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

# IDENTIFICATION OF BLACK ELDERBERRY (*SAMBUCUS NIGRA* L.) VALUABLE BIOTYPES FROM THE SPONTANEOUS FLORA OF OLTENIA REGION

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***Abstract***

*Black elderberry (Sambucus nigra L. is a deciduous shrub species that is widely spread in Europe, Asia and North America. Its fruits and flowers are used for the preparation of syrups, jams, pies, wine etc., and in traditional medicine due to their antioxidant properties. Investigations carried out in the spontaneous flora of Oltenia materialized in identifying several valuable and productive genotypes of black elderberry. Between 2017-2018 period, a number of 100 biotypes were selected in 15 locations from Dolj and Vâlcea counties. Among the selected biotypes, the highest fruit yields were obtained for Râmnicu Vâlcea 147 and Valea Stanciului 24. These genotypes have large fruits and resistance to diseases and pests, these characteristics recommend them to be tested for possible introduction as new cultivars.*

***Key words****: genetic resources, germplasm, selections.*

## INTRODUCTION

The *Sambucus* genus comprises a number of 20 species with a large spreading area in Asia, North America and Europe. Black elderberry *(Sambucus nigra* L.) is one of the most well-known species of the genre, is growing as a 3-5 meters shrub, sometimes as a tree up to 7 meters high and is known for its many uses.

In Romania, the black elderberry grows spontaneously in the river valleys from the plains until the intermountain area, where it is gradually replaced by *S. racemosa* (Botu et al., 1988).

Elderberry fruits have a wide range of uses in the food industry, as jam, syrup, alcohol beverages (Thomas et al., 2016), or the pharmaceutically industry (Valles et al., 2004). Also, there are other uses of elderberry as an ornamental plant (Schmitzer et al., 2004).

Many therapeutic qualities and possibilities of use of elderberry fruits and flowers in the food industry made black elderberry to be improved through cultivar breeding and introduced into culture as commercial crop in countries such as: Austria, Germany, Denmark, Hungary, Czech Republic, Canada, U.S.A., etc.

In Romania, research activities regarding elderberry culture and selecting new varieties started in 1975 at Research Institute for Fruit Growing in Piteşti - Mărăcineni and Fruit Growing Research Station (SCDP) Vâlcea, the following varieties being named: 'Brădet', 'Ina', 'Nora' and 'Flora' (Botu et al., 1988; Braniște et al., 2007).

The cultivars obtained in Romania yielded up to 12 kg of fruits per plant in case of 'Nora', 13 kg of fruits per plant in case of 'Ina', while 'Flora' produced 1 ton/ha of elderberry flowers and up to 9 t/ha of fruits (Braniște et al., 2007).

From the morphological point of view, black elderberry exhibits different types of growth, different shapes of the crown and also different times of phenological phases, etc. (Byers et al., 2005).

Taking into account that Oltenia region flora is rich in various shrub species as elderberry, dog rose, hawthorn, sea buckthorn, blackthorn or sloe, Cornelian cherry, etc., the interest for selection of genotypes that can be used for

culture emerged in the last years. Present study was aimed for identifying, evaluation, and selection of black elderberry genotypes with superior characteristics.

## MATERIALS AND METHODS

For the present study were selected 15 black elderberry genotypes, the biological material being collected from the spontaneous and cultivated flora from Vâlcea and Dolj counties of Oltenia region.

The biological material has been analyzed during a 2 years period (2017-2018), data being collected *in-situ* and *ex-situ.*

Main characters of the plants for the elderberry selections were observed and evaluated:

- Plant habitus;
- Crown shape;
- Plant height;
- Trunk thickness;
- Trunk bark color;
- Density of branches.

Also, inflorescences, rachis thickness, inflorescence weight, fruit dimensions, fruit weight, leaves were measured. Measurements of elderberry leaves and leaflets and calculations have been carried out with Digimizer image analysis software Version 5.3.4. On basis of the data obtained several statistical indices were calculated using MS Excel software.

