FACTORS AFFECTING THE ROOTING OF CUTTINGS OF *Syringa vulgaris* L. CULTIVARS

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Abstract. *Syringa vulgaris* L. is famous for its great diversity of ornamental cultivars and hybrids. The vegetative propagation aims at their conservation and use in the design of gardens and parks. For this reason stem cuttings were collected from old individuals of the species, 'Charles Jolly' and 'Mme Florent Stepman'. One-year old hardwood cuttings were taken in the beginning of spring from dormant individuals and green, softwood cuttings, were collected in the middle of blooming stage. The base of the cuttings was dipped in IBA powder in concentrations 0.3%, 0.5%, and 0.8% and untreated cuttings were used as control. Our results indicated that rooting was not induced on the hardwood cuttings. All treatments with IBA supported the induction of rooting in softwood cuttings and decreased the period of rooting. The cuttings from 'Charles Joly' and *Syringa vulgaris* reached statistically the highest value of rooting (45.0 ± 2.9% and 50.0 ± 5.0%, respectively), but they did not show statistically significant differences between them. The rooting registered the lowest value in the cuttings from 'Mme Florent Stepman' (33.3 ± 13.6%).

Keywords: IBA, lilac, propagation.

Rezumat. Factorii care afectează formarea rădăcinii la butaşii soiurilor de *Syringa vulgaris* L. *Syringa vulgaris* L. este renumit pentru marea sa diversitate de soiuri și hibrizi ornamentali. Înmulțirea vegetativă are ca scop conservarea și utilizarea lor în proiectarea de grădini și parcuri. Din acest motiv, butașii obținuți din tulpină au fost colectați de la plantele mature, aparținând speciilor "Charles Jolly" și "Doamna Florent Stepman". Butașii lemnoşi, de un an, au fost prelevați la începutul primăverii de la specimenele latente și butașii verzi au fost colectați la mijlocul stadiului de înflorire. Baza butașilor a fost scufundată în pudră de IBA, cu concentrații de 0,3%, 0,5%, 0,8%, dar au fost folosiți şi butași netratați, ca probă martor. Rezultatele noastre au indicat că înrădăcinarea nu a fost indusă în cazul butașilor lemnoşi. Toate tratamentele cu IBA au indicat înrădăcinarea la butași obținuți din lăstari și reducerea perioadei de înrădăcinare. Butașii de la "Charles Joly" și *Syringa vulgaris* au atins statistic cea mai mare rată de înrădăcinare (45,0 ± 2,9% și 50,0 ± 5,0%, respectiv), dar nu s-au remarcat diferențe statistice semnificative între ei. Cea mai redusă rată de înrădăcinare a fost înregistrată la butașii proveniți de la "Doamna Florent Stepman" (33,3 ± 13,6%).

Cuvinte cheie: IBA, liliac, înmulțire.

INTRODUCTION

Common lilac (*Syringa vulgaris* L.) is famous for its great diversity of ornamental cultivars and hybrids (KRÜSSMANN, 1984; DIRR & HEUSER,1987; DIRR, 1998; FIALA, 2008) making it very suitable for use in urban areas.

The cloning of its cultivars is performed by grafting on seedlings. However, the production of large quantities of grafts is limited by the season, period duration for rootstock production, and the success depends on the method of grafting (KRÜSSMANN, 1984; DIRR & HEUSER, 1987; DIRR, 1998; FIALA, 2008). Also, the grafting is labour-consuming and needs large areas. That is why the rooting of cuttings is an easier and cheaper method for cloning of the lilac cultivars and hybrids. According to BOJARCZUK (1975) own-root lilacs grow more intensively, exhibit more viability and are considered more resistant to disease than grafted plants. They are also easier to propagate since root sprouts originate from the same cultivar.

Rhizogenesis in cuttings of woody plants can be affected by a variety of factors that include genotype and age of the donor plant, physiological state at the time of excision, age or degree of lignification of the tissues in the cutting and environmental conditions that support the expression of the rooting potential (CAMERON et al., 2003).

