

NEW VARIETY OF PEPPER (*CAPSICUM ANNUUM* L.) INSTITUTE FOR VEGETABLE CROPS SMEDEREVSKA PALANKA - SLAĐINA ČAROLIJA

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Abstract

Pepper (*Capsicum annuum* L.), as one of the most important vegetable species, requires continuous work on the selection of new varieties and hybrids, all with the aim of meeting the various nutritional needs of people. In recent years, the emphasis has increasingly been placed on high-quality and large fruits, with thick pericarp and high yield for industrial processing. For this reason, the goal of our research was to create a new variety of pepper with the required properties. By crossing selected parental lines, after a multi-year selection process, using the pedigree method, Slađina čarolija was created, with very large and attractive fruits, thick pericarp, pronounced red color. It is a medium-late variety, with determinate growth and a large habit. It forms from 5 to 10 fruits per plant (depending on the cultivation method), which are very large (from 150 g to over 300 g), flattened on both sides, with a thick pericarp (over 6 mm). When technologically ripe, the fruits are dark green, and when fully ripe, they are dark red. In full agricultural technology, yields of over 80 t ha⁻¹ can be achieved in an open field. The variety is recognized by the Decision of the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia under No. 320-04-5183/2/2023-11 from June 12, 2025.

Key words: pepper, Slađina čarolija, selection, pedigree method, yield

Introduction

Pepper (*Capsicum annuum* L.) is one of the most economically important vegetable species that is cultivated in the world on about 2.1 million ha and where the total production in 2020 was about 4 million tons (FAO, 2022). Given that there is a large divergence of genotypes within the cultivated species *Capsicum annuum* L., according to research (Ferreira et al. 2019; Singh et al., 2023), this enables a continuous process of selection in the creation of

new varieties and hybrids. Market demands for the fruits of this irreplaceable crop are increasing, both for fresh use and for use in industrial processing. However, lately, increasing emphasis has been placed due to the need of industry and processing for large pepper fruits, thick pericarp and high content of dry matter and intense color (Cvikić et al., 2023). For this reason, it is necessary for the selection process of this vegetable culture to be continuous

¹ Originalni naučni rad (Original Scientific Paper)

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(Cvikić et al., 2024), and the best answer to this is over 40 recognized varieties and hybrids of peppers created at the Institute for Vegetable Crops Smederevska Palanka. The situation is similar in the surrounding countries, where Todorova (2007) states that more and more attention is being paid to the creation of new varieties and hybrids of peppers, intended for industrial processing, with fruits of a bright red color, characterized by a thick pericarp, a high content of dry matter in the gate type. For

the industrial processing of pepper fruit, agronomic characteristics of the fruit such as fruit weight, pericarp thickness and dry matter content stand out (Nascimento et al., 2014; Nejati Sini et al., 2024).

In order to meet the increasing demands of the market (producers and consumers) regarding pepper fruits, primarily for their purpose in industry, the aim of the work was to create a new variety of pepper with very large fruits and a thick pericarp.

Materials and methods

Sladina čarolija variety was created by selection from a population of peppers originating from southern Serbia using the pedigree selection method. A comparative trial was set up in an open field in order to determine the differences of the newly created variety in relation to the already existing ones of this type and then reported to the Commission for Recognition of Varieties. The two-year research was conducted on the experimental field of the Institute for Vegetable Crops Smederevska Palanka during 2021 and 2022. The experiment was set up according to a randomized block system in five replicates with 20 plants per replicate. Existing pepper varieties owned by the Institute for Vegetable Crops Smederevska Palanka were included in the research: Kurtovska kapija, Strižanka, Palanačko čudo, Severija and the newly selected variety Sladina čarolija. During the growing season, standard agricultural techniques were applied (irrigation of plants, fertilization with top dressing, protection against plant diseases and pests). Within the framework of phenological observations, earliness

was determined by the number of days from emergence to the appearance of the first flower, as well as technological and biological maturity expressed by the number of days from emergence. The fruits of all varieties were harvested at full biological maturity, at the moment when the fruits had a red color.

