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Article

Propagation Prospects and Morphobiological Characteristics of Anzur Onion (*Allium stipitatum* Regel)

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Abstract: Laboratory and field experiments were conducted to evaluate different cultivation practices for growing anzur onion (*Allium stipitatum* Regel) from bulbs and seeds. Taking into account the biological and ecological characteristics of the species, the study assessed seed germination and plant development and examined methods of vegetative propagation from bulbs and sexual propagation from seeds. The results of these experiments are presented.

Keywords: anzur onion (*Allium stipitatum* Regel), vegetative propagation, seed propagation, cultivation practices, vegetative organs, bulb, aboveground parts, belowground parts.

Introduction

The propagation of onions under different soil conditions has been studied worldwide as an important agricultural issue. Anzur onion (*Allium stipitatum* Regel) is a wild species with a long history of medicinal use. Its use in traditional medicine dates back centuries, and it has traditionally been used to treat more than 40 ailments. Anzur onion has also received attention in efforts to conserve biodiversity, protect native flora, and promote the sustainable use of plant resources [1].

According to a global biodiversity assessment by the United Nations Environment Programme (UNEP), more than 30,000 plant species are threatened with extinction due to various factors. This underscores the need to identify and conserve wild medicinal plants, particularly rare and declining species, establish plantations for their cultivation, and develop methods for processing them [2].

In recent years, reforms have focused on conserving medicinal plants, promoting the sustainable use of natural resources, establishing plantations for medicinal plant cultivation, and developing processing capacity. Of the more than 4,300 plant species in the country's flora, 750 are considered medicinal. Of these, 112 have been registered for use in conventional medicine, and 70 of the registered species are currently used in the pharmaceutical industry. In 2019, exports of processed medicinal plant products amounted to USD 48 million. Analyses indicate a need to strengthen medicinal plant conservation and develop a value chain that generates added value through plantation cultivation and processing [3].

Medicinal plants differ in which parts are used and for what purposes. Both aboveground and belowground parts, including flowers, fruits, leaves, stems, roots, bark, tubers, and bulbs, are used in remedies for a range of ailments [4].

Bulbous plants are considered here in three groups according to their uses and properties: ornamental, edible, and medicinal and aromatic plants. Onions and other edible bulbous plants are common in the traditional Uzbek diet. They are widely used in cooked dishes and salads and, more recently, in beverages. Common onion and garlic, in particular, are staples of the daily diet. Research is now exploring methods for propagating anzur onion (*Allium stipitatum* Regel) to diversify the diet and help meet demand for natural food products. Anzur onion has been reported to have twice the medicinal activity of garlic [5], [6].

Materials and Methods

Anzur onion (*Allium stipitatum* Regel) reproduces vegetatively through bulbs and sexually through seeds. Its seeds are black, with a rough seed coat enclosing a white embryo. The seeds mature in late May to early June. Under natural conditions, wind dislodges the mature seeds from the flowering stalks, and the seeds fall to the ground. In mountainous habitats, windblown soil and trampling by animals can cover the seeds with soil. Fully mature, well-filled seeds remain beneath the soil surface through the summer heat and winter cold, then germinate and emerge in early spring.



Fig. 1. Seeds and Seed Mass of Anzur Onion (*Allium stipitatum* Regel)

Seed yield and quality are key considerations when propagating plants from seed. Regardless of the intended use of the crop, both crop yield and quality depend in part on the use of seed that meets established quality standards. Anzur onion (*Allium stipitatum* Regel) can be propagated from seeds or vegetatively by dividing the bulbs.

When propagating anzur onion from seed, its prolonged seed dormancy must be taken into account. Presowing treatments include mechanical scarification of the hard seed coat with sandpaper, cold storage, and heat treatment. To account for this dormancy, seeds are either sown before winter or kept in cold storage before sowing.



Fig. 2. Anzur onion (*Allium stipitatum* Regel) plants grown from seed

The seeds of anzur onion (*Allium stipitatum* Regel) have a rough, black seed coat and a white interior. They measure 2.5–4.0 mm in length and 2.0–3.5 mm in width. Peak flowering occurs in April, and the seeds reach full maturity in late May to early June. The reported thousand-seed mass is 6.5–7 kg. Seed mass is associated with bulb and umbel size, and large, healthy bulbs produce healthy seeds. Seed quality standards specify criteria such as seed purity, seed fill, and the absence of disease and mechanical damage.

