-10 cm.

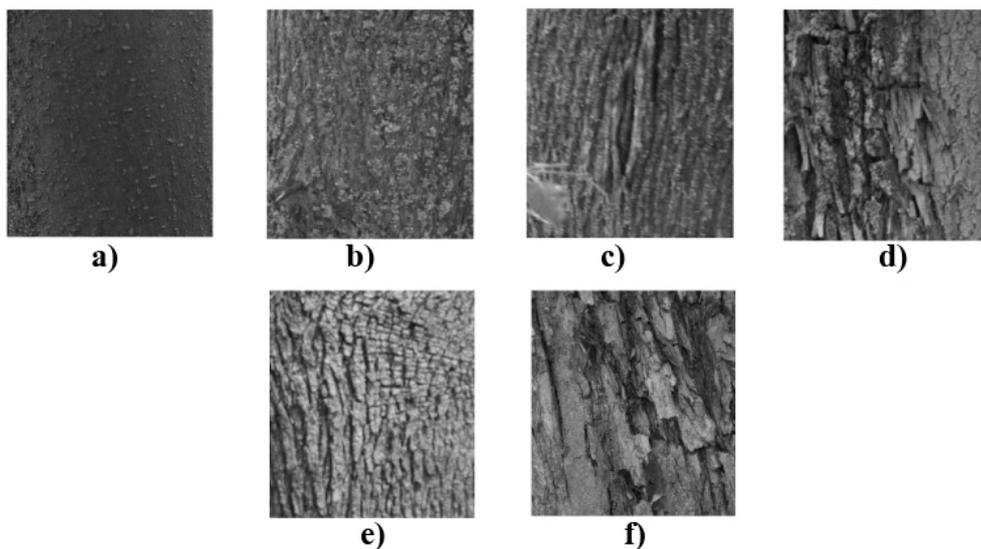


Fig. 1 – Bark: a) virgin trees; b) young generative; c) middle-aged generative; d) old generative; e) subsenile plants; f) senile plants.



Fig. 2 – The formation of plants from xylorhiza

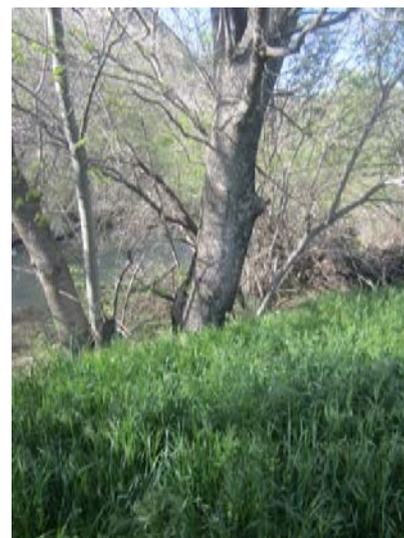


Fig. 3 – Middle-aged generative individual

Young generative individuals ( $g_1$ ): height 6-12 m., crown oblong-ovate shape, stem more than 2 m. On the lower part of the trunk is formed the bark, covered with deep winding cracks (pic.1b). The branching order 4-6, shoots with 4-6 leaves, which acquire a characteristic feathery shape. The diameter of the stem is 12-22 cm. The first flowers appear in small quantities in the middle of the crown. The root system is branched, it is represented by adventitious roots from the base of the primary shoots and from xylorhiza. Anchor roots at this age are poorly developed. In different environmental conditions, this condition can be traced to 20 – 30 years.

Middle-aged generative individuals ( $g_2$ ): height is 10–14 m, shape of crown is oval, stem is 2–3 m. The branching order 6–8, the shoots usually have 5-7 leaves and scars from the place of attachment of inflorescences. The bark of trees becomes fractured over the entire surface of the trunk (Pic. 1v). Flowering and fruiting abundant from the lower to upper branches of the crown. The diameter of the trunk is 20-26 cm. The underground part is dominated by a branched root system, represented by horizontally arranged roots (Pic. 3). Age is 60-90 years.

Old generative individuals ( $g_3$ ). Crown is broad-oval, save at the upper part of the tree. Formation of a wide crown, characteristic of woody plants in adulthood, does not occur. This is due to the death of the primary lateral shoots. At this age, the plants begin to dry. The diameter of the trunks at a height of 130 cm, sometimes 2 m in diameter. Fruiting is not abundant, but quite regular. Almost all old generative trees are damaged by core rot, so it is very difficult to establish the exact age. Bark with deep cracks, with areas of detachment may stay on the trunk areas with a younger Cora (Pic. 1g).

Subsenile individuals are rare. Plants completely lose the ability to bloom, accelerate the process destruction of trees. Bark with deep cracks, rough, peeling in places, visible damage to the wood (Pic. 1d).

Senile individuals are extremely rare. As a rule, they do not have fruiting, trunks are subject to heart-shaped rot (Pic. 4). The diameter of the trunks is 60-100 cm, but some individuals reach 1.5 - 2 m in diameter. Bark with deep cracks, exfoliates (Pic. 1e).

Quasisenil is one of the essential biological properties of perennial plants of different life forms, expressed in the morphological imitation of aging. Quasisenil condition occurs when the deterioration of environmental conditions and is characterized as pseudosenile [52–54].

Quasisenil instances occur in dense stands in low-light conditions, some seed instances are killed, and some individuals in vegetative growth forms a complex quasisenil individuals compact or open, depending on the conditions of the place of habitat. Compact formations are called "stump plant" by foresters.