From the morphological characteristics of the fruits, the length, width and weight of the fruits, as well as the thickness of the pericarp, were measured. Average values were determined on random samples of 30 fruits. The dry matter content of the fruits was determined by drying the plant material at 105 °C to a constant mass. The obtained results were statistically processed by analysis of variance and tested with the LSD test (*Least Significant Difference Test*) in the program IBM SPSS Statistics, version 26.0. *Pearson's* correlation analysis was conducted in Minitab statistical software (trial version) to determine the relationship between the studied traits. The results are presented tabularly and graphically.

Results and discussion

The results of phenological observations for five pepper varieties are shown in detail in Table 1, on the basis of which it is concluded that all varieties have a uniform emergence, that is, with a difference of one to two days in

both examined years. All five examined varieties belong to the so-called peppers for industrial processing, for a better and more accurate comparison with the newly created variety. In terms of early maturity, the data show that

Table 1. Phenological observations (number of days) of different pepper genotypes for the period 2021-2022. year
Tabela 1. Fenološka posmatranja (broj dana) različitih genotipova paprike za period 2021-2022. god.

Year	Genotype	Parameter			
		NSS	NGF	NST	NBZ
2021	Kurtovska kapija	14	80	126	145
	Strižanka	12	75	105	122
	Palanačko čudo	14	79	116	136
	Severija	12	78	115	133
	Sladina čarolija	13	78	118	135
2022	Kurtovska kapija	14	82	134	155
	Strižanka	13	72	107	128
	Palanačko čudo	14	81	126	146
	Severija	13	80	115	135
	Sladina čarolija	13	79	118	144

NSS - number of days from sowing to sprouting; NGF - number of days from germination to flowering; NST - number of days from sprouting to technological maturity; NBZ - number of days from sprouting to biological maturity

the earliest variety is Strižanka, and the latest is Kurtovska kapija. The investigated varieties have a longer vegetation period, which is in agreement with the results of the work conducted by Bogevska et al. (2017) regarding earliness of pepper varieties.

The most important role in achieving the total yield is played by the morphological characteristics of the pepper fruit (Occhiuto et al., 2014, Todorova and Đinović, 2017). During the selection of peppers, very important characteristics for the height of the yield are:



Picture 1. Seeds (a) and fruit (b) of the new pepper variety Sladina čarolija
Slika 1. Seme (a) i plod (b) nove sorte paprike Sladina čarolija

Table 2. Results of testing the influence of observed factors on morfological traits of pepper fruit (F test)
 Tabela 2. Rezultati ispitivanja uticaja posmatranih faktora na morfološke osobine ploda paprike (F test)

Source	FWe	FL	FWi	PT	DM
Year	4267.012987**	16.43835616**	0.705882353 ^{ns}	0.657534247 ^{ns}	35.46486486**
Genotype	43805.48571**	210.760274**	127.2132353**	30.96575342**	233.7243243**
Year x Genotype	583.1688311**	16.54109589**	1.036764706 ^{ns}	0.143835616 ^{ns}	12.49189189**
CV (%)	0.21	1.63	4.79	5.82	2.23

FWe - Fruit weight; FL - Fruit length; FWi - Fruit width; PT - Pericarp thickness; DM - Dry matter. CV - Coefficient Variation. ** - High significant at $p < 0.01$ probability level; ^{ns} - Non significant at $p > 0.05$ level

weight, length and diameter of the fruit (Andrés et al., 2023, Kirana et. al., 2024). The shortest fruit was measured at Kurtovska kapija (14.0 and 15.1 cm), while Severija (18.6 cm in both years) and Sladina čarolija (17.2 and 18.1 cm) have significantly longer fruit. For the trait of fruit width, a significantly higher average value was determined for Sladina čarolija (6.8 cm and 7.1 cm), which is characterized by wider fruits at the base compared to the other tested pepper varieties (Figure 1). The observed factors of year and genotype showed significance and statistical differences were found in the obtained average values for fruit length (Table 2). In the research conducted on peppers, Danojević et al. (2018), more than 250 fruits were included and they recorded a fruit weight that reached up to 300 g,

where a thicker pericarp was measured on fruits with a larger mass. In the case of the newly selected variety Sladina čarolija, the largest fruit weight was measured (Figure 2) and was 184.3 g and 174.3 g with the thickest pericarp (5.6 and 5.5 mm). The influence of year and genotype in this study had a statistically significant effect on the characteristic of fruit weight, as well as their mutual interaction. The smallest fruit weight was measured at Kurtovska kapija (114.3 g and 116.1 g).

