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PROPAGATION OF EDIBLE HONEYSUCKLE (*LONICERA EDULIS* TURCZ) IN *IN VITRO CONDITIONS*

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Aim. To propagate edible honeysuckle (*Lonicera edulis* Turcz) in *in vitro* conditions; to study the impact of sterilization agents on honeysuckle explants; to investigate the impact of the culture medium composition on the coefficient of propagation and rooting; to study the capability to adapt to *in vivo* conditions. **Methods.** Laboratory, mathematical, estimation and comparison. **Results.** The impact of sterilizing substances on obtaining the aseptic culture of edible honeysuckle in *in vivo* conditions was studied. The experiments were conducted on the following species: Alicia, Spokusa, Chaika, Nimfa, Doch Velikana, Karina. Lisoformin 3000 and mercury chloride were used as sterilizing agents. In the variant with Lisoformin 3000 it was studied in three exposures – 5, 7, and 10 minutes. In terms of explant regeneration efficiency after sterilization with Lisoformin 3000, three groups of edible honeysuckle species were isolated: 1 – with high regeneration capacity (94–96 %) – Alicia, Karina and Spokusa; 2 – medium capacity (86–87 %) – Chaika and Doch Velikana, 3 – low capacity (80 %) – Nimfa. The experiments aimed at studying the impact of culture medium components on the propagation efficiency determined the increase in the latter in case of rotating media with different quantitative and qualitative composition. Permanent application of uniform media leads to a sharp decrease in the proliferation coefficient in all the investigated species. Both hormone-free medium and the medium with growth regulators are efficient for rooting. High indices of rooting were achieved in both variants. The use of auxins promoted the formation of a larger amount of plant roots (from 3.09 in Spokusa to 4.21 in Alicia) which in its turn impacted the survivability of plants in *in vivo* conditions. **Conclusions.** It was established that Lisoformin 3000 in the concentration of 3 % and at the exposure duration of 5 min ensured optimal efficiency of sterilization and regeneration of edible honeysuckle explants and did not decrease their propagation coefficients. With corresponding concentrations and sterilization duration, this preparation may be recommended for obtaining the aseptic culture of honeysuckle. It was demonstrated that the rotation of media, rich and poor in macro- and microsalts was efficient for obtaining high indices of proliferation: the plants had a larger amount of tillering even in case of using not high concentrations of cytokinin. The introduction of rhizogenesis inducer, IBA, (1 mg/l) into the culture medium did not increase the percentage of rooted plants compared to hormone-free medium, but stimulated the formation of a larger amount of roots, which had further positive impact on the adaptation properties.

Keywords: honeysuckle, sterilization, proliferation, rooting, adaptation, explant, *in vitro*.

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INTRODUCTION

The culture *in vitro* and microclonal propagation of plants is a promising method, which allows obtaining large amounts of qualitative planting material of fruit plants and berries in short periods of time, on small areas, and regardless of weather conditions. The technology of microclonal propagation of any culture consists of four main stages: introduction of an initial form into the sterile culture, propagation proper, rooting of propagated microsprouts and their adaptation to growing in soil.

The introduction into the culture is one of the stages, which is high cost- and labor-consuming. Successful conducting of this stage requires selecting the phase of active physiological development of a plant and the cor-

responding sterilizing agents. The selection of a sterilizing agent depends on its efficiency and impact on the further development of a plant in general. At present, the most efficient preparations are based on mercury, but their toxicity inhibits further development of microplants [1]. For instance, while using 0.10 % solution of mercury chloride ($HgCl_2$) to obtain the aseptic culture of honeysuckle, species Cheliabinka and Duet, the regeneration from initial explants was only 65.9 % and 64.9 % respectively [2]. The increase in the concentration up to 0.15 % ensured the yield of sterile explants at the level of 95 %, 67.5 % of which regenerated further [3]. While using 0.2 % mercury sulphate ($HgSO_4$), the proliferation was observed in 54.43 % explants, and 4.57 % did not develop at all [4]. Lisoformin 3000 was successfully used for sterilization of explants of decorative and fruit and berry crops of 29 varieties of 14 species of 13 genera which belonged to 3 families [5]. Other sterilization agents, such as sodium and calcium hypochlorite or hydrogen peroxide did not ensure satisfactory yield of sterile explants, thus, the search for efficient and less toxic sterilization agents to obtain the aseptic culture of edible honeysuckle is an urgent problem.

