

Vitis 54 (Special Issue), 159–162 (2015)

Ampelographic characterization - preliminary results of the nine most appreciated autochthonous *Vitis vinifera* L. varieties from Romania

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Summary

The paper presents an up-to-date description of some autochthonous, old and valuable grapevine varieties maintained within the germplasm collection belonging to the University of Agronomical Science and Veterinary Medicine Bucharest, respectively 3 varieties for red wines ('Fetească neagră', 'Băbească neagră', 'Busuioacă de Bohotin') and 6 varieties for white wines ('Fetească albă', 'Fetească regală', 'Galbenă de Odobești', 'Grasă de Cotnari', 'Tămâioasă românească' and 'Zghihară de Huși').

The results obtained by applying standardized methodology for grape quantitative and qualitative parameters for three consecutive years, reveal the main characteristics for each variety and also the specific genotype response to particular pedoclimatic conditions. In comparison to 'Cabernet Sauvignon' as reference cultivar, 'Băbească neagră' and 'Busuioacă de Bohotin' varieties were characterized by higher values for the sizes and weights of the berries, and 'Fetească neagră' by heavier bunches and higher sugar juice content. The white grape varieties in comparison to 'Chardonnay' as reference cultivar, were remarked either by bigger bunches with high to very high sugar content ('Fetească regală', 'Grasă de Cotnari', 'Tămâioasă românească'), or by constancy of bunch weight and titratable acidity of must ('Fetească albă', 'Galbenă de Odobești' and 'Zghihară de Huși').

Key words: grapevine; phenotyping; descriptors; grape quality.

Introduction

Eco-climatic conditions in Romania favoured grapevine-growing since ancient time. Wine production comprising worthy autochthonous varieties that survived the phylloxera invasion became famous for quality wine manufacture (NICOLEANO 1900, ROTARU 2009).

The tools of genetic resources involve ampelographic methodology for description of cultivars aiming at verifying the authenticity of plant material and at providing knowledge on grapevine accessions. The most appreciated old varieties ('Galbenă', 'Grasă', 'Fetească' and 'Tămâioasă'), grown in restricted areas or in germplasm

collections, were described for the first time by IONESCU DE LA BRAD (1869), with a special attention on bunches and berry skin colour. Over time, new information was added and valuable documentation about morphological features and yield potentials were provided by CONSTANTINESCU and NEGREANU (1957) and CONSTANTINESCU *et al.* (1960). Presently the phenotype description, showing the main features of each variety, demonstrated the need for an up-to-date revision of registrations.

During the common work performed in the frame of the COST project-Action FA1003 "East-West Collaboration for Grapevine Diversity Exploration and Mobilization of Adaptive Traits for Breeding", by applying the standardized protocols for phenotyping, it was possible to complete and to update the characterization of a part of our grapevine varieties. In this paper part of these results are presented.

Material and Methods

Data were collected from the grapevine collection located in the southern part of Romania, at the University of Agronomical Science and Veterinary Medicine Bucharest (N Lat.: 44° 47' 07"; E Long.: 26° 07' 28"; alt. 87 m). The genotypes analyzed in this study, all of them for wine production, are: varieties with blue or black berry skin color ('Fetească neagră', 'Băbească neagră', 'Busuioacă de Bohotin', and 'Cabernet Sauvignon' as reference cultivar) and varieties with green-yellow berry skin color ('Fetească albă', 'Fetească regală', 'Galbenă de Odobești', 'Grasă de Cotnari', 'Tămâioasă românească', 'Zghihară de Huși', and 'Chardonnay' as reference cultivar). All these cultivars were genetically characterized by 10 microsatellites.

The description of the main morphological traits was performed by using the OIV standardized descriptors (OIV 2009). The methodology for sampling, measurements and the methods for sugar content (by refractometer in °Brix values) and juice acidity (g tartaric acidL⁻¹) followed the standardized protocols for phenotyping berry enological traits validated through the COST Action FA1003 project (RUSTIONI *et al.* 2014). All the activities were performed in three consecutive years, from 2012 to 2014.

Each data set was analyzed using analysis of variance, the statistical program ANOVA, and the mean values among varieties were compared by Duncan's test.

Table 1
Main distinct morphological characters evaluated by the OIV descriptors (2009)

