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RESPONSE OF ANZUR ONION (ALLIUM STIPITATUM *REGEL)* TO EXTERNAL FACTORS AND ITS INTRODUCTION ASSESSMENT

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Abstract. This article evaluates the ecological characteristics of the Anzur onion, its adaptability to introduction under the conditions of the Tashkent oasis, and its vegetative and generative development indicators. Specifically, the plant's response to heat, moisture, drought, cold, light, and soil factors was analyzed, determining its mesophytic-xeromesophytic nature, frost resistance, and heliophytic properties. The results of the introduction assessment (a score of 4 points) are also presented. Furthermore, observations conducted in shaded, sunny, and natural environments revealed the plant's high viability under new conditions. The findings indicate relatively higher rates of leaf development, bulb mass gain, flowering, and seed production in sunny conditions. Ultimately, the data demonstrate that the Anzur onion adapts successfully to the Tashkent oasis and represents a promising species for introduction and propagation.

Keywords: Allium stipitatum Regel, Anzur onion, plant introduction, introduction assessment, adaptation, ecological factors, heliophyte, vegetative development, seed, generative development, bulb.

Extensive research is being conducted worldwide on conserving medicinal and essential oil plant species, adapting and cultivating them across various climatic and soil conditions, and widely introducing them as sources of raw materials. In particular, special attention is given to determining the agrobiological properties and phytochemical composition of the Anzur onion, investigating the genetic differences among its ecotypes, improving organic and biological cultivation methods, and conducting genome-level analyses of species used in

traditional medicine to develop biopharmaceutical products based on them.

The Anzur onion is a perennial ephemeroid medicinal plant of high biological and economic importance, possessing potent healing properties. Conserving its natural reserves and domesticating the plant require the development of effective seed production technologies. However, the presence of physiological dormancy in the seeds of this species, along with the high dependence of germination on environmental factors, serves as a major limiting factor in its propagation. Therefore, assessing the Anzur onion's response to external factors and its introduction potential is of both scientific and practical relevance [1].

The Anzur onion is a perennial mesophyte widely distributed across the mountain and foothill ecosystems of Central Asia. The species is evolutionarily adapted to a continental climate, and its adaptive mechanisms are clearly reflected in its morpho-anatomical and physiological features. In particular, its large bulb and well-developed, water-storing parenchymal tissues enable the plant to reserve water and nutrients outside the growing season. The species is highly cold-hardy and overwinters as an underground bulb. Because it efficiently utilizes spring moisture, its growing season begins early.

Conversely, during periods of summer drought and high temperatures, the aboveground organs dry up, and the plant enters a state of physiological dormancy. In open, well-lit areas, the species produces high biomass and undergoes active generative development. These characteristics serve as the primary adaptive traits ensuring the successful survival and spread of the Anzur onion in arid mountain ecosystems. Ecologically, the Anzur onion exhibits mesophytic traits, efficiently utilizing spring moisture and spending the summer drought in dormancy. The plant is a light-loving (heliophytic) species. In natural populations, its growth, biomass accumulation, and generative development reach their peak under high-light conditions [2, 3, 4].

The synergy between morpho-anatomical and ecological traits serves as a crucial adaptive factor for the successful survival and distribution of the Anzur onion in mountain ecosystems. The species' resilience to drought and cold, along with its high content of

biologically active compounds and nutrients, makes it a promising candidate for plant introduction and botanical research.

Table 1

Response to ecological factors

Factors	Description	Ecological Significance
Heat	Mesothermic plant	Optimal growth and development occur at temperatures between 15 and 25 °C. At higher temperatures, the growing season ends and dormancy begins.
Cold	Cold-hardy	Underground bulbs withstand low winter temperatures, allowing the growing season to begin in early spring.
Moisture	Mesophytic characteristics	Requires adequate soil moisture during the active growing season, though it is sensitive to excess moisture.
Drought	Xeromesophytic characteristics	Characterized by surviving dry periods as a dormant bulb and retaining water reserves.
Light	Heliophyte	High light intensity promotes strong photosynthetic activity and generative development.
Soil	Sierozem (gray soil)	Thrives in the sierozems and well-drained soils of mountainous and foothill regions.

The species was found to exhibit drought and frost resistance, photophilous properties, and high germination and sprouting rates in typical sierozem soils; consequently, it was concluded that these factors must be considered during plant introduction. During the introduction process, plant growth, development, yield, and tolerance to environmental factors were evaluated using scientifically grounded criteria. Introduction assessment typically accounts for plant life forms, ontogenetic stages, and agrotechnical requirements. This approach determines the degree to which species adapt to new agro-ecological conditions, as well as their practical value [5; pp. 9–58].

In research, synthesizing introduction results through analysis is a crucial step for the plant introducer. Generally, introduction assessment is used to evaluate how well plants grown under introduction conditions adapt to a new environment, their growth and developmental

characteristics, and the extent to which they retain traits valuable for economic use [6; pp. 5–79, 7; pp. 3–9].