## RESULTS AND DISCUSSIONS

During the study period (2017-2018), a total number of 15 black elderberry selections from Oltenia region were analyzed. These selections remarked through variability concerning agro-biological and yielding behavior.

The selections were *in-situ* analyzed regarding their habitus, crown shape, plant height, thickness and trunk color, branch density (Table 1).

Based on the *in-situ* observations of the selections we proposed several descriptors and their components.

- *Plant habitus*. Three categories were observed; erect (3 genotypes), spread (11 genotypes) and pendent (one genotype).
- *Crown shape*. Three categories are proposed: globose, columnar and inverse pyramid.
- *Plant height*. The plants heights varied from 2 to 10 meters. Three categories are obvious: small (2-3 m), medium (4-5) and large (over 6 m);
- *Trunk thickness*. Three groups are proposed: small, medium and large. *Trunk bark color*. Four groups were observed in case of trunk bark color: light gray, dark gray light brown and dark brown.
- *Density of branches*. In this case three groups are proposed: low, medium and high.

Table 1. Description of black elderberry based on the growth descriptors

| No | Selections | County of origin | Plant habitus | Crown shape | Plant height | Trunk thickness | Trunk bark color | Density of branches |
|---|---|---|---|---|---|---|---|---|
| 1 | Căzănești 37 | Vâlcea | spread | globose | small | small | light gray | high |
| 2 | Căzănești 81 | Vâlcea | spread | globose | medium | small | dark brown | high |
| 3 | Bălcești 71 | Vâlcea | spread | globose | large | small | light brown | low |
| 4 | Bălcești 215 | Vâlcea | erect | columnar | medium | medium | dark brown | medium |
| 5 | Oteteliș 78 | Vâlcea | spread | globose | small | small | dark grey | high |
| 6 | Oteteliș 100 | Vâlcea | spread | globose | small | small | light brown | medium |
| 7 | Goruneşti 80 | Vâlcea | spread | globose | small | small | dark grey | medium |
| 8 | Comoșteni 63 | Dolj | spread | columnar | medium | large | dark brown | high |
| 9 | Craiova 69 | Dolj | erect | globose | large | large | light brown | high |
| 10 | Râmnicu Vâlcea 147 | Vâlcea | spread | globose | large | medium | dark brown | high |
| 11 | Dăești 205 | Vâlcea | pendent | globose | small | small | dark brown | medium |
| 12 | Găgeni 166 | Vâlcea | spread | columnar | medium | medium | light brown | high |
| 13 | Craiova 79 | Dolj | erect | columnar | large | medium | dark grey | low |
| 14 | Bujoreni 33 | Vâlcea | spread | columnar | large | large | dark brown | high |
| 15 | Valea Stanciului 24 | Dolj | spread | globose | small | small | light gray | low |

During 2017 - 2018 period, a series of measurements has been carried out in order to establish the fruit yields (Table 2).
Measurements permitted to calculate the average weight of inflorescences, average weight of fruits in the inflorescence, size of inflorescences, etc.
In 2017, in terms of fruits, the yields per plant varied between 697.5 g for Oteteliș 100 and 4074 g for Valea Stanciului 24. Fruit yields over 3000 g per plant were obtained for the following selections: Craiova 79 (3903.2 g), Craiova 69 (3272.7 g), Bujoreni 33 (3030.0 g), Râmnicu Vâlcea 147 (3420 g) and Valea Stanciului 24 (4074 g).
Compared with 2017, in the year 2018 the black elderberry selections proved more productive, due to better climatic conditions.
In 2018, the same two black elderberry selections, which had better production potential, were emphasized. In case of Râmnicu Vâlcea 147 the fruit yield recorded in 2018 was 11034.6 g, while for Valea Stanciului 24 was 16783.2 g.
High fruit yields were also obtained in 2018 for the following selections: Craiova 79 (5896.8 g), Bujoreni 33 (6259.5 g), Dăești 205 (7047 g), Oteteliș 78 (7407.4 g), Oteteliș 100 (8200.2 g).

