THE EFFECT OF GREENHOUSE AND FIELD CONDITIONS ON THE GERMINATION OF ASTRAGALUS KNORRINGIANUS SEEDS

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Annotation: *This article presents the results of experiments on the seed germination of the rare plant species Astragalus knorringianus, which is included in the Red Data Book of the Republic of Uzbekistan. The study was conducted under greenhouse and field conditions, analyzing seed germination rates, biological activity, and responses to ecological factors. The obtained results are of great importance for developing strategies for the artificial propagation and reintroduction of rare plant species into their natural habitats.*

Keywords: *Astragalus knorringianus, rare species, seed germination, scarification.*

Introduction

Germination is the process in which the embryo inside a seed becomes active and develops into a new seedling [1]. Seed germination is a complex process that involves a series of biochemical, physiological, and morphological changes. For a seed to germinate, its embryo must be alive, and there should be no physiological or chemical barriers that restrict germination. In addition, adequate moisture, optimal temperature, oxygen, and for some plant species sufficient light are essential factors for successful germination [2]. Most *Astragalus* seeds possess physical dormancy. When mature, they remain in a dormant state, and various physical and chemical methods are applied to break this dormancy and promote germination [5]. Treatment with sulfuric acid has been recommended as the most effective method for weakening the seed coat [6]. The seeds of legumes have a dense, water-impermeable spermoderm, which gives them hardness [8]. The tough seed coat of *Astragalus* species increases their resistance to various adverse environmental factors and allows them to retain viability for an extended period [7].

U. Hakimov and X. Khalilov studied the advantages of impact treatment and coating with a bentonite powder solution in reducing seed hardness and increasing the germination rate of *Astragalus sieversianus*, a species with valuable forage qualities. The field germination rate of impact-treated seeds was 25.1%, while the germination rate of seeds that were both impact-treated and coated with a bentonite powder solution reached 28.5%. *Astragalus knorringianus* Boriss., belonging to the Fabaceae family, is a rare species listed in the Red Data Book of the Republic of Uzbekistan (Category 2). It is distributed in the Nurata, Molguzar, and Turkistan mountain ranges [3].

The seeds of *Astragalus knorringianus* mature between May and June, depending on the weather conditions of the year. Its fruit is multi-seeded, apocarpous, indehiscent, and 8–10 times shorter than the calyx, with the seeds remaining inside the calyx. Each solitary stem bears 2–3 fruits at its tip. The compound fruit develops from a spike-shaped inflorescence. The pod is bilocular and contains between 10 and 16 seeds. The pod has a circumference of 12.14 ± 0.94 mm and features a short beak. Its surface is covered with white and black hairs lying flat. The pod is arcuate to straight in shape, tapering toward both ends. The weight of the fruits and seeds varies depending on annual weather conditions. In years with high precipitation (such as 2024), the weight of 100 fruits was recorded at 12.5 g, with an average fruit length of 47.65 ± 2.28 mm and an average width of 3.19 ± 0.37 mm [4].

Materials and Methods

Mature seeds of *A. knorringianus* were collected from Koktonli village, Koshrabot district, Samarkand region. Experiments to study the germination of seeds stored for three months under greenhouse conditions were conducted at the "House Plant Cultivation" Research Center of the Department of "Biology and methods of teaching it" at Jizzakh state pedagogical university. In order to examine seed germination under greenhouse conditions, the experiments compared control (untreated) seeds with seeds subjected to scarification and those treated with sulfuric acid. The seeds were sown in triplicate in trays filled with a mixture of biohumus and sawdust-based soil (Figure 2). Similarly, field germination experiments of *A. knorringianus* seeds were carried out by comparing mechanically scarified seeds and chemically treated seeds (with sulfuric acid) to untreated control seeds. Mature and selected seeds were sown in rows in late autumn at the experimental plot of the Zomin State Reserve, using a randomized block design with three replications.

Results

Under greenhouse conditions, the control seeds began to germinate on the 16th day after sowing. The average germination rate of the control seeds was 20%. In contrast, the scarified *A. knorringianus* seeds showed a higher germination rate, reaching 33.33%, compared to the control group.

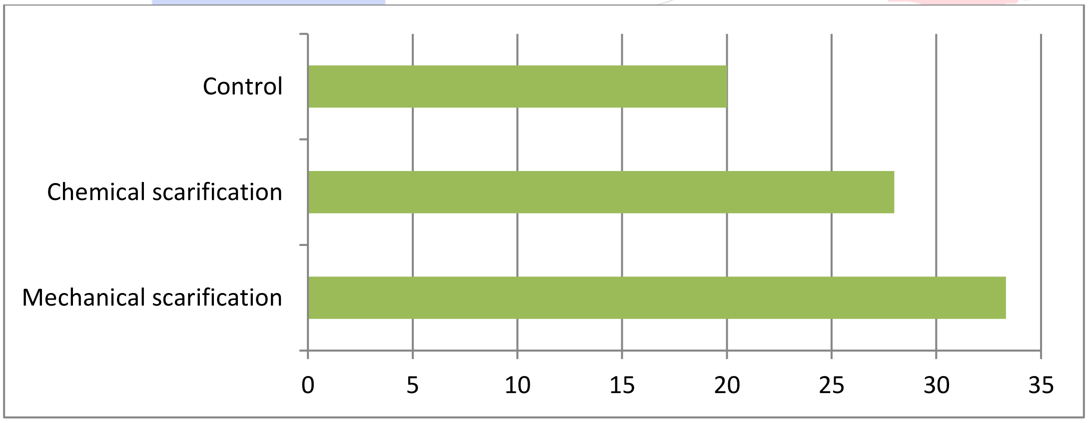

Figure 1. Germination of *A. knorringianus* seeds under greenhouse conditions in control, chemically treated, and mechanically scarified variants.

Seeds treated chemically with sulfuric acid for 15 minutes began to germinate after 10 days. In this variant, the germination rate reached 28% (Figure 1).

Figure 2. Studying the germination of *A. knorringianus* seeds under greenhouse conditions.

Seed germination under field conditions was lower compared to greenhouse conditions. Naturally, various biotic and abiotic factors directly and indirectly affect seed germination in the field. These include ecological factors such as soil moisture, light intensity, fluctuating temperature, and the negative impact of harmful organisms.

In field-sown *A. knorringianus* seeds, germination rates were significantly lower. According to the results, the average germination rate in the control variant was 2%, in mechanically scarified seeds 3.33%, and in chemically treated seeds 2.67% (Figure 3).

Figure 3. Germination of *A. knorringianus* seeds under field conditions.

Conclusion

Based on the results of the experiments, it was found that the germination rate of *A. knorringianus* seeds under greenhouse conditions was higher compared to field conditions. This can be attributed to the stable levels of humidity, temperature, and light in the greenhouse, which provide favorable conditions for uniform and rapid germination. In contrast, under field conditions, sharp temperature fluctuations, insufficient soil moisture, and other external environmental factors reduced seed germination.

Therefore, for the propagation of rare or hard-to-germinate species, it is advisable to conduct the initial germination stages under greenhouse conditions and later acclimatize the seedlings to field conditions. This approach plays an important role in preserving and enhancing the effectiveness of natural population restoration of such plant species.

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