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SERVICE TREE (*SORBUS DOMESTICA* L.) IN BULGARIA – EVALUATION OF LOCAL ACCESSIONS

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Abstract. *The decline in biodiversity is largely due to concentrated efforts in the cultivation of major field crops, vegetables, and fruit crops with well-developed cultivation technologies and markets. Mechanized cultivation, the pursuit of high productivity, and standardized production have gradually led to the disappearance of a number of species from mass production, including the service tree. The species has been outside the scope of attention of scientists in Bulgaria for a long time. This study presents an analysis of the agronomic characteristics of 105 local specimens with a view to their possible use in breeding programs and the creation of suitable varieties for modern agriculture. Indicators related to marketability, such as fruit size and color and early ripening were studied. Forms with large fruits (over 15 g) and attractive colouring were identified. Considering the late spring frosts and the reported losses due to freezing of flowers of many fruit species, trees with different flowering times are also listed. Groups with different ripening periods have been identified, with the earliest ones ready for harvesting as early as the beginning of August and the latest ones by October 30. The diversity of agronomic indicators was assessed through monitoring in two consecutive years – 2024 and 2025 – in locations throughout the country.*

Keywords: *service tree, agronomic characteristics, local accessions*

INTRODUCTION

The service tree (*Sorbus domestica* L.) is a rare but ecologically and economically valuable deciduous tree species in Europe (NIKOLIĆ et al., 1998; ENESCU et al., 2016). The species is characterized by a wide range which includes Central, Southern, and Eastern Europe, as well as parts of North Africa; however, in most regions, populations are scattered and limited in size, making it susceptible to genetic erosion and loss of biodiversity (KAMM et al., 2011; PAGANOVÁ, 2008; ŠPÍŠEK et al., 2018).

Sorbus domestica L. possesses valuable ecological qualities, such as moderate drought tolerance and adaptability to various soil types, making it suitable for afforestation and the restoration of forest ecosystems (KUNZ et al., 2018; CAMARERO et al., 2023).

The fruits and leaves of the service tree are a source of bioactive compounds—phenols, antioxidants, and nutritional components—that have potential for food, pharmaceutical, and dietary use (TERMENTZI et al., 2009; MAJIĆ et al., 2015; TAS et al., 2023). The use of the fruits and their biological properties is considered part of strategies for the conservation and sustainable use of the species' genetic resources (EUFORGEN, 2021; OGNYANOV et al., 2022).

PENKA MONDESHKA published in 1990 a study on the service tree in Bulgaria. There she provides a comprehensive examination of the species' morphology, characteristics, distribution, selection of valuable varieties, and techniques for cultivation and the production of plant material (MONDESHKA, 1990). Unfortunately, in the years after that the topic has not been further explored

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and more than 30 years the species has remained almost entirely outside the scientific spotlight. Currently there is no systematic information on the available local genetic resources of the service tree in Bulgaria—in what condition they are, what are their morphological and biological characteristics, their qualities and potential for use in fruit production or in breeding programs. This study presents an analysis of the agronomic characteristics of 105 local specimens located in different parts of the country.

MATHERIALS AND METHODS

The current study is conducted in 2 consecutive years – 2024 and 2025. Flowering period and ripening period of the first fruits of 105 service trees were monitored in different locations all over Bulgaria – in the areas of Plovdiv, Burgas, Varna, Sliven, Gabrovo, Troyan, Lovech, Vratsa, Montana, Kostenets, Dupnitsa, Blagoevgrad and Gotse Delchev. An average sample of 25 fruits per accession was collected and analzysed for fruit size and fruit skin color.

Fruit weight was measured with a digital scale with a precision of 0.01 g. The specimens belong to one the following groups according to the classification proposed by Mondeshka: very small fruits – with an average weight under 5 g, small fruits – between 5 g and 10 g, medium-sized – between 10 g and 15 g and large fuits – with average weight above 15 g.

Basic and cover color of the fruit skin are determined on ripe but not bletted fruits according to the apple descriptor - ECPGR Characterization and Evaluation Descriptors for Apple Genetic Resources, 2022: yellow, yellow-white, yellow-green, green-white, green, orange for basic skin color and orange, pink, red, dark red, violet, reddish-brown for cover color.

The beginning of the flowering period is considered to be the date on which 5% of the flower buds have opened and are in full bloom, while the rest have not opened yet. The end of the flowering period is defined as the date on which 5% of the flowers are in full bloom, while the remaining flowers have finished blooming.