At the proliferation stage the explants start forming side sprouts. The main task of this stage is obtaining the maximal amount of microplants, identical to the initial one. At this stage, the determining role belongs to variety-wise specificities of the explant, its structure, origin, composition of the culture medium and physical conditions of cultivating. The composition of the medium, the cultivation conditions, different manipulations with explants, the subcultivation duration should ensure the optimal propagation coefficient 1 : 5–10, and the number of passages should not exceed 10–15 [6]. The culture media of Murashige and Skoog (MS) with saccharose, agar-agar, physiologically active substances, phytohormones are usually used at this stage [7]. The rotation of media stimulates the development of a larger number of microplants compared to the control (MS) [8]. The increase in the propagation coefficient to the maximal indices may be achieved by the replacement of standard growth stimulators, BAP, with CPPU-N-(2-chloro-4-pyridyl)-N-phenylurea) 0.7 mg/l [9].

The rooting of plants is the final stage of microclonal propagation. The process of forming adventive roots consists of three stages: induction (prior to the beginning of the cell distribution), initiation (differentiation of meristems to root primordia) and the appearance of roots beyond the stem part of the sprout. Root meristems of microcuttings are more often formed in the places where cambium and phloem have been crossed by medullary rays [10]. The first two stages last for 10–15 days, when the cells obtain the capability of forming the meristem areas, where the synthesis of root-specific proteins starts. At the rooting stage of honeysuckle microcuttings, the Murashige and Skoog medium is most frequently used with the decrease in the content of macrosalts two and even four times (for L. edulis) [11]. The most universal inducer of root formation is IBA in the concentration of 0.2–1.0 mg/l. The increase in the content of IBA in the medium up to 4 ml/l leads to the decrease in the number of rooted plants down to 83 %, whereas the combination of indole butyric and indole acetic acids (2 ml/l and 2.5 ml/l respectively) leads to the increase in the number of rooted plants up to 95 %. Here the number of roots is 4 ± 1.38 per explant, which at the end has a negative impact on the adaptation of honeysuckle plants [12]. As a rule, higher concentrations inhibit the rooting and cause intense development of the early callus [13].

Adaptation and completion of growing is the last stage of all the procedures, resulting in obtaining high quality planting material. This is one of the key stages of microclonal propagation. *In vitro* propagation conditions differ from *in vivo* conditions by a higher level of humidity, a different composition of salts and constant stimulation using growth regulators.

Long-term existence of plants in these conditions leads to different changes. Plant stomata stop working, leaves lose the ability to have active photosynthesis, the formed root system does not provide a plant with a complete volume of required elements from the soil mixture. Thus, the transfer to non-sterile conditions creates a stress for a plant organism, which, in its turn, leads to the death of the plant in most cases. Loss and intake of water should be controlled to decrease the stressful situation.

Firstly, humidity should be maintained close to 100 % with relative sterility of the substrate. It was established that a functioning root system is formed in microplants within 2–4 weeks. The stomata start functioning on the 10^{th}–14^{th} day after the transfer. Plants may perish due to sharp decrease in air humidity. The second stage of adaptation is gradual decrease in air humidity in the zone of the aboveground part of plants. This is the period when the conditions, close to natural ones, should be created for the growth and development of plants, as they would promote more active vegetation. During the adaptation, high relative humidity of 75–90 % is main-

tained in hothouses and the air temperature – at 22–28 °C, with the illumination of 2–5 thousand lx at the photoperiod of 15–18 h [14]. The efficiency of adaptation stage is determined by the specificities of the crop and the terms of transferring plants into the substrate. In case of such crop as currant, high adaptation efficiency is the main problem of the whole technology of microclonal propagation. As a total, plants, propagated via tissue culture, differ by their high adaptation ability to non-sterile conditions, which amounts up to 91–98 % [15]. Up to autumn, the planting material is ready for commercial realization or to being planted in the nursery garden. These plants are more frequently ahead in the development compared to the cuttings, obtained from stiffened cuttings, and after the completion cultivation they form a more powerful aboveground part compared to the plants, obtained by traditional ways of propagation [16].

