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Research Article

Ontogenetic Features of Halo Accumulation of Certain Hemigalophytes under the Conditions of Karakalpakstan

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Abstract

This work is devoted to the ontogenetic features of haloaccumulation of some hemihalophytes in the conditions of Karakalpakstan. The work revealed quantitative and qualitative indicators of haloaccumulation as the development phases of the studied plants progressed: Atriplex tatarica L., Zygophyllum oxianum Boriss., Elaeagnus turcomanica N. Kozl. The change in the content of mineral salts in the leaves of hemihalophytes was investigated. The results of the study showed that different species differ in qualitative and quantitative indicators of haloaccumulation by developmental phases, but the studied species have a single regularity of haloaccumulation intensity: in the initial phases it is low, reaching a maximum during the period of intensive growth and formation of vegetative and generative organs; drops sharply in the flowering phase, increases again at the fruiting stage and gradually decreases towards the end of the growing season as the growth processes diminish.

Key words: *haloaccumulation, ecology, organ, vegetative, hemihalophytes, maximum, water-soluble salts, soil, indicator, quantity, Karakalpakstan.*

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Introduction

The natural conditions of Karakalpakstan are determined by the geographical location on the modern and ancient deltas of the Amu Darya River, in the center of the Eurasian continent, away from the oceans, the main sources of moisture, at the junction of the North Turan and South Turan deserts. Due to the drying up of the Aral Sea, its softening effect on the climate decreased. This time, the territory is characterized by natural conditions conducive to intense salt accumulation and a sharply continental climate, intense insolation, increased air dryness, and low precipitation. Desertification processes in the delta are proceeding rapidly and their consequences are becoming more noticeable from year to year.

In the arid zone, where saline soils are widespread, plant development often takes place under the influence of mineralized soil solutions [3]. In the southern Aral Sea region, the most profound changes occur in natural complexes, which leads to disruption of the natural course of dynamic transformations of ecosystems, in which there is widespread halophytization of vegetation at various serial stages, which often leads to the disappearance of characteristic floristic differences between different communities and types of vegetation [5] ... In this regard, widespread representatives of the Chenopodiaceae family now dominate in Karakalpakstan. Therefore, it becomes necessary to study the issues of haloadaptation and haloaccumulation by plants in connection with desertification and salinization. Haloaccumulation by plants is one of the pronounced manifestations of their haloadaptation. Qualitative and quantitative indicators of haloaccumulation by plants can characterize their halotolerance [7].

Purpose of work

To study the regularities of the accumulation of salts in hemihalophyte plants, to reveal the features of haloaccumulation in the process of ontogenesis, to study their selective ability to accumulate salts.

Research objectives

To establish the qualitative and quantitative parameters of haloaccumulation of hemihalophyte plants in dynamics during the growth and development of plants.

Materials and methods

The objects of the study are plants that are representatives of the ecological groups of hemihalophytes: Atriplex tatarica L., Zygophyllum oxianum Boriss., Elaeagnus turcomanica N. Kozl. The ecological classification of the objects of study was established according to N.

Akzhigitova (1982). The extraction of mineral salts from the plant mass, the study of their chemical composition, were carried out by conventional methods [2]. The total content of water-soluble salts in plants was determined in aqueous extracts of dry plant matter and their ash. An aqueous plant extract was prepared in a ratio of 1:50.

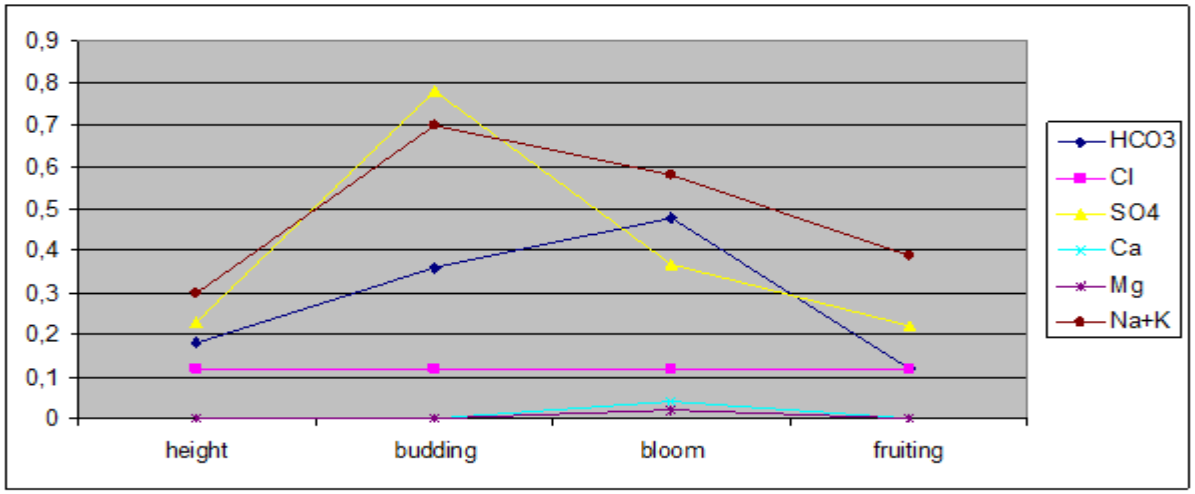
The discussion of the results. Among the investigated wild-growing hemihalophytes are the Turkmen sucker, jiyda (Elaeagnus turcomanica Kozl.), A short tree, one of the edificators of the tree-shrub vegetation of Karakalpakstan, mesoxerophyte.

