VEGETATIVE REPRODUCTION OF *TAXUS CUSPIDATA* SIEBOLD ET ZUCC. EX ENDL. USING GROWTH STIMULANTS

Kalmuk O. , Scherbyna M., Skvarko K.

Botanical Garden of the Ivan Franko National University of Lviv

The article contains characterization of vegetative propagation features of Taxus cuspidata Siebold et Zucc. ex Endl. introduced into Botanical Garden of Ivan Franko National University of Lviv. It is proved that both classic (IAA, Emistym C) and newly synthesized (morpholid, nitryl) growth promoters may be applied to intensify the process of root formation in Taxus.

Key words: vegetative propagation, growth promoters, Taxus.

The use of growth regulators of natural and synthetic compounds results in considerable changes in growth and development of plants, allows for adjustment of the most important processes inside the plant organism, increases resistance of plants to adverse environmental factors [6, 7].

Vegetative reproduction of woody plants under the influence of growth stimulators allows to accelerate rooting and increase the quality of planting stock.

The most highly efficient rooting stimulators include Emistim C, indole-3-acetic acid (IAA), charkor and kornevin, and newly synthesized morpholide and nitryle. The Emistim C is an extract of growth substances in 60% ethanol, growth and development biostimulator for grain and other crops. It is a plant growth biostimulator of wide range of effect (a product of biotechnological cultivation of epiphytic fungi). It increases yield capacity and improves the quality of planting material. Applied to corn plants, grain legumes, technical and forage plants, vegetables, melons, fruit and berry crops, coniferous and deciduous trees, shrubs and flowering plants. In 1934, at the laboratory of F. Kegel (at the apexes of poaceae coleoptiles), natural auxin was identified as indole-3-acetic acid (IAA). Exposing of cuttings to IAA (50 ml/L) results in improved respiration, surge of nutrients, causing positive effect on root formation. In particular, regarding cuttings of woody plants that are difficult to root, immersing them in IAA water solution (5 – 200 ml/l) for 3 – 24 hours accelerates root formation [3, 5]. Charkor is a composition of growth regulators of natural origin and synthetic analogues of plant hormones. Clear light-yellow solution of water and alcohol, active ingredients of which consist of a complex of 2,6 - dimethyl pyridine - 1-Naphthaleneacetic acid and Emisim C oxide, recommended for boost of rooting processes of green and stiffened cuttings, as

well as rooting and transplantation of seedlings of fruit and ornamental trees, bushes and medicinal plants [5]. Kornevin is an analogue of heteroauxin (0,5% indoleacetic acid). Recently, the Organic Chemistry Faculty of Ivan Franko National University of Lviv has been widely researching rhodanine and its substitutes in the reactions of condensation with aromatic aldehydes, obtaining a number of derivatives with a wide range of physiological activity. These include (2-(4-morpholine)-5-(phenylmethylene(-4(5H)-thiazoline (morpholide) and (2-[4-(2-cyanoethylene)-1-piperazine]-4(5H)-thiazoline (nitryle), which have proved efficient for practical use: non-toxicity, thermostability and high water and ethanol solubility of the substance.

Material and methods

The research object was chosen to be *Taxus cuspidata* Siebold et Zucc. ex Endl. (family Taxaceae Lindl.) – a dioecious tree from the Far East, Japan and Northeast China. Cultivated in Ukraine since the early XX century, it was introduced to the collection of botanical garden of Lviv University at the same time. It is characterized by higher cold resistance than the aboriginal Weastern Ukrainian *Taxus baccata* L., resistance to drought, low demands for soil fertility, which determines its wider use for urban plantings and arboretums. *Taxus cuspidata* grows slowly, well endures the forming of leafage. Reproduces by off shoots, cuttings and freshly picked seeds. [1,2]

The cutting was performed in autumn (October), using one- and two-year cuttings. Cuts of planting material had been made straightly before their processing. The operation was carried out indoors at +20-23°C. Prepared cuttings were submerged in a solution: Emistim C ($5{:}10^3$ – $5{:}10^5$), IAA ($5{:}10^3$ – $5{:}10^5$), morpholide ($5{:}10^3$ – $5{:}10^5$), nitryle ($5{:}10^3$ – $5{:}10^5$), immersed for 3 – 5 cm and held for 18 – 20 hours. Simultaneously, they were put under control: the cuttings stayed underwater for 18 – 20 hours. Everything was repeated three times. After the exposure, the cuttings were washed with water and transferred into a substrate for rooting – perlite [4]. +20 – 23°C temperature was maintained in a hotbed with the research material, watering was provided. Constant monitoring was conducted, removing cuttings which started to decompose. Early in spring (in March) the cuttings were planted in pots. Preliminary, detailed descriptions and biometrics of overground parts and root systems of each cutting were done.

Results

Obtained information has been compiled, statistically processed and summarized in the table.

1. Comparative analysis of effect of growth regulators on rooting of one-year cuttings of *Taxus cuspidata* Siebold et Zucc. ex Endl.

