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Environmental Features of Dominant Species of Plants of the South Dried Part of the Bottom of the Aral Sea

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Abstract: ***The article presents the results of studies of the environmental features of dominant plant species of the southern drained part of the bottom of the Aral Sea. As a result of field surveys of the exposed southern part of the bottom of the Aral Sea, more than 50 species were collected that are involved as components, co-dominants and dominants in the formation of plant groups.***

Keywords: drained bottom, Aral Sea, dominant plant species, halophytes, salt tolerance.

1. Introduction

The increasing anthropogenic impact on nature becomes the reason for its change. These changes are often accompanied by degradation of ecosystems, which, first of all, is expressed in simplifying the structure of natural systems and reducing their regenerative ability.

The problem of drying out of the Aral Sea has now gained worldwide fame. This necessitates studying the issues of haloadaptation and haloaccumulation of plants in connection with desertification and salinization. The shrinking of the Aral Sea is a vivid and large-scale example of anthropogenic changes in nature. It not only disastrously affected the ecosystems of the sea itself, but also was accompanied by aridization of the climate, desertification and salinization of soils, increased winds, increased air temperature, degree of erosion, decreased water availability in the territories, and ultimately a decrease in the biological potential of the entire Aral Sea region.

Haloaccumulation of plants is one of the manifest manifestations of haloadaptation of plants. Qualitative and quantitative indicators of haloaccumulation of plants can characterize their halotolerance. Excessive amounts of water-soluble mineral salts in the ecological niche through osmotic, toxic and specific effects on plants increase water demand and cause great environmental damage to the national economy. Therefore, the study of the fundamental principles of plant adaptation to salinization is promisingly based on a knowledge of the physiology and ecology of salt tolerance.

The processes of salinization of soils and surface waters are becoming threatening as a result of the development of reclamation-dysfunctional lands, the deterioration of the quality of irrigation water due to the discharge of collector-drainage water into the rivers and the aeolian intake of saline dust from the drained part of the bottom of the Aral Sea. As a result, more than 60% of irrigated lands are already salted in Uzbekistan. And in Karakalpakstan, 95% of the soil suitable for agriculture is salted. Therefore, studies devoted to this scientific problem could open the way to a deep knowledge of the phenomenon of haloadaptation and halotolerance of living organisms and the management of their vital functions.

2. Material and Methods

Vegetation was studied by describing specific areas of vegetation cover. A total of 8 vegetation plots were described, 16 soil and 36 plant samples were collected. Life forms (ecobioforms) stood out according to N.T. Nechaeva, V.K. Vasilevskaya, G.K. Antonova (1973) [5]. The vegetation was described by phytocenological methods. The species diversity, horizontal and vertical arrangement of coenopopulations, their age composition and vitality were taken into account.

The age of edificators was determined by size, degree of growth and development, habitus, branching, thickness of the root neck and trunk, and the number of their annual rings. The age composition of cenopopulations was determined by separately accounting for the number of seedlings, juvenile, immature, generative, prussic, and dead individuals.

Features of haloaccumulation of cultivated and wild plants were studied using 29 species as an example. Features haloaccumulation of wild plants were studied by collecting them in the field. The species affiliation was determined by the determinants (Bondarenko, 1964; Korovina et al. 1982; 1983). Plant samples were taken in the phase of intensive growth. If necessary, some samples were collected by developmental phases: seedlings, juvenile, immature, budding, flowering, fruiting, ripening, completion of the growing season. The extraction of mineral salts, the study of their chemical composition was carried out according to the method developed in the laboratory of plant ecology and physiology of the Karakalpak Research Institute of Natural Sciences [2, 3]. The degree of soil salinity was estimated by the content of water-soluble salts (ions) according to the following scale [1, 4].

3. Results and Discussion

The drained part of the sea bottom is characterized by extremely primitive forms of soil, which are found only in

the initial floor of the formation: they are not divided into soil horizons that differ in humus content, salts and color. However, they have a certain fertility, allowing the growth of vegetation. According to the granulometric composition of the drained part of the bottom of the Aral Sea, they differ in sandy, sandy loam, loamy, clay soils. This is the basis of various desert landscapes: halomorphic, mesomorphic, xeromorphic.

The dried southern part of the Aral Sea is characterized by various salt marshes (more than 250 thousand hectares): marching, cortical, crusty-puffy: sandy soils (about 500 thousand hectares): soils with an inspired sand cover, cumulus, cellular-sand dunes [2, 3, 4]. They are a function of time and the intensity of environmental factors.

Different territories of the drained part of the bottom of the Aral Sea, depending on the timing of drying and particle size distribution, differ in the degree of salinity of the soil. The territories drained in 1960-1970, when the average salinity of sea water was 11-20g/l, are characterized by less salinity than the territories drained in 1980-1999, when the salinity of sea water reached 55-60 g/l.

A characteristic feature of the vegetation of the drained southern part of the bottom of the Aral Sea is the complexity of a small number of species. This leads to the presence of a large number of vacant (unfilled) ecological niches and, as a result, ecosystem instability. Vegetation is the main autotrophic block of the ecosystem, the main factor of its normal functioning, an integral indicator of environmental quality. It determines the nature of ecosystems, qualitative and quantitative indicators of biological systems.