Results

Laboratory experiments showed that anzur onion (*Allium stipitatum* Regel) seeds germinated after exposure to both warm and cold conditions. Studies on other *Allium* species have similarly reported that thick-coated seeds germinate only after experiencing summer heat and winter cold in the soil. In repeated laboratory trials, seed germination was evaluated under different germination media, temperature regimes, and mechanical and chemical treatments. Of the four treatment variants tested in a temperature-controlled incubator, two yielded germination percentages of 87–90%.



Fig. 3. Laboratory Assessment of Seed Germination in Anzur Onion (*Allium stipitatum* Regel) for Seed Propagation

During laboratory germination tests, seed damage, disease, dormancy, a dry germination substrate, and unsuitable microclimatic conditions were identified as possible reasons for failure to germinate. Before the tests, the interior of the incubator was wiped with alcohol-moistened cotton in accordance with the standard procedures for seed germination testing. The incubator door was then left open for 2 h to allow the interior to dry. The Petri dishes and forceps were also cleaned and dried.

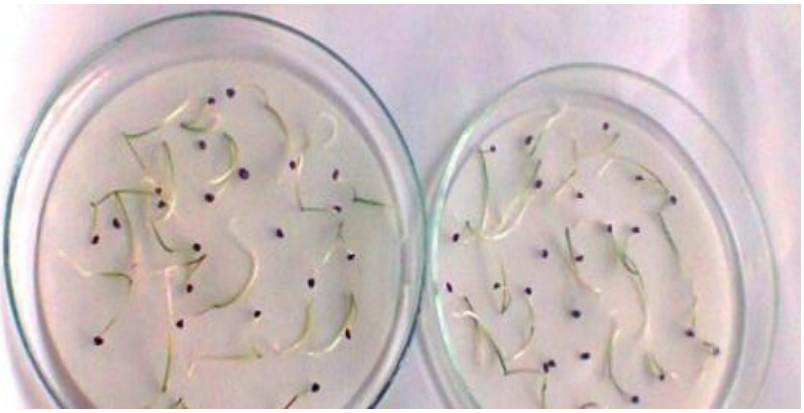

Fig. 4. Laboratory Evaluation of Seed Germination in Anzur Onion (*Allium stipitatum* Regel)

Anzur onion (*Allium stipitatum* Regel) naturally develops small bulbs during its first two years of growth. The initial bulbs and offsets separated from three- to five-year-old plants range from 1 to 4 cm in diameter. Anzur onion requires ample light and grows poorly under excessively wet conditions. The bulbs are usually planted before winter, at the same time as winter garlic, which allows them to establish roots before cold weather sets in. Care should be taken to avoid damaging newly formed roots during planting. The bulbs are planted 20 cm apart. Depending on bulb size, the planting depth is 12–15 cm, measured from the soil surface to the top of the bulb. If planted too shallowly, the bulbs may become exposed at the soil surface.



Fig. 5. Growth and Development of Anzur Onion (*Allium stipitatum* Regel)

Secretory structures were observed in the bulbs, leaves, and flowers of anzur onion (*Allium stipitatum* Regel). The species yields well in loose, nutrient-rich soils, where it forms large, smooth bulbs. It tolerates cold winters, severe frost, shade, and drought, but grows poorly in excessively wet soils. The leaves are flat and broad, measuring 30–60 cm in length. Leaf blade shape varies among the species compared. Anzur onion has the broadest, elliptic leaf blades, while giant onion has the narrowest, strap-shaped blades. A distinctive feature of anzur onion is a short pseudostem formed by the leaf sheaths. This feature was absent in the other species compared. Each plant produces a single flowering stalk (scape) that reaches 50–180 cm in height, depending on plant age and mass.