Aim. To study the main stages of honeysuckle propagation in *in vitro* conditions, to investigate the impact of new sterilization agents on obtaining sterile explants, to select the media by their composition to increase proliferation and rooting coefficients, to study the adaptation of plants to *in vivo* conditions.

MATERIALS AND METHODS

The experiments were conducted in 2015–2018 in the department of virology, improvement and propagation of fruit and berry crops of the Institute of Horticulture, NAAS of Ukraine. The explants of the following varieties of edible honeysuckle (*Lonicera edulis* Turcz. of *Caprifoliaceae*) were used for sterilization): Alicia, Spokusa, Chaika (Ukraine), Karina (Poland), Doch Velikana, Nimfa (Russia). The selection of stiffened sprouts with dormant buds was performed in early spring (February–April). As honeysuckle has buds of mixed composition, explants (5–10 mm), germinated in controlled conditions, were selected for sterilization from each genotype. The explants were selected directly from the sprouts of honeysuckle plants after the formation of young increment with 2–3 internodes. The sterilization was conducted using sodium hypochlorite, alcohol, mercury chloride solution (control) and Lisoformin-3000. The first sterilization variant consisted of the following stages: 1) treating explants in sodium hypochlorite solution – 20 min with subsequent washing in water; 2) sterilizing with alcohol (C_2H_5OH) – 20 sec with washing in water; 3) sterilizing in 0.1 % mercury chloride solution ($HgCl_2$) – 2 min with three washings in sterile distilled water. In the second variant, the mercury chloride solution was replaced by 3 % solution of Lisoformin and the sterilization was conducted for 5, 7 and 10 min. The explants were planted in Murashige-Skoog medium [17], containing 0.5 mg/l BAP. The propagation was conducted via direct morphogenesis on the media of MS, DKW [18], WPM [6], and their rotation with the addition of 6-benzylaminopurine (BAP), 1 mg/l, indole butyric acid (IBA) and gibberellic acid, 0.1 mg/l each, 8 g/l agar-agar and 30 g/l saccharose. The rooting was conducted in Murashige and Skoog medium without growth regulators (control) and

Table 1. The impact of sterilization agents on the efficiency of sterilization and regeneration of honeysuckle explants, %

Variety	0.1 % HgCl2 – control		Lisoformin 3000					
			Sterilization duration, min					
			5		7		10	
	Sterilization efficiency	Regeneration efficiency	Sterilization efficiency	Regeneration efficiency	Sterilization efficiency	Regeneration efficiency	Sterilization efficiency	Regeneration efficiency
Karina	100	69	100	95	100	97	100	95
Alicia	100	67	100	96	100	95	100	92
Spokusa	100	61	100	94	100	91	100	87
Chaika	100	63	95	87	100	88	100	86
Doch Velikana	100	59	90.8	86	100	76	100	73
Nimfa	100	56	93.6	80	100	78	100	74
For regeneration efficiency by experiment variants $HIP_{05} = 2.1$								
For regeneration efficiency of varieties $HIP_{05} = 2.7$								

with the addition of 1 mg/l IBA. The adaptation was conducted in conditions of maintaining high humidity and temperature of 24–27 °C, using peat-sand mixture to enhance aeration and drainage conditions of the substrate. The plants, rooted in aseptic conditions, and rootless plants, which were rooted directly in peat-sand mixture, were used for adaptation. The calculation of sterilization indices was performed on the 7th day in the percentage ratio of sterile explants to the total number of the introduced ones. The efficiency of regeneration, the coefficient of propagation (proliferation) and rooting were estimated on the 21st day. The efficiency of regeneration was estimated in the percentage ratio of regenerated explants to the total number of obtained sterile explants. The coefficient of propagation (proliferation) was estimated via the ratio of the number of obtained microplants, within 6–7 passages depending on the variety on average, to the plants, planted at the initial passages. The rooting coefficient was estimated via the percentage ratio of the rooted microplants to the total number of the ones, planted for rooting.

RESULTS

Lisoformin 3000 was first used by us to obtain the aseptic culture of edible honeysuckle. It contains glyoxal (7.5 %), glutaric aldehyde (9.5 %), didecyldimethylammonium chloride (9.6 %) and different additional ingredients. The preparation has bactericidal (including sporocidal), virucidal, and fungicidal effect. In case of using 1–3 % Lisoformin solution for 5–7 min, a high yield of viable explants (70–95 %) was obtained for some rare and endangered kinds of plants while sterilizing seeds, isolated germs and segments of tubers [5].

