INFLUENCE OF SCION/ ROOTSTOCK INTERACTION ON SOME MORPHOLOGICAL CHARACTERISTICS OF GRAFTED ROSE PLANTS

INFLUENȚA INTERACȚIUNII ALTOI/ PORTALTOI ASUPRA UNOR CARACTERE MORFOLOGICE ALE TRANDAFIRILOR ALTOIȚI

IUROAEA Gheorghe[1]*, APOSTOL Maria[1], CHELARIU Elena Liliana[1], DRAGHIA Lucia[1]
*Corresponding author e-mail: igh_cat@yahoo.com

Abstract. *The main aim of this research was to determine the influence of cultivar/rootstock on the morphological characters of some Hybrid Tea varieties of roses (`Explorer', 'White Chocolate', `Nina' and `Catrina'), grafted on three biotypes of Rosa canina: one of R. canina `Laxa' and two of R. canina `Inermis' (collected from Buzău and Braşov). From the analysis of the characters of the grafted plants, a number of aspects were found: the rootstock of R. canina `Laxa' showed a larger diameter of the grafting point in all varieties; 'White Chocolate', formed the longest shoots, regardless of rootstock; the number and diameter of the shoots were the characters least influenced by the variety/rootstock influence; `Explorer' grafted on R. canina `Laxa' recorded direct correlations between the diameter of the grafting point and the number of shoots, the length of the shoots and of the internode of the shoots, the length of the shoots and the number of leaves; indirect correlations were recorded between the diameter of the grafting point and the number of shoots/plant in `Nina' and `Catrina' varieties grafted on R. canina `Laxa', and in `Explorer' and `Catrina' varieties grafted on R. canina `Inermis' (from Braşov); indirect correlations also appeared between shoot length and diameter in 'White Chocolate' grafted on R. canina `Laxa'.*
Key words: rose, grafting, rootstock, scion, influence

Rezumat. *Scopul lucrării a fost de a determina influența soi/portaltoi asupra caracterelor morfologice ale unor soiuri de trandafiri din grupa Tea hybrida (`Explorer', 'White Chocolate', `Nina' și `Catrina'), altoite pe trei biotipuri de Rosa canina: unul de R. canina `Laxa' și două de R. canina `Inermis` (colectate din Buzău și Braşov). Din analiza caracterelor plantelor altoite s-a constatat o serie de aspecte: portaltoiul R. canina `Laxa` a imprimat la toate soiurile un diametru mai mare al punctului de altoire; 'White Chocolate', a format cei mai lungi lăstari, indiferent de portaltoi; numărul și diametrul lăstarilor au fost caracterele cel mai puțin influențate de influența soi/portaltoi; `Explorer' altoit pe R. canina `Laxa' a înregistrat corelații directe între diametrul punctului de altoire și numărul de lăstari, lungimea lăstarilor și lungimea internodului lăstarilor, lungimea lăstarilor și numărul de frunze; corelații indirecte s-au înregistrat între diametrul punctului de altoire și numărul de lăstari/ plantă la `Nina' și `Catrina' altoite pe R. canina `Laxa', și la `Explorer' și `Catrina' altoite pe R. canina*

[1]"Ion Ionescu de la Brad" University of Life Sciences, Iasi, Romania

Inermis (de Braşov); corelaţii indirecte s-au manifestat şi între lungimea şi diametrul lăstarilor la 'White Chocolate' altoit pe R. canina `Laxa'.
Cuvinte cheie: trandafir, altoire, portaltoi, altoi, influenţă

INTRODUCTION

Roses are perennial woody plants of the genus *Rosa* (family Rosaceae, subfamily Rosidae). In the spontaneous flora, most Rosa species are found in temperate and subtropical regions of the Northern Hemisphere (Leus *et al*., 2018).