Research aimed at assessing the influence of genotype on pepper fruit characteristics showed great diversity among cultivars (Fratanni et al., 2020). Traits such as fruit length and pericarp thickness are important determinants of pepper fruit quality (Hong et al., 2020).

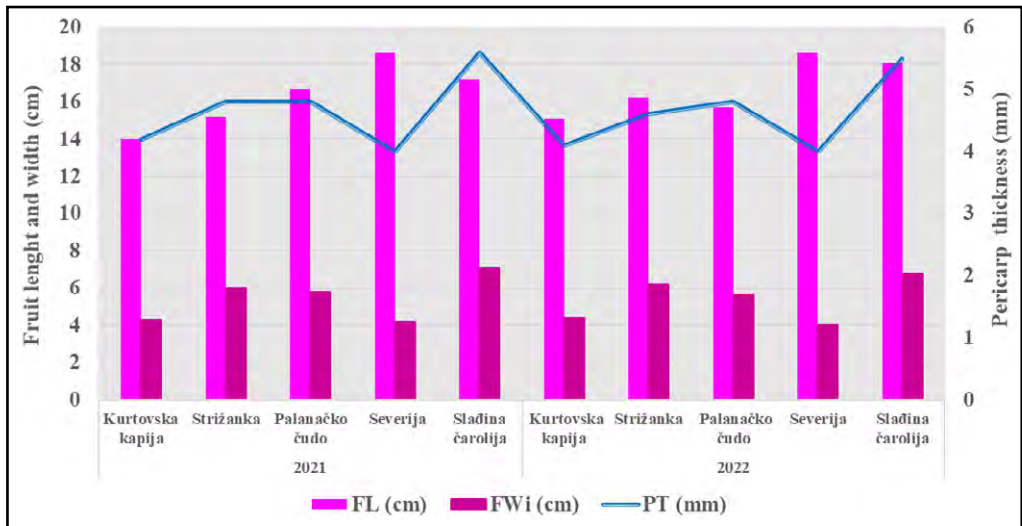


Figure 1. Average values of fruit length and width (cm) i pericarp thickness (mm) in different pepper varieties in a two-year study

Grafikon 1. Prosečne vrednosti dužine i širine ploda (cm) i debljine perikarpa (mm) kod različitih sorti paprike

