INFLUENCE OF FACTORS ON THE EFFECTIVENESS OF VEGETATIVE PROPAGATION OF SOME SPECIES OF ORNAMENTAL PLANTS

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The preservation and enrichment of vegetation with highly decorative cultivars and forms in the urban environment is very important. Protection of environment is an important task that is closely related to human health. Solving this problem it is necessary to expand the exploit of plantations for green construction and landscaping of various territories.

The development of decorative landscaping is hampered by the shortage of high-quality planting material of the above-mentioned species. Eventually, an important task for today is also the development of agrotechnological) measures for the accelerated production of planting stuff, given the biologic and botanic features of crops and soil and climatical conditions.

The goal of the research. Improvement of technical methods of vegetative propagation of various types of ornamental plants, obtaining rooted cuttings for further cultivation and use in the improvement of recreational objects.

The implementation of the purpose leads to the definition and decision of the next tasks:

- analyzing the literature on the features of distribution of decorative plant species and their forms;
- to research the effect of the substratum on the rooting process of some plant types;
- to research the regeneration ability of cuttings of ornamental plant species depending on the time of their harvesting;
- to use the effect of a biologically active compound on the regeneration ability of microshoots of ornamental plant species;
- to research using of ornamental plants in the improvement of recreational acilities.

Object of research: measures for growing ornamental planting material.

The subject of research: peculiarities of vegetative propagation of ornamental plant species in artificial fog conditions.

Research methods. The research work was performed in the academic building with the educational laboratory "Landscape Design" of Sumy National Agrarian University. To research the regeneration ability of micropropagules (doi.org) of ornamental species, mother plants aged 7-10 years were used. The length of the cuttings ranged from 5 to 12 cm. The prepared cuttings were planted in ridges in the conditions of a cultivation structure.

The research work investigated the influence of soil mixture during the period of cuttings harvesting and an auxin compound (Rhizopon) on the process of root system regeneration.

The search work was conducted using the following scheme:

Factor A - type of substrate: 1) control (humus + sand + peat); 2) forest soil; 3) (peat + sand). Factor B - term of cuttings: 1) control (5.04); 2) 25.06; 3) 5.08. Factor B - physiologically active compound: 1) Rhizopon; 2) control (water).

Planting material should be planted from length of 6-12 cm between each other, and 10-13 cm between rows. Harvested cuttings were planted in the compound of soil to a depth of 3-6 cm. The explore was recurring four times.

High humidity of the substrate was maintained by daily watering for 60 days, and then the soil mixture was moistened as needed.

The search work was conducted using the way of plant reproduction [8].

Research resalts. During the period of vegetative propagation of plants, it is necessary to create conditions for the restoration and formation of the cuttings root system [2-3, 9-10, 12]. An important key to this process is optimal environmental conditions (Table 1).

The results of the research in general prove that the maximum rhizogenic ability of micropropagules of ornamental plant species was documented in the option_ where sand mixture and peat was exploited as a substratum, and the minimum value was recorded in other variants.

The high content of nutrients in the medium negatively affects the rhizogenic ability of micropods of experimental species. Probably that the agrophysical features of the substratum also affect the process of reproduction of the root system [12].

Table 1. Effect of substratum on the regenerative ability of scion

Variant	Plant species	Rooting, %	± to control
Control (peat + sand + humus)	*Cotoneaster horizontalis*	21	-
	Juniperus scopulorum	0	-
	Berberis thunbergii	0	-
Forest land	*Cotoneaster horizontalis*	60	+ 39
	Juniperus scopulorum	5	+ 5
	Berberis thunbergii	3	+ 3
Sand + peat	*Cotoneaster horizontalis*	90	+ 69
	Juniperus scopulorum	9	+ 9
	Berberis thunbergii	10	+ 10

The intensification of the manufacturing process for growing plant seedlings and their ornamental forms is becoming increasingly important through to the busy demand for it. Harvesting of living material in favorable periods provides an opportunity to control biochemical reactions that take place in micropropagules, and also greatly improve the cultivation technology [2, 7].