The genus comprises over 300 species (Qi *et al*., 2018; Balaj *et al.,* 2022) and thousands of cultivars and hybrids. Cultivated roses are grouped not only according to botanical criteria, but also according to horticultural criteria based on morpho-decorative characteristics of interest (height, habit, flowering and flower characteristics, etc.), so that modern varieties are classified into Hybrid Teas, Floribunda, Polyantha, Miniature (Leus *et al*., 2018; Wagner, 2002).

Rosa species have the basic number of chromosomes x=7, but most of the wild rose and modern rose varieties are polyploid (Qi *et al.,* 2018), the degree of ploidy being different: diploid Polyantha (2n=2x), Hybrid Teas and Floribunda triploids or tetraploids (2n=3x, 4x), Miniature diploids, triploids and tetraploids (2n=2x, 3x, 4x) (Yokoya *et al.,* 2000).

Cultivated for millennia, the rose can be considered one of the most popular ornamental plants around the world. The special economic importance of roses is due not only to their use for decorative purposes, but also in other fields (food, perfume and cosmetic industry, pharmacy, aromatherapy, etc.) (Qi *et al.,* 2018; Nadeem *et al.,* 2014).

From an ornamental point of view, rose varieties are used as garden plants, pot plants or as cut flowers (Balaj *et al.,* 2022; Australian Government, 2009). Most Floribunda cultivars are recommended for the garden, while Hybrid Tea cultivars are most important for use as cut flowers (Leus *et al.,* 2018; Australian Government, 2009). The first Hybrid Tea variety (probably resulting from natural crosses) was introduced in 1867 by Gulliot, but currently their number is impressive (over 10000 varieties) (Esselink *et al.,* 2003; Patel and Fatmi, 2021).

The propagation of highly heterozygous rose varieties is done vegetatively (cuttings, grafting, layering, tissue cultures), precisely to maintain the desired characters (Balaj and Zogaj, 2011; Wagner, 2002). Grafting, however, is considered to be the main method of producing planting material, due to the advantage it presents in increasing the adaptability of plants to less favorable environmental conditions (Buck, 1953). Also, the rootstock contributes to the improvement of the quality characteristics of the variety (flower size, length and thickness of floral stems, etc.), different types of rootstock having different effects on the grafted plants (Kwon *et. al.,* 2022). *R. canina* L. and *R. multiflora* Thunb. are considered as the main suppliers of rootstock plants (Monder *et al*., 2023).

R. canina, the most widespread species of the genus *Rosa*, adapts successfully to the most different habitats, has a strong root system and fast

growth (Tomljenović *et al.,* 2021), being suitable as a rootstock for most groups and varieties of roses (Monder *et al.,* 2023).

The present work aims to analyze the behavior of some Hybrid Tea varieties recommended for cut flowers, grafted on different taxa of *R. canina*, by evaluating some phenotypic traits.

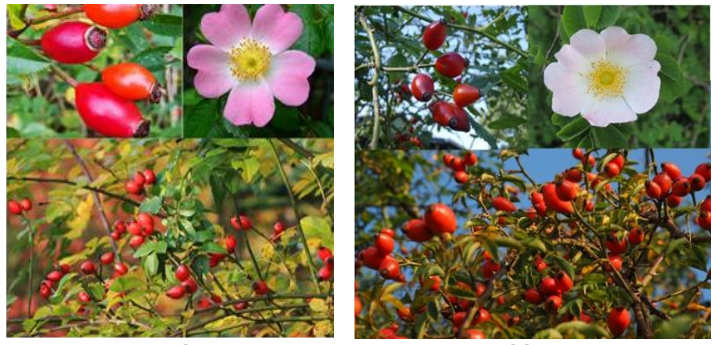
MATERIAL AND METHOD

The research was carried in year 2023, under the conditions of the nursery in Vânători town, Galați county. The study included four varieties of Hybrid Tea roses (`Explorer', `White Chocolate', `Nina' and `Catrina') and three rootstock biotypes of *Rosa canina*, from the varieties 'Laxa' and `Inermis'.

***R. canina* 'Laxa'** has a very strong root system, being mainly suitable for heavy and calcareous soils (Atman, 2000), long and thick shoots, almost without thorns and quite vigorous growth, which allows it to be used as material good for grafting from the first year. It also has the advantage that it rarely drains.