The introduction, germination, sprouting capacity, seasonal and phenological development, and adaptation of the Anzur onion require a dedicated study of its key characteristics. As noted in the literature, it is crucial during plant introduction evaluation to examine the various life forms of plants, their ontogenetic stages, and their adaptability to ecological conditions. The methodological approaches developed for this purpose currently serve as the primary scientific criteria in plant introduction research.

N.A. Bazilevskaya conducted research aimed at determining the potential for adapting plants to new conditions based on their life forms and developmental stages [8; pp. 169–189]. Furthermore, N.A. Avrorin investigated approaches to assessing plant tolerance to ecological factors during the introduction process [9; pp. 3–286]. The studies by P.I. Lapin and S.V. Sidneva, which focused on establishing the theoretical and practical foundations of introduction evaluation, are of particular significance [10; pp. 7–67]. A specially tailored evaluation scale for medicinal plants was developed by Yu.M. Murdakhayev, who examined plant adaptability in relation to their floristic range, life form, and ecogeographical distribution characteristics [12; p. 76].

B.E. Tukhtaev, meanwhile, thoroughly studied the introduction of 111 medicinal plant species in the saline-soil areas of Uzbekistan's Syrdarya and Bukhara regions. He developed a 100-point assessment scale based on their response to moisture, tolerance to high and low temperatures, and ability to reproduce under natural conditions [11; p. 38].

The scale developed by G.N. Andreev for evaluating the introduction results of annual plants is based on their developmental characteristics during the growing season, seed-producing capacity, and the completion of all phenological stages. In this context, the effectiveness of herbaceous plant introduction is assessed based on their life forms [13; p. 166]. Furthermore, through the methodological approach proposed by B.A. Golovkin, a specific scale is applied to evaluate the introduction results of perennial herbaceous plants [14;

p. 266].

The introduction assessment of the Anzur onion was conducted using the 6-point eco-introduction scale proposed by I.V. Belolipov (1976). This 6-point scale developed by I.V. Belolipov features a unique scientific and practical approach, where the primary criteria are the degree of a plant's adaptation to a new environment and its reproductive characteristics. Known as the "Eco-introduction Assessment," this methodology was developed and put into practice by I.V. Belolipov at the Botanical Garden [5; pp. 9–58]. The scale is defined by the following indicators:

5 points - species that adapt quickly to new conditions while posing a risk of spreading widely as weeds;

4 points - species that complete all stages of ontogenesis, propagate easily by seed, and require no special agrotechnical measures;

3 points - species that bloom and produce seeds annually, but do not propagate regularly by seed and can only be maintained through agrotechnical practices;

2 points - species that either fail to produce seeds or yield seeds of low viability, propagating mainly vegetatively;

1 point - species whose reproductive activity has ceased, yet are capable of surviving in natural conditions for three years or more;

0 points - species that fail to grow at all in new conditions or die off completely after the first growing season.

Table 2

Eco-introduction assessment of the Anzur onion according to I.V. Belolipov's scale

№	Score	Description	Level of Adaptation	Biological Development
1	**5**	Risk of becoming a weed (self-propagates)	Not applicable	The plant does not spread uncontrollably on its own; it is maintained under anthropogenic management. Therefore, there is no risk of it becoming a weed. Controlled propagation is

				observed.
2	**4**	Undergoes complete ontogenesis, easily reproduces by seed, and requires no agrotechnical care	Applicable	*Allium stipitatum Regel* as a perennial ephemeroid plant, passes through all stages of ontogenesis, has high seed germination rates, and grows successfully under standard agrotechnical conditions.
3	**3**	Produces seeds, but does not reproduce from seed every year	Partially applicable (reproduces every year, but does not produce seeds)	*Allium stipitatum Regel* seeds germinate annually at high rates, yet the plant does not produce seeds. This description is a partial match.
4	**2**	Flowers, but does not produce seeds or reproduces only vegetatively	Not applicable	The plant is capable of producing seeds; it does not reproduce solely by vegetative means.
5	**1**	Does not reproduce, but survives	Not applicable	Does not fit this category due to its ability to reproduce
6	**0**	Fails to grow at all, or dies after surviving for one year	Not applicable	In the Tashkent oasis and other regions, the plant grows successfully and its seeds reach maturity.

Applying the methodology proposed by I.V. Belolipov et al. enables a comprehensive analysis of the Anzur onion's adaptability, developmental activity across phenological phases, yield levels, stress resistance, and reproductive potential. Therefore, using these approaches in the eco-introduction assessment of the Anzur onion enhances the reliability of scientific results and serves to more fully highlight its practical significance.

When agrotechnical practices were applied to the Anzur onion plant, it demonstrated stable development, full completion of ontogenetic stages, an absence of significant anomalies during the growing season, and the capacity for natural self-propagation through seed shedding. Based on these biological and ecological-phenological characteristics, this species

scored 4 points on I.V. Belolipov's 6-point eco-introduction assessment scale. This indicates that the plant adapts well to introduction conditions and holds high practical value.