Syringa vulgaris cuttings are generally considered difficult to root because they can be rooted only for a short period during the year i.e. only during the phase of full bloom (SCHMIDT, 1978; BOJARCZUK, 1975, 1978a, 1979; DIRR & HEUSER, 1987; DIRR, 1998; HARTMANN et al., 2002; CAMERON et al., 2003). Rooting varies considerably between the cultivars (SCHMIDT, 1978; BOJARCZUK,1979; BASSUK et al., 1984; TYATYUSHKINA, 2007) and depends on their age (WALDENMAIER & BÜNEMANN, 1991), and different part of the shoots (BOJARCZUK & JANKIEWICZ, 1975; SCHMIDT, 1978). It was demonstrated that severe pruning, which promotes rapid growth from relatively few shoots, is beneficial and is widely used since it is considered to restore or maintain juvenile characteristics, including ease of rooting (CAMERON et al., 2003). It was found that etiolation could facilitate the rooting of cuttings (BASSUK et. al.,1984; PATIENCE & ALDERSON, 1984, HOWARD & RIDOUT, 1992). It has been shown that the type of auxin and its concentration is essential for rooting of softwood lilac cuttings; however the percentage of rooted cuttings and the optimal concentrations of auxin are cultivar dependant (BOJARCZUK, 1975; DIRR, 1987).

The aim of this work was to study the effect of the physiological status of the stock plants, cultivar, and concentration of IBA on rooting of *Syringa vulgaris* cuttings.

MATERIAL AND METHODS

Stem cuttings of 8 to 12 cm in length were collected from old individuals of the species, 'Charles Jolly', and 'Mme Florent Stepman'. To study the effect of physiological condition of the donor plant on the rooting, one-year old hardwood cuttings were taken in the beginning of spring from dormant individuals (on March 20 and 21, 2012) and green, softwood cuttings, were collected in the middle of blooming stage (on May 7, 8, and 9, 2012). The leaves from the lower part of the stem (4-8 cm) were removed and discarded and the cuts were made 2-3 mm under the lowest buds. For decreasing of the transpiration, most leaves were eliminated and two-thirds of the leaf blade of all upper leaves was removed. The base of the cuttings was dipped into indole-3-butyric acid (IBA) powder in concentrations 0.3%, 0.5%, and 0.8% and non-treated cuttings were used as control. They were inserted at 3 × 3 cm spacing directly into rooting substrate of peat and perlite (2:1; v/v) on a mist propagation bench in glasshouse (Fig. 1). Air temperature on the mist bench was 20 ± 2°C. The air humidity was controlled by automatic mist system and was 70%. Rooting was defined as the emergence of one or more roots of 3 mm or longer in length. The formation of callus, percentage of rooted cuttings, number of roots per cutting, and root length (total length of all first order roots per cutting was calculated) was recorded after 35, 55, 75, and 95 days.

Figure 1. Cuttings inserted into rooting substrate of peat and perlite (2:1; v/v) on a mist propagation bench in glasshouse.

Each treatment, cultivar, and season contained three replicates and for each of them 20 cuttings were used. The results were analysed by One-Way ANOVA followed by a post hoc LSD test at $p < 0.05$, using SPSS 20.0 for Windows. Percentage values were transformed using arcsine square root (√P) (COMPTON 1994) to normalize error distribution prior variance analysis.

RESULTS

Callus formation was not observed on the hard-wood cuttings. However, its formation was observed before the rooting of soft-wood cuttings (Fig. 2) after 35 days from the beginning of the experiment and depended on the genotype peculiarities of the investigated cultivars. However, in 'Charles Joly' the rate of cuttings, formed callus increased until the 55th day. In the highest concentrations of IBA (0.5% and 0.8%) the callus formation continued in the cuttings of 'Charles Joly' until the 55th day when 0.5% IBA was used. After these periods, some of the cuttings with callus died but, statistically, their mean rate remained the same (Table 1).

Figure 2. Callus and root primordium formation on the cuttings.

In the end of experiment the size of the callus reached about 1.0 cm. Different treatments did not affect statistically the rate of the cuttings with callus in 'Charles Joly' and 'Mme Florent Stepman', but in *Syringa vulgaris*, the cuttings formed callus decreased with the increasing of IBA concentration (Table 1). However, a higher rate of cuttings formed callus was observed after treatment with 0.3% IBA and it was statistically higher in the cuttings of 'Charles Joly' and *Syringa vulgaris* (46.7 ± 4.4% and 61.7 ± 9.3%, resp.) in comparison with 'Mme Florent Stepman' (20.0 ± 10.4%) (Table 1).

Table 1. Factors affecting the dynamics of callus formation (%).