***R. canina* `Inermis'**, from Buzău biotype, was collected from the area of Măgura village, Buzău county (fig. 1a). It forms numerous well-developed roots, and the bushes are characterized by a strong growth base, with 2.8-3.0 m long shoots, slightly recurved, almost without thorns. The flowers are pale pink in color and bloom in June. The fruit, ovate-oblong, 2.4 cm long and 1.5 cm thick, reaches maturity in August. It is recommended for stem rose production and is compatible with most rose varieties (grafted plants produce long stems and brightly colored flowers). It is sensitive to flouring, and sometimes has a tendency to dry out.

***R. canina* `Inermis'**, from Brașov biotype, was collected from the area of Sâmbăta de Sus commune, Brașov county (fig. 1b.). The plant is vigorous, 2.6 m tall, perennial stems with few thorns, and annual growths without thorns. It blooms early (the first decade of May), and the flowers are white. The fruit is ovoid, 1.7 cm long and 1.5 cm thick, ripening in the first half of September. It has a low degree of dragonation, is tolerant to aphids and resistant to diseases.



a) **b)**

Fig. 1. *R. canina* `Inermis': a) Buzău biotype; b) Brașov biotype (Source: personal archive)

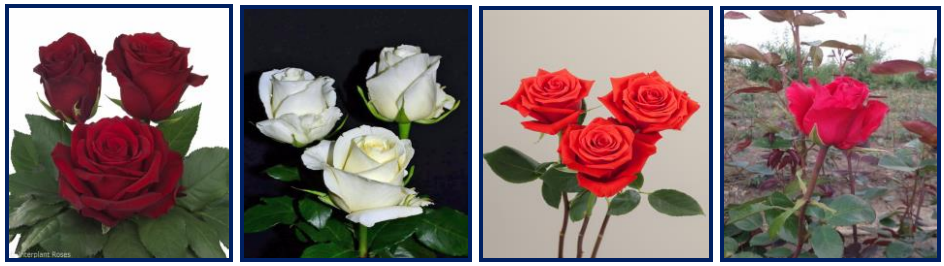
'Explorer' (fig. 2a) is a variety created in 2015 by the company Interplant NV from the Netherlands. It has vigorous growth, flower stalks about 85 - 90 cm long, without thorns, large leaves, with a slightly corrugated limb, dark green with reddish

shades, slender flower buds, 5 - 6 cm in diameter, and the open flowers with 40 - 50 of dark red petals and discreet fragrance.

'White Chocolate' (fig. 2b) is a variety created in 2016 by the Terra Nigra company from the Netherlands. The buds are cup-shaped, the flowers, faintly scented, with 45-55 petals, when fully opened 10-12 cm in diameter, the main color is white-cream, towards the middle of the flower the shade of white chocolate, good shelf life as a cut flower (2 -3 weeks).

'Nina' (fig. 2c) is a variety created by Brown Breeding in Ecuador and is classified either in the Hybrid Tea group or in the Floribunda group. The flower stems are 75-90 cm tall and have numerous small thorns. The large, dark green leaves with slight reddish shades, the spherical flower buds, with a diameter of 6.5 - 7 cm, and the flowers with a discreet fragrance, cup-shaped and 65-70 red-scarlet petals with an orange reverse.

'Catrina' (fig. 2d) is our own creation (a mutation of the 'Grand Gala' variety), approved in 2019. It shows compact growth, with erect shoots, without thorns. The flowers, red-purple, are 7-8 cm in diameter. It is winter sensitive. It can be used for the production of cut flowers both in the field and in sheltered areas.



a) b) c) d)

Fig. 2. Hybrid Tea varieties: a) 'Explorer'; b) 'White Chocolate'; c) 'Nina'; d) 'Catrina'
(Source: (a) https://www.interplantroses.nl; (b) www.stickhealthcare.co.uk;
(c) https://www.rosaprima.com; (d) personal archive of the author)

