INFLUENCE OF SOME FACTORS ON MULTIPLICATION OF ORNAMENTAL SPECIES *PASSIFLORA COERULEA* AND *PASSIFLORA QUADRANQULARIS*

INFLUENŢA UNOR FACTORI ASUPRA ÎNMULŢIRII SPECIILOR ORNAMENTALE *PASSIFLORA COERULEA* ŞI *PASSIFLORA QUADRANQULARIS*

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Abstract. *In the current paper are presented the results of a research regarding the influence of cuttings' type, substrate and treatments on cuttings rooting at floral species Passiflora coerulea and Passiflora quadranqularis. Research was carried out in the didactical greenhouse of Floriculture discipline from USAMV Iaşi, experiments being organized in 8 variants. During research was observed the influence of cuttings type, substrate and treatments with bio-stimulators on rooting capacity of cuttings. At the end of research was noticed that at those two studied species rooting of cuttings had good results if are treated with a rooting stimulator and placed into a perlite substrate for rooting. The type of manufactured cuttings, it influences to a lesser extent the rooting ability.*
Key words: *Passiflora coerulea, Passiflora quadranqularis*, multiplication by cuttings

Rezumat. *În această lucrare sunt prezentate rezultatele cercetării privind influența tipului de butaş, a substratului şi a tratamentelor asupra înrădăcinării butaşilor la speciile floricole Passiflora coerulea şi Passiflora quadranqularis. Cercetările s-au desfăşurat în sera didactică a disciplinei de Floricultură din cadrul USAMV Iaşi, experiențele fiind organizate în 8 variante experimentale. Pe parcursul cercetărilor s-a urmărit influența tipului de butaş, a substratului şi a tratamentelor cu biostimulatori asupra capacității de înrădăcinare a butaşilor. În urma cercetărilor s-a constat că la cele două specii luate în studiu înrădăcinarea butaşilor se face cu rezultate bune dacă sunt tratați cu un stimulator de înrădăcinare şi aşezați la înrădăcinat în substrat de perlit. Tipul de butaş confecționat, influențează într-o mai mică măsură capacitatea de înrădăcinare.*
Cuvinte cheie: *Passiflora coerulea, Passiflora quadranqularis,* înmulțirea prin butaşi

INTRODUCTION

Passiflora genus belongs to Passifloraceae family and include species native from tropical areas (South America, Australia and Asia) (Patil, 2013; Boboc *et al.,* 2017). Ornamentally speaking the most well known are species *Passiflora coerulea* L. and *Passiflora quadranqularis* L.

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Passiflora coerulea L. is a species of ornamental liana, with climbing port, clinging. Leaves are trefoil, having a dark green colour, with an alternate disposal. In axil, leave present tendrils with the help of which clings on supports. Flowers are big with a diameter of 10-12 cm, having a pink-violet colour. Sepals are, juicy, with a pink-violet colour on internal side, having a length of 3-4 cm. Petals are threadlike and equal as dimensions. It presents numerous and very big stamina. Fruit is fleshy, and seeds are brownish blackish (Draghia and Chelariu, 2011; Chelariu, 2015; Cordoba, 1980; Nagy *et al.,* 1990).

Passiflora quadranqularis L. presents thick, edged and smooth stems, with an intense green colour. Plants have tendrils situated in leaf's axil and have a length of 22.5-35 cm and a thickness of 0.15-0.2 cm. The leave have the limb with an oval or elliptical shape, with entire edge, petiolate, with a length of 10-20 cm and a width of 8-15 cm. Those ones are alternate disposed on edged sprouts. On superior side leaves have a dark green colour, and on inferior side the colour is light green (Draghia and Chelariu, 2011; Geilfus, 1994; Nagy *et al.,* 1990). Flowers have around 12 cm in diameter; the colour could be violet, pink, white or blue. Sepals are ovate and have a length up to 3.5 cm, are fleshy, have a green colour at exterior, and pink or white on the interior side. Petals have an oblong-ovate shape till an oblong-lancelet shape and are equal as dimensions. Stamina is numerous and very big, has the length bigger than petals, have an undulated peak and present alternative transversal stripes, with a violet with white colour. Ovary is elliptical, with a yellowish colour, opaque. Stigmas at the beginning of flowering have a yellow colour and after that became light brown (Avilán *et al*., 1989; Draghia and Chelariu, 2011). Fruit is fleshy, having a length of 10-25 cm and a diameter of 8-10 cm (Cordoba, 1980), weighting 225-450 g or more, mesocarp or pulp have a white colour, reaching 2.5 cm up to 4 cm in diameter, is a juicy fruit with a not so pleasant taste (Nagy *et al.,* 1990).

