INTRODUCTION OF PLANTS WITH THE AIM OF ESTABLISHING PLANTATIONS TO PREVENT FURTHER DEVELOPMENT OF DESERTIFICATION PROCESSES IN THE SOUTHERN REGIONS OF RUSSIA AND IMPROVEMENT OF THE ENVIRONMENT

[1]Lyubimov V.B., [2]Soldatova V.V.

[1]FSBEI IN «Bryansk State University name after the acad. I.G. Petrovsky», Bryansk, e-mail: lubimov-v@mail.ru;
[2]Balashovskiy Institute (branch) FSBEI IN «Saratov State University named after N.G. Chernyshevsky», Balashov

The most effective way of improving the environment, prevent further deepening of ecological crisis, the neutralization of desertification processes in southern and Central regions of Russia is the creation of plantations for various purposes (intensification of the development of protective afforestation, sand fixation, ravines, creation of vegetation along small rivers and streams, the development of silvicultural production, greening of towns and villages).For establishing and reconstructing the man-made ecosystems of different designated use it is necessary to work out the range of plants characterized by the great stability, decorative value, and other commercially valuable features differentiated according to the natural environment of the region under study. While introducing plants by means of the ecological method it is necessary to pay a special attention to the theoretical selection of species composition prospective for being introduced in the region. The next important stage is singling out the factors limiting the introduction, defining the possibility of their neutralization in the region of establishing the man-made ecosystems and modeling the conditions which are optimal for keeping the introduced species in the culture. The whole research process should be based on the environmental laws, patterns, rules and phenomena directed at reducing the terms of the empiric research into developing new species and introducing them into the culture.

Keywords: introduction, plants, crisis, desertification, environment, ecology, resistance

The most effective way of improving environment, prevent further deepening of ecological crisis, the neutralization of desertification processes in southern and Central regions of Russia is the creation of plantations for various purposes (intensification of the development of protective afforestation, sand fixation, ravines, creation of vegetation along small rivers and streams, the development of silvicultural production, greening of towns and villages).

The poverty of the natural flora, especially in the deserts and semi-deserts, dry steppes, steppes and even in the forest-steppe zone of trees and shrubs defines the relevance of its enrichment at the expense of introduction of new species from other regions of the world. The lack of theory-based, effective methods for the introduction of plants improves the relevance of research in this direction [1–7].

The purpose of the study

Development of environmental method of introduction of woody plants, allowing to create a sustainable artificial ecosystem differentiated natural conditions of the study area, plantations, allowing to neutralize the negative impact of desertification processes on the environment.

Materials and methods of research

Studies were conducted on the Mangyshlak Peninsula (Kazakhstan) is in Lipetsk, Saratov and Bryansk region (Russia). The development of science in physiology and ecology of plants contributed to the explanation of many natural laws that formed the basis for the selection of promising types, depending on the conditions of introduction region.

Of practical importance is the use in the process of selection of promising regional species of plants and their relocation to a new region environmental laws that explain the formation of species composition of phytocenoses, their biological productivity and life-form, habitat and tolerance within the phytocenosis species. Of particular interest in plant introduction present research, devoted to studying of mechanisms of their adaptation. It is established that the adaptation of plants manifest in the dynamic compliance of morphological organization and their adaptive reactions to typical and leading factors of the Environment in which this happened. Physiological adaptation of organisms is the basis of their adaptations to changes in environmental factors within the area and aims to save populations and species as a whole. Each species has its own ecological valence in relation to the factor and in the process of evolution formed their own, inherent ecological spectrum. Selection and introduction of exotic species in the mobilization of the area requires the development of practical recommendations, with a clear program and sequence of its implementation [5]. Particular attention should be paid to the study of the biology and ecology of the species, the development and introduction of advanced agricultural methods of mass reproduction, breeding of plants, depending on the environmental spectrum type , kind of resistance to the introduction of the main limiting abiotic factors and the natural conditions of the study area. This study showed the importance of the comparative analysis of the hydrothermal regime in the area of natural habitat to species introductions area [2–5]. During the research, it is necessary to pay attention to the possibility of neutralization in the introduction region of those of abiotic factors, which are beyond the