Early ripening is determined by the first ripe fruits, i.e., when the fruits of the respective specimen begin to ripen. The entire fruiting period lasts between one and two months. The varieties are classified as:

1.very early ripening: August 1–15; 2. early ripening: August 16–31; 3. mid-season ripening: September 1–15; 4. late ripening: September 16–30; and 5. very late ripening: October 1–31

RESULTS AND DISCUSSIONS

The flowering period is determined via in situ monitoring of 43 service trees in the areas of Plovdiv, Troyan, Burgas, Varna, Sliven, Mezdra, Gotse Delchev and Blagoevgrad. It was impossible to visit all 105 trees during the flowering so 43 of them in different parts of the country were studied. The climate norms used cover the period 1991–2020. The most important factor affecting the flowering is temperature. April 2024 (Table 1) and April 2025 (Table 2) are very different in terms of both temperature and precipitation which determines the different flowering periods of *S. domestica* in those years.

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Table 1

Weather Report for April 2024 in some of the studied areas in Bulgaria

Station	Air temperature t°C						Rainfall, mm	
	Average monthly t°C	Deviation from the norm	Max. t°C	Date	Min. t°C	Date	Monthly rainfall	% of norm
Montana	14,8	2,8	32,5	1	3,9	19	42	79
Vratsa	15,2	3,0	32,2	15	3,1	19	45	61
Varna	15,0	4,3	30,3	2	5,7	21	59	153
Burgas	15,3	4,1	31,3	15	6,2	21	47	110
Sliven	16,0	3,9	29,5	15	4,8	21	63	154
Plovdiv	16,2	3,5	31,2	15	2,9	9	32	77
Blagoevgrad	15,0	2,7	29,5	15	2,0	19	69	144

The average monthly temperatures for April 2024 deviated from the monthly norm in the country by between +0.9 °C and +5.2 °C. This was one of the warmest Aprils in the past 30 years as it can be seen in the Monthly hydrometeorological bulletin of National Institute of Meteorology and Hydrology of Bulgaria for April 2024.

On the other hand, average monthly temperatures in the country in April 2025 show deviation from the norm by between -2.5 °C and +1.0 °C. April 2025 is much colder than April 2024 as it can be seen in the Monthly hydrometeorological bulletin of National Institute of Meteorology and Hydrology of Bulgaria for April 2025. That is the reason why the blooming in 2025 is later than 2024 when the blooming began around 13 days earlier.

Table 2

Weather Report for April 2025 in some of the studied areas in Bulgaria

Station	Air temperature t°C						Rainfall, mm	
	Average monthly t°C	Deviation from the norm	Max. t°C	Date	Min. t°C	Date	Monthly rainfall	% of norm
Montana	12,2	0,3	27,1	22	-2,7	8	75	143
Vratsa	12,3	0,1	26,5	17	-2,0	11	89	121
Varna	9,9	-0,8	22,4	26	-1,4	11	39	101
Burgas	10,0	-1.2	24,3	26	-0,7	8	42	100
Sliven	11,0	-1,2	25,2	21	-1,9	8	51	125
Plovdiv	12,5	-0.2	26,4	26	-1,0	11	78	189
Blagoevgrad	12,3	0,0	27,0	17	-3,1	8	16	33

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Data collected for 2024 show earlier than usual flowering due to the high temperatures in the end of March and in April (Table 3). The first service trees began flowering on 3 April in the area of Plovdiv which is one of the warmest areas in Bulgaria. The flowering lasted 11 days and finished on 14 April. The service trees in the areas of Troyan, Burgas and Varna followed on 7 and 8 April. They stopped flowering on 20 and 21 April. In the area of Gotse Delchev the studied service trees are located at an elevation between 700 and 900 meters and the flowering begins relatively late – on 10 April. The trees in the Blagoevgrad area bloom last – from 19 April until 1 May. They are located at an elevation between 840 and 1020 meters in Vlahina mountain and spring arrives there later. The shortest flowering period observed in 2024 is 10 days in the area of Mezdra and the longest one is 15 days in the area of Gotse Delchev.