Cultivar	Concentration of IBA	35th day	55th day	75th day	95th day
		M ± SE	M ± SE	M ± SE	M ± SE
1	Control	48.3 ± 8.3 c A	76.7 ± 10.9 d C	66.7 ± 8.3 d BC	56.7 ± 8.3 ef AB
	0.3 %	48.3 ± 4.4 c A	73.3 ± 7.3 d B	65.0 ± 7.3 d AB	61.7 ± 9.3 f AB
	0.5 %	40.0 ± 5.0 c A	41.7 ± 4.4 bc A	31.7 ± 1.7 b A	28.3 ± 1.7 abc A
	0.8 %	35.0 ± 5.8 c A	51.7 ± 8.3 bc A	45.0 ± 5.8 bc A	41.7 ± 4.4 cde A
2	Control	10.0 ± 2.9 a A	36.7 ± 1.7 bc B	40.0 ± 5.8 bc B	36.7 ± 1.7 bcd B
	0.3 %	30.0 ± 7.6 abc A	55.0 ± 7.6 c B	51.7 ± 9.3 cd B	46.7 ± 4.4 c-f AB
	0.5 %	30.0 ± 5.8 abc A	50.0 ± 7.6 bc B	53.3 ± 10.1 cd B	53.3 ± 6.0 def B
	0.8 %	35.0 ± 2.9 bc A	36.7 ± 1.7 bc A	43.3 ± 1.7 bc A	45.0 ± 5.0 c-f A
3	Control	13.3 ± 10.9 ab A	11.7 ± 9.3 a A	8.3 ± 3.3 a A	10.0 ± 5.0 a A
	0.3 %	30.0 ± 5.0 abc A	33.3 ± 10.1 b A	25.0 ± 5.0 ab A	20.0 ± 10.4 ab A
	0.5 %	33.3 ± 7.3 bc AB	38.3 ± 7.3 bc B	35.0 ± 2.9 bc AB	16.7 ± 6.0 ab A
	0.8 %	33.3 ± 6.0 bc A	41.7 ± 6.0 bc A	45.0 ± 11.5 bc A	31.7 ± 8.3 bc A

The means (M) ± standard error (SE) within a column followed by the same small letter and in the rows followed by the same capital letter are not significantly different estimated by One-Way ANOVA followed by a post hoc LSD test at $p \leq 0.05$

Legend: 1 – *Syringa vulgaris*, 2 – *Syringa vulgaris* 'Charles Joly', 3 – *Syringa vulgaris* 'Mme Florent Stepman'

Our results indicated that rooting was not induced on the hardwood cuttings (data not shown). The beginning of the adventitious roots formation in softwood cuttings was observed incidentally in some treatments after 35 days from the beginning of the experiment. In the control variant, the rooting began after 55 days and statistically increased until the 75th day. Although all investigated genotypes demonstrated lowest rooting rates of the non-treated cuttings, it could be noticed that cuttings from 'Charles Joly' and *Syringa vulgaris*, demonstrated statistically higher rooting potential in the end of experiment (18.3 ± 4.4% and 20.0 ± 5.8%, resp.) than 'Mme Florent Stepman' (1.7 ± 1.7%), which can be ascribed to the higher potential of the genotype rootability of these cultivars. However, all treatments with IBA supported the induction of rooting and decreased the period of rooting. The cuttings from 'Charles Joly' and *Syringa vulgaris* reached statistically the highest value of rooting (45.0 ± 2.9% and 50.0 ± 5.0%, respectively), but they did not show statistically significant differences between them (Fig. 3).

Figure 3. Morphological peculiarities of the root system of a cutting.

The rooting registered the lowest value in the cuttings from ‘Mme Florent Stepman’ (33.3 ± 13.6%), but it was not statistically different from ‘Charles Joly’ (Table 2).

Table 2. Factors affecting the dynamics of the rooting process (%).