The sterilization procedures were proven to be successful for all the experiment variants and ensured the yield of sterile explants from 90 to 100 % (Table 1).

The number of viable explants differed considerably depending on the variety, duration of sterilization procedures and sterilization agent. In the control variant this index fluctuated from 56 % (Nimfa) to 69 % (Karina). The number of viable explants was considerably higher (from 73 till 97 %) while using Lisoformin compared to the control. This comparison gives us all the grounds for the conclusion about the fact that the use of Lisoformin solution as a sterilization agent ensures a high level of sterility and does not have any toxic impact on the process of regeneration of explants, and thus may be recommended for obtaining the aseptic culture of honeysuckle.

Fig. 1. The aseptic explant of honeysuckle, Alicia variety

Three groups of varieties were isolated in the variant with Lisoformin with the exposure of sterilization for 5 min in terms of regeneration efficiency: with high regeneration ability (94 %–96 %) – Alicia, Karina and Spokusa; medium (86%–87%) – Chaika and Doch Velikana, and low capacity (80 %) – Nimfa.

In case of exposure for 7 and 10 min, variety-wise specificities of regeneration were mainly preserved – high regeneration ability was noted for varieties Alicia and Karina, and low ability – Doch Velikana and Nimfa.

In case of increasing the sterilization regeneration from five to seven minutes, there is an increase in regeneration capacity of plants for varieties Alicia, Karina, Chaika, Nimfa, but as for varieties Spokusa and Doch Velikana, this index is somewhat lower. Further decrease in the regeneration capacity of most varieties was observed while prolonging the sterilization duration up to 10 min (Table 1).

Thus, the variant with the shortest duration of sterilization using Lisoformin 3000 – 5 min – should be considered to be the best variant.

However, the sterilization agents and the duration of their application impacted not only the efficiency of sterilization and regeneration of honeysuckle explants, but also the coefficients of propagation of the latter (Table 2). The studies established that the use of Lisoformin for sterilization purposes increased the coefficient of propagation for explants of all the studied varieties considerably. Compared to the control (0.1 % $HgCl_2$, 2 min), in the variant with Lisoformin and exposure for

Table 2. The propagation coefficients for the explants of honeysuckle varieties *in vitro*

Variety	0.1 % HgCl2 – control	Lisoformin 3000		
		Sterilization duration, min		
		5	7	10
Karina	2.46	3.45	3.36	3.06
Alicia	1.58	2.34	2.17	2.02
Spokusa	1.92	2.58	2.21	2.1
Chaika	1.66	2.47	2.02	1.99
Doch Velikana	1.5	2.04	1.93	1.87
Nimfa	1.66	2.38	1.99	1.89
By experiment variants HIP_{05} = 0.30				
By varieties HIP_{05} = 0.24				

Table 3. The propagation coefficients for explants of honeysuckle varieties *in vitro* on different media

Variety	Murashige and Skoog (MS)				
	Passages and propagation coefficients				
	1	2	3	4	5
Karina	1.9	3.15	3.05	2.36	1.56
Alicia	1.82	3.02	2.04	1.97	1.09
Spokusa	1.72	2.94	2.48	2.20	1.11
Chaika	1.66	2.95	2.49	2.09	1.49
Doch Velikana	1.54	3.01	2.84	2.33	1.67
Nimfa	1.69	2.92	2.78	1.98	1.29
By varieties HIP_{05} = 0.49					
Variety	DKW				
	Passages and propagation coefficients				
	1	2	3	4	5
Karina	1.99	3.05	2.90	2.16	1.16
Alicia	1.89	2.92	1.74	1.37	1.19
Spokusa	1.90	2.98	2.18	1.70	1.01
Chaika	2.06	2.75	2.09	1.59	1.19
Doch Velikana	2.14	2.91	1.84	1.33	1.17
Nimfa	1.77	2.76	2.08	1.68	1.29
By varieties HIP_{05} = 0.51					
Variety	WPM				
	Passages and propagation coefficients				
	1	2	3	4	5
Karina	1.94	2.95	2.05	1.36	1.06
Alicia	1.80	2.97	2.04	1.17	1.08
Spokusa	1.56	2.91	2.18	1.20	1.01
Chaika	1.49	2.74	2.19	1.09	0.9
Doch Velikana	1.51	3.12	2.14	1.33	1.21
Nimfa	1.73	2.90	2.18	1.18	1.20
By varieties HIP_{05} = 0.55					
By experiment variants HIP_{05} = 0.68					

5 min, this index increased more than by 40 % in the medium, containing 1 mg/l BAP, on average by varieties.

