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REPRODUCTION EFFICIENCY OF MEDICINAL PLANTS LYCIUM CHINENSE MILL. and LYCIUM BARBARUM L. BY GREEN CUTTINGS TREATED WITH STIMULANTS IN THE CONDITIONS OF A BOTANICAL GARDEN IN TASHKENT

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Abstract:

One of the most effective ways to obtain planting material is vegetative propagation of plants using cuttings. The article presents the results of studying the kornevin rate of semi-lignified and green cuttings of shrubs of medicinal plants *Lycium chinense* Mill. and *Lycium barbarum* L., introduced in the Botanical Garden of the city of Tashkent. Based on the results of the study, data were obtained on the duration of the period of root formation and the percentage of kornevin rate of shrubs. To determine the quality and quantity of kornevin of cuttings, various options for the concentration of stimulants were selected. The influence of some environmental factors on the growth and development of green cuttings has been studied. The biological potential in indoor and outdoor conditions was revealed. Growth stimulants in aqueous solution accelerate root formation and increase the number of roots in green cuttings. The experience of cuttings with semi-lignified green cuttings makes it possible to reveal the adaptive capabilities of the studied plants and to start developing reproduction on a large scale. Rooted cuttings should be studied in various soil and climatic conditions of Uzbekistan.

Keywords: Lycium chinense Mill., Lycium barbarum L., rhizogenesis, root formation, green cuttings, epin, kornevin, IAA (β-indolyl acetic acid), IBA (β-indolyl butyric acid), substrate, growth, development, physiological processes, temperature.

INTRODUCTION.

The main task in the modern world is to solve the problem of providing pharmaceutical production for the population with medicinal raw materials. It is necessary to develop bioecological, chemical and physiological foundations for the creation of industrial plantations, since the reduction or complete disappearance, as well as the depletion of natural medicinal plants, makes it necessary to solve the problem.

The medicinal plants *Lycium chinense* Mill. and *Lycium barbarum* L. were studied in the Botanical Garden named after N.F. Rusanov in the city of Tashkent. In connection with the introduction, it is necessary to develop resistance to environmental factors and effective reproduction of introduced species.

Vegetative reproduction of medicinal plants is becoming more and more important. The seed method of reproduction, due to the long germination of seeds, as well as the slow growth of shrub plants, does not allow obtaining full-fledged seedlings in a short time. In addition, plants lose their decorative qualities. These difficulties can be overcome by vegetative propagation. The most common method of vegetative reproduction of plants is stem cuttings. Stem cuttings of plants are mainly divided into two types - green (semi-lignified-spring) or summer, lignified or winter [14,15,16]. The ability of plants to reproduce by cuttings is determined by their ontogenesis.

The ability to regenerate is an inseparable property of living plants. Under the influence of a number of internal and external factors, the process of rhizogenesis (the process of root development) develops. Among the external conditions that determine the course of root formation are such factors as: light, temperature, humidity, substrates, aeration, etc. The influence of these factors on regeneration processes is carried out by acting on growth regulators, the effect depends on the physiological state of plants. For root formation, the optimal conditions for

different plants can differ to varying degrees. It has been proven that the air temperature affects such physiological processes as photosynthesis, respiration rate, water exchange, occurring in the whole plant and its separate parts [21]. It is known that different plant species have different biological characteristics and environmental requirements. Under the same conditions for their reproduction by cuttings, they exhibit a different ability for kornevin [22,23].

The essence of vegetative reproduction of plants consists in obtaining a whole organism from a part of it. Moreover, all the signs, characteristics and properties of the maternal organism are transmitted to the development of the offspring [24].

Vegetative reproduction (green cuttings) takes a significant place. Green cuttings allow economical use of mother liquors to quickly propagate valuable medicinal plants. Therefore, it is necessary to develop methods for plant reproduction by cuttings. For vegetative reproduction, it is effective to use growth stimulants. Stimulants are one of the main elements of green cuttings technology.