Multiplication of passiflora species is realised on generative way as well as on vegetative way (Cordoba, 1980; Nagy *et al.,* 1990; Hartmann and Kester, 1997; Draghia and Chelariu, 2011; Chelariu, 2015).

The current paper present the results regarding the influence of some factors on multiplication by cuttings at two ornamental species belonging to genus *Passiflora*, cultivated in pots, in the conditions of didactical greenhouse belonging to Floriculture discipline, from Faculty of Horticulture, Iaşi, Romania.

MATERIAL AND METHOD

Research was carried out into the didactical green house belonging to Floriculture discipline, Faculty of Horticulture, USAMV Iaşi, Romania, during February 2018 – Mai 2019. Study material was represented by two species of ornamental plants, which in conditions of continental temperate climate are cultivated as plants in pots: *Passiflora coerulea* L. 'Amethyst' kind and *Passiflora quadranqularis* L.

For each species was organized three factorial experiences, where the aimed factors were: rooting substrate type, stimulating substance and type of realized cutting.

By combination of factors were obtained, at each species, the following variants: V1 – water + peak cuttings; V2 – water + section cuttings; V3 – perlite + peak cuttings; V4 – perlite + section cuttings; V5 – perlite + peak cuttings + 1 treatment applied at making cuttings; V6 – perlite + section cuttings + 1 treatment applied at making cuttings; V7 – perlite + peak cuttings + 1 treatment applied at making cuttings and another three at a 10 days difference; V8 – perlite + section cuttings + 1 treatment applied at making cuttings and another three at a 10 days difference (tab. 1).

Table 1

Experimental design

Variant	Substrate	Treatment for cuttings	Cuttings type	Cuttings number	Date of realization
V1	water	untreated	sprout peak	10	26.02.2018
V2	water	untreated	sprout section	10	26.02.2018
V3	perlite	untreated	sprout peak	10	26.02.2018
V4	perlite	untreated	sprout section	10	26.02.2018
V5	perlite	1 treatment with Cropmax	sprout peak	10	26.02.2018
V6	perlite	1 treatment with Cropmax	sprout section	10	26.02.2018
V7	perlite	4 treatments with Cropmax	sprout peak	10	26.02.2018
V8	perlite	4 treatments with Cropmax	sprout section	10	26.02.2018

For each experimental variant was utilised biological material (cuttings) as uniform as possible regarding size, respectively development degree of the utilised part of plant. Substrate was utilised water and perlite, and as bio-stimulator Cropmax.

Was aiming to determine the summed influence of substrate, cutting type and bio-stimulator, on cuttings' rooting at *Passiflora coerulea* L. and *Passiflora quadranqularis* L, as well as the determination of unilateral influence of substratem cutting type and bio-stimulator on cuttings' rooting.

The obtained results were centralized in graphs and tables, and statistical interpretation was made by using the limit differences.

RESULTS AND DISCUSSIONS

Analyzing the obtained results we noticed that at first observations, after 10 days from establishing the experience, at *Passiflora coerulea* 'Amethyst' kind rooting started after about 20 days from manufacturing, at cuttings planted in perlite (V3-V8) and after 30 days at variants at which the rooting substrate was water (V1 and V2). At *Passiflora quadranqularis* rooting started after around 10 days at variants with perlite (V3-V8) and after 20 days at the ones with water (V1-V2) (tab. 2).

At the last observations, at *Passiflora coerulea* 'Amethyst' rooting rate varied from 30% to 90%, and at *Passiflora quadranqularis* between 50% and

100%. At the last ones, for variants V7 and V8, rooting finished earlier than at others (tab. 2). At both species the best results were recorded at section cuttings, rooted on perlite substrate and treated with Cropmax (tab. 2, fig. 1).

Table 2

Dynamics of cuttings rooting (%)

Variant	Number of rooted cuttings (after … days)									
	***Passiflora coerulea* 'Amethyst'**					***Passiflora quadrangularis***				
	10	**20**	**30**	**40**	**50**	**10**	**20**	**30**	**40**	**50**
V1	-	-	10	20	30	-	10	30	40	50
V2	-	-	10	30	40	-	20	40	50	60
V3	-	10	20	40	50	20	30	50	70	80
V4	-	10	30	50	60	20	40	60	70	90
V5	-	30	50	60	70	30	50	70	90	100
V6	-	40	50	60	70	40	50	70	90	100
V7	-	30	40	60	80	40	60	80	100	-
V8	-	40	50	70	90	40	60	90	100	-

