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VARIABILITY OF FEATURES IN HALF-SIB POSTERITY AS A BASIS IN PLANT BREEDING OF THE SPECIES *KOELREUTERIA PANICULATA* LAXM.

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Abstract - Based on the comparative morphophysiological analysis of the seedlings *Koelreuteria paniculata* Laxm. produced in a generative manner by using one line of the oldest half-sib tree and two lines of younger half-sib trees, data regarding the seedlings' features and the variability of the plant breeding are presented. Recorded parameters are the indexes which point to the influence of age over biological reproduction. This paper also puts forward that the variability of the seedlings exerts an influence on the selection of mother trees, and provides the technology of production of breeding plants with desired features and its practical usage in landscape architecture, horticulture and forestry. Namely, by selecting the superior genotypes and with their breeding, different sorts of koelreuteria (China-tree) could be synthesized and thanks to the high level of general adaptability would provide reciprocally high productivity of studied parameters and be the base material for plants for specific purposes.

Keywords: Urban coenosis, age, selection, Koelreuteria paniculata

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INTRODUCTION

Among the numerous plant life forms, trees are the most useful and they are irreplaceable in city green spaces. The analysis of the Belgrade dendrological collection shows that a substantial number of trees and shrubs are of exotic origin (Pančić 1892; Jovanović 1956; Grbić 2004; Ocokoljić 2006, Ocokoljić et al., 2009, etc.). Belgrade greenery (Jovanović 2000) consists of 700 woody species (77% of broadleaf species/autochthonous species 33%: allochthonous species 67%/ and 23% of coniferous species /autochthonous species 48%: allochthonous species 52%), including also the species *Koelreuteria paniculata* Laxm. The cultivation of *Koelreuteria* and other allochthonous species has not only enriched the stock of tree species, but has also enabled selection experiments over the decades, because only the species which were able to adapt to the specific ecological conditions in Belgrade could survive.

In the inner Belgrade zone, there is one *Koelreuteria* tree and another 66 Monuments of Nature – tree and shrub representatives protected during the period 1949 - 2001 (Karas et al., 2003). These old, protected specimens are a valuable material which can also be of practical benefit. For this reason, the long-living protected trees should be conserved and their genotype should be multiplied. The selected individuals can serve as the base for the generation of better seeds and planting material for horticultural purposes by further selection and by applying synthetic methods of plant breeding, because their superiority has been confirmed by their longevity.

MATERIALS AND METHODS

To assess the effect of age on *Koelreuteria* reproductive capacity, we selected three trees based on an in-depth study: scientific papers, maps, environmental conditions, development rate and success, degree of seed-bed functionality and ornamental value in green spaces. In addition to the above characteristics, a very important parameter for tree selection was the longevity. For this reason, one old, protected tree and two younger trees were selected from the existing and preliminarily investigated individuals.

The seeds were collected in the stage of full (technical) maturity, during two successive growing seasons, and after a short drying, they were kept till the following spring. In the following years, after previous soil preparation, seeding was performed in April, in nursery seedbeds, in a Belgrade suburb. The seedbeds were formed by randomized block design of half-sib families in each replication, and divided into four identical blocks. Intensive tending was applied during the cultivation.

To assess the species potential and the effect of age on reproduction capacity, we performed a comparative analysis of survival percentage and growth elements, and the specific phenotype characteristics of the progeny were identified.

The survival degree of seedlings in seedbeds was determined by counting the seedlings 30 days after sowing and at the end of the growing season. This was compared to the number of sown seeds for two successive years. The growth elements, i.e. the variability of seedling height and root collar diameter were measured 30 days after sowing, in the middle and at the end of the vegetation period.

The depth of root penetration was measured on 25 seedlings in one replication and half-sib line (25 seedlings x 4 replications x 21 half-sib lines = 2100 seedlings). After that, the seedlings were desiccated in an oven at a temperature of 60°C. The desiccation lasted until the same specimen mass (about 36 hours) was measured two times successively. After desiccation, the specimens were kept under room conditions for 2 h, after which the above-ground parts and the roots of all the seedlings were measured to the nearest 0.01 g.