Table 2. Fruit yields recorded in 2017 -2018 period for the black elderberry selections

| No | Selection | Fruit yield (g/plant) | | |
|---|---|---|---|---|
| | | 2017 | 2018 | *Mean* |
| 1 | Căzănești 37 | 1380.0 | 3561.1 | *2470.6* |
| 2 | Căzănești 81 | 1470.0 | 5559.3 | *3514.7* |
| 3 | Bălcești 71 | 2957.5 | 3436.4 | *3197.0* |
| 4 | Bălcești 215 | 1611.2 | 5912.2 | *3761.7* |
| 5 | Oteteliș 78 | 2089.5 | 7407.4 | *4748.5* |
| 6 | Oteteliș 100 | 697.5 | 8200.2 | *4448.9* |
| 7 | Goruneşti 80 | 1076.7 | 4488.0 | *2782.4* |
| 8 | Comoşteni 63 | 2232.0 | 5775.0 | *4003.5* |
| 9 | Craiova 69 | 3272.7 | 4804.8 | *4038.8* |
| 10 | Râmnicu Vâlcea 147 | 3420.0 | 11034.6 | *7227.3* |
| 11 | Dăești 205 | 2142.0 | 7047.0 | *4594.5* |
| 12 | Găgeni 166 | 2399.8 | 5960.0 | *4179.9* |
| 13 | Craiova 79 | 3903.2 | 5896.8 | *4900.0* |
| 14 | Bujoreni 33 | 3030.0 | 6259.5 | *4644.8* |
| 15 | Valea Stanciului 24 | 4074.0 | 16783.2 | 10428.6 |

Measurements of the inflorescences of the 15 black elderberry genotypes were carried out in 2017 and 2018. Means of large and small diameters of the inflorescences, mean rachis thickness and mean inflorescence weight were calculated (Table 3).
The highest values of the mean large diameter of the inflorescences were observed for Bujoreni 33 (140.60 mm) and Valea Stanciului 24 (162.55 mm). The lowest value was recorded in case of Râmnicu Vâlcea 147 (87.55 mm). Regarding the mean small diameter of inflorescence, the highest values proved to be obtained for Valea Stanciului 24 selection (109.80 mm), followed by Bujoreni 33 (106.15 mm). The lowest value was observed for Râmnicu Vâlcea 147 genotype (68.40 mm).
Mean values of rachis thickness varied between 3.34 mm for Râmnicu Vâlcea 147 selection up to 4.36 mm for Valea Stanciului 24 and 4.54 mm for Bujoreni 33 selections. The mean inflorescence weight oscillated from 2.69 g for Râmnicu Vâlcea 147 genotype to 3.65 g for Valea Stanciului 24.
Statistical indices as variance, standard deviation and coefficient of variance were calculated (Table 3). During the study period, compound leaves from the 15 genotypes of black elderberry from Oltenia region were harvested. The compound leaves of these genotypes had 5 or 7 leaflets (Table 4). In case of the black elderberry selections the average leaflet length varied from 6.80 cm (Dăești 205) to 10.36 cm (Râmnicu Vâlcea 147). The minimum value recorded was 4.34 cm in case of Comoșteni 63, while the maximum value was 11.81 cm for Râmnicu Vâlcea 147.
The highest average perimeter of leaflets (24.27 cm) was observed in case of Râmnicu Vâlcea 147 selection (Table 5). In case of Căzănești 81, the highest average surface of leaflets (29.08 $cm^2$) was recorded. All of the black elderberry selections had a good behavior regarding main diseases and pests during the study period.