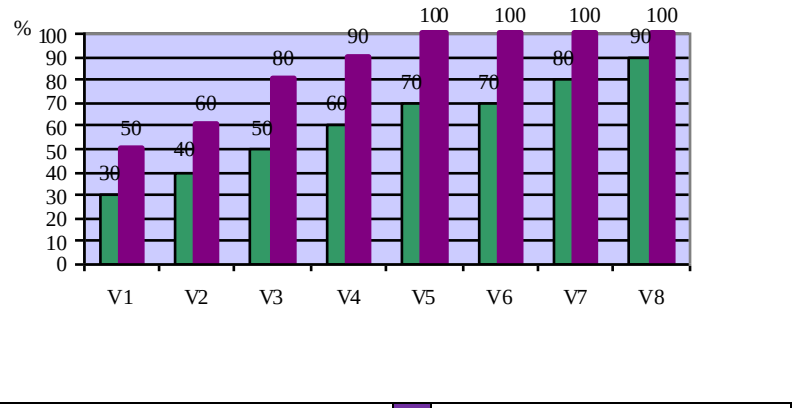

Fig. 1 Rate of cuttings rooting

Statisticallty speaking the influence of interaction, substrate, cutting type and bio-stimulator on rate of rooting for cuttings of *Passiflora* was observed that at *P. coerulea* 'Amethyst' differences face to variants' mean were very significant positive at V8, significant positive at V7. At V1 differences were very significant negative, and at V2 were significant distinct negative. At variants V3-V6, differences face to mean were insignificant (tab. 3). At *Passiflora quadranqularis* differences face to mean were significant positive at variants V5-V8, very significant negative at V1 and V2; at V3 and V4, differences were insignificant (tab. 3).

Table 3

Influence of substrate, cutting type and bio-stimulator influence on cuttings rooting rate

Variant	*Passiflora coerulea* 'Amethyst'			*Passiflora quadranqularis*		
	Rooted cuttings (%)	% face to mean	Difference (±d)	Rooted cuttings (%)	% face to mean	Difference (±d)
V1	30^{000}	48.94	-31.3	50^{000}	58.82	-35.00
V2	40^{00}	65.25	-21.3	60^{000}	70.59	-25.00
V3	50^{ns}	81.57	-11.3	80^{ns}	94.12	-5.00
V4	60^{ns}	97.88	-1.3	90^{ns}	105.88	+5.00
V5	70^{ns}	114.19	+8.7	100*	117.65	+15.00
V6	70^{ns}	114.19	+8.7	100*	117.65	+15.00
V7	80*	130.51	+18.7	100*	117.65	+15.00
V8	90***	146.82	+28.7	100*	117.65	+15.00
Mean	61.3	100.00	0.00	85	100.00	0.00
	LD 5% = 14.3 LD 1% = 19.8 LD 0.1% = 27.5			LD 5% = 11.3 LD 1% = 15.6 LD 0.1% = 21.7		

Statiscally analysing the unilateral influence of substrate on cuttings rooting was observed that perlite determine, face to variants mean, distinct positive significant differences at *P. coerulea* 'Amethyst' and very significant positive differences at *Passiflora quadranqularis*, while substrate represented by water determined distinct significant negative differences at *P. coerulea* 'Amethyst' and very significant negative differences at *Passiflora quadranqularis* (tab. 4).

Table 4

Influence of substrate on cuttings rooting rate

Variant	*Passiflora coerulea* 'Amethyst'			*Passiflora quadranqularis*		
	Rooted cuttings (%)	% face to mean	Difference (±d)	Rooted cuttings (%)	% face to mean	Difference (±d)
water	35.0^{00}	66.67	-17.5	55.0^{000}	73.33	-20.00
perlite	70.0**	133.33	+17.5	95.0***	126.67	+20.00
Mean	52.5	100.00	0.00	75	100.00	0.00
	LD 5% = 15.9 LD 1% = 25.0 LD 0.1% = 42.5			LD 5% = 6.6 LD 1% = 10.4 LD 0.1% = 17.7		

From statistical analysis of unilateral influence of bio-stimulator on cuttings rooting rate was noticed that at both *Passiflora* species, differences face to variants mean were distinct significant positive at treated variants, and distinct significant negative at untreated variants (tab. 5).