It is noteworthy that the propagation coefficients for explants depended on genetic specificities of the variety: it was the highest for Karina variety – 3.45, and the lowest – 2.04 for Doch Velikana variety. The rest of investigated varieties did not have any significant differences by the propagation coefficient for the explants, and this index fluctuated in the range of 2.34–2.58.

The increase in the sterilization duration of the explants using Lisoformin also had some impact on the coefficient of their propagation. For instance, in the variant with the 10-minute-exposure this index was considerably lower compared to the variant of 5 min for all the varieties, except for Doch Velikana variety.

We also established that constant application of Murashige and Skoog medium for the cultivation of honeysuckle decreased the number of newly formed microsprouts. Further on, similar results were obtained

Table 4. The propagation coefficients for the explants of honeysuckle varieties *in vitro* while rotating media

Variety	MS/DKW				
	Passages and propagation coefficients				
	1 MS	2 DKW	3 MS	4 DKW	5 MS
Karina	2.55	2.71	3.55	2.87	3.86
Alicia	2.85	2.82	3.94	2.97	4.05
Spokusa	1.92	2.64	2.98	2.15	3.01
Chaika	1.96	2.15	2.89	2.02	2.69
Doch Velikana	2.43	2.10	3.14	2.63	3.57
Nimfa	2.69	2.12	3.08	2.05	3.09
By varieties HIP_{05} = 0.45					
Variety	MS/WPM				
	Passages and propagation coefficients				
	1 MS	2 DKW	3 MS	4 DKW	5 MS
Karina	2.34	2.56	3.69	2.80	3.97
Alicia	2.14	2.77	3.97	2.14	4.12
Spokusa	1.98	2.34	2.99	2.05	3.11
Chaika	2.01	2.12	3.84	2.11	3.71
Doch Velikana	2.45	2.23	3.20	2.55	3.65
Nimfa	2.48	2.18	3.12	2.10	3.30
By varieties HIP_{05} = 0.39					
By experiment variants HIP_{05} = 0.52					

Table 5. The rooting of honeysuckle varieties in in vitro conditions and their adaptation to *in vivo* conditions

Variety	MS (control)			$MS_{(IBA)}$		
	Percentage of plants with roots	Number of roots	Percentage of adapted plants	Percentage of plant rooting	Number of roots	Percentage of adapted plants
Karina	100	2.16 ± 0.15	100	100	3.51 ± 0.31	100
Alicia	99	2.12 ± 0.10	95	100	4.21 ± 0.29	99
Spokusa	98	2.23 ± 0.20	98	100	3.09 ± 0.20	100
Chaika	100	1.92 ± 0.08	92	100	3.11 ± 0.18	96
Doch Velikana	100	2.99 ± 0.24	97	100	3.16 ± 0.17	100
Nimfa	100	3.18 ± 0.32	100	100	3.20 ± 0.28	100
By varieties HIP_{05} = 0.34						
By experiment variants HIP_{05} = 0.48						

Fig. 2. The honeysuckle of Karina variety, rooted in the control

Fig. 3. The adapted plant of honeysuckle, Alicia variety

for other culture media as well (Table 3). BAP in the amount of 0.5 mg/l was used on all the media at the first stage of cultivation.

The decline in the proliferation coefficient was noted in all three investigated media with every subsequent passage. The highest decrease in the coefficient was found in WPM medium, which is related to its poor content of macro- and microelements. In the second passage the gain of microsprouts for all the varieties on all the media was the highest, which is conditioned by the increase in BAP concentration from 0.5 mg/l to 1.0 mg/l.