Cultivar	Concentration of IBA	35th day	55th day	75th day	95th day
		M ± SE	M ± SE	M ± SE	M ± SE
1	Control	0.0 ± 0.0 a A	0.0 ± 0.0 a A	18.3 ± 6.0 bcd B	20.0 ± 5.8 bc B
	0.3 %	3.3 ± 1.7 a A	43.3 ± 1.7 e B	48.3 ± 3.3 f B	50.0 ± 5.0 e B
	0.5 %	5.0 ± 2.9 a A	23.3 ± 1.7 cd B	23.3 ± 1.7 cde B	25.0 ± 0.0 bc B
	0.8 %	3.3 ± 1.7 a A	31.7 ± 4.4 de B	31.7 ± 7.3 de B	33.3 ± 6.0 cd B
2	Control	0.0 ± 0.0 a A	1.7 ± 1.7 ab A	5.0 ± 2.9 ab AB	18.3 ± 4.4 bc B
	0.3 %	0.0 ± 0.0 a A	21.7 ± 9.3 cd B	36.7 ± 6.0 ef BC	41.7 ± 1.7 de C
	0.5 %	0.0 ± 0.0 a A	15.0 ± 5.0 abc AB	30.0 ± 5.0 de BC	45.0 ± 2.9 de C
	0.8 %	0.0 ± 0.0 a A	18.3 ± 8.3 cd AB	28.3 ± 10.1 de B	33.3 ± 8.8 cd B
3	Control	0.0 ± 0.0 a A	0.0 ± 0.0 a A	1.7 ± 1.7 a A	1.7 ± 1.7 a A
	0.3 %	0.0 ± 0.0 a A	8.3 ± 1.7 abc A	8.3 ± 1.7 abc A	13.3 ± 3.3 ab A
	0.5 %	1.7 ± 1.7 a A	16.7 ± 4.4 bcd AB	23.3 ± 8.8 cde B	23.3 ± 8.8 bc B
	0.8 %	0.0 ± 0.0 a A	18.3 ± 13.3 cd B	31.7 ± 14.2 de B	33.3 ± 13.6 cd B

The means (M) ± standard error (SE) within a column followed by the same small letter and in the rows followed by capital letter are not significantly different estimated by One-Way ANOVA followed by a post hoc LSD test at $p \leq 0.05$

Legend: 1 – *Syringa vulgaris*, 2 – *Syringa vulgaris* ‘Charles Joly’, 3 – *Syringa vulgaris* ‘Mme Florent Stepman’

The results of the experiments showed conclusively that the rooting potential is determined by all investigated factors. The duration of cultivation was statistically the most significant factor for the rooting of cuttings (Table 3, F = 55.598, p = 0.000). Another key factor, also statistically significant, was the concentration of IBA (Table 3, F = 25.528, p = 0.000). Adventitious root induction depended also on the genotype of the donor plant (Table 3, F = 16.661, p = 0.000) but it was the most insignificant of the investigated factors.

Table 3. Significance of the studied factors and their combinations on the dynamic of rooting estimated by a post hoc LSD test.

Factors	F	Level of significance
CV	16.661	0.000
C	25.528	0.000
DR	55.598	0.000
CV × C	5.191	0.000
CV × DR	2.555	0.024
C × DR	2.465	0.014
CV × C × DR	107.658	0.298

a R Squared = 0.792 (Adjusted R Squared = 0.691), $p < 0.05$.

Legend: CV = Cultivar, C = Concentration of IBA, DR = Duration of rooting

Our investigation showed that the number of roots was statistically least on non-treated cuttings (control). The number of induced roots increased statistically significantly until the 55th day after all treatments with IBA.

In the end of the experiment, the highest number of roots was induced in *Syringa vulgaris*, after the treatment of their cuttings with 0.5% IBA (10.3 ± 1.4), in ‘Charles Joly’ after the treatment with 0.3% IBA (5.1 ± 0.5), and in ‘Mme Florent Stepman’ the maximal number of roots was observed after the treatment with 0.8% IBA (8.3 ± 1.4). However, it should be noted that the concentration of IBA did not affect statistically the number of roots within a cultivar. A exception of this tendency was found only in the cuttings of ‘Mme Florent Stepman’, which formed statistically more roots after the treatment with 0.8% IBA (Table 4).

Table 4. Factors affecting the number of inducted roots.