Substance	Concentration (mg/ml)	Rooting (%)	Root length (mm)	Number of roots (pcs.)
Control		13,9±0,8	4,6±0,8	2,5±0,3
Emistim C	$5:10^3$	4,3±2,0	9,0±1,2	1,3±0,4
	$5:10^4$	60,4±5,1	13,4±3,6	2,0±0,8
	$5:10^5$	38,0±4,0	17,1±2,0	5,3±0,7
IAA	$5:10^3$	20,1±2,3	12,5±2,3	3,5±0,3
	$5:10^4$	35,9±2,9	22,2±2,0	2,0±0,8
	$5:10^5$	62,5±5,2	32,2±4,5	2,3±0,9
Morpholide	$5:10^3$	50,6±4,5	11,0±1,7	3,0±0,8
	$5:10^4$	38,6±3,0	17,9±2,3	5,0±0,5
	$5:10^5$	36,1±4,1	13,5±4,7	1,2±0,6
Nitryle	$5:10^3$	24,2±3,1	15,7±3,2	2,0±1,1
	$5:10^4$	38,0±4,3	20,9±3,6	6,0±0,5
	$5:10^5$	36,4±3,9	28,5±4,3	3,7±0,7

2. Comparative analysis of effect of growth regulators on rooting of two-year cuttings of *Taxus cuspidata* Siebold et Zucc. ex Endl.

Substance	Concentration (mg/ml)	Rooting (%)	Root length (mm)	Number of roots (pcs.)
Control		15,0±0,4	13,2±4,3	5,0±0
Emistim C	$5:10^3$	24,3±1,9	17,4±2,1	9,5±0,3
	$5:10^4$	15,5±1,7	13,9±2,4	5,0±2,6
	$5:10^5$	25,1±2,3	31,4±4,0	5,5±1,6
IAA	$5:10^3$	-	-	-
	$5:10^4$	15,7±0,9	36,3±5,8	4,0±0
	$5:10^5$	-	-	-
Morpholide	$5:10^3$	40,3±3,8	22,2±3,3	5,0±0
	$5:10^4$	20,7±1,9	43,2±8,9	4,0±0
	$5:10^5$	25,0±2,7	23,6±4,2	2,3±0,9
Nitryle	$5:10^3$	25,2±4,1	24,5±4,5	2,7±1,1
	$5:10^4$	28,6±3,3	30,5±5,7	3,3±1,9
	$5:10^5$	20,1±1,8	22,4±6,1	5,0±0

The highest percentage of rooting in comparison with the controlled one-year cuttings is observed when exposed to IAA ($5:10^5$ mg/ml), Emistim C ($5:10^4$ mg/ml),

morpholide ($5:10^3$ mg/ml), and morpholide ($5:10^3$ mg/ml) with two-year cuttings.

Maximum root system growth of one-year was reached by the effect of IAA ($5:10^5$ mg/ml) and nitryle ($5:10^5$ mg/ml); for two-year cuttings – when exposed to morpholide ($5:10^4$ mg/ml), IAA ($5:10^4$ mg/ml), Emistim C ($5:10^5$ mg/ml) and nitryle ($5:10^4$ mg/ml).

By the number of formed roots, the most efficient one-year cutting growth simulators proved to be nitryle ($5:10^4$ mg/ml), Emistim C ($5:10^5$ mg/ml) and morpholide ($5:10^4$ mg/ml).

Conclusions:

We have established that rooting of *Taxus cuspidata* Siebold et Zucc. ex Endl., the length and number of formed roots depend on nature and concentration of growth stimulators: Emistim C, IAA, morholide and nitryle.

The use of IAA ($5:10^5$ mg/ml) for one-year cuttings and morpholide ($5::10^3$ mg/ml) for two-year cuttings is most efficient.

References

1. Дендрофлора України. Дикорослі та культивовані дерева і кущі. Голонасінні: Довідник / М.А. Кохно, В.І. Гордієнко, Г.С. Захаренко та ін.; за ред М.А. Кохно, С.І. Кузнецова.– К.: Вища школа, 2001. – 207 с.
2. Каталог деревних рослин Ботанічного саду Львівського національного університету імені Івана Франка / О.Б.Щерба, М. О. Щербина, Г.В.Тимчишин [та ін.] // Львів: ЛНУ імені Івана Франка, 2010. – 74 с.
3. Мусієнко М. М. Фізіологія рослин: Підручник. – К.: Вища шк., 1995. - 503 с.: іл.
4. Прокопів А.І., Кальмук О.П., Семенюк І.В., Скварко К.О. Вплив стимуляторів росту на живцювання *Magnolia x soulangiana Soul.-Bod.* Наук. вісн. НЛТУ України – Львів, 2009. – Вип. 19.11. – С. 8-10.
5. Терек О.І. Ріст рослин: Навч. посіб. Львів: Видавничий центр ЛНУ ім. Івана Франка. 2007 – 248 с.
6. Дерфлінг К. Гормоны растений. Системный подход: Пер. с англ. – М: Мир. 1985. – 304 с.
7. Graser H. (1977). Biochemie und Physiologie der Phytoeffektoren. Verlag Chemie, Weinheim.