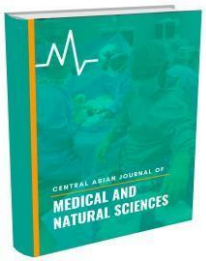

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Article

Effect of Storage Duration on The Germination of *Tetradium Daniellii* Seeds Under Andijan Conditions

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Abstract: This article investigates the influence of storage duration on the germination of *Tetradium daniellii* seeds. Experimental results showed that as the storage period increased, the germination rate consistently decreased. The lowest germination rate, 8%, was observed in seeds stored for three years. The study scientifically confirmed that extended storage negatively affects the biological activity of *T. daniellii* seeds. According to the results, seeds stored for one year demonstrated the highest germination rate, reaching 46.6%. The seed's placement within the soil determines how well it can access air, moisture, and temperature. For this reason, the experiment also examined three different sowing depths: 0.5–1.0 cm, 1.0–1.5 cm, and 1.5–2.0 cm, and the results are presented accordingly.

Keywords: Agrometeorological Conditions, Korean Evodia, Stratification, Seed Viability Index, Germination Energy, Thermal Treatment, Germination, Initial Emergence Time

1. Introduction

To investigate the dependence of Tetradium daniellii seed germination on storage duration, laboratory experiments were conducted in October 2022 using seeds collected from the Tashkent Botanical Garden. The experiments included three variants based on seed storage periods: 1 year, 2 years, and 3 years.

After harvesting, the seeds were stratified and stored in a refrigerator until the start of the experiments. For the second and third-year experiments, seeds were stored in a dry, dark, and well-ventilated environment for two years. Germination tests were conducted from 2023 to 2025, beginning when the ambient temperature exceeded 25°C. During these years, the temperature exceeded 25°C around the second decade of April.

2. Materials and Methods

Field trials to determine the germination of 1-year-old seeds were performed in April 2023, 2-year-old seeds in April 2024, and 3-year-old seeds in April 2025. Prior to sowing in all experiments, seeds underwent pre-treatment by soaking in water at 40°C for 24 hours.

3. Results

The results showed a clear decline in seed germination with increased storagee time. The lowest germination rate, 8%, was recorded in seeds stored for three years. Initial seed emergence took 12–14 days, and complete germination (8%) was observed after 27–30

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days. Seeds stored for two years showed only 14.4% germination, with initial emergence occurring within 8–10 days and complete germination after 24–25 days. The highest germination rate (46.6%) was observed in 1-year-old seeds, with initial emergence within 4–5 days and full germination by 20–22 days, see Table 1.

Table 1. Effect of Storage Duration on Seed Germination of Tetradium daniellii (2023-2025)

Storage Duration	Germination (%)	Initial Emergence Time (days)	Complete Germination Time (days)
1 year	46,6%	4–5	20–22
2 year	14,4%	8–10	24–25
3 year	8%	12–14	27–30

The Negative Impact of Prolonged Storage Duration on the Viability of Tetradium daniellii Seeds Is Scientifically Established. According to experimental results, seeds stored for one year demonstrated the highest germination rate (46.6%), with initial sprouting occurring within 4–5 days and the germination period lasting 20–22 days. Seeds stored for two years showed a decreased germination rate of 14.4%, with prolonged initial sprouting time (8–10 days) and a germination period of 24–25 days. The lowest germination rate, 8%, was observed in seeds stored for three years, with a germination period extending to 27–30 days. These data indicate that as the storage duration of seeds increases, their physiological activity diminishes, leading to a loss of germination capacity. Furthermore, it was found that sowing Tetradium daniellii seeds within one year is advisable to achieve rapid and high germination rates.

Although sowing time is not classified as an ecological factor, it significantly influences the physiological maturation process of seeds, their size, quantity, and quality indicators [1], [2], [3]. Therefore, selecting the correct sowing date in various soil-climate conditions plays a crucial role in maximizing seed quality [4], [5], [6]. Several scientific studies investigating the effect of seed developmental stages on quality have identified sowing time as one of the key factors [2], [7], [8], [9].

During the research, experiments were conducted to study the effect of sowing dates and sowing schemes on the viability, growth, and development of Tetradium daniellii. Seeds, stratified from October 2022 until the second decade of March 2023, were soaked in water at 40°C for 24 hours one day prior to sowing. Sowing was performed in three different periods: early (March 15), medium (April 15), and late (May 15).

The experimental results indicated that the sowing date significantly affected the physiological activity, germination speed, and overall growth dynamics of Tetradium daniellii seeds (Table 2).

During the early sowing period (March 15), the soil and air temperatures were relatively low (approximately 15–20°C), causing the physiological reaction of seeds to proceed slowly. As a result, germination began 5–6 days after sowing. Under these conditions, germination energy was 12%, total germination rate was 25.3%, and the viability index was 19%. Observations revealed that some of the emerging seedlings ceased development or grew weakly. This was attributed to the low temperature's suppressive effect on metabolic processes and a reduced water absorption activity. Therefore, stable growth was not ensured during this sowing period, and asymmetric growth patterns were observed in the plants.