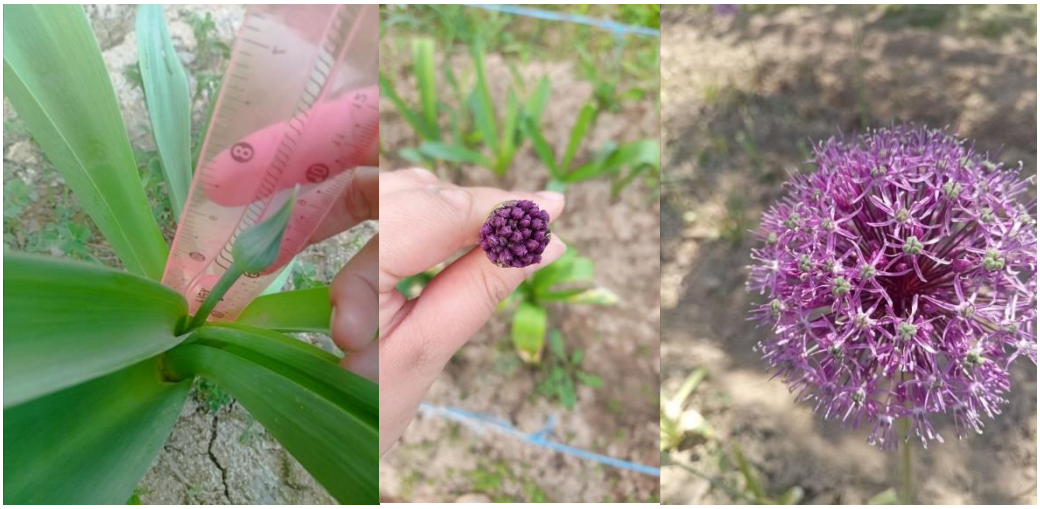

Fig. 6. Growth and Development of Anzur Onion (*Allium stipitatum* Regel)

The flowers of anzur onion (*Allium stipitatum* Regel) are borne in spherical or hemispherical umbels. Each plant has four to six sessile, thick, strap-shaped leaves measuring 30–40 cm in length and approximately 4 cm in width. The leaves are green, and the flowers are purple or white. The plant completes its aboveground growth, flowering, and seed production within approximately three months. Bulb shape and size and the white to cream coloration of the dry and fleshy bulb scales are characteristic features of anzur onions.

Anzur onion forms large, flattened, rounded bulbs. Firm, pink shoots emerge from beneath the snow in spring and turn green as they develop. Depending on the species, mature leaves may be broad and elliptic or long, linear, and pointed. The bulbs are lifted in June, when the leaves begin to wither rapidly. They are then dried thoroughly and stored until autumn. Before planting, the bulbs are divided into segments in the same manner as garlic and immediately planted in their final growing location. Cabbage, potato, and cucumber are suitable preceding crops. Anzur onion requires little special care, and irrigation is applied during prolonged periods without rainfall.



Fig. 7. Bulb Dimensions of Anzur Onion (*Allium stipitatum* Regel)

The growth, development, and yield of anzur onion (*Allium stipitatum* Regel) were studied under mountainous conditions. The study examined the timing of phenological stages, the development of leaves, stems, and roots, the daily and seasonal patterns of flowering, and potential and actual seed productivity. A comparative assessment was made of key plant water relations parameters and the rates of photosynthesis and respiration. Plant yield and phytochemical composition were also determined. A cultivation protocol was developed for the species.

Anzur onion (*Allium stipitatum* Regel) is traditionally consumed for its purported immune-supporting properties. The mature bulbs are consumed after processing. The leaves and underground parts contain a range of compounds, including vitamins, minerals, essential oils, sugars, alkaloids, and saponins.

Discussion

A plot was allocated to the Department of Medicinal Plants at the Research and Production Experimental Station of Tashkent State Agrarian University. The experimental treatments and replicates were arranged systematically within the plot, following Dospekhov's recommendations for field trial layout [7].

Table 1. Field Layout of the Experimental Treatments

Treatment	1	2	3	4	Irrigation supply ditch	5	6	7	8	Irrigation supply ditch	9	10	11	12	Irrigation supply ditch	13	14	15	16
	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
	4	3	2	1		2	3	4	1		3	4	1	2		2	4	1	3
	3	2	1	4		3	4	1	2		4	1	2	3		3	1	4	2
	2	3	4	1		4	1	2	3		2	3	4	1		4	3	2	1
Replicate	I					II					III					IV			

Table 2. The bulbs were planted according to the layout shown below

№	Treatments				Rows
1	Treatment No. 1 (Control)	Treatment No. 2 (Chemically Treated Bulbs)	Treatment No. 3 (Bulbs Cut into Two Equal Halves through the Bud Region and Planted)	Treatment No. 4 (Delayed Bulb Planting)	I
2	Treatment No. 4 (Delayed Bulb Planting)	Treatment No. 1 (Control)	Treatment No. 2 (Chemically Treated Bulbs)	Treatment No. 3 (Bulbs Cut into Two Equal Halves through the Bud Region and Planted)	II
3	Treatment No. 3 (Bulbs Cut into Two Equal Halves through the Bud Region and Planted)	Treatment No. 4 (Delayed Bulb Planting)	Treatment No. 1 (Control)	Treatment No. 2 (Chemically Treated Bulbs)	III
4	Treatment No. 2 (Chemically Treated Bulbs)	Treatment No. 3 (Bulbs Cut into Two Equal Halves through the Bud Region and Planted)	Treatment No. 4 (Delayed Bulb Planting)	Treatment No. 1 (Control)	IV