Table 5

Influence of bio-stimulator on cuttings rooting rate

Variant	*Passiflora coerulea* 'Amethyst'			*Passiflora quadranqularis*		
	Rooted cuttings (%)	% face to mean	Difference (±d)	Rooted cuttings (%)	% face to mean	Difference (±d)
untreated	45.0^{00}	73.41	-16,3	70.0^{00}	82.35	-15.00
treated	77.5**	126.43	+16,2	100**	117.65	+15.00
Mean	61.3	100.00	0,00	85.0	100.00	0.00
	LD 5% = 8.0 LD 1% = 14.6 LD 0.1% = 32.3			LD 5% = 29.0 LD 1% = 53.3 LD 0.1% = 118.1		

Regarding the unilateral influence of cutting type on its rooting was observed that the differences face to variants mean was insignificant at both species of *Passiflora* (tab. 6).

Table 6

Influence of cutting type of rooting rate of cuttings

Variant	*Passiflora coerulea* 'Amethyst'			*Passiflora quadranqularis*		
	Rooted cuttings (%)	% face to mean	Difference (±d)	Rooted cuttings (%)	% face to mean	Difference (±d)
Peak cuttings	57.5^{ns}	93.80	-3.8	82.5^{ns}	95.06	-2.50
Section cuttings	65.0^{ns}	106.04	+3.7	87.5^{ns}	102.94	+2.50
Mean	61.3	100.00	0.00	85	100.00	0.00
	LD 5% = 8.0 LD 1% = 14.6 LD 0.1% = 32.3			LD 5% = 9.2 LD 1% = 16.9 LD 0.1% = 37.4		

At species *Passiflora coerulea* 'Amethyst' kind, analysing the influence of those three studied factors, on mean length of roots and mean number of roots/cutting was observed that differences face to variants mean is very significant positive at variants V5-V8 and very significant negative at variants V1-V5 (tab. 7). Those results show that treatments with bio-stimulators determine formation of a rich and compact radicular system.

At *Passiflora quadranqularis*, influence of those three factors on mean length of roots was manifested by determination of some very significant positive differences at variants V6-V8 and significant positive at V5; very significant negative differences at V1-V3 and significant negative at V4. Regarding mean number of roots formed on cutting, differences face to variants mean were very significant positive at variants V5-V8, very significant negative differences at V3 and insignificant differences at V4 (tab. 8).

Table 7

Combined influence of substrate, cutting type and bio-stimulator on features of *Passiflora coerulea* 'Amethyst' cuttings

Variant	Mean length of roots (cm)		Mean number of roots (pieces)	
	main	secondary	main	secondary
V1	1.05^{000}	0.45	2.45^{000}	2.10
V2	1.42^{000}	0.56	2.65^{000}	2.34
V3	2.48^{000}	0.68	3.45^{000}	5.85
V4	2.78^{000}	0.85	3.85^{000}	5.97
V5	3.75***	0.98	5.15***	7.15
V6	4.12***	1.12	5.65***	7.85
V7	5.50***	1.24	6.55***	10.20
V8	5.75***	1.37	6.86***	10.85
Mean	3.36	0.91	4.58	6.54
	LD 5% = 0.1 LD 1% = 0.2 LD 0.1% = 0.2		LD 5% = 0.1 LD 1% = 0.2 LD 0.1% =0.3	

Table 8

Combined influence of substrate, cutting type and bio-stimulator on features of *Passiflora quadranqularis* cuttings

Variant	Mean length of roots (cm)		Mean number of roots (pieces)	
	main	secondary		main
V1	2.00^{000}	1.32	3.00^{000}	3.00
V2	2.74^{000}	1.40	3.25^{000}	5.14
V3	2.98^{000}	0.82	5.25^{00}	14.00
V4	3.82^{0}	0.95	5.80^{ns}	14.83
V5	4.92*	0.98	6.70***	15.35
V6	5.60***	1.24	6.90***	15.60
V7	5.96***	1.35	7.35***	16.40
V8	6.10***	1.45	7.64***	16.80
Media	4.27	1.89	5.74	12.64
	LD 5% = 0.4 LD 1% = 0.5 LD 0.1% = 0.7		LD 5% = 0.2 LD 1% = 0.2 LD 0.1% =0.3	

CONCLUSIONS

At *Passiflora coerulea* 'Amethyst' rooting rate varied from 30% to 90%, and at *Passiflora quadranqularis* between 50% and 100%. At both species better results were recorded at section cuttings, rooted on perlite substrate and treated with bio-stimulator.

At *Passiflora quadranqularis,* treatments with bio-stimulator determined a 100% rooting, and application of other four treatments determined a shortage of

cuttings rooting period.

At both studied species, cuttings formed a mass of well developed roots at variants treated with bio-stimulators. Rooting of cuttings is realised with good results if they are treated with a rooting bio-stimulator and is utilised perlite as rooting substrate. The manufactured cutting type, influence in a slightly manner the rooting.

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