Cultivar	Concentration of IBA (mg l^{-1})	35th day	55th day	75th day	95th day
		M ± SE	M ± SE	M ± SE	M ± SE
1	Control	0.0 ± 0.0 a A	0.0 ± 0.0 a A	2.1 ± 0.4 a B	3.5 ± 0.7 ab C
	0.3 %	1.5 ± 0.5 b A	4.5 ± 0.6 cdf AB	7.0 ± 0.9 b BC	7.9 ± 1.1 c C
	0.5 %	1.5 ± 0.5 b A	7.6 ± 1.4 g AB	10.6 ± 1.3 c B	10.3 ± 1.4 c B
	0.8 %	5.0 ± 2.0 c A	6.1 ± 1.0 eg A	7.6 ± 1.2 b A	8.3 ± 1.3 c A
2	Control	0.0 ± 0.0 a A	1.0	1.7 ± 0.3 a B	2.0 ± 0.4 a B
	0.3 %	0.0 ± 0.0 a A	5.3 ± 0.9 de B	4.8 ± 0.6 a B	5.1 ± 0.5 b B
	0.5 %	0.0 ± 0.0 a A	3.6 ± 1.0 bcd B	3.9 ± 0.6 a B	4.9 ± 0.5 b B
	0.8 %	0.0 ± 0.0 a A	4.6 ± 0.9 cde B	4.4 ± 0.7 a B	5.0 ± 0.7 ab B

3	Control	0.0 ± 0.0 a A	0.0 ± 0.0 a A	1.0	1.0
	0.3 %	0.0 ± 0.0 a A	2.4 ± 0.7 bc B	2.6 ± 0.7 a B	2.0 ± 0.5 ab B
	0.5 %	2.0	2.0 ± 0.3 b A	2.3 ± 0.5 a A	2.8 ± 0.6 ab A
	0.8 %	0.0 ± 0.0 a A	6.2 ± 1.4 efg B	7.1 ± 1.0 b BC	8.9 ± 1.3 c C

The means (M) ± standard error (SE) within a column followed by the same small letter and in the rows followed by capital letter are not significantly different estimated by One-Way ANOVA followed by a post hoc LSD test at $p \leq 0.05$. The results of some treatments are not included in the statistical comparison because only single cuttings are rooted.

Legend: 1 – *Syringa vulgaris*, 2 – *Syringa vulgaris* 'Charles Joly', 3 – *Syringa vulgaris* 'Mme Florent Stepman'

All investigated factors in our experiment, individually or jointly, had high level of significance at $p \leq 0.05$. The duration of rooting and genotype were statistically the most significant factors for the number of the induced adventitious roots (Table 5, F = 50.282 and 36.637, respectively, $p = 0.000$). Another key factor, also statistically significant, was the concentration of IBA (Table 5, F = 33.513, $p = 0.000$).

Table 5. Significance of the studied factors and their combinations on the number of inducted roots estimated by a post hoc LSD test.

Factors	F	Level of significance
CV	36.637	0.000
C	33.513	0.000
DR	50.282	0.000
CV × C	7.392	0.000
CV × DR	4.210	0.000
C × DR	3.930	0.000
CV × C × DR	1.356	0.143

a R Squared = 0.138 (Adjusted R Squared = 0.124), $p < 0.05$.

Legend: CV = Cultivar, C = Concentration of IBA, DR = Duration of Rooting

The length of the roots increased in the period between the 35th and the 95th day of cultivation. In the end of the experiment, the roots of not treated cuttings (control) had in general the lowest length. The length of roots in each genotype was not affected significantly by different treatments with IBA. In 'Mme Florent Stepman', statistically the highest length of the roots was reached after the treatment of the cuttings with 0.8% IBA (547.4 ± 81.3 mm, resp.) in comparison with the other treatments (Table 6).

All investigated factors in our experiment, individually or jointly, had high level of significance at $p < 0.05$, with exception of the combination Cultivar × Concentration of IBA × Duration of rooting (CV × C × DR). Expectably, the most significant factor, having an effect on the mean length of the induced adventitious roots, was the duration of cultivation of the cuttings (F = 59.129). Another key factor, also statistically significant, was the concentration of the used IBA (F = 31.323). The genotype peculiarities of the cultivar (F = 27.927) exerted the lowest influence (Table 7).

Table 6. Factors affecting the length of inducted roots (mm).

