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VEGETATIVE PROPAGATION AND ESTABLISHMENT OF LYCIUM CHINENSE MILL. AND LYCIUM BARBARUM L. PLANTATIONS IN NAMANGAN REGION

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Abstract
This article presents the results of research on vegetative propagation and the establishment of industrial plantations of Lycium chinense Mill. and Lycium barbarum L. in the Namangan region. Green semi-woody cuttings treated with growth stimulants (Epin, Kornevin, IAA, IBA) were planted in a film greenhouse with artificial fog. The rooting period, rooting percentage, and optimal conditions for harvesting and planting cuttings were determined. The obtained results allow developing recommendations for the rational organization of plantations for industrial cultivation of Lycium.

Keywords: Lycium chinense Mill., Lycium barbarum L., vegetative propagation, rooting, green cuttings, growth stimulants, mist greenhouse, industrial plantation.

Introduction

The reduction of natural populations of medicinal plants and depletion of natural resources necessitates the development of effective methods for reproduction and industrial cultivation of plants with pharmacological value [1, 2].

The genus Lycium, in particular L. chinense Mill. and L. barbarum L., is widespread due to the high content of bioactive compounds, vitamins, amino acids, minerals, and pronounced antioxidant activity of its fruits [3–5]. In Uzbekistan, goji berries are used as a dietary supplement and medicinal raw material [6, 7].

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Seed propagation of Lycium shrubs is associated with a long germination period and slow growth of young plants, making the production of high-quality planting material labor-intensive and time-consuming [8, 9]. Vegetative propagation using green cuttings allows rapid production of plants while preserving all morphological and chemical characteristics of the mother plant, which is especially important for industrial cultivation [10, 11].

Objective

To study the rooting characteristics of green cuttings of L. chinense Mill. and L. barbarum L., and to evaluate the effects of growth stimulants and microclimatic conditions in a mist film greenhouse on root development and plant growth.

Materials and Methods

Semi-woody, one-year-old shoots of three-year-old mother plants of Lycium were used. Cuttings were collected in spring (March) and summer (June). Cutting length was 5–15 cm, diameter at least 0.5 cm, with 3–4 buds. The lower cut was made 1–1.5 mm below the bud, the upper cut above the bud. Leaves on the lower part were removed, and upper leaves were shortened [16, 17].

Cuttings were treated in aqueous solutions of growth stimulants: Epin, Kornevin, IAA (indole-3-acetic acid), IBA (indole-3-butyric acid) at different concentrations. Control variants included untreated cuttings and cuttings soaked in water only [18, 19].

Planting was carried out in a sand–peat mixture (1:1) at a depth of 2–3 cm at a 40° angle. Experiments were performed in triplicate. Humidity was maintained at 70–80%, temperature at 23–34 °C. Statistical analysis was performed according to standard methods [20].

Results and Discussion

Effect of Shoot Part on Rooting. Analysis showed that rooting of green cuttings of L. chinense Mill. and L. barbarum L. strongly depended on the part of the shoot from which they were taken. Cuttings from the lower and middle parts of shoots showed significantly higher rooting rates (80–95%) compared to upper cuttings (50–60%). This is associated with more mature physiological tissues and accumulation of nutrients in the lower part of the shoot. Upper cuttings, despite

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active apical meristem development, showed slower root formation and lower rooting percentage.

Table 1. Effect of Shoot Part and Timing of Cutting Collection on Rooting of Lycium

Shoot Part	Collection Time	Rooting (%)	Days to First Roots	Average Root Length after 15 Days (cm)
Lower	Spring (March)	90–95	5–6	6.5–7.5
Lower	Summer (June)	80–85	6–8	6–7
Middle	Spring (March)	85–90	6–7	6–7
Middle	Summer (June)	75–80	7–9	5.5–6.5
Upper	Spring (March)	50–60	12–15	4–5
Upper	Summer (June)	40–50	13–16	3.5–4.5

One-year-old shoots produced cuttings with faster root initiation, but their aboveground growth was less intensive. Three-year-old shoots formed a more developed root system and demonstrated higher survival after transplantation, making them preferable for industrial propagation.