Table 3. Measurements of inflorescences of the black elderberry selections during the 2017 - 2018 period

| No. Crt. | Selections | Mean large diameter of inflorescence (mm) | Mean small diameter of inflorescence (mm) | Mean rachis thickness (mm) | Mean inflorescence weight (g) |
|---|---|---|---|---|---|
| 1 | Căzănești 37 | 123.25 | 97.10 | 4.53 | 3.19 |
| 2 | Căzănești 81 | 102.20 | 83.35 | 4.70 | 3.13 |
| 3 | Bălcești 71 | 96.25 | 76.40 | 3.50 | 2.85 |
| 4 | Bălcești 215 | 100.15 | 80.20 | 3.35 | 2.83 |
| 5 | Oteteliș 78 | 124.80 | 82.40 | 5.01 | 3.17 |
| 6 | Oteteliș 100 | 138.90 | 106.15 | 3.86 | 3.33 |
| 7 | Gorunești 80 | 112.80 | 96.60 | 4.55 | 3.02 |
| 8 | Comoșteni 63 | 114.35 | 80.45 | 4.29 | 3.05 |
| 9 | Craiova 69 | 133.65 | 104.25 | 4.54 | 3.30 |
| 10 | Râmnicu Vâlcea 147 | 87.55 | 68.40 | 3.34 | 2.69 |
| 11 | Dăești 205 | 109.60 | 68.70 | 3.93 | 2.97 |
| 12 | Găgeni 166 | 116.30 | 80.25 | 4.58 | 2.99 |
| 13 | Craiova 79 | 107.15 | 70.05 | 3.70 | 3.06 |
| 14 | Bujoreni 33 | 140.60 | 106.15 | 4.54 | 3.33 |
| 15 | Valea Stanciului 24 | 162.55 | 109.80 | 4.36 | 3.65 |
| *Mean* | | *118.01* | *87.35* | *4.19* | *3.10* |
| *Standard deviation* | | *19.73* | *14.62* | *0.53* | *0.24* |
| *Variance* | | *389.36* | *213.78* | *0.28* | *0.06* |
| *Coefficient of variation (%)* | | *16.62* | *16.74* | *12.67* | *7.73* |

Table 4. The characteristics of the leaves and average length of leaflets for the black elderberry selections studied

| No. Crt. | Selections | Average no. of leaflets/ compound leaves | Average leaflets length (cm) | | | |
|---|---|---|---|---|---|---|
| | | | Mean | Standard deviation (± SD) | Min. | Max. |
| 1 | Căzănești 37 | 5 | 8.82 | 1.42 | 7.31 | 10.78 |
| 2 | Căzănești 81 | 5 | 9.67 | 1.27 | 8.22 | 11.51 |
| 3 | Bălcești 71 | 7 | 8.21 | 0.66 | 7.33 | 9.04 |
| 4 | Bălcești 215 | 7 | 8.60 | 1.74 | 6.68 | 9.93 |
| 5 | Oteteliș 78 | 7 | 6.93 | 0.96 | 5.11 | 8.06 |
| 6 | Oteteliș 100 | 7 | 6.95 | 1.03 | 5.37 | 8.26 |
| 7 | Gorunești 80 | 5 | 7.94 | 1.24 | 7.27 | 9.45 |
| 8 | Comoșteni 63 | 7 | 6.82 | 1.66 | 4.34 | 8.50 |
| 9 | Craiova 69 | 5 | 7.60 | 0.93 | 6.32 | 8.84 |
| 10 | Râmnicu Vâlcea 147 | 5 | 10.36 | 1.59 | 8.24 | 11.81 |
| 11 | Dăești 205 | 5 | 6.80 | 1.85 | 4.53 | 8.97 |
| 12 | Găgeni 166 | 5 | 7.91 | 1.44 | 5.40 | 9.00 |
| 13 | Craiova 79 | 5 | 7.60 | 0.93 | 6.32 | 8.84 |
| 14 | Bujoreni 33 | 5 | 8.78 | 1.43 | 7.31 | 10.69 |
| 15 | Valea Stanciului 24 | 5 | 8.79 | 1.67 | 6.17 | 10.38 |