Table 3. The seeds were sown according to the experimental layout shown below

№	Treatments				Rows
1	Treatment No. 1 (Control)	Treatment No. 2 (Seeds Mechanically Scarified with Sandpaper)	Treatment No. 3 (Seeds Stored under Cold Conditions Before Sowing)	Treatment No. 4 (Seeds Exposed to Warm Conditions Before Sowing)	I

2	Treatment No. 4 (Seeds Exposed to Warm Conditions Before Sowing)	Treatment No. 1 (Control)	Treatment No. 2 (Seeds Mechanically Scarified with Sandpaper)	Treatment No. 3 (Seeds Stored under Cold Conditions Before Sowing)	II
3	Treatment No. 3 (Seeds Stored under Cold Conditions Before Sowing)	Treatment No. 4 (Seeds Exposed to Warm Conditions Before Sowing)	Treatment No. 1 (Control)	Treatment No. 2 (Seeds Mechanically Scarified with Sandpaper)	III
4	Treatment No. 2 (Seeds Mechanically Scarified with Sandpaper)	Treatment No. 3 (Seeds Stored under Cold Conditions Before Sowing)	Treatment No. 4 (Seeds Exposed to Warm Conditions Before Sowing)	Treatment No. 1 (Control)	IV

Crop yield depends on several factors, including site selection, water and fertilizer management, sowing rate, sowing date, and cultivation practices [8]. Even when these factors are well managed, the crop may fall short of the expected yield if the seed fails to meet the required quality standards [9].

Table 4. Table. Field Observations of Anzur Onion (*Allium stipitatum* Regel)

Sample	**In the Field**						
	Sowing date	Emergence date	After 10 days	After 15 days	After 20 days	After 25 days	After 30 days
Grown from seed	05.11	20.02.	2 cm	4 cm	6 cm	10 cm	14 cm
Number of leaves	05.11	1 leaf	2 leaf	3 leaf	4 leaf	6 leaf	8 leaf
Leaf length	05.11	0,5 cm	4 cm	5 cm	7 cm	12 cm	17 cm

Anzur onion (*Allium stipitatum* Regel) is a perennial bulbous plant that can grow in the same location for up to 10 years while retaining its characteristic biological traits. It forms a globose bulb whose characteristics vary with plant age [10]. Roots emerge from the base of the bulb and absorb water and nutrients from the soil. Anzur onion resembles garlic in several respects [11]. It reaches maturity in late May, after which the leaves and stems dry rapidly. Dormancy begins in late June and continues until the following spring. Anzur onion is valued for its early flowering, alongside tulips and saffron crocuses, and for its potential health benefits [12].

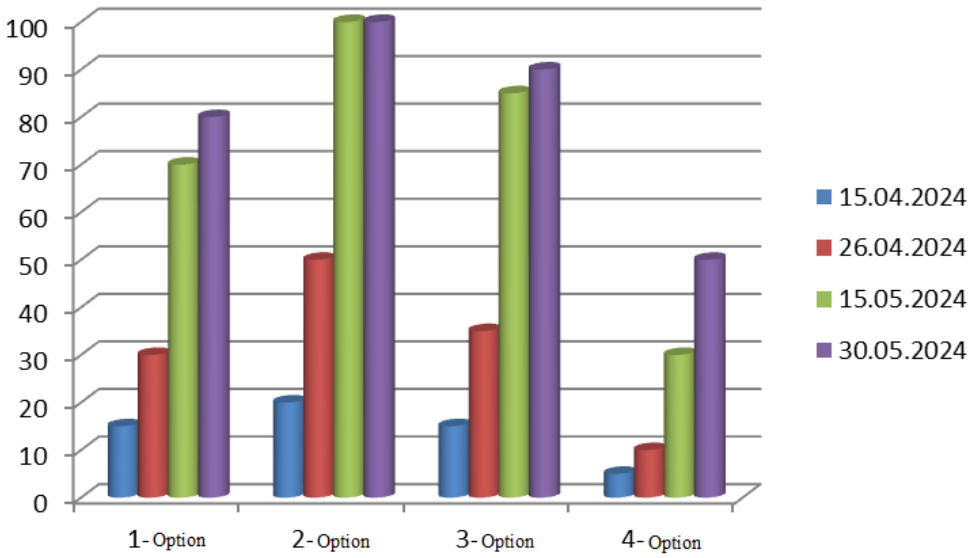

Fig. 8. Inflorescence Development in Anzur Onion (*Allium stipitatum* Regel)

