Original Article

Ecological Features and Agrotechnology of Growing Atropa Belladonna l. and Echinops Ritro L in the Conditions of Karakalpakstan

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Abstract

The article deals with the study of ecological features and agrotechnology of growing *Atropa belladonna* L. and *Echinops ritro* L in the conditions of the Republic of Karakalpakstan. The adaptive adaptability is the highest in *Atropa belladonna* L., the plant has a high combined resistance to local climatic conditions, massively blooms and bears fruit, actively self-propagates vegetatively.

Keywords: Karakalpakstan, Introduction, Medicinal Plants, Ecological Features, Agricultural Technology.

INTRODUCTION

Currently, the need for the use of herbal medicines has increased by more than 25%. Topical all over the world are the issues of introduction of promising medicinal plants, the study of their bioecological properties, as well as the conservation of biodiversity of valuable medicinal plants. In this regard, the introduction of promising medicinal plants into environmental conditions is of great scientific and practical importance [1, 5].

Scientific research conducted in the leading scientific centers of the world, the reduction of habitats of plant species under the influence of anthropogenic factors leads to the complete disappearance or reduction in the number of medicinal plants. Studies of the introduction of medicinal plants belonging to other flora into local conditions, the study of their bioecological properties, the development of propagation and cultivation methods are promising areas in the field of plant introduction [2]. For this reason, for the protection and rational use of medicinal plant resources, as well as enrichment at the expense of imported species, their introductory assessment is of great scientific and practical importance.

Numerous publications on the ecology and distribution of medicinal plants were published by a number of scientists of Karakalpakstan - A. Bakhiev (1999), S. Erezhepov (1971, 1978), S. D. Davletmuratov (1991) and many others.

THE MAIN FINDINGS AND RESULTS

The study of the biological characteristics of introduced medicinal plants, the search for ways to adapt them to various conditions, the knowledge of phylogenetic changes in the structure of taxa at different levels is a particularly urgent task. It is also necessary to collect more material on introduced plants in the face of a growing threat to biodiversity. The analysis of such data expands the possibilities of assessing introduced plants in the introduction processes and determining whether they are promising [7, 8].

Scientific work was carried out in 2011-2019 at the experimental sites of Ellikkala and Kegeyli regions of the Republic of Karakalpakstan.

CHARACTERISTICS OF THE STUDIED PLANTS

plant species	belladonna (*Atropa belladonnaL.)*	Mordovnik white (*Echinops ritro L.*)
Photo		
Lifestyle	perennial herbaceous plants	
plant height	1,5-2 m	120-150 sm
flowering time	May-August	July August
flower coloring	Dirty purple or brown purple	blue-violet, purple

In the course of research, we summarized the results of such parameters as the state of introducers after sowing, seed germination, storage and germination of seedlings, storage, plant growth and development indicators, productivity, soil and climate influence on introduction, and assessed the level of plant prospects on a 100-point scale introductory assessment of plants, proposed by prof. B. Yo. Tukhtaev (2009).

The soils of the Republic of Karakalpakstan, due to the extreme nature of the climate and hydrogeological conditions, are characterized by a low content of humus and a high tendency to salinity. Recently, mass land development, when even saline and unsuitable for development lands were introduced into circulation, has led to their degradation, an increase in their salinity, a decrease in soil fertility, and an increase in deflation and erosion processes. In view of the use of an increased amount of mineral fertilizers and pesticides, a significant part of the irrigated soils is contaminated with various ingredients [4].

In the South Prearalie, soil salinization (mainly sulfate and chloride) is a widespread and progressive process. So, in 1975, 43% of irrigated lands were saline, in 1985 - 80%, in 1997 - 94%. Since 1960, takyr and solonchakous soils have increased by 91 thousand hectares, solonchaks and sands - by 43 thousand hectares. The soils of the lower reaches of the Amu Darya annually accumulate more than 1 million tons of salts [1, 4].

In areas with an arid climate, and especially in semi-deserts and deserts, where evaporation far exceeds precipitation, conditions are created for the accumulation of salts in groundwater and soil-forming rocks. In these areas, mainly saline soils are located. To assess soil salinity by the amount of water-soluble salts, the following gradations were adopted: non-saline - less than 0.25%; moderately saline - 0.25-1%; highly saline - 1-2%; extremely highly saline - more than 2%. Salt marshes include soils containing a large amount of water-soluble salts near the surface. Depending on the chemistry of salinity, the salt content in the upper horizon of solonchaks varies from 0.6–0.7 to 2–3% or more (Fig. 1) redistribution of salts due to uneven terrain [3, 4].