Cultivar	Concentration of IBA (mg l^{-1})	35th day	55th day	75th day	95th day
		M ± SE	M ± SE	M ± SE	M ± SE
1	Control	0.0 ± 0.0 a A	0.0 ± 0.0 a A	60.2 ± 18.2 a B	200.0 ± 50.4 ab C
	0.3 %	7.0 ± 3.0 b A	129.5 ± 22.0 bc AB	287.2 ± 38.3 cd B	416.1 ± 62.5 cd C
	0.5 %	7.0 ± 3.0 b A	211.9 ± 52.3 d A	402.4 ± 60.1 de B	480.3 ± 70.7 d B
	0.8 %	33.5 ± 19.5 c A	193.6 ± 41.8 cd A	407.7 ± 59.3 e B	407.0 ± 58.0 cd B
2	Control	0.0 ± 0.0 a A	23.0	36.0 ± 16.3 ab B	58.8 ± 18.8 a B
	0.3 %	0.0 ± 0.0 a A	125.5 ± 30.0 bc B	170.3 ± 26.6 ab B	210.1 ± 23.0 ab C
	0.5 %	0.0 ± 0.0 a A	67.9 ± 25.5 b B	142.7 ± 30.1 ab C	181.1 ± 23.6 ab C
	0.8 %	0.0 ± 0.0 a A	121.9 ± 38.5 bc B	210.9 ± 54.7 bc C	231.8 ± 33.5 b C
3	Control	0.0 ± 0.0 a A	0.0 ± 0.0 a A	18.0	23.0
	0.3 %	0.0 ± 0.0 a A	58.4 ± 20.1 ab B	99.6 ± 43.5 ab BC	129.8 ± 36.1 ab C
	0.5 %	37.0	90.9 ± 30.4 b A	149.0 ± 36.6 ab AB	255.9 ± 75.2 abc B
	0.8 %	0.0 ± 0.0 a A	196.8 ± 42.9 cd B	356.7 ± 62.6 de C	547.4 ± 81.3 d D

The means (M) ± standard error (SE) within a column followed by the same small letter and in the rows followed by capital letter are not significantly different estimated by One-Way ANOVA followed by a post hoc LSD test at $p \leq 0.05$. The results of some treatments are not included in the statistical comparison because only single cuttings are rooted.

Legend: 1 – *Syringa vulgaris* L., 2 – *Syringa vulgaris* 'Charles Joly', 3 – *Syringa vulgaris* 'Mme Florent Stepman'

Table 7. Significance of the studied factors and their combinations on the length of inducted roots estimated by a post hoc LSD test.

Factors	F	Level of significance
CV	27.927	0.000
C	31.323	0.000
DR	59.129	0.000
CV × C	6.832	0.000
CV × DR	4.328	0.000
C × DR	5.357	0.000
CV × C × DR	1.788	0.021

a R Squared = 0.144 (Adjusted R Squared = 0.129), $p < 0.05$.

Legend:, CV = Cultivar, C = Concentration of IBA, DR = Duration of Rooting

DISCUSSION

It was found that rooting ability of lilac cuttings depended markedly on the physiological status of the donor plant at the time of cutting excision and is of high importance for the rooting process (COGGESHALL, 1962; BOJARCZUK, 1975; BOJARCZUK & JANKIEWICZ, 1975; SCHMIDT, 1978; CAMERON et al., 2003). It was pointed that the rank-growing, succulent tissues are likely to have insufficient or even inappropriate reserves of carbohydrate storage (HARTMANN & KESTER, 2002), and high nitrogen content (HARTMANN & KESTER, 2002; DICK & DEWAR, 1992). Also, softwood cuttings, in comparison with dormant, hardwood cuttings, tend to have higher auxin. They have a moderate light requirement, since some photosynthesis enhances their rooting and their rooting requires more intensive water management, using mist or fog. For this reason softwood cuttings are recommended as the best plant material for rooting of difficult-to-root species (HARTMANN & KESTER, 2002).

The biochemical studies for root formation in common lilac cultivars implies that the better rooting cultivars compared to the poorer rooting cultivars may be caused by their higher content of ortho-dihydroxyphenols, which lower the activity of auxin. These cultivars are also characterized by a low level of monohydroxyphenols, which lower the activity of auxin (BOJARCZUK, 1978, 1979).

In agreement with the results of several authors (BOJARCZUK & JANKIEWICZ, 1975; BOJARCZUK, 1975, 1978, 1979; SCHMIDT, 1978; DIRR & HEUSER, 1987; DIRR, 1998, HARTMANN et al., 2002; FORD et al., 2002; CAMERON et al., 2003) our best results were obtained with cuttings made at flowering time. These results indicate that common lilac is one of the exceptions for the most suitable physiological state at the time of excision of cuttings in woody plants.