To analyze the plant's adaptability to the introduction environment, experiments were conducted in both shaded and sunny conditions, and the observational results were compared with those from its natural habitat. This provides us with a reliable basis for accurately assessing the plant's introduction. Based on these indicators, the growth, development, and generative characteristics of the bulbs in shaded and sunny environments were evaluated in comparison with plants growing under natural conditions. The research findings revealed that plant survival rates were high in both environments, and the sprouting of bulbs across all planted variants occurred within nearly the same timeframe. This confirms that the introduction conditions are favorable for this species.

Although the onset and duration of the growing season in both shaded and sunny environments closely mirrored those in the natural habitat, certain differences in growth rates were observed. While vegetation in natural conditions began on January 25, this process started relatively later in the introduced plants, in early February. In terms of vegetative growth indicators—specifically leaf length, leaf count, and bulb weight—plants in the sunny environment outperformed those in the shade. This is attributed to sunlight accelerating photosynthesis, which positively impacts the accumulation of organic matter. Conversely, while vegetative growth was sustained in the shaded environment, certain morphometric parameters were slightly lower than in the sunny variant. An analysis of generative development revealed that the sunny environment yielded the best results regarding the total number of flowers, the number of seed-producing flowers, and the formation of new bulbs.

At the same time, generative organs formed even in the shaded environment, preserving the plant's reproductive capacity. Under natural conditions, certain metrics—specifically total bulb weight and the duration of the growing season—remained relatively stable, demonstrating the species' adaptation to its native ecological environment. Overall, the research findings confirm that the introduced plants have successfully adapted to the new

ecological conditions. The sunlit environment proved most favorable for the plant's vegetative and generative development, positively impacting flowering, seed production, and bulb mass accumulation. Meanwhile, the shaded environment maintained the plant's viability and supported vegetative growth, though yield metrics were comparatively lower.

Thus, it was established that under introduction conditions, an open, sunlit site provides the optimal environment for the bulb to more fully express its biologically and economically valuable traits. In the conditions of the Tashkent Oasis, the Anzur onion was assessed as a low-maintenance perennial plant that completes all stages of morphogenesis and propagates effectively via both seeds and bulbs. These characteristics demonstrate its high adaptability to introduction conditions, highlighting the species' potential as a promising medicinal plant.

Instances of various diseases also occur during the cultivation of the Anzur onion. When growing the plant in an introduced environment, severe disease and pest infestations are not typically observed. However, certain diseases may develop during the growing season. Among fungal diseases, downy mildew (peronosporosis) is particularly common. The susceptibility of introduced plants to diseases and pests in a new floristic region depends on humidity, temperature, and other external factors.

Downy mildew (peronosporosis). Downy mildew is one of the fungal diseases that affects the leaves of the Anzur onion. The initial symptoms of the disease appear as light green or yellowish spots on the leaves. In cool, humid conditions, a grayish-purple mold forms on the leaf surface. As the disease progresses, the leaves may turn yellow, wilt, and dry out.

Control Measures. To prevent the disease, it is recommended to use healthy planting material, avoid overcrowded planting, prevent overwatering, and remove infected plant debris from the field. If disease symptoms appear, fungicides approved for the respective crops should be applied in accordance with current application guidelines. When applying these products, it is essential to strictly adhere to the application rates, treatment timing, and pre-harvest intervals. For disease prevention, spraying with a 1% Bordeaux mixture or the Topaz preparation (100 ml/ha) is highly effective. Spraying is carried out once the Anzur onion

leaves have fully emerged. The treatment is applied three times a week, i.e., every other day. The plants are then monitored for 7–10 days. If positive results are observed in the plants during this period, the treatment is considered sufficient. However, if disease symptoms reappear, the treatment process is repeated.

To help the plants recover after the disease, a single spray of Unum solution is applied (15 ml/ha suspension). Implementing these preventive and curative measures in a timely manner and according to established standards reduces the risk of disease spread in Anzur onions, helps maintain stable vegetative growth, and accelerates the post-damage recovery process.

CONCLUSIONS

1. It was established that when introduced to the conditions of the Tashkent oasis, the Anzur onion (Allium *stipitatum* Regel) exhibits high survival rates and stable development, successfully completing the main stages of ontogenesis.

2. An evaluation of the ecological characteristics of the species revealed that it is a cold-hardy, heliophilous plant that requires sufficient moisture during its active growing season and is adapted to surviving the summer drought dormant as an underground bulb.

3. Based on I.V. Belolipov's eco-introduction assessment scale, the Anzur onion scored 4 points; it was found that under introduction conditions, the plant develops fully, propagates via both seeds and bulbs, and does not require complex agricultural practices.

4. In plants grown in sunny conditions, leaf development, bulb mass gain, flowering, and seed production rates were higher compared to those in a shaded environment, demonstrating that high light intensity positively affects both the vegetative and generative development of the species.

5. The obtained results demonstrated that the Anzur onion can adapt to the agro-ecological conditions of the Tashkent oasis, retain its biologically and economically valuable traits, and holds potential for propagation as a promising introduced medicinal plant.

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