As a result of field surveys of the exposed southern part of the bottom of the Aral Sea, more than 50 species were collected that participate as components, co-dominants and dominants in the formation of plant groups. Of these, the following species are widespread in coastal plains and in the exposed part of the sea bottom: Haloxylon aphyllum, Tamarix hispida, T. ramosissima, Halimodendron halodendron, Calligonum aphyllum, C.aralense, C. leucocladum, C.setosum, C. microcarpum, C. junceum , C. eriopodum, C. caput-Medusae, Atraphaxis spinosa, A. repeicata, Astragalus villosissimus, A.unifoliolatus, Nitraria sibirica, N. schoberi, Halostachys belangeriana, Phragmites australis, Typha angustifolia, Eremosparton ahpyllum, Aristida pen, Aristida pen, Aristida penis, Aristida penis A.diffusa, Salsola dendroides, S.Paulsenii, S.nitraria, Halogeton glomeratus, Climacoptera aralensis, C. olgae, Zygophyllum oxianum, Atriplex fominii, Suaeda crassifolia, Bassia hyssopifolia, Salicorniaumialiospalioala europa europa lepaliuma europa pseudalhagi, Glycyrrhisa glabra et al.

Adaptation of plants to salinization conditions is carried out in many ways. The most important among them are osmoregulation and specialization, or a modification of transport processes. Therefore, to obtain salt-tolerant forms of plants, it is necessary to carefully study the transport of ions depending on the ionic composition of the medium and the genotype of plants. Salt tolerant species have the ability to accumulate Na + in vacuoles, absorb it from xylem and transport it to the environment. Peculiarities of K-Na exchange on the plasmalemma and accumulation of Na + and C1- in the cell vacuoles and in the cell walls were noted in some studies, which suggested the existence of a highly effective mechanism for pumping Na ions in salt tolerant plants.

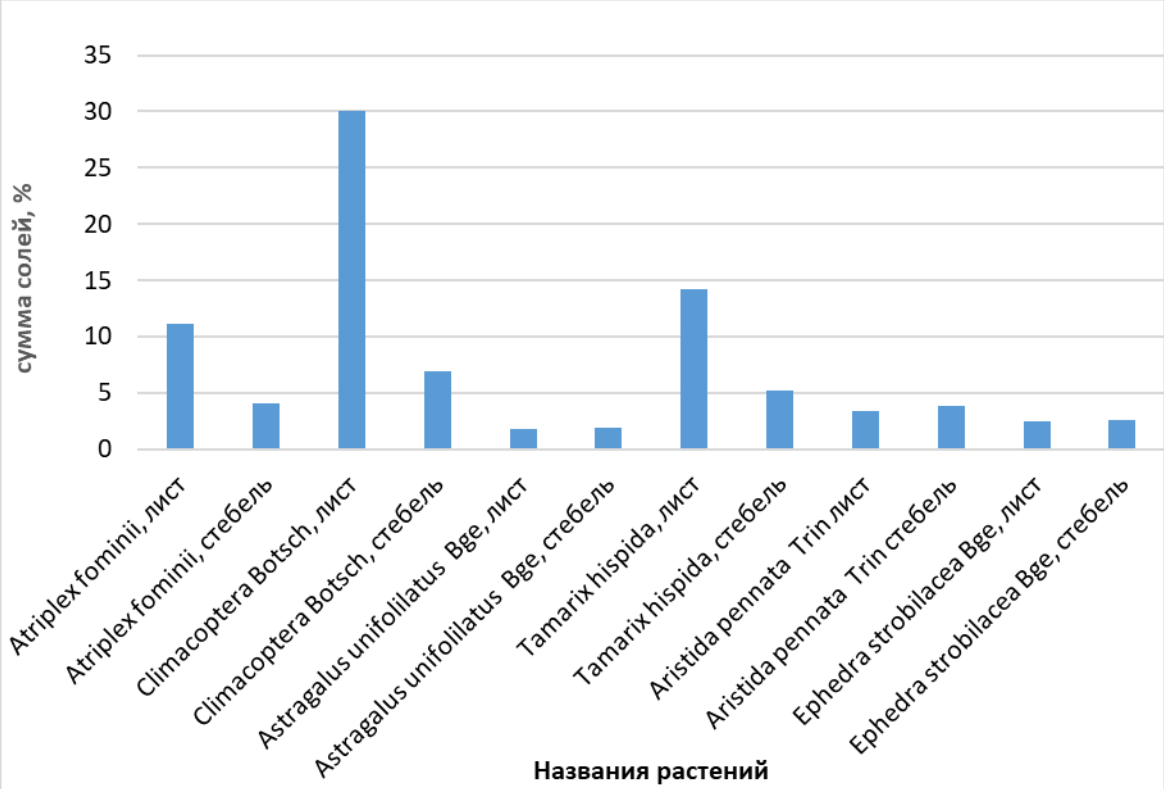

Figure 1: Indicators of accumulation of the amount of salts (%) in plants of the dried bottom of the Aral Sea

Considering the results of indicators of the accumulation of the sum of salts (%) in the stems and leaf cover of the plants under consideration, it can be noted that the largest values were noted for the following plants - Atriplex fominii, Tamarix hispida and Climacoptera Botsch (11.1; 30.1 and 14, 2, respectively)

Thus, the harmful effect of a high concentration of salts is associated with damage to the surface layers of the cytoplasm, as a result of which its permeability increases, and the ability to selectively accumulate substances is lost. It is known that salts enter the cells passively together with the transpiration current of water.

Since in most cases saline soils are located in areas characterized by high summer temperatures, the transpiration rate in plants is very high. As a result, a lot of salts comes in, and this increases the damage to the plants. It should also be taken into account that in saline soils, a high concentration of sodium prevents the accumulation of other cations, including plants necessary for life, such as potassium and calcium.

The decrease in plant productivity in the conditions of chloride salinity is determined by the inhibition of their growth, which is an integral characteristic of the response of plants to environmental changes.

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