Scientific Papers. Series B, Horticulture. Vol. LXIII, No. 1, 2019
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

VARIABILITY OF MORPHOLOGICAL CHARACTERISTICS IN GENOTYPES OF *CORNUS MAS* L. IDENTIFIED IN OLTENIA REGION

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Abstract

Cornelian cherry (Cornus mas L.) is a valuable species with great diversity in terms of variability of morphological characteristics. Cornelian cherry's genetic diversity is important for the adaptability of genotypes to environmental conditions in different areas. The aim of this paper was to study the variability of some cornelian cherry shrubs from local populations in Oltenia region, in order to identify and select genotypes of interest that are adapted to local climatic conditions. A high variability of the plant's morphological characteristics has been observed both within populations as well as between populations analyzed, variability which can be an important source in selecting genotypes of interest with an important role in the breeding programs.

Key words*: Cornus mas L., morphologic characteristics, selection.*

INTRODUCTION

Cornelian cherry (*Cornus mas* L.) is a valuable species because it has no particular requirements for environmental factors and it grows in extreme conditions. Its greatest advantage is high plasticity and fruit value (Cosmulescu et al., 2017, 2019; Cornescu, 2017). Neither the importance of landscaping, nor the importance of land reconstruction should be neglected (Dokoupil & Řezníček, 2013; Gavrila Calusaru & Cosmulescu, 2018). Cornelian cherry is a slow-growing shrub, which develops on well-drained calcareous soils, supporting very well the shadow of tall trees (Ďurkovič, 2008). It is also encountered on hills, forests, clearings, rarely in meadows, near solitary paths in the forest as well as in farming culture. In order to avoid the loss of Cornelian cherry biodiversity, it is necessary to collect and preserve genotypes with high variability and adaptability to environmental conditions (Mratinić et al., 2015). Cornelian cherry genetic preservation will be essential for the development of productive cultivars, suitable to the needs of commercial farmers and small farmers (Klimenko, 2004). Knowing the history of the areas where Cornelian cherry appears is important to know the adaptability of some genotypes under environmental conditions in different regions of as many countries as possible (Yilmaz et al., 2009). Higher altitudes, even 1400 m -at which the Cornelian cherry is encountered- do reflect the high degree of tolerance to the action of various abiotic and biotic factors (Brindza et al., 2007). The aim of this paper was to study the variability of *Cornus mas* L shrubs in Oltenia's local populations, in order to identify and select genotypes of interest that are well adapted to local climatic conditions.

MATERIALS AND METHODS

Materials. The study was carried out on 85 cornelian cherry genotypes in spontaneous flora within three populations: two in Northern Oltenia, Gorj county, namely the village of Calaparu (44°41′40″N 23°17′3″E; 155m altitude) and Strimba-Jiu (44°45′N 23°19′E; 150m altitude), and the third one in Eselnita (44°42′7″N 22°21′48″E; 86m altitude) in the South-Western area of Mehedinti County.

Methods. The identified genotypes were coded with digits and letters, the letter representing the research area and the number is the genotype of the respective population: Calaparu (C1...Cn), Strimba-Jiu (So1...Son,

Svm1...Svmn) and Eselnita (E1...En). Pomological characteristics were evaluated in genotypes selected according to UPOV morphological descriptors used for cherry tree and adapted to Cornelian cherry (Bosančić, 2009; Mratinić et al., 2015). Pomologic characteristics analysed in the selected genotypes were: number of stems on genotype, plant habitus, stem diameter, canopy diameter, plant height, stem section area and ability to form basal shoots in genotypes of the analysed populations (Cosmulescu et al., 2018a,b). The number of stems of each genotype in the populations analysed was determined by counting the stems, thus making a nominal description by populations. Stem diameter in each genotype was calculated using the formula D = 2R, where R = L/2π, L being the circumference measured in cm for each stem of Cornelian cherry genotype. Habitus of genotypes has also been described nominally by populations according to classification criteria for fruit tree species with regard to habitus. The plant height was determined by measuring meter and expressed in meters. Canopy diameter was determined by measuring two diameters in two perpendicular directions by means of the meter and calculating the average diameter of canopy expressed in meters. Stem section area (SST) was calculated according to the SST=πr^2 formula for each stem of genotype, after which the sum and the mean surface area of the stem sections were calculated for each genotype using the formulas $\sum SST = SST1 + \cdots + SSTn$ and X=$\frac{\sum SST}{n}$.
The ability to form basal shoots in each genotype was determined based on the number of basal shoots observed in the immediate proximity of the parent plant (a circle with a 1 m radius was drawn and the basal shoots inside the circle were counted) on a 1 to 5 scale (Vescan, 2011). The recorded data was processed using the statistical analysis program (Data analysis).