Table 2. Impact of the propagation harvesting period on the regeneration capacity of landing stuff

Harvesting time propagation	Variance	Rooting, %	± to control
Control (5.04)	*Cotoneaster horizontalis*	90	-
	Juniperus scopulorum	9	-
	Berberis thunbergii	0	-
25.06	*Cotoneaster horizontalis*	87	-3
	Juniperus scopulorum	3	-6
	Berberis thunbergii	10	+10
5.08	*Cotoneaster horizontalis*	12	-78
	Juniperus scopulorum	0	-9
	Berberis thunbergii	0	0

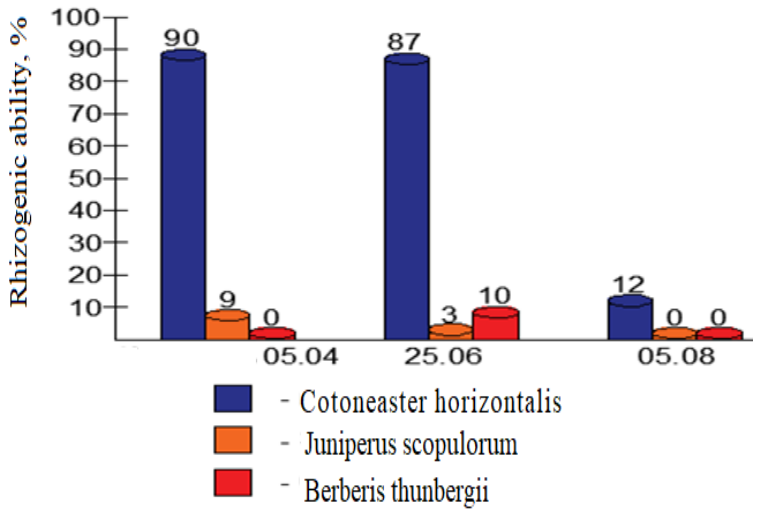

Fig. 1. *The impact of the time of harvesting cuttings on their ability to regenerate*

The results of the experimental labor (Table 2 and Fig. 1) show that when cotoneaster horizontal cuttings were harvested in April (5.04), the regenerative ability was 90%, and for another type was minimal.

The cuttings of barberry thunberg after the flowering phase (25.06) provided the maximum index of rhizogenic ability, relative to other terms of micropropagules harvesting.

The rooting rates of ornamental plant species were minimal under the settings of cuttings in August.

With asexual propagation of hard-rooted cultivars, and in particular the ornamental forms of *Juniperus scopulorum* and *Berberis thunbergii*, the task of activating the processes associated with callus and correction by using exogenous growth regulators that can regulate the reproductive capacity of cuttings appears [2, 12].

It has been majored and proven that physiologically active compounds are analogs of antagonists or plant hormones that have the capacity to substitute the ratio of hormonal substances in the body [3]. Using of these combinations creates the foundation for controlling processes which are closely related to callus and correction, as well as understanding the capabilities of the plant organism [7, 10].

According to P. J. Davis [3] and some other scientists [2, 9, 12], activation of the regenerative potencial of microshoots using exogenous analogues of phytohormonal compounds indicates that the regenerative potencial of cuttings is affected by the amount of auxin compounds in the plant (onlinelibrary.wiley.com) organism.These substances exert their effect in interaction with other biologically active compounds. Nowadays rhizogenic ability of micropropagules can reproduce the root system is determined according to the content of auxin-like and other phytohormonal substances, but also by their ratio [3, 7].

According to V. L. Kretovych [7], the increase in the regeneration capacity of cuttings is closely connected with the activation of biochemical reactions and the moving of soluble compounds to the basal part.

Table 3. Plant growth effects regulator on the reproductive capacity of cuttings

No.	Experiment variant	Plant species	Rooting, %	± to control
1.	*Rhizopon*	*Cotoneaster horizontalis*	98	+ 8
		Juniperus scopulorum	73	+ 64
		Berberis thunbergii	79	+ 69
2.	Control (water)	*Cotoneaster horizontalis*	90	-
		Juniperus scopulorum	9	-
		Berberis thunbergii	10	-

The exogenous effect of auxin hormones on the cuttings creates prerequisites for cell differentiation, which are necessary for active restoration of the root system and its further growth [3, 10], and also the growth of the aerial part of rooted micropropagules (Table 3).

The research results proves that Rhizopon, in the studied concentration, can affect the processes of callus and corrosion in the planting material of ornamental plant species. The researches of species have shown the best results were got while treating cuttings of *Juniperus thunbergii* and *Berberis thunbergii*.

The rhizogenic capacity of *Berberis thunbergii* cuttings was 10%, in the control variant and 79% of cuttings rooted in the experimental variant which is 69% more than in the control variant. While using the above compound on *Cotoneaster horizontalis*, the above figure was only 98%.

Thus, the using of Rhizopon for the cuttings treatment of ornamental plant species provides an increase in the capacity of grown products.