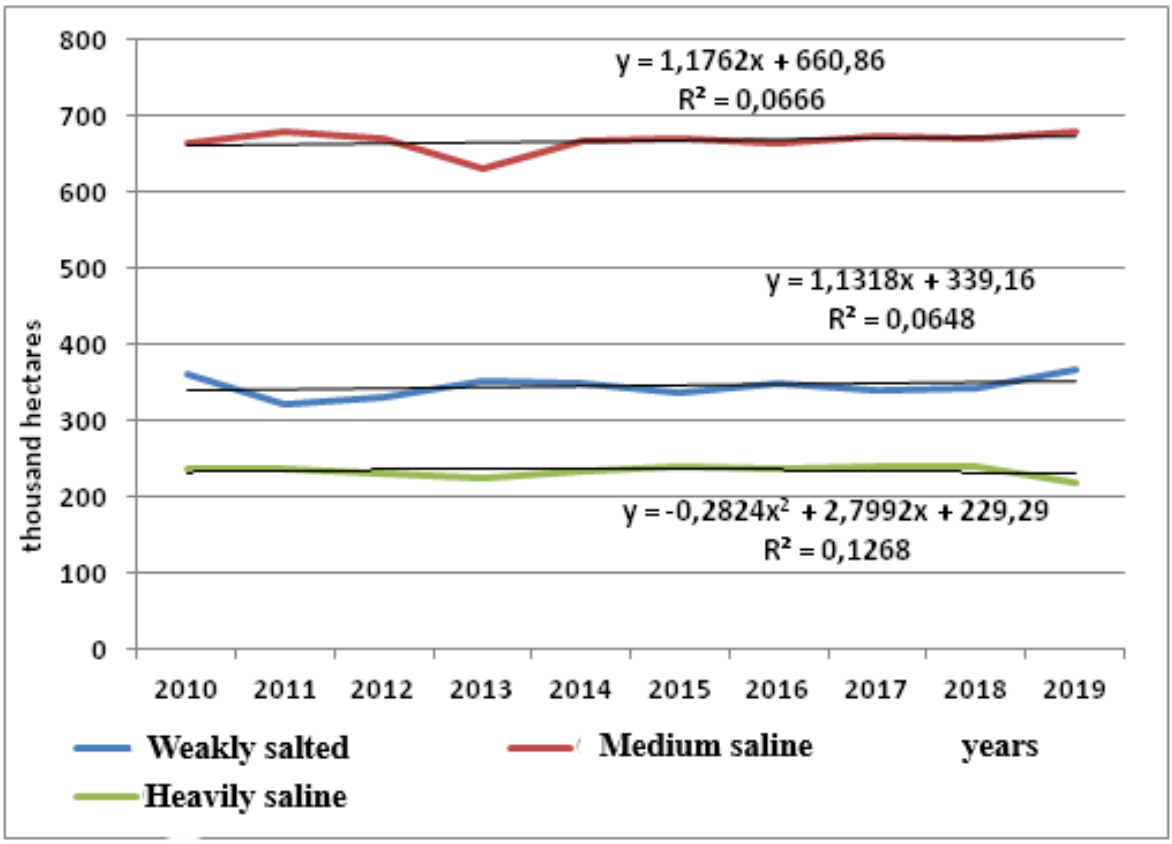

Fig. 1. Dynamics of the degree of soil salinization in the South Prearalie

The accumulation of salts in soils is the essence of the solonchak process, which manifests itself in the close occurrence of ground mineralized waters in a predominantly arid climate with an effusion type of water regime [4]. When water evaporates, the upper soil horizons are enriched with water-soluble salts. The seasonal influx of soluble salts due to the evaporation of mineralized groundwater can reach 500-1000 tons per 1 ha.

In the conditions of Karakalpakstan, the growth strategy of introduced plants is to reduce the growth period and accelerate the pace. Therefore, in the conditions of Karakalpakstan, the limiting factor for the growth of stems is high temperature and low humidity. We also note that representatives of species living in conditions of humid air and the boreal zone grow more slowly and finish growth earlier.

The entry of plants in shady conditions (exposure) into the generative period during the growing season was characterized by a later onset than in plants under sun conditions and the absence of buds and flowers in them [5]. In plants in shady conditions, the total number of flowers opened during the mass flowering period is 7, simultaneous opening of 2 or 3 flowers on one plant per hour during the day was not observed.

Observing the final period of flowering (10.X) of the plant in sunny weather, one can notice that with a decrease in temperature in autumn, the period of open flowers decreases. Flowering of *Atropa belladonna* L. usually begins in the second year. Introduced into the introduction in the conditions of the Republic of Karakalpakstan, *Atropa belladonna L*. bloomed in the first year. The density of plants and the onset of phenological phases largely depend on the time of planting. Since the plant is a perennial, flowering in the first year of the growing season started late, and in the second and third years of the growing season, the flowering period was found to start early and last until the end of the growing season. This means that the beginning of its phases varies depending on the age of the plant and the weather.

Fig. 2. Blooming belladonna (Atropa belladonna L.)