In some literatures, the sucker is referred to as crinohalophytes, and according to such data, salts are absorbed by the roots of plants, but do not accumulate in the cell sap. This is explained by the fact that the absorbed salts are released through special secreting cells present on all aboveground plant organs [4].

In our studies, it is once again asserted that, although it grows on moderately saline soils, it accumulates very little water-soluble salts - 2.0-2.1%. According to the developmental phases of the loch, the amount of chloride ion in free and bound form does not change at all and remains within 0.12-0.21%. Data on the content of free and bound mineral elements in plant leaves are given in Schemes 1 and 2.

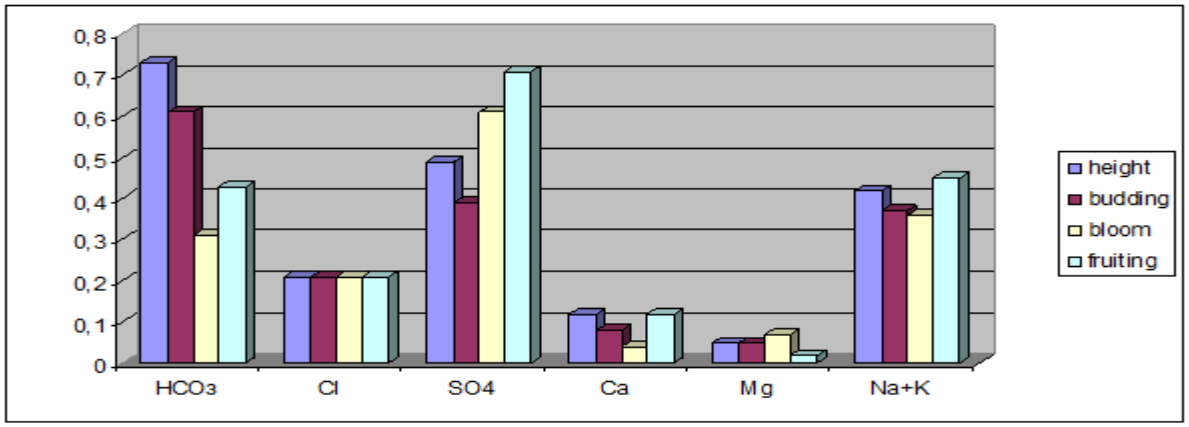
Scheme1

Content of associated mineral elements in the leaves of Elaeagnus turcomanica Kozl.



Scheme 2

Content in the leaves of Elaeagnus turmanica Kozl. of free mineral elements of components of inorganic salts (in % of dry weight)



For other representatives, data on haloaccumulation are presented in the table.

The Amu Darya green leaf (Zigophyllum oxianum Boriss) is a mesoxerophytic perennial, grows on weakly - moderately saline soils of light texture, is distinguished by a shallow root system. It grows in places on the drained part of the bottom of the Aral Sea. On the drained shores of the Aral Sea, when soil salinity reached 2.3%, the green leaf fell out of the phytocenosis.

The samples collected at the same time in two places: in the recreation park of the city of Nukus and on the territory of the Nizhne-Amudarya biosphere reserve did not differ sharply in terms of haloaccumulation. The total amount of water-soluble mineral salts in the leaves was 10.6-10.9%.

At the initial stage, the parifolia is characterized as glycophytes with a low (2.2%) rate of haloaccumulation. Apparently, this is due to its bioecological features. It has a shallow (20-50 cm) root system. The soil in the root of the inhabited layer is almost completely freed from water-soluble mineral salts due to autumn-earth-spring precipitation in spring. In this regard, the green leaf grows in approximately the same conditions as glycophytes in relation to soil salinity.