Fig. 2. *Clones of Berberis thunbergii*

Changes in the amount of hormonal compounds in planting material under the effect of Rhizopon affect the process of root system reproduction than cuttings without the using of this compound.

Landscaping of gardens and parks is impossible without the using of coniferous and deciduous species, they give the surrounding landscape an attractive appearance. *Berberis thunbergii*, *Juniperus scopulorum* and *Cotoneaster horizontalis* are the leaders among the ornamental species used for landscaping open areas. Their important advantages include the appearance of some variations of ornamental forms, the appearance of crowns and their color, unpretentiousness to the urban environment, no need for haircuts, in addition to that slow growth and plants development [1, 4-6, 11].

The following varieties of *Berberis thunbergii* are very popular: Auricoma, Superba and Silver Miles (Fig. 2). Due to the usage of decorative forms with different colors of needles and crown appearance: Skyrocket (Fig. 3), Moonglow, Blue Arrow - *Juniperus scopulorum* occupies a special place in ornamental gardening.

Fig. 3. *Juniperus scopulorum Skyrocket*

Skyrocket resembles the Moonglow variety at a young age, but can grow up to 5 m in height and have a crown up to 2.0 m wide (Fig. 3). It has a dense columnar crown with blue-green needles and branches pressed against the central conductor that point upward. It is a widespread variety: it is not very picky about soil, it prefers sunny areas, and is relatively wind-resistant. It is used for hedges, tapeworms and group plantings in landscape design, *Juniperus* needles saturate the air with phytoncides, this process has a detrimental effect on pathogenic microflora and purify the air. Skyrocket is very easy to take care for, requiring low-intensity watering.

Fig. 4. *Tapeworm plantings of ornamental plant species*

The studied plant species can grow in tapeworm plantings, since in landscape design they are self-sufficient and must not be surrounded by other taxa of plants (Fig. 4). In tapeworm plantings, the bushes are placed in the center of the sod-forming cover or in the relaxion area between the benches.

Fig. 5. *Group plantings of Juniperus scopulorum*

Nevertheless if you have the opportunity and desire to create compositions, it will be the perfect option. Experimental plants are planted in groups, they go well with other deciduous and coniferous species (Fig. 5). Nowadays, *Juniperus scopulorum* takes center stage in the compositions. To give the site a special decorative effect, brightly flowering taxa are planted next to it. In addition, undersized plant species are planted between them.

Fig. 6. *Using Berberis and Cotoneaster in rockeries*

Ornamental plant species are applayed in the design of borderlines, rockeries, alpine hills, they are beautiful in combination with different plant species (Fig. 6). This is facilitated by a fairly great amount of clones that differ in color, heightof the leaves and crown habit.

Fig. 7. *Cotoneaster horizontalis in landscape design*

Cotoneaster horizontalis in landscape design is a highlight for alpine rockeries and slides, where it is used in combination with other ground cover and flowering plants to create attractive compositions (Fig. 7).

Early flowering plant species are planted next to cotoneaster: daffodils, crocuses, etc. Its low-growing varieties look attractive with conifers: *Picea canadensi* and *Taxus baccata. Berberis* is planted in rose gardens or flower beds in combination with other plants; compositional combinations with flowers look especially decorative (Fig. 8).

Fig. 8. *Berberis thunbergii in a flower bed*

Conclusions and Suggestions

1. The regeneration capacity of cuttings of ornamental plant forks depends on the different types of soil and substrate, biological features of the cultivar, the period of harvesting micropropagules, and the using of plant growth regulators.

2. To root the cuttings of decorative plant species it is required to applay a mixture of sand and peat.

3. Cotoneaster horizontalis belongs to the easy-rooted species and should be propagated during April-June.

4. It is advisable to harvest micropods of *Juniperus scopulorum*
should be harvested in April (the regenerative ability was 9%).

5. Cuttings of *Berberis thunbergii* should be carried out after the flowering phase (the index of rhizogenic ability was 10%).

6. An effective plant growth regulator is Rhizopon for the reproduction of the root system in micropropagules of ornamental plant species.

7. The studied plant species and their decorative forms are used everywhere in rock gardens, hedges, borders, tapeworms and group plantings. You also should remember that color of the needles and leaf surface of plants is so diverse.

For the plant material production of ornamental plant species, we propose to use auxin substances. Considering the ecological and botanical properties of the studied varieties, there is a necessity for their widespread use in the creation of recreational areas.

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