Echinops ritro L. - is a sun-loving, drought-resistant and unpretentious plant that grows on any soil, on fertile soils it forms a strong stem and produces many seeds do not tolerate stagnant water in the soil. This leads to root rot. Forms a rosette of leaves in the first year.

Fig. 3. Flowering Mordovnik ordinary (Echinops ritro L.)

Stems solitary, rarely branched in the upper part, pubescent. The leaves are alternate, deeply incised, 6-20 cm long, arranged in the following order: dark green above, white-felt below, tubular flowers, blue in single-flowered baskets, collected in large spherical inflorescences, 3-5 cm in diameter, the fruit is cylindrical achene, 6 mm long, with cup-shaped tuft.

It is noted that the period of mass flowering lasts longer, from July to mid-September, and the final completion of flowering occurs in early October. From mid-July, the transition to the period of mass flowering began, and from the first decade of October to the final period of the flowering phase. According to our observations, the flowering order of the plant is as follows. In the Republic of Karakalpakstan, 120-130 days pass from germination to the ripening of the first fruits. The phases of phenological development depend on the biological characteristics of the species, climatic conditions and planting time. Winter and early spring sowing periods provide early and rapid seed germination, and the onset of the next phases 5-10 days earlier than in the late spring period. When the seeds are sown in early spring, there is enough moisture in the soil, the temperature also rises, and the seeds germinate well.

Based on the results of experiments conducted to determine the sowing rate of *Atropa belladonna L*. seeds and recommend the most optimal options, it turned out that seed germination and emergence of seedlings are proportional to the number of seeds sown. The beginning of vegetation (spring overgrowth) of plants in the second year of vegetation occurs at the end of April - beginning of May and coincides with the transition of daily temperatures from 8 to 10 degrees [5, 6]. The seeding rate of 5-6 kg of seeds per hectare of belladonna provides an optimal yield. According to the results of scientific research, it was noted that at a planting rate of 8-10 kg / ha, plants are denser, many plants in the field delay the transition to the generative phase and plant bushes interfere with each other in the growth process. According to our observations, it is noted that belladonnas enter the development phases simultaneously in all variants (Table 1)

Table 1: The yield of fruits and seeds of Atropa belladonna L. by maturity (2011-2019)

Harvest date (date)	Weight of wet fruits, g.	Number of seeds			
		From one plant	From one fruit	From one plant	From one fruit
First (27.07)	48,7±2,1	0,50±0,02	4,13±0,20	0,26±0,03	186±5,23
Second (03.08)	87,6±4,2	0,44±0,02	7,44±0,24	0,24±0,03	169±6,44
Third (10.08)	101,0±4,9	0,39±0,01	9,11±0,37	0,21±0,02	155±5,22
Fourth (17.08)	83,5±4,3	0,36±0,02	7,90±0,27	0,20±0,01	137±5,10

Thus, the seeds of *Atropa belladonna* L. collected at different times have different qualities. *Atropa belladonna L*. forms a combination of fruits, seeds and their fractions. To study their diversity, we collected fruits from five individual plants and divided them into the following fractions: with a small diameter - 0.9-1.2, with a medium diameter - 1.3-1.6 and large - 1.7-2.0 cm. Then the seeds were separated from the fruits of each fraction and the elements of the mass of the seeds and their yield were determined, corresponding to their unit weight.

In the total weight of the harvest, small fruits were found to be 19%, medium fruits 45%, and large fruits 36%. Plants of *Atropa belladonna L*. of the first generation, grown from seeds of a large fruit fraction, grew rapidly in the early stages of ontogeny, and were found to produce 15% more phytomass than a smaller fraction. Thus, the highest quality seed material is obtained from large belladonna fruits, which, in turn, ensures a high yield of raw materials and seeds.

The roots of *Echinops ritro L*. go very deep, so it is necessary to carry out autumn plowing to a depth of 27-30 cm. When the plant is planted or transplanted in early spring, the soil with a reserve of moisture provides the plant with a dry period and creates soil for the rapid growth and development of the plant. According to the results of our experiments, *Echinops ritro L*. does not require special coverage in the first year of planting, this year only periodic weeding in the field is strictly necessary.

CONCLUSION

Thus, during the years we observed, there were practically no significant differences in the potential and actual yields of seeds of plants grown under both conditions. The highest productivity factor was determined in sunny conditions. The adaptive adaptability is the highest in *Atropa belladonna L*., the plant has a high combined resistance to local climatic conditions, massively blooms and bears fruit, actively self-propagates vegetatively. *Echinops ritro L.* is estimated at 6 points, as a species that is also stable, regularly flowering and fruiting, but with a weak ability to self-disperse. Due to the fact that the plant is a perennial in seasonal flowering, flowering began late in the first year of vegetation, and in the second and third years of vegetation, it was found that the flowering period begins early and lasts until the end of the growing season.

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