All biometrical analyses were performed on sufficiently large samples. Root collar diameter measurement was performed using a micrometer to the nearest 0.1 mm; and plant height was measured using a ruler, from the root collar to the tip of the terminal bud, to the nearest 1 mm. The data were statistically computed by an Excel program, including the arithmetical mean ($\bar{x}$), standard deviation (S), coefficient of variation (V), and errors ($S_{\bar{x}}$, S_S, S_V). The analysis of variance of the study parameters was computed by the statistical program Statistica 5.0.

RESULTS AND DISCUSSION

Based on the data analysis of the total number of sown plants, per tree, thirty days after sowing, the survival percentage in the first study year was 39.05% and 11.99%, respectively, for the younger trees and 1.35% for the oldest tree. In the second study year, under the same monitoring term, survival percentage amounted to 74.28% and 67.71%, respectively, for the younger trees and 66% for the old tree. The comparative analysis of survival percentage after 30 days in two study years showed high differences in survival percentage per study years. Namely, the survival percentage of the oldest *Koelreuteria* tree in Belgrade in the first year was 1.35% and in the second year it was 66%, which was a 10 % higher value than the average *Koelreuteria* survival degree at the level of the species in both study years. The differences between the survival percentages calculated by the analysis of variance confirm the highest levels of significance of differences between the trees, a high level between the study years, and no significant differences between the replications in both monitoring terms (Table 1). At the end of both vegetation periods the survival percentage was almost identical to the percentage determined 30 days after sowing, which was also confirmed by the statistical analysis, so the minimal differences can be neglected.

The analysis of 30-day-old seedlings in the first year showed an average height of 3.88 cm at the level of the species. *Koelreuteria* tree 2 attained the lowest average height (3.66 cm) at the individual level, and *Koelreuteria* tree 1 attained the maximal height (4.28 cm). The average height at the level of the species of 60-day-old seedlings was 13.39 cm. The lowest average height at the individual level was attained by *Koelreuteria* tree 2 (10.14 cm), and the maximal height by *Koelreuteria* tree 1 (19.33 cm). The average height of one-year-old seedlings at the level of the species was 27.86 cm. The minimal average height was attained by *Koelreuteria* tree 2, and the maximal average height by *Koelreuteria* tree 1 (38.24 cm). The variable value of the coefficients of variation showed the high variability of seedling height within the same family (Table 2), and the highest coefficient of variation was calculated for *Koelreuteria* tree 3, amounting to 56.41 for one-year-old seedlings.

In the second study year, the analysis of 30-day-old seedling height at the level of the species showed an average value of 6.97 cm. The lowest average height at the individual level was reached by *Koelreuteria* 1 (5.84 cm), and the maximal average seedling height was reached by *Koelreuteria* 3 (8.80 cm). The analysis of 60-day-old seedling height at the level of the species showed an average height of 15.52 cm. The lowest average height at the individual level was attained by *Koelreuteria* tree 1 (10.87 cm), and the maximal average seedling height - by *Koelreuteria* tree 3 (21.13 cm). One-year-old seedlings, at the level of the species, reached an average height of 30.03 cm. The minimal average height was attained by *Koelreuteria* tree 1 (11.04 cm), and the maximal average height was reached by *Koelreuteria* tree 3 (44.18 cm).

Table 1. Analysis of variance of survival percentage

Variability factor	Sum of squares	F-calculated	Significance level
	age: 30 days	I. year	
Tree	2997,563	1429,490	0,000000
Study year	1985,901	956,177	0,000123
Replication	12,234	0,45112	0,988997
	age: 1 year	I. year	
Tree	2993,278	1862,683	0,000000
Study year	1243,230	1743,640	0,000022
Replication	10,222	0,34543	0,754670
	age: 30 days	II. year	
Tree	3465,249	944,2512	0,000000
Study year	2978,123	834,332	0,000043
Replication	14,677	0,76547	0,767584
	age: 1 year	II. year	
Tree	3306,360	849,3911	0,000000
Study year	2978,345	790,000	0,000000
Replication	9,012	0,121876	0,907806

Table 2. Statistical parameters of: (A) seedling height, (B) root collar diameter, (C) root length, (D) above-ground mass, and (E) root mass of *Koelreuteria* seedlings