In two experiment variants, the increase in the proliferation coefficient was noted while rotating media. The rotation of media with higher and lower content of macro- and microsalts stimulates the formation of sprouts in plants during the re-planting. The increase in the propagation coefficient was observed in all the varieties while re-planting into Murashige and Skoog medium. The propagation indices were high for all the varieties, whereas they were somewhat lower for Chaika and Spokusa varieties in both experiment variants, which is conditioned by variety-wise specificities of these plants.

The rooting was conducted in Murashige and Skoog medium without growth regulators (control) and with the addition of 1 mg/l IBA (Table 5). The plants were planted after 6–7 passages with preliminary decrease in BAP content in the last passage.

The calculations were made after 4 weeks after planting into the medium for rooting. The first roots appeared on the 10^{th}–14^{th} day. In both variants the rhizogenesis efficiency was high, amounting to 98–100 % depending on the variety. Still the number of the roots in the control was lower practically for all the varieties, which is explained by the absence of indole butyric acid in the medium, which impacts their formation. The largest number of roots in the hormone-free medium was for Nimfa variety (3.18), and the smallest (1.92) – for Chaika variety. The addition of auxin into the medium resulted in the increase in the number of roots, in this variant the largest numbers were formed in Alicia and Karina varieties – 4.21 and 3.51 respectively. These two varieties were also remarkable for high indices of regeneration and proliferation, which has already been mentioned above.

The adaptation to *in vivo* conditions was successful for microsprouts of all the investigated varieties, amounting to 96–100 % (Fig. 3).

CONCLUSIONS

The studies established that Lisoformin 3000 in the concentration of 3 % and exposure duration of 5 min ensured optimal efficiency of sterilization and regeneration of edible honeysuckle explants and did not decrease their propagation coefficients. Three groups of edible honeysuckle varieties were isolated by the regeneration efficiency at the background of Lisoformin 3000: with high regeneration ability (94–96 %) – Alicia, Karina and Spokusa; medium (86–87 %) – Chaika and Doch Velikana, and low ability (80 %) – Nimfa.

The propagation of honeysuckle in the same medium had a negative impact on propagation coefficients. It was determined that the rotation of media raised the proliferation indices. The highest proliferation indices

were achieved in MS medium for Alicia variety (4.12) after re-planting from WPM medium, thus it was efficient to rotate media with rich and poor content of macro- and microsalts, here even if 1 mg/l of BAP was used, the plants had more tillering from minimal 2.12 in the second passage for Chaika in WPM medium, with 3.71 for this index in MS medium.

Both hormone-free medium and the medium with rhizogenesis inducers were efficient for rooting. High indices of root formation were achieved in both variants. The use of auxin IBA (1 mg/l) promoted the formation of a larger amount of plant roots (from 3.09 in Spokusa to 4.21 in Alicia) which in its turn impacted the survivability of plants in *in vivo* conditions.

Розмноження жимолості їстівної (*Lonicera edulis* Turcz) в умовах *in vitro*

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Мета. Дослідити основні етапи розмноження жимолості їстівної (*Lonicera edulis* Turcz) в умовах *in vitro*. Вивчити вплив стерилізуючих агентів на експланти жимолості. Дослідити вплив складу живильного середовища на коефіцієнт розмноження та укорінення. Вивчити адаптаційну здатність до умов *in vivo*. **Методи.** Лабораторний, математичний, розрахунково-порівняльний. **Результати.** Досліджено вплив стерилізуючих речовин на отримання асептичної культури жимолості їстівної в умовах *in vitro*. Досліди проводили на сортах: Алісія, Спокуса, Чайка, Німфа, Дочь Вєлікана, Каріна. Як стерилізуючий агент використовували Лізоформін 3000 та хлорид меркурію. У варіанті з використанням препарату Лізоформін 3000 його досліджували при трьох експозиціях – 5, 7 та 10 хвилин. За ефективністю регенерації експлантів після стерилізації препаратом Лізоформін 3000 виділено три групи сортів жимолості їстівної: 1 – з високою регенераційною здатністю (94–96 %) – Алісія, Каріна і Спокуса; 2 – середньою (86–87 %) – Чайка і Дочь Вєлікана, 3 – низькою (80 %) – Німфа. В дослідах по вивченню впливу складових живильного середовища на ефективність розмноження встановили, що вона зростає при чергуванні середовищ із різним кількісним та якісним складом. Постійне використання однотипних середовищ призводить до різкого зниження коефіцієнта проліферації на всіх досліджуваних сортах. Для вкорінення ефективним є використання як безгормонального, так і середовища із регуляторами росту. В обох варіантах були досягнуті високі показники вкорінення. При використанні ауксинів у рослин формувалося більше коренів (від 3,09 у Спокуси до 4,21 у Алісії), що в свою чергу впливає на приживлюваність рослин в умовах *in vivo*. **Висновки.** Встановлено, що препарат Лізоформін 3000 в концентрації 3 % і тривалості експозиції 5 хв забезпечує оптимальну ефективність стерилізації та регенерації експлантів жимолості їстівної і не знижує їх коефіцієнтів розмноження. Цей препарат при відповідних концентрації та тривалості стерилізації можна рекомендувати для отримання асептичної культури жимолості. Показано, що для отримання високих показників проліферації ефективним є чергування середовищ із багатим та бідним вмістом макро- і мікросолей: у рослин істотно збільшується кількість галужень навіть при використанні невисоких концентрацій цитокініну. Додавання в живильне середовище індуктора ризогенезу ІМК (1мг/л) не збільшує відсоток укорінених рослин в порівнянні з безгормональним середовищем, але стимулює утворення більшої кількості коренів, що в подальшому позитивно впливає на адаптаційні властивості.