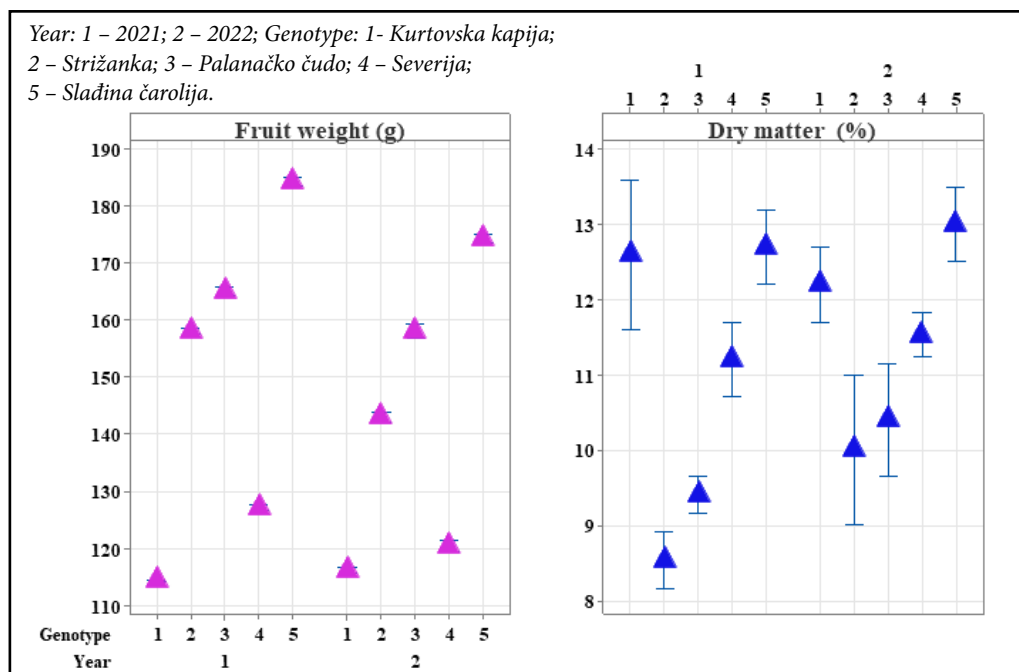


Figure 2. Average values of fruit weight (g) and dry matter content (%) for different pepper varieties
Grafikon 2. Prosečne vrednosti težine ploda (g) i sadržaja suve materije (%) kod različitih sorti paprika

Fruits that have a higher percentage of dry matter, due to smaller losses in fruit mass, are characterized by an advantage in the trans-

port and storage processes, according to Lama et al. (2020) in their research. This feature is very important for industrial processing and

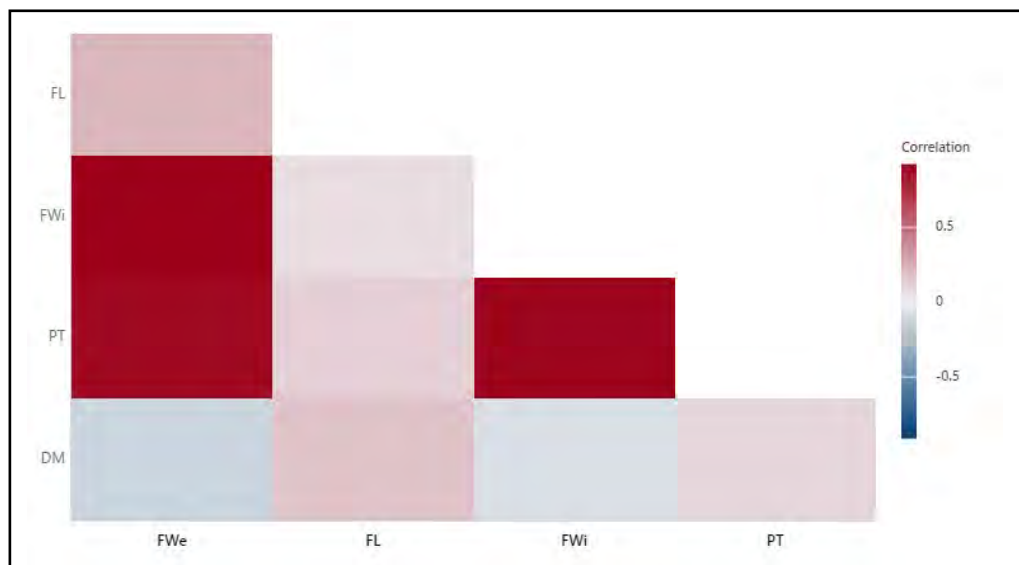


Figure 3. Pearson's correlation coefficient between the studied morphological traits of pepper fruits. **. Correlation is statistically very significant at the 0.01 level

Grafikon 3. Pirsonov koeficijent korelacije između proučavanih morfoloških osobina kod plodova paprike. **. Korelacija je statistički vrlo značajna na nivou 0,01

obtaining different products from paprika. In both years of testing, Sladina čarolija had the highest content of dry matter in the fruit and it amounted to 12.7% and 13%, followed by Kurtovska kapija 12.6% and 12.2%. The influence of both factors individually and in interaction had a significant effect on the obtained values.