Characteristics of the fruits of medicinal plants *Lycium chinense* Mill. and *Lycium barbarum* L. is associated with its great popularity abroad and the CIS [1,2]. Genus Lycium L. (Goji) is widely used in medical practice. We have studied the morpho-anatomical structure of leaves, shoots, fruits and seeds of plants *Lycium chinense Mill.*, *Lycium barbarum L.* (Goji) belonging to the family *Solanaceae* Juss. [5,6,7,8].

The fruits of these species are used in medicine as a means to combat obesity and strengthen the immune system [1]. The fruits are used as medicinal raw materials and food additives [9]. In Uzbekistan, Goji berries began to be used relatively recently. Berries have polysaccharides, are the main active ingredient and have a wide spectrum of pharmacological action. Studies carried out on the fruits of the common wolfberry show anti-inflammatory and immunomodulatory effects [10,11]. The amino acid and fatty acid composition and antioxidant activity of fruits have been ascertained [12, 13]. Berries contain trace elements, some of them are irreplaceable, which contributes to the manifestation of therapeutic effects and allows the plant to be used to create a medicine. Elements such as zinc, copper, cobalt, iron, chromium, iodine and others are essential for the functioning of the immune, nervous, cardiovascular systems. In terms of the number and composition of natural components, *Lycium barbarum* berries have no known analogues in the world. Foreign scientists investigated the chemical composition of berries, it was found that plants contain minerals: iron, zinc, phosphorus, calcium, potassium, selenium, copper, iodine, manganese, nickel, chromium, magnesia, cobalt, cadmium, germanium and others. There is 15 times more iron in *Lycium barbarum* L. berries than in spinach. *Lycium* contains vitamins B1, B2, B6, E, C, carotene [3]. Vitamin C (ascorbic acid) is 5 times more than in an orange, and 20 times more carotene than in carrots. Beta-carotene is necessary for the synthesis of vitamin A - it improves vision, cellular structure, strengthens bones and teeth, and heals the skin. Berries are rich in natural antioxidants such as zeaxanthin, omega 3 and 6 fatty acids, beta sitosterol, and sugars. In addition, *Lycium* berries contain 18 amino acids (more than in uterine bee pollen), 8 of which are irreplaceable, i.e. are not produced by the human body, as well as 4 essential polysaccharides (*Lycium barbarum* L. (LBP) - LBP-1, LBP-2, LBP-3, LBP-4, which are not present in food [4].

MAIN PART. THE PURPOSE AND OBJECTIVES OF THE STUDY.

To study the features of rhizogenesis and to reveal the effect of stimulants on the kornevin rate of green cuttings of *Lycium Chinense* Mill. and *Lycium Barbarum* L.

In the field and under conditions of artificial fog, the plants were grown in a vegetative way - by green cuttings of this culture.

To achieve this goal, the following tasks were solved: to identify the optimal timing of cuttings of green cuttings, to determine the location of cuttings (upper, middle, lower part of the shoot), the length of the cuttings, the age of the shoots for harvesting cuttings [25]. To reveal the influence of the microclimate on the kornevin of green cuttings in a film greenhouse with artificial fog, to study the natural (without stimulants) and stimulants of kornevin of green cuttings, to determine the effects of stimulants that contribute to the acceleration of rhizogenesis in harvested green cuttings and the need for their use in production conditions.

OBJECTS AND METHODS.

For vegetative propagation, before planting, cuttings were cut from 1-3-year-old mother plants from green, semi-lignified annual shoots. The number of cuttings of two plant species - 100 pcs. Cuttings were taken from the upper, middle and lower parts of the shoot. Before planting, cuttings were kept for 14 hours in aqueous solutions of stimulants epin, kornevin, IAA (β-indolyl acetic acid), IBA (β-indolyl butyric acid) in various concentrations (Turetskaya R.Kh., 1968, 1975) [17, 18]. The experiment includes 36 options, of which control-1-cuttings without treatment and control -2-exposure of cuttings in water, using the drug.

The experiment was carried out in a film greenhouse with artificial fog and in an experimental area. Cuttings were carried out in the first ten days of June and in the spring in the second ten days of March. A mixture of sand and peat (1:1 by volume). The experiments were repeated three times. The scheme of replanting cuttings is in 5x2 cm. The humidity in the greenhouse was maintained at the level of 70-80%. The temperature in the greenhouse changed according to the changes in air temperature. Statistical processing of the data obtained was carried out according to the generally accepted method [19, 20].