The experimental site was organized in randomized blocks with three replications (five plants/replication). The experiences were bifactorial:

- factor A – rootstock, with three variables: a_1 – *R. canina* 'Laxa' (**RCL**); a_2 – *R. canina* `Inermis' (Măgura-Buzău) (**RCBZ**); $a_3$ – *R. canina* `Inermis' (Sâmbăta de Sus-Brașov) (**RCBV**);

- factor B – variety, with four variables: b_1 – `Explorer' (**E**); $b_2$ – 'White Chocolate' (**CW**); $b_3$ – `Nina' (**N**); b_4 - `Catrina' (**C**).

The combination of factors resulted in 12 experimental variants: V_1 RCL/E; V_2 – RCL/CW, V_3 – RCL/N, V_4 – RCL/C, V_5 – RCBZ/E, V_6 – RCBZ/CW, V_7 – RCBZ/N, V_8 – RCBZ/C, V_9 – RCBV/E, V_{10} – RCBV/CW, V_{11} – RCBV/N, V_{12} – RCBV/C.

In all variants, the grafting was carried out in August 2021, in oculation (in "T"), at a height of 5 cm from the ground level. In the experiment, the plants were placed at distances of 60 x 25 cm. All maintenance works (watering, fertilization, protection against diseases and pests) were applied uniformly, regardless of the experimental variant. During the vegetation period, biometric measurements were made for the following parameters: the length of the flower stalks, the height of the plant, the number and diameter of the graft shoots, the number and length of the branches, etc.

In order to highlight the extent to which the rootstock and the variety influenced a series of characters of the obtained plants, statistical-mathematical processing was used, respectively the analysis of variance. The values obtained for each variant were compared with the experience average (considered control), and the interpretation was made using the analysis of variance, with the "LSD" test (Săulescu & Săulescu, 1967). Also, to establish the correlations between certain morphological characters of the grafted plants, the method of correlation and correlation coefficients was used.

RESULTS AND DISCUSSIONS

From the analysis of the results obtained in the second year of vegetation of the grafted plants, it was found that the influence of the two experimental factors manifested itself differently, depending on the character.

In the case of the diameter of the grafting point (tab. 1), the differences compared to the control were generally large. The highest values were recorded in plants grafted on RCL (V_1, V_2, V_3 and V_4), the differences compared to the control being very significant or distinctly significantly positive.

Table 1

Influence of scion/rootstock interaction on the diameter of the grafting point and number of scion shoots

Variants	Diameter of the grafting point (mm)				Number of scion shoots/plant (pc.)			
	Abs. val.	% from x̄	Diff. from x̄	Signif.	Abs. val.	% from x̄	Diff. from x̄	Signif.
V_1 RCL/E	84.50	105.89	4.7	xxx	5.60	114.29	0.7	x
V_2 RCL/CW	82.60	103.51	2.8	xxx	4.30	87.76	-0.6	0
V_3 RCL/N	81.50	102.13	1.7	xx	4.90	100.00	0	ns
V_4 RCL/C	83.80	105.01	4.0	xxx	5.20	106.12	0.3	ns
V_5 RCBZ/E	79.40	99.50	-0.4	ns	4.90	100.00	0	ns
V_6 RCBZ/CW	77.80	97.49	-2.0	00	4.70	95.92	-0.2	ns
V_7 RCBZ/N	76.70	96.12	-3.1	000	4.50	91.84	-0.4	ns
V_8 RCBZ/C	74.90	93.86	-4.9	000	4.80	97.96	-0.1	ns
V_9 RCBV/E	79.70	99.87	-0.1	ns	5.30	108.16	0.4	ns
V_{10} RCBV/CW	81.40	102.01	1.6	x	5.10	104.08	0.2	ns
V_{11} RCBV/N	76.60	95.99	-3.2	000	4.80	97.96	-0.1	ns
V_{12} RCBV/C	78.10	97.87	-1.7	00	5.10	104.08	0.2	ns
Average (x̄)	**79.80**	**100.00**	**-**	**control**	**4,90**	**100,00**	**-**	**control**
	LSD 5% = 1.2 LSD 1%= 1.6 LSD 0.1%= 2.2				LSD 5% = 0.6 LSD 1%= 0.8 LSD 0,1%= 1.1			

Also with above average values, but with smaller (significant) differences was the V_{10} variant (RCBV/CW). In the other variants, the values were either close to those of the control and the differences were not statistically assured (V_5 and V_9), or they were below the control values, with very significant differences (V_7, V_8, V_{11}) or distinctly significantly negative (V_6, V_{12}).