Table 3

Flowering period of *Sorbus domestica* L. in Bulgaria in 2024 and 2025

Research area	Flowering period of *Sorbus domestica* L.			
	2024		2025	
	Beginning	End	Beginning	End
1.Plovdiv	3 April	14 April	16 April	30 April
2.Troyan	7 April	21 April	18 April	29 April
3.Varna	8 April	20 April	20 April	5 May
4.Burgas	7 April	20 April	20 April	6 May
5.Sliven	9 April	22 April	22 April	7 May
6.Mezdra	9 April	19 April	23 April	2 May
7.Gotse Delchev	10 April	25 April	23 April	11 May
8.Blagoevgrad	19 April	1 May	2 May	13 May

The data for 2025 reveal a different phenology about the flowering period of *S. domestica*. In 2025 the flowering period begins on 16 April much later than in 2024 and extends into May which is colder than May 2024. Average monthly temperatures for May 2025 deviate from the monthly norm by between -2.5 °C and +0.3 °C. However, the dates listed in 2025 are closer to the norm observed by MONDESHKA between 1983 and 1990 (MONDESHKA, 1990). The shortest flowering period observed in 2025 is 9 days again in the area of Mezdra and the longest one is 18 days again in the area of Gotse Delchev. If we compare the data about the flowering period in Bulgaria with the results published by Sebek in 2020 we can conclude that the service trees in Bulgaria bloom earlier and for a shorter period of time than those in Montenegro.

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Early ripening is a very important factor that largely determines the duration of the harvest season. It is determined for 105 service trees across Bulgaria in 2024 and 2025 (Fig.1). Trees that start bearing fruit in the middle of the season represent the largest share – 38%. The late ripening service trees are the second largest group with 28%. One-fifth of the trees begin bearing fruit in the second half of August. 11% are the very late ripening trees which bear fruits in October. Service trees that ripen in early August represent the smallest share – only 2% of the studied specimens. The presence of all groups in Bulgaria means a long harvest season – around three months. If stored properly, fresh fruits may be available until Christmas (Mondeshka, 1990).

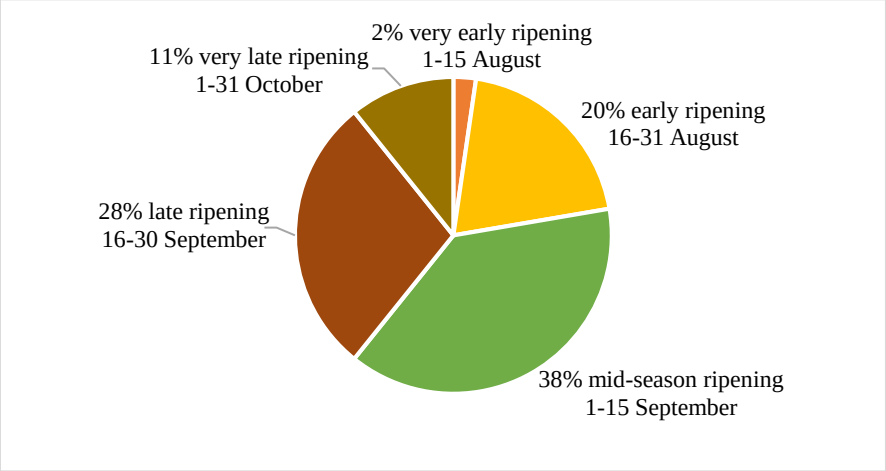


Figure 1. Early ripening of the 105 examined service trees in 2024 and 2025 in Bulgaria, %

The size of the service tree fruits is one of the most important indicators related to marketability. Large, intensely colored fruits are the most sought-after for fresh consumption. Five service trees with large fruits above 15 g have been identified. Tree of them are late ripening, one is early ripening and one is mid-season ripening. They should be further examined. The majority of the studied trees have an average weight between 5 g and 10 g and are categorized as small fruits according to classification made by MONDESHKA (Fig.2). Around one quarter or 24% of the service trees bear very small fruits. Medium sized fruits are found in 19% of the specimens. Large fruits are rare – only 5% of the studied trees bear fruits with an average weight above 15g. These results are similar to those in eastern Serbia, where MILETIĆ and PAUNOVIĆ found that 52.3% of the monitored local trees had small fruits with an average weight between 7.5 g and 9.8 g, 41.1% of the trees bear medium to large fruits ranging in weight from for 10.3 g to 18.6 g and 6.6% of the trees gave large and very large fruits weighing from 21.7g to 25.6 g (MILETIĆ and PAUNOVIĆ, 2012).