Tree	A (cm) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$	B (mm) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$	C (cm) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$	D (g) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$	E (g) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$
I. year: 30 days					
1	4,28 ± 0,86	1,32 ± 0,26	-	-	-
	0,92 ± 0,19	0,19 ± 0,02			
	21,61 ± 3,02	14,34 ± 2,00			
2	3,66 ± 0,73	1,36 ± 0,27	-	-	-
	0,70 ± 0,10	0,25 ± 0,09			
	19,20 ± 2,68	18,56 ± 2,60			
3	3,70 ± 0,74	1,34 ± 0,27	-	-	-
	0,83 ± 0,12	0,24 ± 0,08			
	22,41 ± 3,13	17,76 ± 2,48			
I. year: 60 days					
1	19,33 ± 3,86	3,85 ± 0,77	-	-	-
	4,41 ± 1,07	0,76 ± 0,54			
	22,83 ± 3,19	19,87 ± 2,78			
2	10,14 ± 2,03	3,38 ± 0,67	-	-	-
	2,74 ± 0,41	0,77 ± 0,07			
	27,07 ± 3,79	22,88 ± 3,20			
3	10,20 ± 2,04	2,84 ± 0,57	-	-	-
	5,45 ± 1,42	0,97 ± 0,09			
	53,47 ± 7,47	34,36 ± 4,80			
The first year: 1 year					
1	38,24 ± 7,64	6,04 ± 1,21	24,84 ± 4,97	2,76 ± 0,55	4,98 ± 0,99
	8,04 ± 1,34	1,87 ± 0,04	3,92 ± 0,47	1,71 ± 0,29	3,98 ± 0,68
	21,03 ± 2,94	30,95 ± 4,33	15,78 ± 2,20	61,90 ± 8,65	79,83 ± 11,16
2	16,83 ± 3,36	6,54 ± 1,30	23,79 ± 4,75	2,11 ± 0,42	6,60 ± 1,32
	8,10 ± 0,22	1,66 ± 0,09	6,56 ± 1,32	1,07 ± 0,19	4,72 ± 0,92
	48,15 ± 6,74	25,45 ± 9,99	27,69 ± 3,87	50,99 ± 7,13	71,46 ± 9,99
3	28,51 ± 5,70	8,06 ± 1,61	24,26 ± 4,85	3,39 ± 0,68	6,34 ± 1,27
	16,08 ± 3,98	3,46 ± 1,12	7,32 ± 1,19	2,59 ± 0,17	5,63 ± 0,18
	56,41 ± 7,88	42,94 ± 6,00	30,19 ± 4,22	76,52 ± 10,70	88,90 ± 12,43

Table 2. Continued

Tree	A (cm) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$	B (mm) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$	C (cm) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$	D (g) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$	E (g) $\bar{x} \pm S\bar{x}$ $S \pm S_S$ $V \pm S_V$
II. year: 30 days					
1	5,84 ± 1,17 1,33 ± 0,18 22,75 ± 3,18	2,43 ± 0,48 0,31 ± 0,01 12,67 ± 1,77	-	-	-
2	6,28 ± 1,26 1,37 ± 0,17 21,93 ± 3,07	2,79 ± 0,56 0,42 ± 0,04 15,22 ± 2,13	-	-	-
3	8,80 ± 1,76 2,20 ± 0,23 25,04 ± 3,50	2,86 ± 0,57 0,39 ± 0,03 13,86 ± 1,94	-	-	-
II. year: 60 days					
1	10,87 ± 2,17 4,02 ± 0,52 37,02 ± 5,18	3,52 ± 0,70 0,74 ± 0,09 20,90 ± 2,92	-	-	-
2	14,53 ± 2,90 2,96 ± 0,31 20,40 ± 2,85	4,08 ± 0,81 0,67 ± 0,17 15,65 ± 2,19	-	-	-
3	21,13 ± 4,22 5,16 ± 1,19 24,41 ± 3,41	4,77 ± 0,95 1,19 ± 0,16 24,95 ± 3,49	-	-	-
The second year: 1 year					
1	11,04 ± 1,80 4,12 ± 1,25 45,79 ± 6,40	5,00 ± 1,00 1,86 ± 0,40 37,24 ± 5,21	17,51± 3,50 18,76 ± 2,44 107,14 ± 14,98	0,84 ± 0,06 0,56 ± 0,01 67,21 ± 9,40	2,04 ± 0,41 1,63 ± 0,21 80,30 ± 11,23
2	36,88 ± 7,37 7,91 ± 1,15 21,44 ± 2,99	6,32 ± 1,26 1,13 ± 0,18 18,12 ± 2,52	35,68 ± 7,07 7,39 ± 1,54 20,88 ± 2,92	3,03 ± 0,60 1,33 ± 0,42 44,09 ± 6,16	8,04 ± 1,61 5,04 ± 1,12 62,76 ± 8,78
3	44,18 ± 8,83 10,13 ±1,18 24,75 ± 5,46	6,42 ± 1,28 1,71 ± 0,19 26,68 ± 3,73	34,80 ± 6,95 8,70 ± 1,87 25,00 ± 3,50	5,44 ± 1,09 3,03 ± 0,56 55,71 ± 7,80	9,52 ± 1,91 6,14 ± 1,33 64,48 ± 9,12