In contrast, the number of shoots/plant was one of the characters that varied very little, with small, non-significant differences from the control prevailing (tab. 1). Only the variants V_1 (RCL/E) and V_2 (RCL/CW) recorded significantly positive and significantly negative differences, respectively.

The length of the shoots of the graft (tab. 2) can be considered as the character influenced especially by the graft and less by the rootstock, if we take into account the fact that the growth tendency of the shoots is specific to each variety of roses, regardless of the rootstock on which it was grafted.

Table 2

Influence of scion/rootstock interaction on the length and the diameter of the scion shoots

Variants	Length (cm)				Diameter (mm)			
	Abs. val.	% from $\bar{x}$	Diff. from $\bar{x}$	Signif.	Abs. val.	% from $\bar{x}$	Diff. from $\bar{x}$	Signif.
V_1 RCL/E	49.50	83.05	-10.1	000	8.50	100.00	0	ns
V_2 RCL/CW	78.60	131.88	19.0	xxx	9.60	112.94	1.1	xxx
V_3 RCL/N	56.50	94.80	-3.1	000	8.80	103.53	0.3	ns
V_4 RCL/C	48.70	81.71	-10.9	000	7.90	92.94	-0.6	0
V_5 RCBZ/E	50.30	84.80	-9.3	000	8.70	102.35	0.2	ns
V_6 RCBZ/CW	80.50	135.07	20.9	xxx	8.50	100.00	0	ns
V_7 RCBZ/N	58.70	98.49	-0.9	0	8.20	96.47	-0.3	ns
V_8 RCBZ/C	51.50	86.41	-8.1	000	8.30	97.65	-0.2	ns
V_9 RCBV/E	49.40	82.89	-10.2	000	8.80	103.53	0.3	ns
V_{10} RCBV/CW	77.60	130.20	18.0	xxx	9.10	107.06	0.6	x
V_{11} RCBV/N	58.60	98.32	-1.0	0	8.30	97.65	-0.2	ns
V_{12} RCBV/C	54.70	91.78	-4.9	000	7.80	91.76	-0.7	0
Average ($\bar{x}$)	**59.60**	**100.00**	**-**	**control**	**8.50**	**100.00**	**-**	**control**
		LSD 5% = 0.8 LSD 1%= 1.0 LSD 0.1%= 1.4				LSD 5% = 0.5 LSD 1%= 0.7 LSD 0.1%= 1.0		

Compared to the control (59.6 cm), the variety 'White Chocolate' was distinguished by the longest shoots (77.6–80.5 cm), on each of the three types of rootstock (V2, V6, V10), and the varieties 'Explorer' and `Catrina' by the shortest shoots, their length being between 49.4-50.3 cm, respectively 48.7-54.7 cm. The variety 'Nina', although with shorter shoots than the control (56.5-58.7 cm), showed slight differentiated tendencies according to the rootstock, in the sense that the minimum values of the length of the shoots were on the RCL rootstock (very significant negative differences), on the other two rootstocks, RCBZ and RCBV, the differences being slightly diminished (significantly negative).