RESULTS AND DISCUSSIONS.

The microclimate was created under the influence of weather conditions and the operating mode of the fogging installation. Observations showed that in 2018 the following temperature regime was observed: the average air temperature during the kornevin period was 25-30^{0}C, the substrate was 29-34^{0}C, the amount of precipitation was 9.5 mm, in 2019 it was 24-29^{0}C, the substrate was 27-32^{0}C, and in 2020 23-28^{0}C, substrate –24-29^{0}C. The relative humidity of the air during the kornevin period was maintained within 70-80%.

The size of the cuttings (cut taking into account the size of internodes) was at least three buds, 5–15 cm long and at least 0.5 cm in diameter, were cut at the beginning of June. The lower cut on the cuttings was made 1–1.5 mm below the bud, and the upper cut was made directly above the bud. To reduce the transpiration processes, the leaves were completely removed from the lower part of the cuttings; only a few truncated leaf blades were left in the upper part. The cuttings were treated with stimulants epin, kornevin and IAA, IBA. The planting material was laid to a depth of 2–3 cm at an angle of 40°. In 2019, in conditions of higher temperatures, the roots appear 10-12 days after planting. The duration of the period of root formation depended on the method of treatment and in the variants of epin, kornevin, IAA, and IBA.

It was found that the ability to reproduce by green cuttings with stimulants is determined not only by hereditary characteristics, but also by the ecological, physiological and age states of mother plants (Fig. 1). Plants at the early stages of their ontogenesis exhibit a high regenerative capacity, which subsequently decreases with aging [28, 29].

Fig. 1. Sections of green cuttings *of Lycium chinense* Mill. and *Lycium barbarum* L. before planting, harvested from various parts of the shoot and treated with growth stimulants

Several very effective methods have been developed for preparing mother plants for reproduction by cuttings. Restrained shoot growth facilitates easier formation of root buds. A highly effective technique - growing mother plants in artificial fog, the yield of cuttings is 5–20 times higher than in open ground, which is especially important at the initial stages of reproduction (Fig. 2). The favorable period for cuttings increases up to three weeks. According to the literature data, in a number of difficultly propagated plants, the kornevin rate of cuttings increases by 20–35% [30].

а **б** **в**

Fig. 2. Film greenhouse with artificial fog in the experimental area: a-fogging installation; b-green cuttings of *Lycium chinense* Mill*.* in greenhouses; in-green cuttings of *Lycium barbarum* L. in protected ground

Physiological processes were also successful. Good tissue hydration is favorable for the successful kornevin of cuttings, therefore, from an environmental point of view, it is important to know edaphic factors. The moisture content of the soil in the mother liquors must be at least 70–80% of the total field moisture capacity (TFC). In this regard, especially in protected ground conditions, continuous mulching of the soil is justified. Moisture is better preserved under the film, the soil warms up earlier in spring, manual weeding is excluded. Favorable temperature and water conditions in the root layer provide powerful root growth, promote better growth of the aerial part, and increase cuttings productivity by 15–20% [31].

The use of growth stimulants on mother stocks is new in the preparation of the original plants for reproduction by cuttings. Growth stimulants (aqueous solution) increase kornevin, accelerate root formation and increase the number of roots in green cuttings [26]. The kornevin of green cuttings is positively influenced by the preliminary keeping of their basal part in water for 12-18 hours, without the use of growth stimulants [27].

Based on the studies carried out, we obtained data on vegetative reproduction of plants. The results of the experiment showed that cuttings harvested from different parts of the shoots root to different degrees. Rapid kornevin was noted in green cuttings harvested in June. Cuttings harvested from the lower and middle parts of the shoot root faster and better than those harvested from the upper part of the shoot.

The use of a fogging installation is a good reserve in reducing the cost of production of own-rooted seedlings, which contributes to an increase in the yield of rooted cuttings. The use of a fogging installation will allow, due to the minimum water consumption, to improve the microclimate conditions. Growth stimulants (epin, kornevin, IAA, IBA) enhance the process of kornevin, while the percentage of kornevin of cuttings increases (Fig. 3).