RESULTS AND DISCUSSIONS

Cornelian cherry grows from the plain up to 1600 m altitude. The studied populations are located at different altitudes ranging from 86 m in Eselnita population and, respectively, 155 m in Calaparu population, Gorj County (Table 1). Bošnjaković et al. (2012) studied Cornelian cherry genotypes in Montenegro at an altitude of 1280 m, Bijelić et al. (2012) in Serbia at 1300 m, Rop et al. (2010) in Czechia at over 1400 m and in Iran at over 1511 m (Hassanpour et al., 2012). Drkenda et al. (2014) found Cornelian cherry plants in Bosnia Herzegovina at an altitude between 345 and 700 m. Taking into account the results with regard to pomological characteristics (Table 2) it is noted that they show high variability both between populations and within each population. Thus, the number of stems varied in the Strimba-Jiu population between 1 and 5 stems on genotype as follows: a stem in genotypes So1, So5, So7, two stems in So3, So4, So6, Svm1, Svm7. One single genotype had 5 stems (Svm10), while the rest had 3 stems. Genotypes in Calaparu population presented between two (C16) and five stems (C5, C8 and C10). In Eselnita population genotypes have a variable number of stems, between one stem (E2, E4, E20, E30) and six stems (E26, E35, E41, E43). Knowing the number of stems, the sum of stem section areas was calculated, on the basis of which the mean section area was calculated, which had values between 47.29 cm² (C10) and 236.84 cm² (C4) in Calaparu population; in Eselnita population, the mean of stem section area varied between 31.78 cm² (E47) and 424.64 cm² (E8), while in Strimba-Jiu population the mean of trunk section area had values ranging from 17.78 cm² (So7) to 103.17 cm² (Svm8). The average diameter of stems varied between 7.39 cm (C13) and 17.27 cm (C4) in Calaparu population, between 6.25 cm (E47) and 22.60 cm (E14) in Eselnita population, and between 4.74 cm (So7) and 11.16 cm (Svm8) in Strâmba-Jiu population. The very large differences between genotypes of the three populations analyzed are due to age, knowing that stem diameter is correlated with genotype age. As for the stem diameter, the literature specifies values between 10-12 cm (Gradinariu et al., 1998), between 25-45 cm (Batsatsashvili et al., 2016) and between 3.42 - 7.80 cm (Jaćimović & Božović, 2016) in genotypes in Montenegro. Regarding the canopy mean diameter, the highest value was calculated in genotypes E5, E18 and C3 (7.5 m), while the lowest (2.25 m) in S1genotype.

Table 1. Geographic coordinates of Cornelian cherry populations (*Cornus mas* L.) analysed

No	Populations	Geographic coordinates			Number of individuals
		Latitude	Longitude	Altitude	
1	Eselnita, Mehedinți county	44°42′7″N	22°21′48″E	86 m	50
2	Calaparu, Gorj county	44°41′40″N	23°17′3″E	155 m	17
3	Strimba-Jiu, Gorj county	44°45′N	23°19′E	150 m	18

Table 2. Variability of morphologic characteristics of genotypes selected in research areas

Population	Statistical analysis	Sum SST (cm²)	Mean SST (cm²)	Mean diameter of stem (cm)	Mean diameter of canopy (m)	Shrub height (m)
Calaparu	X±SD	379.46±186.75	94.19±43.30	10.45±2.46	5.08±1.44	5.46±0.81
	Minimum	140.68	47.29	7.39	3.15	4.20
	Maximum	947.37	236.84	17.27	7.50	7.20
	CV%	49.21	45.97	23.53	28.35	14.82
Eselnita	X±SD	544.72±363.11	173.75±91.65	13.42±3.72	5.26±1.05	6.18±1.27
	Minimum	89.28	31.78	6.25	2.50	4.00
	Maximum	1929.96	424.64	22.60	7.50	10.00
	CV%	66.65	52.74	27.70	20.03	20.60
Strîmba Jiu	X±SD	139.32±85.54	54.55±26.15	7.84±1.97	3.35±0.86	3.84±0.83
	Minimum	17.78	17.78	4.76	2.25	3.00
	Maximum	323.95	103.17	11.16	5.00	5.40
	CV%	61.39	47.93	25.13	25.63	21.62