A correlational analysis of the relationships between the investigated morphological characteristics of different pepper varieties was conducted (Figure 3). A strong and positive correlation was established between fruit weight and pericarp thickness ($r=0.88^{**}$),

in agreement with the results of Šević et al. (2024), then between fruit weight and fruit width ($r=0.91^{**}$) and fruit width and pericarp thickness ($r=0.90^{**}$), which indicates that the increase of one trait supports the increase of the other. Danojević et al., (2016) also found a positive correlation between fruit weight and pericarp thickness. A very weak negative correlation was found between fruit width and dry matter content ($r=-0.08$). These analyzes can serve as reliable selection criteria in pepper breeding with the aim of simultaneously improving yield and fruit quality.

Conclusion

Thanks to the great wealth of pepper populations in southern Serbia, one of the most important tasks is to constantly collect and preserve this material for the needs of breeding work. As a result of such selection, a new variety of pepper called Sladina čarolija was created at the Institute for Vegetable Crops Smederevska Palanka. The newly created variety belongs to the so-called peimento type of peppers and group of medium varieties. It is characterized by very large double-sided flattened fruits, which when fully ripe can reach a weight of over 300 g. The fruits are long, wide and have a thick pericarp. The color of the fruit at technological maturity is dark green, and at

biological maturity it is dark red. Due to the high content of dry matter, as well as the intense color of the fruit, it is very suitable for making home-made products, as well as in industrial processing for making various pepper products, but also for use fresh, because it has a very pleasant taste. With the application of full agrotechnics, it can achieve yields of over 80 t ha⁻¹, which ranks it among high-yielding varieties. Compared to the varieties that were included in the test, it is characterized by tolerance towards the most prevalent plant diseases on pepper, which is why it is given priority, as well as a recommendation for cultivation in the open field.

Acknowledgments

This research is part of a scientific project (Contract number: 451-03-136/2025-03/200216, 451-03-136/2025-03/200010, 451-03-136/2025-03/200214) and is supported by

the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.

Author contributions

Conceptualization, D. C.; Methodology, D. C. and B. Š.; Software, B. Š.; Data curation, S. S. and M. D. M.; Formal analysis, D. C., B. Š., V. P.; Investigation, D. C.; Resources, D. C.; Project administration, D. C. and V. P;

Supervision, S. S.; S. A., V. P.; Visualization, I. Ž., S. A. and M. D. M.; Validation, B. Š., S. S. and I. Ž.; Writing — original draft, D. C., B. Š. and S. A.; Writing — review & editing, D. C.; B. Š. and S. S.

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NOVA SORTA PAPRIKE (*CAPSICUM ANNUUM* L.) INSTITUTA ZA POVRTARSTVO SMEDEREVSKA PALANKA - SLAĐINA ČAROLIJA

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Sažetak

Paprika (*Capsicum annuum* L.) kao jedna od najvažnijih povrtnarskih vrsta zahteva kontinuiran rad na selekciji novih sorata i hibrida, a sve u cilju zadovoljavanja različitih potreba u ishrani ljudi. Poslednjih godina akcenat se sve više stavlja na kvalitetne i krupne plodove, debelog perikarpa i visokog prinosa za industrijsku preradu. Iz tog razloga, cilj našeg istraživanja je bio stvoriti novu sortu paprike sa traženim osobinama. Ukrštanjem odabranih roditeljskih linija, nakon višegodišnjeg procesa selekcije, *pedigree* metodom stvorena je Slađina čarolija, veoma krupnih i atraktivnih plodova, debelog perikarpa, izražene crvene boje. Srednje kasna je sorta, determinantnog porasta i velikog habitusa. Formira od 5 do 10 plodova po biljci (u zavisnosti od načina gajenja), koji su veoma krupni (od 150 g do preko 300 g), dvostrano spljošteni, debelog perikarpa (preko 6 mm). U tehnološkoj zrelosti plodovi su tamno zelene boje, a punoj zrelosti tamno crvene boje. U punoj agrotehnici mogu se ostvariti prinosi i preko 80 t ha⁻¹ na otvorenom polju. Sorta je priznata Rešenjem Ministarstva poljoprivrede, šumarstva i vodoprivrede Republike Srbije pod br. 320-04-5183/2/2023-11 od 12.06.2025.

Ključne reči: paprika, Slađina čarolija, selekcija, pedigree metod, prinos

Primljen: 29.10.2025
Prihvaćen: 27.11.2025.