The comparative analysis of seedling heights in the two study years showed that seedling heights were greater in the second year, at the level of the species, by 2.17 cm. At the individual level, the maximal average height in the first study year was reached by the younger *Koelreuteria* tree 1, and in the second year, the maximal seedling height was reached by the old *Koelreuteria* tree 3. The statistical differences in seedling heights between the old tree and the younger trees confirm the hypothesis that the differences in seedling heights were of genetic nature, i.e. that the age of the parent tree did not affect the seedling height, which confirms the good constitution of the old trees. This hypothesis is also confirmed by the results of the analysis of variance of seedling heights at the age of 30 days, 60 days, and one year, in both study years (Table 3).

Table 3. Analysis of variance of seedling height

Variability factor	Sum of squares	F-calculated	Significance level
	I. year		
30 days			
Tree	26,6872	3,6642	0,027000
Replication	1,0009	0,1374	0,976767
	60 days		
Tree	423,014	22,6972	0,000000
Replication	11,882	0,6375	0,529441
	One year		
Tree	22,07	0,2008	0,818210
Replication	108,12	0,9863	0,375411
	II. year		
	30 days		
Tree	32,6727	6,4362	0,001879
Replication	0,2290	0,0491	0,955908
	60 days		
Tree	912,74	40,1491	0,000000
Replication	24,357	1,0714	0,344076
	One year		
Tree	1643,68	17,5828	0,000000
Replication	3,62	0,0387	0,962028

The average root collar diameter of 30-day-old seedlings in the first year was 1.79 mm at the level of the species. At the individual level, the highest average value was recorded for *Koelreuteria* tree 1 (1.36 mm), which also showed the lowest value (1.32 mm). The values of standard deviation point to a substantially lower deviation of the root collar diameter from the average value compared to the values of seedling height (Table 2). The mean value of root collar diameter of 60-day-old seedlings at the level of the species was 3.35 mm. The lowest average root collar diameter, at the individual level, was attained by *Koelreuteria* tree 3 (2.84 mm), and the maximal by *Koelreuteria* tree 1 (3.85 mm). The mean value of root collar diameter of one-year-old seedlings at the level of the species was 6.88 mm. The lowest average root collar diameter, at the individual level, was reached by *Koelreuteria* tree 1 (6.04 mm), and the maximal - by *Koelreuteria* 3 (8.06 mm).

In the second study year, the average root collar diameter of 30-day-old seedlings, at the level of the species, was 2.69 mm. At the individual level, the maximal average value was attained by *Koelreuteria* tree 3 (2.86 mm), and the lowest by *Koelreuteria* tree 1 (2.43 mm).The mean value of 60-day-old seedlings was 4.12 mm. The lowest average root collar diameter, at the individual level, was found in *Koelreuteria* tree 1 (3.52 mm), and the maximal in *Koelreuteria* tree 3 (4.77 mm). The mean value of root collar diameter of one-year-old seedlings, at the level of the species, was 5.91 mm. The lowest average root collar diameter, at the individual level, was reached by *Koelreuteria* tree 1 (5.00 mm), and the maximal - by *Koelreuteria* tree 3 (6.42 mm).

The analysis of root collar diameters of one-year-old seedlings in the two study years showed that root collar diameters were larger by 0.97 mm in the first year, at the level of the species. The largest root collar diameter in the first year was reached by the old *Koelreuteria* tree 3, and in the second year, by the seedlings of the younger *Koelreuteria* tree 2.