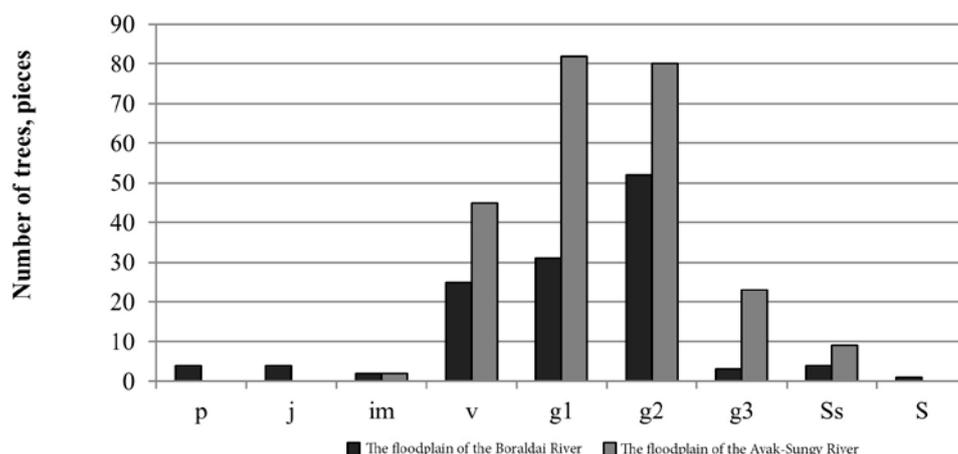


Fig. 4 – Senile individual of sogdian ash



Fig. 5 – Quasisenil individual of sogdian ash

In the population in the floodplain of the river Boraldai range of age-related conditions shifted to the left, which indicates "youth" population, a small proportion of the aging and dying individuals indicates of cutting down adult trees, possibly for economic purposes in the recent past (Fig. 2). In the population in the floodplain of the river Ayak-Sungy, the spectrum of age States is shifted to the right, which indicates some aging of the population, which is associated with the absence of traces of economic use (Fig. 6).



Range of age-related conditions Fraxinussogdiana: 1 – the population in the floodplain of the river Boraldai; 2 – population in the floodplain of the river Ayak-Sungy (im – immature condition; v – virginile condition; g1 – young generative individuals of t; g2 – middle-generative individuals; g3 – old generative individuals; Ss – subsenile individuals; S – senile individuals).

## CONCLUSION

In order to protect the gene pool of the ancient Ranunculaceae family and biodiversity of the ecosystems of the Boraldai mountains, it is necessary to regulate the use of resources of this unique place. The role of rare plants in our country is especially great, as there are few areas occupied by natural vegetation.

Effective measure for the conservation of this species *fraxinussogdiana* is the introduction of its culture as well as the creation of special reserves of medicinal plants on the territory of the Turkestan region.

## REFERENCES

- 1 Abduova A., Tolegen M., Kupriyanov A., Moshkalov B., Zharylkapov Organization of Farm for the cultivation and sale of ornamental and rare plants on the basis of the Syrdarya-Turkestan Regional Natural Park. *Industrial Technology and Engineering*. 2018, no. 3(28), pp.5-12.
- 2 A.A.Abduova, A.N.Kupriyanov, B.M.Moshkalov, I.Zharylkapov Issledovaniye drevesnykh rasteniy Boroldayskikh gor v predelakh Syrdar'ya–Turkestanskogo regional'nogo prirodnogo parka [Research of woody plants of the Boroldai Mountains within the Syr Darya – Turkestan Regional Natural Park]. «Vestnik Karagandinskogo universiteta» Seriya «Biologiya. Meditsina. Geografiya» - «Bulletin of the Karaganda University” Series “Biology. Medicine. Geography», 2018, No. 4, pp.46-54
- 3 A.A.Abduova. A.N.Kupriyanov, B.M.Moshkalov. Otsenka dekorativnosti drevesnykh rasteniy khrebtu Boroldaytau v granitsakh Syrdar'ya–Turkestanskogo regional'nogo prirodnogo parka [Assessment of the decorativeness of woody plants of the Boroldaytau ridge within the boundaries of the Syr Darya – Turkestan Regional Natural Park]. *Vestnik nauki Kazakhskogo agrotekhnicheskogo universiteta im. S.Seyfullina (mezhdistsiplinarnyy) - Bulletin of Science of the Kazakh Agro Technical University. S.Seifullina (interdisciplinary)*, 2017, no. 3(94), pp.4-9.
- 4 Abduova A.A., Yessengeldi A., Satayev M.I., Kupriyanov A.N., Moshkalov B.M. Research of localization places of rare and adornment plants of Syrdarya-Turkestan state regional Natural Park. *Vestnik KazNRTU*, 2019, Vol. 132, No. 2, pp. 6-12.
- 5 Petr Pyšek, Wayne Dawson, Franz Essl, Holger Kreft, Jan Pergl, Patrick Weigelt, Anke Stein, Stefan Dullinger, Christian König, Bernd Lenzner, Noëlie Maurel, Dietmar Moser, Hanno Seebens, John Kartesz, Misako Nishino, Alla Aleksanyan, Michael Ansong, Antonova Liubov A., Barcelona Julie F., Breckle Siegmund W., Giuseppe Brundu, Cabezas Francisco J., Dairon Cárdenas, Juliana Cárdenas-Toro, Nicolás Castaño, Eduardo Chacón, Cyrille Chatelain, Barry Conn, Michele de Sá Dechoum, Jean-Marc Dufour-Dror, Ebel Aleksandr L., Estrela Figueiredo, Ori Fragman-Sapir, Nicol Fuentes, Groom Quentin J., Lesley Henderson, Inderjit, Nejc Jogan, Pavel Krestov, Andrey Kupriyanov. The Global Naturalized Alien Flora (GloNAF) database. *Журнал: Ecology*.2018.Vol. 100, No. 1, pp. 5-20. DOI: 10.1002/ecy.2542