Fig. 3. Green cuttings of *Lycium chinense* Mill. and *Lycium barbarum* L. outdoors

We found that the change in weather conditions does not have a large effect on the timing of the phenophase of mother plants. We have shown that IAA (β-indolyl acetic acid), IBA (β-indolyl butyric acid) in various concentrations of 50,100, 150 ml/l are among the most effective growth regulators in preparing mother plants for reproduction (Fig. 4, 5).

Fig. 4. Effects of plant treatment with *Lycium chinense* Mill. stimulants (a-epin, b-kornevin, c-IBA, g-IAA in various concentrations (25,50,100,150-mg/l)) on the quality of rooted cuttings.

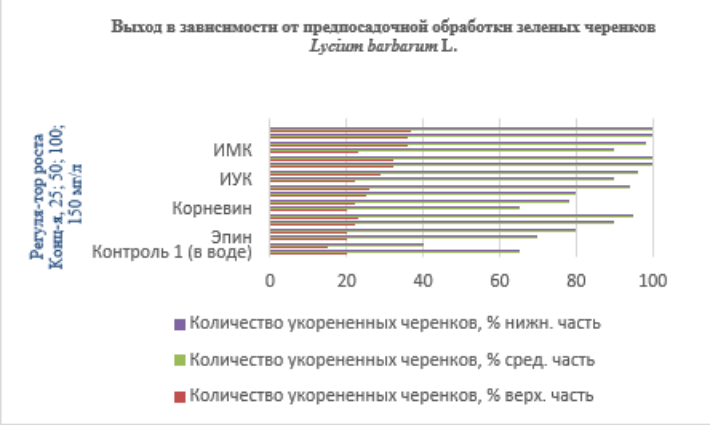

Fig. 5. The dynamics of root formation in green cuttings of *Lycium barbarum* L.

In the variant with the use of the drug Kornevin, Epin, a higher kornevin rate of cuttings was revealed in comparison with the control. The longest period of kornevin was noted in the control (15-18 days), rapid kornevin (5-7 days) was noted with the use of IAA and IBA stimulants. As for the percentage of kornevin when using IAA, IBA, it should be noted that 100% kornevin was observed in both species (Table 1).

Table 1

Pre-planting treatment of cuttings harvested from various parts of the *Lycium chinense* Mill shoot

Species name	Concentration, mg/l	Control 1 (in water)	Control 2 (without	Epin				Kornevin				IAA				IBA			
				25 mg / l	50 mg/l	100 mg/l	150 mg/l	25 mg/l	50 mg/l	100 mg/l	150 mg/l	25 mg/l	50 mg/l	100 mg/l	150 mg/l	25 mg/l	50 mg/l	100 mg/l	150 mg/l
Lyciumchinense Mill. in % of planted cuttings	upper part	25	20	25	25	27	29	25	30	30	30	25	30	35	35	26	37	37	38
	mid. part	70	40	50	70	89	95	70	75	80	95	90	96	100	100	89	99	100	100
	lower part	75	40	50	70	89	95	70	75	80	95	90	96	100	100	89	99	100	100

From the above it is clear that the age and physiological state of cuttings is important for the process of regeneration of roots and buds. The age of the mother plant, the individual shoot and its parts, as well as environmental factors are very important to be considered, especially in the reproduction of introduced plants. During cuttings, the adaptive properties of plants are revealed.

CONCLUSION

Thus, it was found that the tested species reproduce well vegetatively better than seed. Cuttings harvested from different parts of the shoots take root to varying degrees. Cuttings harvested from the lower and middle parts of the shoot root faster and better than those harvested from the upper part of the shoot. Cuttings grown in a greenhouse with a fogging installation, starting from June to July, quickly take root, and after 2-3 months they should be transplanted into open ground. To accelerate the process of root development (rhizogenesis), growth stimulants must be used. Stimulants contribute to the accelerated rhizogenesis of the studied species, which makes it possible to obtain rather quickly a significant amount of ready-made rooted material. Stimulants of IAA and IBA are effective, which leads to 100% kornevin of cuttings, for planting in large tracts.

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