As the height and diameter growth is genetically determined, it can be concluded that there is variability in the genetic predispositions of the analyzed trees. This hypothesis is confirmed by the results of the analysis of variance in both study years (Tables 3 and 4). The statistical differences in growth elements between the old and the younger trees show that they were not affected by the age of parent trees, i.e. this confirms the hypothesis that the differences were primarily caused by genetic agents.

The depth of root penetration and the shoot and root masses of one-year-old seedlings were analyzed at the end of the first and the second years. In the first year, the average value of root length of one-year-old seedlings, i.e. the depth of root penetration, at the level of the species was 24.30 cm. The lowest average root length at the individual level was measured for *Koelreuteria* tree 2 (23.79 cm), and the maximal root length was attained by *Koelreuteria* tree 1 (24.84 cm). The variable value of the coefficients of variation points to the high variability of seedling root length within the same family (Table 2). The average value of root length of one-year-old seedlings in the second year at the level of the species amounted to 29.33 cm. *Koelreuteria* tree 1 had the lowest average root length at the individual level (17.51 cm), and *Koelreuteria* tree 2 had the maximal root length (35.68 cm) as well as the highest degree of variability, V = 107.40 (Table 2). The comparative analysis of root length of one-year-old seedlings in the first and the second years showed that, at the level of the species, root length in the second year was longer by 5.03 cm.

In the first year, the average value of shoot mass of one-year-old seedlings, at the level of the species, amounted to 2.75 g. *Koelreuteria* tree 2 had the lowest average above-ground mass at the individual level (2.11 g), and *Koelreuteria* tree 3 had the maximal average shoot mass (3.39 g). The value of the coefficients of variation points to a high variability of dry shoot mass (Table 2). The average value of dry shoot mass of one-year-old seedlings in the second year, at the level of the species, was 3.10 g. The lowest above-ground seedling mass was reached by *Koelreuteria* tree 1 (0.83 g), and the maximal - by *Koelreuteria* 3 (5.44 g). The comparative analysis of above-ground mass of one-year-old seedlings in the two study years showed that the mass in the second year was greater by 0.35 g. The maximal above-ground mass in both study years was measured in the old tree. The statistical differences in above-ground seedling masses between the old and the younger trees showed that the differences in seedling masses were of a genetic nature.

The average value of root mass of one-year-old seedlings at the level of the species in the first year was 5.97 g. The lowest average root mass, at the individual level, was reached by *Koelreuteria* tree 1 (4.98 g), and the maximal by *Koelreuteria* tree 2 (6.60 g). The value of the coefficients of variation points to a very high variability of dry root mass (Table 2). The average value of dry root mass of one-year-old seedlings in the second year, at the level of the species, was 6.53 g. The lowest root mass was measured for *Koelreuteria* tree 1 (2.04 g), and the highest for *Koelreuteria* tree 3 (9.52 g). The comparison of seedling shoot and root masses showed that the maximal average values for both parameters were found for the same tree. The comparative analysis of root mass of one-year-old seedlings in the two study years showed that the mass in the second year was greater by 0.56 g. Just as in the case of the analysis of seedling above-ground mass, the analysis of root mass also showed the differences in mass production by study years.

Table 4. Analysis of variance of root collar diameters

Variability factor	Sum of squares	F-calculated	Significance level
	The I. year		
	30 days		
Tree	1,01400	1,1715	0,311596
Replication	0,02657	0,0307	0,969772
	60 days		
Tree	7,9550	8,3522	0,000307
Replication	0,7852	0,8245	0,439649
	One year		
Tree	14,35834	2,99923	0,051608
Replication	13,53039	2,82628	0,611120
	The II. year		
	30 days		
Tree	0,89089	5,0788	0,006880
Replication	0,00479	0,0273	0,973045
	60 days		
Tree	11,5064	13,0308	0,000004
Replication	4,0202	0,8653	0,583082
	One year		
Tree	14,0969	9,68911	0,000088
Replication	0,5627	0,38676	0,679660

The average value of total mass of one-year-old seedlings, at the level of the species in the first year, was 8.12 g. The lowest total seedling mass, at the individual level, was shown by *Koelreuteria* tree 1 (7.74 g), and the maximal by *Koelreuteria* tree 3 (9.73 g). In the second year, the average value of total mass of one-year-old seedlings at the level of the species was 9.63 g. The lowest total seedling mass, at the individual level, was shown by *Koelreuteria* tree 1 (2.88 g), and the maximal by *Koelreuteria* tree 3 (14.96 g).