tolerance of the species. Only in this case it is possible to ensure the establishment of forest plantations for different purposes, i.e. sustainable plantings that meet the requirements of modern landscape gardening, protective afforestation and silvicultural production. Unfortunately, environmental laws are not always applied in practice for the selection and relocation of plants [6, 7]. Methods of introduction were built without reference to the theory of evolution, the development of biocenoses, forming of tolerance of the species, its life form and habitat. Studies were limited to the search for sustainable species to the natural conditions of the region of plant introduction. Conducted the search is not existing in the nature of species. Biological productivity of the species, its life form, habit depends on environmental conditions of the habitat and, especially, the degree of security of the region with moisture and warmth, as evidenced by the periodic law of geographical zoning, as well as a comparative analysis of the dependence of biological productivity of ecosystems, phytocenoses, species from their characteristic hydrothermal regime. Displacing the species in more stringent forest conditions, we will be faced with the problem of inconsistencies ecological spectrum of the species with the conditions of introduction region. Most often, in the area of introduction beyond the ecological valences of the species will leave the water deficit and heat, as well as the closely related edaphic and other factors. The solution of these problems provides, our proposed ecological method of plant introduction [2, 4–5]. The base of the formation, ecological method of introduction is a complex environmental laws, laws, rules and phenomena, revealing the evolution of the species, the formation of the environmental spectrum. Axiom adaptability of Darwin, namely that each species has adapted to a strictly defined, specific set of conditions of existence leads to the need to identify the main limiting factors to the introduction, followed by neutralization of their negative influence on the exotic species. The need for these actions in the introduction is confirmed by a number of laws and, above all, the fundamental laws of the optimum, minimum and tolerance. Need to address the negative influence of the environmental factors that go beyond sustainability, providing an artificial kind of energy resources is determined by the phenomenon of ecological succession. As a result of development of the phenomenon of ecological succession, in place of the man-made ecological community, the left, for example, without the provision of moisture and nutrition always restored natural landscape. In the desert restored desert landscape, desert – steppe, taiga – taiga, what you need to remember when developing recommendations for the creation and care of plants. Therefore, only the modeling of optimal conditions in the introduction region corresponding to the natural habitat of exotic plants, to ensure the normal growth and development, will implement the exotic plants its biological potential. Use in introduction of the law of variability, variability and diversity of responses to environmental factors in individual individuals of a species, allows to minimize experimental studies to test the mobilized species. Visual observations of juvenile and immature plants on the background of natural conditions and dynamics of water-salt regime of soils, to determine their stability and prospects for the region. In the introduction of plants ecological method, it is proposed to focus on the selection and theoretical justification of the prospects of the species, identifying the limiting factors to the introduction, the determination of their neutralization and modeling of optimal conditions for the species in the introduction region [5].

Results of research and their discussion

To achieve this goal was the analysis of Russian and foreign experience in the migration of plants, carried out comprehensive studies on the introduction of woody plants in the extremely harsh conditions of the desert of the Mangyshlak Peninsula, characterized by a high moisture deficit, widespread soil salinity close occurrence of impermeable layer, high temperatures and intense wind regime. Introduction of the species on the Mangyshlak Peninsula was carried out based on the comparison and analysis of the minimum temperatures of atmospheric air at home with the minimum temperature of the study region, which for the Peninsula are coastal – 26 °C, and in continental – 34 °C [4].

Table 1 shows the percentage of attracted to the Peninsula Mangyshlak species of plants and species introduced to the greening of cities and villages of the Peninsula, according to their degree of frost resistance, in accordance with the zones A. Rehder [8].

The minimum temperature in the zones of Raeder are: area II – 46–40; III – 40–34; IV – – 34–29; V – 29–23; V I – 23–18; VII – 18–12 °C.

The Table 2 presents data on the distribution of plant species, Botanical collection exhibits Mangyshlak experimental Botanical garden (the city of Shevchenko, Mangyshlak Peninsula Kazakhstan).

Table 1

Distribution of exotic species in zones of Raeder (Rehder, 1949)

Zone	II	III	IV	V	VI	VII
1	2	3	4	5	6	7
Percentage of the total number of species in the collection	12	15,5	55,3	16,2	1	–
Percentage to the number of species introduced to the greening of cities and villages of the Peninsula of Mangyshlak	10,8	18,9	43,3	27	–	–

Table 2

Distribution of species of the plant collection
of the Botanical garden in zones Rehder, 1949 (Rehder, 1949)

Zone	II	III	IV	V	VI	VII
1	2	3	4	5	6	7
Distribution of species of the plant collection of the Botanical garden in zones Rehder, 1949	40	74	241	76	5	–