Inflorescence development in anzur onion (*Allium stipitatum* Regel) was assessed under four experimental treatments in April and May. As shown in Figure 8, plants in Treatment 2 showed better inflorescence development than those in the other treatments [13].

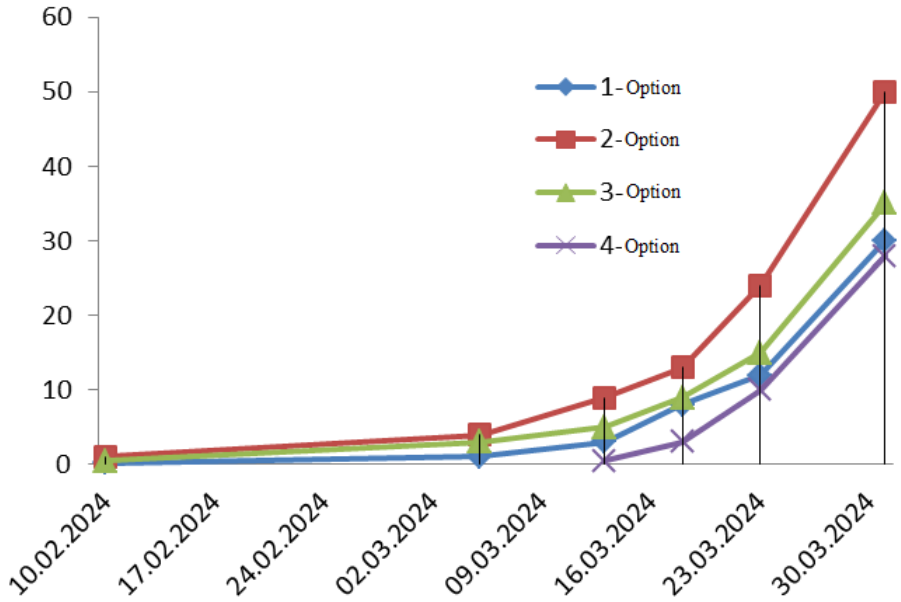

Fig. 9. Onset of Vegetative Growth in Anzur Onion (*Allium stipitatum* Regel)

Anzur onion (*Allium stipitatum* Regel) was grown under four experimental treatments with four replicates. Observations during the growing season focused on reproductive development. The recorded variables included flower and umbel formation, the timing of first flower opening and full bloom, the number of flowers per umbel, and the timing of seed formation and maturation. At maturity, the total number of seeds per umbel was recorded, and the minimum and maximum counts were determined. Filled and unfilled seeds were counted separately [14].

Anzur onion occurs mainly in mountainous and foothill regions of Asia, including areas of Uzbekistan, Tajikistan, Iran, and Pakistan where growing conditions are suitable. When introducing the species to a new locality within Uzbekistan, selecting a site with conditions similar to those of its natural habitats can help the plants establish and develop [15].

Conclusion

In the field trials, anzur onion (*Allium stipitatum* Regel) seeds sown in late October or early November showed good emergence, whereas spring-sown seeds failed to emerge. The results indicate that autumn sowing favors field emergence by allowing the seeds to overwinter in the soil.

Seed germination was assessed under laboratory conditions, and seedling emergence was evaluated in the field. Before field sowing, the soil was prepared according to standard agronomic practices. Sowing 100 seeds per furrow and covering them with a layer of sand supported seedling development.

Throughout the field trials, irrigation rates, weed control, and plant development were monitored. The observations highlighted the importance of timing agronomic operations to match the developmental stages of anzur onion.

Row sowing in the open field in late October or early November reduced the amount of seed required. Under the conditions of the Tashkent Oasis, field trials indicated that this period favored seedling emergence from seed and shoot emergence from bulbs that had completed their previous growing season.

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