The comparative analysis of total mass of one-year-old seedlings over the study years showed that in the second year the mass was greater by 1.51 g. At the individual level, *Koelreuteria* 2 showed the lowest difference in total seedling mass in the study years (2.36 g), and *Koelreuteria* 1 showed the highest difference in total seedling mass (4.86 g).

The results of the analysis of variance of root length, shoot and root masses of one-year-old seedlings are presented in Table 5. The highest significance levels of the differences were confirmed between the trees within the species for all three parameters, in both study years. There were no significant differences between the replications, which confirms the hypothesis that the differences in root length, shoot and root masses of one-year-old seedlings were the results of the genetic constitution of the analysed trees.

Table 5. Analysis of variance of root length and mass of one-year-old seedlings

Variability factor	Sum of squares	F-calculated	Significance level
	I. year		
	root length		
Tree	259,046	3,03642	0,049767
Replication	80,169	0,93970	0,392111
	above-ground mass		
Tree	31,931	0,442441	0,642982
Replication	71,974	0,99722	0,370353
	root mass		
Tree	359,102	3,74843	0,024878
Replication	104,999	1,09602	0,335786
	II. year		
	root length		
Tree	207,985	3,52526	0,030905
Replication	69,067	1,17065	0,311846
	above-ground mass		
Tree	54,9562	9,89263	0,000073
Replication	15,9482	2,87083	0,058507
	root mass		
Tree	73,3927	4,33236	0,014129
Replication	40,5784	2,395334	0,093214

CONCLUSION

The experiments on generative progeny in two successive years, in which the old and protected *Koelreuteria* tree was tested and correlated with the younger trees, confirmed the following:

- the effect of positive natural selection (longevity at the site with a high concentration of air pollution) on the produced progeny;
- the differences in seedling survival percentage between the old and the younger trees, and also between the study years. (Survival percentage served as an indicator of tree quality and vitality, so the trees with higher survival degrees can be selected);
- the minimal differences in the adaptation of seedlings produced from the seeds of the old tree and the younger trees. (In the first study year the old tree, *Koelreuteria* 3, showed the largest root collar diameters, and in the second year, it had the maximal average seedling heights and root collar diameters. The statistical differences in the analyzed growth parameters between the old tree and the younger trees, in both study years, confirmed that they were mainly not affected by the parent tree age);
- the differences in seedling biomass production from the seeds of the old tree and the younger trees (in the first study year, the old tree, *Koelreuteria* 3 showed the highest average values for seedling above-ground mass and in the second year for total seedling mass), and
- the justification of seed collection and seedling production from the seeds of the old, protected *Koelreuteria* tree.

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ВАРИЈАБИЛНОСТ СВОЈСТАВА ХАЛФ-СИБ ПОТОМСТВА КАО ОСНОВА ЗА ОПЛЕМЕЊИВАЊЕ ВРСТЕ *KOLEREUTERIA PANICULATA* LAXM.

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У раду се истражује унутарврсни варијабилитет и потенцијал келреутерије путем тестирања садног материјала добијеног из семена сакупљеног са најстаријих стабала у компарацији са садним материјалом добијеним из семена сакупљеног са млађих стабала који омогућавају одговор на питања о прилагођености врсте еколошким условима Београда, као и о утицају старости на биолошку репродукцију.

Компаративном анализом процената преживљавања и елемената раста садница у огледима са генеративним потомством, који су постављени у узастопним вегетационим периодима, потврђена је оправданост заштите најстаријих стабала келреутерије. Наиме, констатовано је да је дошло до испољавања индивидуалне варијабилности, која према доказаним статистичким разликама између старих и млађих стабала потврђује претпоставку да су разлике генетичке природе односно да старост матичних стабала није утицала на елементе раста.

У раду се, такође, констатује промењљивост садница која утиче на селекцију материнских стабала и технологију производње садног материјала са жељеним особинама, за примену у пракси пејзажне архитектуре и хортикултуре и шумарства. Наиме, одабирањем супериорних генотипова и њиховим размножавањем могу се „синтетисати“ сорте келреутерије, које ће захваљујући високом степену опште адаптивности обезбедити сразмерно високу продуктивност истражених параметара и бити полазни материјал за оснивање наменских култура.