Table 5. The characteristics of the leaves and average perimeter of the leaflets for the black elderberry selections studied

| No. Crt. | Selections | Average no. of leaflets/ compound leaves | Average perimeter of leaflets (cm) | | | |
|---|---|---|---|---|---|---|
| | | | Mean | Standard deviation (± SD) | Min. | Max. |
| 1 | Căzăneşti 37 | 5 | 20.95 | 2.46 | 18.30 | 24.59 |
| 2 | Căzăneşti 81 | 5 | 23.43 | 1.25 | 21.86 | 25.05 |
| 3 | Bălceşti 71 | 7 | 18.63 | 1.11 | 16.73 | 19.81 |
| 4 | Bălceşti 215 | 5 | 20.09 | 3.36 | 16.18 | 22.73 |
| 5 | Oteteliş 78 | 7 | 16.22 | 1.94 | 12.41 | 18.20 |
| 6 | Oteteliş 100 | 7 | 16.41 | 2.14 | 16.21 | 20.21 |
| 7 | Goruneşti 80 | 5 | 19.31 | 2.34 | 17.79 | 22.09 |
| 8 | Comoşteni 63 | 7 | 15.98 | 3.74 | 9.40 | 19.50 |
| 9 | Craiova 69 | 5 | 18.02 | 2.07 | 15.59 | 21.06 |
| 10 | Râmnicu Vâlcea 147 | 5 | 24.27 | 2.84 | 21.17 | 27.31 |
| 11 | Dăeşti 205 | 5 | 16.86 | 3.76 | 12.30 | 21.23 |
| 12 | Găgeni 166 | 5 | 17.81 | 2.95 | 12.70 | 19.94 |
| 13 | Craiova 79 | 5 | 18.02 | 2.07 | 15.59 | 21.06 |
| 14 | Bujoreni 33 | 5 | 20.46 | 2.94 | 17.16 | 24.60 |
| 15 | Valea Stanciului 24 | 5 | 21.60 | 4.01 | 15.04 | 24.66 |

Table 6. The characteristics of the leaves and average surface of leaflets for the black elderberry selections studied

| No. Crt. | Selections | Average no. of leaflets/ compound leaves | Average surface of leaflets ($cm^2$) | | | |
|---|---|---|---|---|---|---|
| | | | Mean | Standard deviation (± SD) | Min. | Max. |
| 1 | Căzăneşti 37 | 5 | 25.74 | 4.46 | 22.52 | 33.35 |
| 2 | Căzăneşti 81 | 5 | 29.08 | 1.92 | 25.94 | 30.91 |
| 3 | Bălceşti 71 | 7 | 16.35 | 1.49 | 14.04 | 18.80 |
| 4 | Bălceşti 215 | 5 | 21.75 | 5.65 | 15.42 | 29.19 |
| 5 | Oteteliş 78 | 7 | 14.29 | 3.62 | 8.70 | 19.08 |
| 6 | Oteteliş 100 | 7 | 15.59 | 3.81 | 8.90 | 21.19 |
| 7 | Goruneşti 80 | 5 | 19.42 | 5.11 | 16.41 | 28.07 |
| 8 | Comoşteni 63 | 7 | 11.65 | 4.26 | 4.09 | 15.97 |
| 9 | Craiova 69 | 5 | 18.79 | 4.50 | 14.90 | 26.15 |
| 10 | Râmnicu Vâlcea 147 | 5 | 28.59 | 3.70 | 25.30 | 34.50 |
| 11 | Dăeşti 205 | 5 | 18.33 | 6.16 | 10.76 | 25.04 |
| 12 | Găgeni 166 | 5 | 15.94 | 4.48 | 9.84 | 20.74 |
| 13 | Craiova 79 | 5 | 18.80 | 4.50 | 14.90 | 26.15 |
| 14 | Bujoreni 33 | 5 | 22.90 | 7.26 | 14.97 | 32.52 |
| 15 | Valea Stanciului 24 | 5 | 23.12 | 7.70 | 12.33 | 31.99 |

## CONCLUSIONS

Râmnicu Vâlcea 147 and Valea Stanciului 24 black elderberry selections proved to be productive due to the inflorescences and fruit yields during 2017 - 2018 period.

Taking into account that these two genotypes showed tolerance to pests and diseases, they will be propagated in order to be further tested *ex- situ*.

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