Ключові слова: жимолость, стерилізація, проліферація, укорінення, адаптація, експлант, *in vitro.*

Размножение жимолости съедобной (*Lonicera edulis* Turcz) в условиях *in vitro*

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Цель. Исследовать основные этапы размножения жимолости съедобной (*Lonicera edulis* Turcz) в условиях *in vitro.* Изучить влияние стерилизующих агентов на экспланты жимолости. Исследовать влияние состава питательной среды на коэффициент размножения и укоренения. Изучить адаптационную способность к условиям *in vivo*. **Методы**. Лабораторный, математический, расчетно-сравнительный. **Результаты**. Исследовано влияние стерилизующих веществ на получение асептической культуры жимолости съедобной в условиях *in vitro*. Опыты проводили на сортах: Алисия, Искушение, Чайка, Нимфа, Дочь Великана, Карина. В качестве стерилизационного агента использовали Лизоформин 3000 и хлорид ртути. В варианте с использованием препарата Лизоформин 3000 его исследовали при трех экспозициях – 5, 7 и 10 минут. По эффективности регенерации эксплантов после стерилизации препаратом Лизоформин 3000 выделено три

группы сортов жимолости съедобной: 1 – с высокой регенерационной способностью (94–96 %) – Алисия, Карина и Искушение; 2 средней (86–87 %) – Чайка и Дочь Великана, 3 – низкой (80 %) – Нимфа. В опытах по изучению влияния составляющих питательной среды на эффективность размножения установили, что жимолость растет при чередовании сред с разным количественным и качественным составом. Постоянное использование однотипных сред приводит к резкому снижению коэффициента пролиферации на всех исследуемых сортах. Для укоренения эффективным является использование как безгормональной, так и среды с регуляторами роста. В обоих вариантах были достигнуты высокие показатели укоренения. При использовании ауксинов у растений формировалось больше корней (от 3,09 в Искушения до 4,21 в Алисии), что в свою очередь влияет на приживаемость растений в условиях in vivo. **Выводы**. Установлено, что препарат Лизоформин 3000 в концентрации 3 % и продолжительности экспозиции 5 мин обеспечивает оптимальную эффективность стерилизации и регенерации эксплантов жимолости съедобной и не снижает их коэффициентов размножения. Этот препарат при соответствующих концентрации и продолжительности стерилизации можно рекомендовать для получения асептической культуры жимолости. Показано, что для получения высоких показателей пролиферации эффективно чередование сред с богатым и бедным содержанием макро- и микросолей: у растений существенно увеличивается количество ветвлений даже при использовании невысоких концентраций цитокинина. Добавление в питательную среду индуктора ризогенеза ИМК (1 мг/л) не увеличивает процент укоренившихся растений по сравнению с безгормонального средой, но стимулирует образование большего количества корней, в дальнейшем положительно влияет на адаптационные свойства.

Ключевые слова: жимолость, стерилизация, пролиферация, укоренение, адаптация, эксплантов, *in vitro*.

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