Our results are in agreement with the findings of a number of researchers, which reported that the rooting depends on the genotype of the donor plant and vary from 0% to 100% (SCHMIDT, 1978; BOJARCZUK, 1978b, 1979; TYATYUSHKINA, 2007).

Improving the rooting of cuttings of ‘Charles Joly’ has been obtained by treatment of etiolated shoots with black plastic tape, soaked with 0.1% or 0.8% IBA and wound about the base of the new shoots (BASSUK et al., 1984; MISKE & BASSUK, 1985; MAYNARD & BASSUK, 1987). However, it was found that the annual pruning (CAMERON et al., 2003) or using of etiolated shoots could significantly facilitate the rooting of softwood cuttings of this cultivar.

Some authors have evaluated the rooting ability after 5-14 weeks (BOJARCZUK, 1975, 1978b; BOJARCZUK & JANKIEWICZ, 1975; SCHMIDT, 1978; BASSUK et al., 1984, MISKE & BASSUK, 1985, FORD et al., 2002; CAMERON et al., 2003) but others have not indicated the duration of rooting process (BOJARCZUK 1979; MAYNARD & BASSUK, 1987; TYATYUSHKINA, 2007). Our results showed that the rooting ability of the cuttings of *Syringa vulgaris* is strongly influenced by the duration of cultivation. Although IBA supported the induction of rooting, the period of rooting should not be shorter than 75 days.

It has been reported that the type and concentration of the auxin used are of critical importance for rooting of woody species (SCHMIDT, 1978; BONGA & VON ADERKAS, 1992; ILIEV, 1996; DE KLERK et al., 1997; HARTMANN et al., 2002; DANCHEVA, 2005; ILIEV et al., 2010). It was found that concentration of IBA in the diapason of 0.1% - 0.8% facilitate the rooting of cuttings in common lilac and its cultivars (BASSUK et al., 1984; MISKE & BASSUK, 1985; MAYNARD & BASSUK, 1987). Although the tested concentrations of IBA in our experiment were unable to overcome the influence of the physiological status of the donor plant, it supported the rootability of softwood cuttings and decreased the period of rooting. However, there is always an effect of the particular genotype with respect to the percentage of rooting. This is in agreement with previous findings for common lilac cultivars (SCHMIDT, 1978; BOJARCZUK, 1979; TYATYUSHKINA, 2007) or hybrids (COGGESHULL, 1962; BASSUK et al., 1984).

Root number has been used as an expression of rhizogenesis potential (VAN DR KRIEKEN et al., 1992; GUAN & DE KLERK, 2000; CAMERON et al., 2003; DANCHEVA, 2005; ILIEV et al., 2010; LYUBOMIROVA &

ILIEV, 2013), the assumption being greater root numbers correlate with greater rooting potential. Also, it has been shown that the quality of formed root system is an important factor for successful acclimatization (MCCLELLAND et al., 1990; HARTMANN et al., 2002). Our study showed that once roots reach a certain stage of development, they inhibit further initiation of root primordial. The inhibition might be a result of activation of a gene responsible for the root elongation and synthesis of plant growth regulators, which repress the root primordia induction. Gibberellins have been shown to inhibit rooting directly (KAWAI ,1997) and the action of growth retardants on improving root induction may be associated with their anti-gibberellin properties (WIESMAN & RIOV, 1994; PORLINGIS & KOUKOURIKOU-PETRIDOU, 1996). This consideration seems to be a possible explanation of the results achieved in our study. However, more detailed studies are necessary especially since root number is likely to be used widely as a variable in studies of the genetic control of rooting.

In conclusion, in view of our results and according the classification of HARTMAN et al. (2002) *Syringa vulgaris*, 'Mme Florent Stepman', and 'Charles Joly' could be considered into the class of moderately-easy-to-root.

ACKNOWLEDGEMENTS

This research was supported by the grant No BG051PO001-3.3.06-0056, financed by the Human Resources Development Operational Programme (2007 – 2013) and co-financed jointly by the ESF of the EU and the Bulgarian Ministry of Education and Science. The authors are thankful of Assoc. Prof. Dr. Peter Zhelev for his helpful advices related with the statistical comparison of the results.

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Received: March 15, 2014
Accepted: April 21, 2014