Table 2. Effect of Sowing Dates on Germination and Viability of Tetradium daniellii Seeds

Sowing Date	Germinination Time	Germination Energy (%)	Germination (%)	Viability (%)	Notes
15 March	5–6 days	12%	25,3%	19%	Low temperature, slow development, asymmetry
15 April	3–4 days	46%	59,1%	52%	Optimal conditions, high stability, symmetry
15 May	2–3 days	52%	61,8%	22%	High temperature, rapid growth, low viability

The sowing on April 15th coincided with the most favorable agrometeorological conditions for the germination and other indicators of the seeds. The soil temperature was about 24–25 °C, and the seeds began to germinate within 3–4 days. Germination energy reached 46%, total germination was 59.1%, and viability was 52%. These indicators clearly show that during the April sowing period, seedlings not only germinated quickly and uniformly, but most of them continued to develop well under cultivation conditions, resulting in high viability. From a morphological standpoint, this group also demonstrated symmetrical development, meaning balanced structure, leaf size, and stem growth. Therefore, this period was identified as the optimal time with the highest biological efficiency.

On May 15th, the late sowing period, the temperature rose to 30 °C. Seeds began germinating within 2–3 days, germination energy was 52%, total germination reached 61.8%, and viability was only 22%. Although the germination rate was high, many seedlings quickly withered and stopped developing or died at later stages. This condition was related to the high temperature causing physiological stress to the seedlings. Additionally, morphological asymmetry was noted during development, such as bending of the stem, uneven leaf formation, and a higher demand for care. As a result, although the temperature accelerated growth and increased germination, it decreased viability. Thus, late sowing under high temperature conditions increased germination but led to decreased seedling survival.

One of the important factors influencing the development of Tetradium daniellii seeds is the depth at which they are planted in the substrate. Since Tetradium daniellii (Benn.) T.G.Hartley seeds exhibit epigeal germination, a relatively shallow planting depth is required. However, planting the seeds too shallowly can slow the stratification process.

Typically, the planting depth of any plant seed is determined based on its size; it is considered optimal to plant seeds at a depth about three times their size. However, precise conclusions require experimental determination.

The position of the seed in the soil determines to what extent it is supplied with air, moisture, and temperature. For this reason, the experiment considered three planting depth variants: 0.5–1.0 cm, 1.0–1.5 cm, and 1.5–2.0 cm.

The size of Tetradium daniellii seeds ranges from 2.4 to 4.0 mm, with most seeds approximately 2.8–3.0 mm in size. Based on seed size, germination rate, germination

energy, total germination, and viability were evaluated for the above planting depth variants (Table 3).

Relatively shallow placement of seeds, i.e., at a depth of 0.5–1.0 cm, ensures faster access to moisture and air. In this variant, seeds germinated within 2–3 days. Due to the rapid germination, growth and development proceeded evenly. In the experiment, this planting depth showed 55% germination energy, 63% total germination, and 72% viability.

Table 3. Effect of Planting Depth on Germination and Viability of Tetradium daniellii Seeds

Planting Depth (cm)	Germination Time	Germination Energy (%)	Germination (%)	Germination (%)	Notes
0.5 – 1.0	2–3 days	55%	63%	72%	Seeds germinated quickly and uniformly; growth was rapid and stable
1.0 – 1.5	4–5 days	46%	59%	52%	Growth was slow due to lack of air, but results are acceptable
1.5 – 2.0	7–8 days	18%	42%	15%	Seeds germinated late; asymmetric seedlings observed; growth was slow

Seeds placed slightly deeper in the soil (1.0–1.5 cm) germinated within 4–5 days. Although moisture was well retained at this depth, the growth rate slowed somewhat due to insufficint air supply to the seeds. Under these conditions, germination energy was recorded at 46%, germination at 59%, and viability at 52%. If temperature and moisture are optimal, this depth can ensure stable growth.

4. Discussion

When seeds were planted deeper, germination time extended up to 7–8 days. As a result, germination energy dropped to 18%, germination to 42%, and viability to only 15%. Deep planting not only delays germination but also negatively affects the number and quality of growing plants, causing asymmetric seedlings to appear.

The most effective planting depth for Tetradium daniellii seeds is considered to be between 0.5 and 1.0 cm. At this depth, germination is rapid, development is complete, and plants form symmetrically. Planting at 1.0–1.5 cm depth may be acceptable depending on conditions, but its efficiency is lower than the shallower depth. The deepest planting variant—1.5–2.0 cm—reduces overall growth indicators and significantly decreases seed viability. Therefore, as an agrotechnical recommendation, placing seeds relatively close to the surface is considered advisable.

5. Conclusion

In conclusion, it can be stated that planting in the second decade of April resulted in seedlings that germinated quickly and uniformly, leading to high viability. From a morphological standpoint, this planting period showed symmetrical development, with

balanced structure, leaf size, and stem growth. Hence, this period was determined to be the most biologically effective and optimal. Thus, based on experiments, planting Tetradium daniellii seeds at a depth of 0.5–1.0 cm in the second decade of April is scientifically substantiated as the best practice.

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