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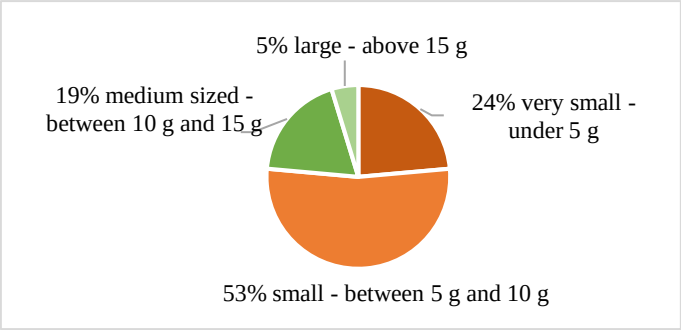


Figure 2. Average size of the collected fruits in 2024 and 2025 from 105 service trees in Bulgaria, %

Basic and cover color of the fruit skin are also studied on 105 service trees. Data collected shows that the most frequent basic skin color is the yellow one (Fig.3) - observed in more than a half of the specimens followed by the yellow-green color with 45%. Only 4% of the studied trees bear fruits with green basic skin color. Fruits with yellow-white, green-white and orange basic skin color are not identified. The yellow cover color is the most attractive for potential customers so it is positive that it is identified in 51% of the fruits of the studied specimens.

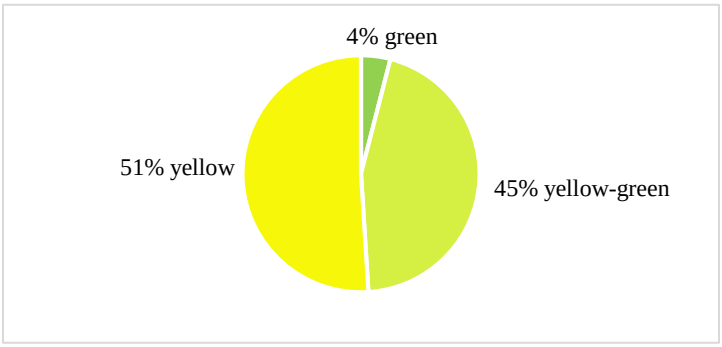


Figure 3. Basic skin color of the 105 service tree fruit samples examined in 2024 and 2025 in Bulgaria, %

There is a greater variety in the cover color of the fruit skin although 65% of the fruit express orange cover color (Fig.4). In 19% the cover color is red and in 11% it is pink. Reddish-brown and violet cover colors are found only in 4% and respectively 1% of the fruit samples examined. The different cover colors are not specific to any particular region. They are found in various parts of the country.

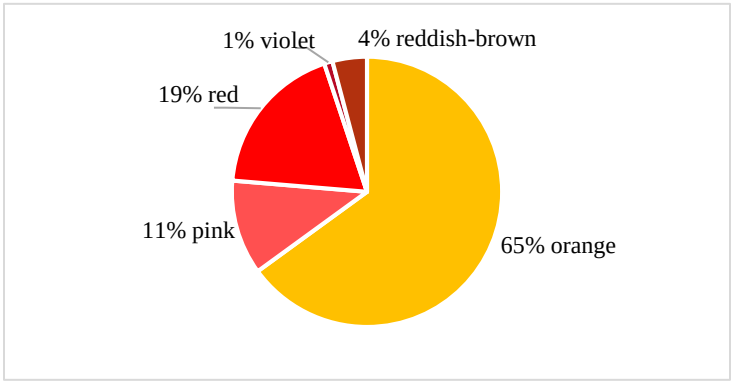


Figure 4. Cover color of the 105 service tree fruit samples examined in 2024 and 2025 in Bulgaria, %

CONCLUSIONS

1. The flowering of *S. domestica* in 2024 in Bulgaria is earlier than usual due to the higher temperatures in spring and lasts from 3 April until 1 May. In 2025 the flowering period is closer to the norm. It begins on 16 April and ends on 13 May.
2. In Bulgaria service tree fruits begin ripening from early August through late October. Most service trees start bearing fruit in the first half (38%) and in the second half (28%) of September.
3. The majority of the studied service trees have small fruits with an average weight between 5 g and 10 g. Only 5% of the trees bear large fruits with an average weight above 15g. They should be propagated and further studied.
4. The most frequent basic colors of the fruit skin are yellow (51%) and yellow-green (45%). The most frequent cover colors of the fruit skin are orange (65%), red (19%) and pink (11%).

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