Table 3

Influence of scion/rootstock interaction on the length of the internodes and leaves number of the scion shoots

Variants	Length of the internodes (cm)				Number leaves/plant (pc.)			
	Abs. val.	% from $\bar{x}$	Diff. from $\bar{x}$	Signif.	Abs. val.	% from $\bar{x}$	Diff. from $\bar{x}$	Signif.
V_1 RCL/E	5.60	87.50	-0.8	0	54.70	103.01	1.6	xxx
V_2 RCL/CW	7.40	115.63	1.0	xx	47.90	90.21	-5.2	000
V_3 RCL/N	6.70	104.69	0.3	ns	52.80	99.94	-0.3	ns
V_4 RCL/C	5.80	90.63	-0.6	ns	51.80	97.55	-1.3	00
V_5 RCBZ/E	5.80	90.63	-0.6	ns	58.60	110.36	5.5	xxx
V_6 RCBZ/CW	7.50	117.19	1.1	xx	49.70	93.60	-3.4	000
V_7 RCBZ/N	7.10	110.94	0.7	x	55.30	104.14	2.2	xxx
V_8 RCBZ/C	6.20	96.87	-0.2	ns	52.80	99.44	-0.3	ns
V_9 RCBV/E	5.70	89.06	-0.7	0	56.60	106.59	3.5	xxx
V_{10} RCBV/CW	7.20	112.50	0.8	x	48.90	92.09	-4.2	000
V_{11} RCBV/N	6.40	100.00	0	ns	51.80	97.55	-1.3	00
V_{12} RCBV/C	5.90	90.63	-0.6	ns	55.80	105.08	2.7	xxx
Average ($\bar{x}$)	**7.70**	**100.0**	**-**	**control**	**53.10**	**100.0**	**-**	**control**
		LSD 5% = 0.6 LSD 1%= 0.8 LSD 0.1%= 1.1				LSD 5% = 0.8 LSD 1%= 1.1 LSD 0.1%= 1.5		

The diameter of the shoots (tab. 2) fell within fairly narrow limits (7.8-9.6 mm), so that the reference to the control (8.5 mm) revealed non-significant differences in most variants. The thickest shoots (9.6 mm) were at the RCL/CW

combination, and the thinnest shoots (7.8-7.9 mm) at the RCBV/C and RCL/C combinations.

The length of the internodes had smaller variations between the variants, the differences compared to the control being non-significant or at most distinctly significant (tab. 3). The variety 'White Chocolate' grafted on all types of rootstocks had the longest internodes. Above the control values was also the variant composed of the RCBZ/N combination. Short internodes, below the control value and with significant differences, were characteristic of the variety 'Explorer', from the combinations RCL/E and RCBV/E. In the other variants, the positive or negative differences compared to the control were non-significant.

The number of leaves/plant was more strongly influenced by the graft/rootstock interaction (tab. 3), only in two cases the differences were non-significant (RCL/N and RCBZ/C); otherwise, most differences were highly significant. Plants from the 'White Chocolate' variety had little foliage, regardless of the rootstock used. With rich foliage, the variety 'Explorer' stood out in all combinations of rootstocks (which proves that it is an imprinted character of the variety, and less determined by the rootstock), as well as in the varieties 'Nina' (only in combination with RCBZ) and 'Catrina' (in combination with RCBV). Although the data refer to the number of leaves/plant and not to the number of leaves/shoot, given that the number of shoots/plant did not show large differences between the variants (tab. 1), an indirect correlation with the length of the internodes can be found (long internodes – few leaves).

Table 4

The value of the correlation coefficient (r) for correlated phenotypic characters