Tatar quinoa (Atriplex tatarica L.) - belongs to the Chenopodiaceae family, a widespread plant in the territory of Karakalpakstan. In many literary sources, the Tatar swan was attributed to the group of salt-localizing halophytes. Salts that penetrate the protoplasm of the cells of such plants are localized in special vesicular hairs, which cover the upper and lower sides of the leaves with a continuous layer. In the plants we selected for chemical analysis, such a phenomenon was not found.

Table Change in the content of mineral salts in the leaves of hemihalophytes according to the phases of development (1-free, 2-linked) (in% and mg / eq of absolutely dry plant matter)

Development phase	Content	The sum of the salts %	Jonah											
			HCO_3^-		Cl^-		SO_4^{2-}		Ca^{2+}		Mg^{2+}		Na^++K^+	
			%	mg / eq	%	mg / eq	%	mg / eq	%	mg / eq	%	mg / eq	%	mg / eq
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Zygophyllum oxianum														
Intense growth 19. IV.	1 2	2,17	0,37	6	0,21	3,5	0,95	19,7	0,04	2	0,02	2	0,58	25,2
Budding1. V.	1 2	10,5	1,9	32	3,6	101	2,06	42,8	0,16	8	1,12	92	1,75	76,3
Bloom 11. V.	1 2	10,2	1,7	29	3,3	94	2,6	54,1	0,32	16	1,39	114	0,9	39
The beginning of fruiting 2. VI.	1	10,6	2,1	35	2,4	70	3,5	74,1	0,36	18	1,56	1,28	0,7	33
Atriplex tatarica														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Juvenile phase10/III	1 2	8,1 2,06	1,4 0,54	24 3	3,6 0,37	101 10,5	0,49 0,27	10,2 5,82	1,08 0,08	54 4	0,29 0,51	24 22,3	1,32 0,51	57,2 22,3
Intense growth 11/V	1 2	10,9 2,5	2,4 0,30	40 5	3,7 0,49	105 14	1,38 0,28	28,7 5,9	0,96 0,04	78 2	0,32 0,87	26 37,9	2,2 0,87	99,7 37,9
Budding2/VIII	1 2	9,8 3,73	1,59 0,42	26 7	3,4 0,74	98 21	1,53 0,78	31,8 16,4	0,76 0,04	38 2	0,10 1,2	8 55,7	2,5 1,28	109 55,7
Bloom19/VII	1 2	8,6 3,9	1,77 0,30	29 5	2,7 0,74	77 21	1,45 0,95	30,1 19,8	0,60 0,04	30 2	0,32 1,35	26 58,8	1,84 1,35	80,1 58,8
Fruiting25/IX	1 2	10,2 2,6	2,32 0,54	38 9	2,9 0,49	84 14	1,88 0,13	39,1 2,9	1,28 0,04	64 2	0,41 0,89	34 38,9	1,45 0,89	63 38,9

Ripening of seeds 12/X	1	9,2	2,2	36	2,7	77	1,4	29,1	0,76	38	0,24	20	1,93	84,1
	2	2,45	0,42	7	0,37	10,5	0,34	7,1	0,04	2	0,81	35,6	0,81	35,6

The total content of water-soluble salts in the juvenile phase (March) was 8.1% of the absolutely dry weight. In the phase of intensive growth, that is, after 2 months, it accumulated in itself almost 2 times more - 15.6% of water-soluble salts. By the budding phase, the amount of salts is reduced to 9.8%, and even less in the flowering phase - 8.6%. During fruiting, the haloaccumulation of plants increases to - 10.2%, at the end of the growing season at the stage of seed ripening, the sum of salts is - 9.2%.

Conclusion

The study investigated haloaccumulation by the phases of development of some representatives of the ecological groups of hemihalophytes. According to the results of the study, the intensity of haloaccumulation of plants Atriplex tatarica L., Elaeagnus turcomanica N. Kozl. reached its maximum during the period of intensive growth. At the initial stage, the parifolia plant is characterized by a low (2.2%) rate of haloaccumulation. We think that this is due to the shallow root system, since the soil in the root of the inhabited layer is almost completely freed from water-soluble mineral salts due to precipitation in spring. In this regard, in terms of salt accumulation, the parifolia is closer to glycophytes.

Among the studied plants, the oak tree is very drought-resistant, almost does not suffer from hot weather. It is unpretentious to soils; tolerates significant soil salinity and accumulates very little water-soluble salts (2.0-2.1%). We suggest planting this very useful plant in the city as a drought-resistant, salt-tolerant plant.

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