Similarly, the representation of species of plants and planting stock of the cities and towns of the Peninsula Mangyshlak. Statistical analysis of minimum temperatures, characteristic for the country of exotic species, showed that the average for exotic species, the minimum air temperature (M. ar.) is – 28,3 ± of 0,4 °C, With coefficient of variation (Cv) – 24 %, the accuracy rate of experience (P) – 1,27 %, criterion of reliability (t) – 78. The greatest number of species of plants in the collection of the Mangyshlak experimental Botanical garden of Academy of Sciences of Kazakhstan presented the fourth and fifth zones. Representatives of the sixth and seventh zones are practically absent in the collections of the garden, and planting a range of settlements of Peninsula Mangyshlak. Their tolerance is already the strength of the effect of the temperature factor in the conditions of introduction region. Representatives of the second and third zones promising for all of the Mangyshlak Peninsula and can be recommended in the southern regions of Russia. Botanical exposition introduced among angiosperm species of trees and shrubs, there are 428 species, hybrids, forms and varieties from 80 genera belonging to 32 families. Table 3 shows the distribution of the areas most promising for Peninsula families: Rosaceae Juss., Salicaceae Mirb., Oleaceae Lindl. and Leguminosae Juss. The highest percentage in families represent the types of the fourth and fifth zones. The most promising source for introduction of the material, especially in arid regions are Circumboreal, Asian, Atlantic North American, Rocky mountains and The Iran-Turan floristic region.

In terms of Mangyshlak (Kazakhstan), and then in Lipetsk, Saratov and Bryansk region (Russia) conducted research to identify techniques and methods for optimization of the hydrothermal regime for reproduction, growth and development of exotic species. As a result of the study determined the feasibility of using the method of growing plants with closed root system, as well as drip irrigation and use for sowing seeds waterproofed with checks constantly fed through a drain moisture [2, 5].

Scientific novelty and practical value of the work

As a result of years of research developed environmental method of introduction of woody plants, that allows you to create a sustainable wood plantations for various purposes, differentiated natural conditions of the study area. Practical value of the work attributable to higher volumes in the enrichment of the cultural dendroflora of Russia's regions and neighboring countries economically valuable exotics, as well as the proposed practical activities in these regions to create effective spaces for various purposes and primarily for the creation of anthropogenic ecosystems in areas exposed to desertification. The purpose of creation of anthropogenic ecosystems is the neutralization of the negative impact of desertification on the environment and public health.

Table 3

Distribution of species of several families, introduced
on Mangyshlak, in the zones Rehder, 1949

Family	Zones Raeder					
	II	III	IV	V	VI	VII
Rosaceae Juss.	8,9	8,9	34,5	47,2	0,5	–
Salicaceae Mirb.	11,5	7,7	42,2	38,6	–	–
Oleaceae Lindl.	7,8	5,1	30,6	56,5	–	–
Leguminosae Juss.	11,9	9,5	34,5	44,1	–	–

The reliability of the research results

The reliability of the results provided by the analysis of research conducted in the field of woody plant introduction modern methods in different soil and climatic conditions from semi-desert and to steppe, forest-steppe and forest zones, as well as processing of the obtained results using computer programs Microsoft Excel 2010.

Conclusion

The use in the practice of evidence-based environmental methods and recommendations for the introduction of plants will facilitate the establishment of effective forest plantations for various purposes, including in regions that are prone to the development of the environmental crisis and desertification processes. The introduction of new for the region species of woody plants will increase the smartness and sustainability of forest plantations and their health effects. Implementation of advanced technologies for the propagation and cultivation of exotic species will allow to reduce terms of establishing plantations, will reduce the cost of planting material and to conserve natural, including water and land resources. In arid regions of Kazakhstan and Russia was successfully tested methods of drip irrigation, cultivation of plants with the closed root systems and use for sowing seeds sowing waterproofed with checks constantly fed through a drain moisture.

References

1. Andreev L.N. Rol fiziologicheskih issledovanij v razrabotke problemy introdukcii rastenij // Aktualnye zadachi fiziologii i biohimii rastenij v botanicheskih sadah SSSR (tezisy dokladov). – Pushhino: ANSSSR, 1984. – P. 3–4.

2. Zinov'ev V.G. Progressivnye tehnologii razmnozhenija derev'ev i kustarnikov / V.G. Zinov'ev, N.N. Verejkina, N.N. Harchenko, V.B. Ljubimov. – Belgorod – Voronezh: BGU, 2002. – 135 p.

3. Kolesnikov A.I. Dekorativnaja dendrologija. – M.: Izd-vo Lesnaja promyshlennost', 1974. – P. 633–695.

4. Kotova N.P. Gidrotermicheskij rezhim soderzhanija introducentov / N.P. Kotova, V.B. Ljubimov. – Brjansk: Izd-vo BGU, 2012. – 140 p.

5. Ljubimov V.B. Introdukcija rastenij. – Brjansk: BGU, 2009. – 364 p.

6. Rusanov F.N. Novye metody introdukcii rastenij // Bjul. gl. botan. sada. – M.: Nauka, 1950. – Vyp. 7. – P. 26–37.

7. Mayr H. Waldbau auf naturgeschichtliher Grundlage. – Berlin, 1909. – 319 p.

8. Rehder A. Manual of cultivated trees and shrubs. – New York, 1949. – 725 p.