No. ctr.	Variant	Value of *r* for correlated phenotypic characters						
		a x b	**a x c**	**a x d**	**b x c**	**c x d**	**c x e**	**c x f**
RCL								
1	V_1	**0.99***	0.54	0.72	0.43	-0.19	**1.00***	**1.00***
2	V_2	0.36	**-0.98º**	**0.98***	-0.19	**-1.00º**	-0.50	0.42
3	V_3	**-0.94º**	**0.94***	**-0.87º**	**-0.79º**	**0.99***	**-0.79º**	**0.94***
4	V_4	**-0.99º**	0.18	0.58	-0.03	**0.91***	**0.94***	**1.00***
RCBZ								
5	V_5	0.35	**-0.86º**	-0.50	0.18	-0.01	-0.18	-0.34
6	V_6	**0.96***	**-0.92º**	-0.40	**-0.79º**	0.72	0.65	0.65
7	V_7	-0.36	0.64	0.03	**-0.94º**	**0.79***	0.42	0.56
8	V_8	0.54	**-0.82º**	-0.69	**-0.93º**	**0.98***	0.76	**0.94***
RCBV								
9	V_9	**-0.99º**	**-0.99º**	**-0.91º**	**1.00***	**0.96***	-0.24	**0.99***
10	V_{10}	-0.09	-0.76	**0.94***	0.72	-0.50	**-0.98º**	-0.57
11	V_{11}	-0.06	**-0.95º**	-0.13	0.37	-0.19	0.19	0.65
12	V_{12}	**-0.78º**	**-1.00º**	-0.54	**0.80***	0.50	**0.96***	0.63

P5% = 0.64 P1% = 0.77

Note: *- significantly positive values; º - significantly negative values.

Table 4 shows the results obtained after performing the calculation regarding the correlations between the following characters: the diameter of the

grafting point (a) and the number of shoots per plant (b), the diameter of the grafting point (a) and the length of the shoots (c), the diameter of the point of grafts (a) and shoot diameter (d), number of shoots/plant (b) and shoot length (c), shoot length (c) and shoot diameter (d), shoot length (c) and internode length (e) , shoot length (c) and number of leaves/plant (f).

Correlation between diameter of grafting point and number of shoots/plant (a x b) showed both negative and positive correlations with values ranging from -0.06 to 0.99. In the case of variants V_1 (RCL/E) and V_6 (RCBZ/CW), the values were significantly positive, which means that the diameter of the grafting point influences directly and proportionally the number of shoots/plant. In the case of variants V_3 (RCL/N), V_4 (RCL/C), V_9 (RCBV/E) and V_{12} (RCBV/C), the values were significantly negative, which means that the diameter of the graft point inversely proportionally influences the number of shoots/ plant.

The correlation between graft shoot length and graft shoot internode length (c x e), as well as the correlation between graft shoot length and number of leaves/plant (c x f) recorded absolute maximum values (1.00) in variant V_1 (RCL/E), which means that there is a strong, directly proportional relationship between these characters. The correlation between graft shoot length and graft shoot diameter (c x d) recorded in the V_2 variant (RCL/CW) has a maximum negative absolute value, which means that there is a strong, inversely proportional relationship between these characters.

CONCLUSIONS

1. In all the grafted plants, the *R. canina* `Laxa' rootstock imprinted a larger diameter of the grafting point, unlike the *R. canina* `Inermis' biotypes, which had the effect of reducing the dimensions.

2. The length of the shoots formed from the grafts was mainly influenced by the varieties of roses used (on all types of rootstocks, 'White Chocolate' formed the longest shoots, and 'Explorer', `Catrina' and 'Nina' with the length below that of the witness).

3. In the cultivars 'Explorer' and 'White Chocolate' the number of leaves on the grafted shoots was less influenced by the rootstock. The `Nina' and `Catrina' varieties, only in the case of grafting in the RCBZ/N and RCBV/C variants, showed a tendency to form longer shoots.

4. The characters for which a smaller influence of the experimental factors (rootstock, variety) was noted were the number and diameter of the shoots.

5. In the RCL/E combinations, direct correlations were shown between the diameter of the grafting point and the number of shoots/plant, the length of the grafted shoots and the internode length of the grafted shoots, the length of the grafted shoots and the number of leaves/plant.

Indirect correlations were recorded between the diameter of the grafting point and the number of shoots/plant in the combinations RCL/N, RCL/C,

RCBV/E and RCBV/C, and between the length and diameter of the graft shoots in the combination RCL/CW.

4. It is recommended to extension of use in production, in addition to the *R. canina* `Laxa' rootstock, and the two biotypes of *R. canina* `Inermis'.