Canopy diameter in Calaparu population varied between 3.15 m (C1, C15) and 7.50 m (C3), in Strimba-Jiu genotypes ranged between 2.25 m (Svm1, Svm10, Svm11) and 5 m (So6), and in Eselnita population the canopy diameter was between 2.50 m (E40) and 7.50 m (E18). The highest coefficient of variation calculated for canopy diameter (28.35%) was found in Calaparu genotypes, while the lowest (19.96%) in Eselnita population genotypes. The height of shrubs varied between 3m (So1) and 10m (E18) and ranged from 4m (E2) and 10m (E18) in genotypes of Eselnita population, between 4.20m (C14) and 7.20m m (C9) in Calaparu genotypes, and between 3 m (Svm1, Svm4, Svm 6, Svm11) and 5.40 m (So2, So6) in those in Strimba-Jiu. The highest variation coefficient for the shrub height (21.26%) was calculated for the genotypes of Strîmba Jiu population, and the lowest (14.82%) for Calaparu genotypes. The data obtained for the plant height are in accordance with literature, where Cornelian cherry is mentioned as a shrub, sometimes arbustoid, with a height of 0.71-1.35 m (Řezníček & Salaš, 2004), 5-8 m (Mamedov & Craker, 2004) and even 8 m (Bijelić et al., 2010; Bošnjaković et al., 2012). Prokaj et al. (2009) mentions cornelian cherry as a shrub or tree with 5-12 m height, often found from southern Europe to southern Belgium and central Germany. Regarding the growth habitus, most of genotypes studied grow in the arbustoid shape with several stems in the collar area, unequally developed. In Strimba-Jiu population 3 genotypes with the actual tree habitus (So1, So5 and So7) were identified, while the remaining 15 were arbustoid. In Calaparu all 17 genotypes have arbustoid habitus. In Eselnita, of all 50 individuals, only 6 genotypes (E2, E4, E20, E28, E29, E30) grow in the shape of tree, the rest of genotypes being arbustoid. Cornelian cherry growth habitus ranges from bush to small trees that can reach a height of 5m (Bosančić, 2009). In analysing the ability of basal shoots forming data (Table 3) it shows that of the 85 genotypes of Cornus mas L., the highest ability to form basal shoots was in Eselnita genotypes, with a range of variation between 0-15 basal shoots, while the lowest was recorded in Strimba-Jiu population, with variation limits between 0 and 6 basal shoots.

Table 3. Ability to form basal shoots in genotypes of studied populations

Population	Statistical analysis		
	Mean ±SD	Variation range	CV%
Eselnita	3.42±4.65	0-15	136.00
Calaparu	5±2.89	0-11	57.87
Strimba-Jiu	1.55±2.40	0-6	154.69

The highest coefficient of variation for basal shoots ability was recorded in genotypes of Strîmba Jiu population (154.69%), while the lowest in Calaparu population genotypes (57.87%). Thus, taking into account the ability to form basal shoots, genotypes with a very high basal shoots ability (15 basal shoots in a 1 m perimeter around the mother plant) cannot be recommended for use as root-stock in breeding programs. Basal shoots ability plays a role in genotype selection with decorative value (Negrea & Zlatic, 2010). Table 4 shows that 50.59% of the studied genotypes did not form basal shoots.

Table 4. Genotype distribution in analysed populations in terms of basal shoots number

Bin	Frequency	Cumulative %
0	45	51.14
1.66	0	51.14
3.33	3	54.55
5	20	77.27
6.66	4	81.82
8.33	4	86.36
10	5	92.05
11.66	2	94.32
13.33	2	96.59
More	3	100.00

These genotypes may be recommended for setting up plantations, as it is well known that propagating material used for plantation set-up should not form basal shoots. A percentage of 27.06% of studied genotypes recorded low ability to form basal shoots (1-5 basal shoots), average drainage (5-10 basal shoots) in only 15.29% of the genotypes, and strong ability (10-15 basal shoots) and very strong ability (15-20 basal shoots) had a percentage of 7.06% of genotypes analysed. Genotypes with strong and very strong ability to form basal shoots can be recommended in reconstruction of degraded lands due to the highly developed radicular system that helps to fix the soils. In the literature, Prokaj et al. (2009) stated that, in addition to its fruit-bearing role, cornelian cherry is of particular importance in protecting the environment by fixing the soil and preventing its erosion due to basal shoots forming ability.

CONCLUSIONS

A high variability of the plant's morphological characteristics has been observed, both within populations and between populations analysed, variability that can be key source in selecting genotypes of interest with a major role in breeding programs.

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