Effect of Cutting Collection Timing. The timing of cutting collection significantly affected rooting and development. Spring cuttings (March) began root formation on days 5–7, while summer cuttings (June) on days 7–10. Spring cuttings showed uniform root development along the cutting, whereas summer cuttings formed roots mainly at the base. This is due to higher physiological activity of the mother plant in spring and sufficient endogenous growth hormone reserves.

Effect of Growth Stimulants. Use of growth stimulants significantly accelerated rooting and increased its efficiency:

- IAA and IBA were most effective, achieving 95–100% rooting, roots appeared on days 5–7, root length by day 15 reached 6–8 cm, with more active branching.
- Epin and Kornevin increased rooting to 70–85%, accelerated root initiation by 2–3 days, but root length and branching were less than with IAA and IBA.
- Untreated cuttings (control) started rooting only on days 12–15, with 50–60% rooting.

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Pre-soaking cuttings in water for 12–14 hours before planting reduced transplant stress and increased rooting even without stimulants, emphasizing the importance of a comprehensive approach to planting material preparation.

Table 2. Effect of Growth Stimulants on Rooting and Rooting Speed of Lycium

Growth Stimulant	Concentration	Rooting (%)	Days to First Roots	Root Length after 15 Days (cm)
IAA	500 mg/L	95–100	5–7	7–8
IBA	500 mg/L	95–100	5–7	6.5–7.5
Epin	0.2%	70–80	7–9	5–6
Kornevin	0.3%	75–85	7–10	5–6.5
Control (water)	—	50–60	12–15	4–5

Fig. 1 — Cross-sections of green Lycium cuttings before planting, treated with growth stimulants.

Effect of Microclimatic Conditions.

A film greenhouse with artificial fog provided optimal conditions for rooting and growth of cuttings:

- Maintaining humidity at 70–80% and temperature at 24–32 °C promoted stable photosynthetic activity, metabolism, and root formation.
- The mist system reduced water loss from the cuttings and ensured uniform moisture distribution in the substrate.
- In greenhouse conditions, the output of rooted cuttings was 2–3 times higher than in open field cultivation, which is critical for industrial propagation.

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Fig. 2 — Green Lycium cuttings in the open field.

Cutting Growth Dynamics

Rooted cuttings showed more intensive growth than mother plants of the same age:

- One-year-old cuttings had 20–25% higher shoot growth than mother plants and developed a root system of 5–6 cm by the end of the first month.
- Three-year-old cuttings had 30–35% shoot growth with a more branched root system and high transplant survival.

These data confirm the high regenerative capacity of young Lycium plants, which gradually decreases with the age of the mother plant. For industrial propagation, it is recommended to use mainly one- and two-year-old shoots to combine rapid rooting with high plant productivity.

Recommendations for Industrial Plantation Establishment

1. Vegetative propagation using green semi-woody cuttings provides fast and high-quality planting material.
2. Optimal cutting collection times are spring and June, preferably from lower and middle shoot parts.
3. Application of growth stimulants (IAA, IBA) significantly increases rooting percentage and accelerates root formation.
4. Film greenhouses with artificial fog create optimal microclimatic conditions, reduce transplant stress, and increase plant productivity.
5. A rational planting scheme (spacing between plants 60–70 cm, between rows 1–1.2 m) ensures optimal light, water, and nutrient availability.
6. A comprehensive approach — selection of shoot part, collection time, stimulants, and microclimate control — maximizes rooted cuttings output and

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accelerates plant growth, ensuring efficient industrial production of planting material.

Conclusions

1. Lycium chinense Mill. and Lycium barbarum L. are effectively propagated using green semi-woody cuttings.
2. Optimal cutting collection times are spring and June, preferably from lower and middle shoot parts.
3. Growth stimulants (IAA, IBA, Epin, Kornevin) accelerate rooting and increase rooting percentage to 95–100%.
4. Film greenhouses with artificial fog create optimal microclimatic conditions, enhancing rooting speed and quality.
5. Young mother plants have high regenerative capacity, which should be considered when planning industrial plantations.
6. Developing a rational planting scheme allows efficient land use, increasing yield and plant quality.

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