REFERENCES

1. **Balaj N., Zogaj R., 2011** - *Production seedlings of roses by grafting with bud for hybrid teas and climbing roses cultivars*. Research Journal of Agricultural Science, 43 (2):155-160, https://www.researchgate.net/publication/266876331
2. **Balaj N., Rizani H., Kamberi N., Haxhinasto L., 2022** - *The effect of rootstock on vegetative development and flower production in modern garden roses (Rosa canina L.).* Bulgarian Journal of Agricultural Science, 28 (3), 395–400, https://www.agrojournal.org/28/03-04.pdf
3. **Buck, G. J.,1953** -*The histology of the bud graft union in roses*. Ph.D. thesis. Iowa State University, Ames, Iowa. 45 pp.
4. **Esselink G. D., Smulders M.J.M., Vosman B., 2003** - *Identification of cut rose (Rosa hybrida) and rootstock varieties using robust sequence tagged microsatellite site markers.* Theor. Appl. Genet., 106:277–286 DOI 10.1007/s00122-002-1122-y; https://link.springer.com/article/10.1007/s00122-002-1122-y
5. **Kwon O.H, Choi H.G, Kim S.J., Lee Y.R., Jung H.H., Park K.Y., 2022** - *Changes in Yield, Quality, and Morphology of Three Grafted Cut Roses Grown in a Greenhouse Year-Round.* Horticulturae, 8(7), 655, https://doi.org/10.3390/horticulturae8070655; https://www.mdpi.com/journal/horticulturae
6. **Monder M.J., Bąbelewski P., Sołtan S., 2023** - *Diversity in anatomical features of rose rootstock root necks: Rosa canina 'Inermis', 'Pfander', 'Schmid's Ideal', Rosa laxa Retz. and Rosa multiflora Thunb.* Scientia Horticulturae 316, 112004, https://doi.org/10.1016/j.scienta.2023.112004
7. **Nadeem M., Wang X., Akond M., Awan F.S., Khan A.I., Riaz A., Younis A., 2014** - *Hybrid identification, morphological evaluation and genetic diversity analysis of Rosa × hybrida by SSR markers*. Australian Journal of Crop Science, 8(2):183-190, https://www.researchgate.net/publication/259624641
8. **Patel S.S., Urfi Fatmi U., 2021** - *Evaluation of hybrid tea roses (Rosa hybrida) under Prayagraj agroclimatic conditions.* The Pharma Innovation Journal 2021; 10(12): 991-995, https://www.thepharmajournal.com/archives/
9. **Săulescu N.A., Săulescu N.N., 1967 –** *Câmpul de experiență.* Editura Agro-Silvică, București.
10. **Qi W., Chen X., Fang P., Shi S., Li J., Liu X., Cao X., Zhao N., Hao H., Li Y., Han Y., Zhang Z., 2018** - *Genomic and transcriptomic sequencing of Rosa hybrida provides microsatellite markers for breeding, flower trait improvement and taxonomy studies*. BMC Plant Biology 18:119, https://doi.org/10.1186/s12870-018-1322-5
11. **Tomljenović N., Jemrić T., Vuković M., 2021** - *Variability in pomological traits of dog rose (Rosa canina L.) under the ecological conditions of the Republic of Croatia*. Acta Agriculturae Serbica, 26 (51), 41–47, doi: 10.5937/AASer2151041T, https://www.researchgate.net/publication/353348176
12. **Wagner S., 2002** – *Trandafirul – de la mit la mileniul trei*. ECHARD & Co., Cluj-Napoca.
13. **Yokoya K., Roberts A.V., Mottley J., Lewis R., Brandham P.E., 2000** - *Nuclear DNA Amounts in Roses*. Annals of Botany 85:557-561, doi:10.1006/anbo.1999.1102, https://academic.oup.com/aob/article/85/4/557/2588194
14. *****, 2009** - *The Biology of Hybrid Tea Rose (Rosa x hybrida).* Australian Government. https://www.ogtr.gov.au/sites/default/files/files/2021-07/the_biology_of_hybrid_tea_rose.pdf