Accession name	OIV003	OIV004	OIV007	OIV008	OIV051	OIV053	OIV067	OIV068	OIV070	OIV076	OIV081-1	OIV083-2
Băbească neagră	3	1	3	3	2	1	3	3	5	2	9	9
Busuioacă de Bohotin	1	5	2	1	2	3	3	3	1	5	1	1
Fetească albă	3	1	3	2	3	1	5	3	2	5	1	1
Fetească regală	1	7	1	2	2	5	2	2	3	5	1	1
Fetească neagră	5	1	3	3	2	1	3	3	2	2	1	1
Galbenă de Odobești	5	9	3	2	3	7	4	2	4	2	1	1
Grasă de Cotnari	5	5	3	2	3	5	4	2	2	5	1	1
Tămâioasă românească	3	1	3	2	2	1	3	3	1	5	1	9
Zgihără de Huși	5	9	3	2	3	7	2	2	4	2	1	1
Cabernet Sauvignon	3	5	2	1	3	5	4	3	2	3	1	1
Chardonnay	3	3	3	2	2	1	3	2	3	2	1	1
Accession name	OIV084	OIV087	OIV094	OIV155	OIV202	OIV204	OIV206	OIV208	OIV223	OIV225	OIV236	OIV351
Băbească neagră	3	3	5	1	7	3	5	3	1	6	1	7
Busuioacă de Bohotin	1	1	5	5	3	9	3	1	2	5	2	5
Fetească albă	1	1	5	5	3	7	3	2	1	1	1	9
Fetească regală	3	3	3	1	3	5	1	1	1	1	5	5
Fetească neagră	1	1	7	5	5	7	3	3	1	6	5	9
Galbenă de Odobești	7	3	3	5	7	7	3	2	3	1	1	7
Grasă de Cotnari	3	3	3	5	5	5	3	2	3	1	1	5
Tămâioasă românească	1	5	5	5	7	7	5	2	2	1	2	5
Zgihără de Huși	5	3	3	5	7	5	3	3	2	1	1	7
Cabernet Sauvignon	5	5	5	9	3	7	1	2	2	6	4	7

Results and Discussion

In Tab. 1 only the coded OIV (2009) descriptors with numerical evaluation showing the distinct features among analyzed varieties are presented. For some ampelographic characters, the whole range of expressions were evaluated: density of prostrate hairs on the shoot tips (004), colour of the dorsal (007) and ventral (008) side of internodes (on shoots during flowering), area of anthocyanin coloration of main veins of mature leaves (070) and bunches shape (208).

Some cluster traits were characterized by a wide variation. Bunch length (202) varied from relatively short-medium long clusters ('Fetească neagră' and 'Grasă de Cotnari') to long clusters ('Băbească neagră', 'Galbenă de Odobești', 'Tămâioasă românească' and 'Zgihără de Huși'). Bunch density (204) ranged from medium dense to dense and very dense bunches, with the only exception of 'Băbească neagră' with loose berries. Particular flavours (236) varied from none specific flavour ('Băbească neagră', 'Fetească albă', 'Galbenă de Odobești', 'Grasă de Cotnari'), to muscat flavour ('Busuioacă de Bohotin' and 'Tămâioasă românească') and characteristic freshness and flavour ('Fetească regală' and 'Fetească neagră'). With respect to berry shape (223), a relatively narrow variation was recorded: most of the varieties have a round shape, however 'Băbească neagră' and all types of 'Fetească' show a characteristic slightly flattened shape. Among studied varieties, 'Băbească neagră' was distinguished by the presence of a high frequency of teeth in the petiole sinus and, very often, the same leaves had teeth in the upper lateral sinuses. The presence of teeth on the lateral sinuses of mature leaves is considered as a particular distinctiveness in the case of 'Tămâioasă românească'.

The standardized methods have been applied in three consecutive years and the computed results gave us a real view concerning the genetic potential of each genotype as response to a specific eco-climatic condition. In Tab. 2 the main grape berry characteristics are presented for the nine autochthonous varieties in parallel with the reference ones ('Cabernet Sauvignon' and 'Char-

Table 2
Grapes quantitative and qualitative parameters at harvesting time a) varieties for red and rose wines

Variety	Bunch weight (g)		10 berries weight (g)		Berry length (mm)		Berry width (mm)		Sugar content (°Brix)		Titratable acidity (g/L tartaric acid)	
	2012-2014	CI % of the mean	2012-2014	CI % of the mean	2012-2014	CI % of the mean	2012-2014	CI % of the mean	2012-2014	CI % of the mean	2012-2014	CI % of the mean
Busuioacă de Bohotin	209.0 ± 9.6 b	3.0	25.9 ± 3.6 a	9.1	16.5 ± 0.8 a	3.8	16.1 ± 0.7 b	3.3	21.6 ± 2.8	8.5	4.4 ± 0.4 d	6.8
Băbească neagră	328.8 ± 58.2 a	11.6	28.2 ± 2.8 a	6.4	16.0 ± 0.4 a	1.8	16.9 ± 0.5 a	1.8	21.1 ± 1.0	3.1	5.8 ± 0.9 b	10.1
Fetească neagră	258.2 ± 92.9 b	23.5	20.1 ± 4.1 b	13.3	14.9 ± 1.4 b	6.1	14.7 ± 0.9 c	4.2	22.8 ± 2.4	6.9	5.0 ± 0.4 c	5.2
Cabernet Sauvignon	128.4 ± 32.6 c	16.6	14.7 ± 1.5 c	6.7	13.6 ± 0.6 c	2.7	13.4 ± 0.5 d	2.6	21.4 ± 0.8	2.5	6.5 ± 0.5 a	4.6
b) varieties for white wines												
Fetească albă	151.2 ± 14.5 c	6.2	18.4 ± 0.9 d	3.3	14.6 ± 0.5 d	2.4	14.5 ± 0.6 c	2.6	19.1 ± 2.2 b	7.5	3.4 ± 0.5 d	8.5
Fetească regală	161.1 ± 29.7 c	12.0	21.5 ± 1.5 c	4.6	14.8 ± 0.7 d	3.1	15.2 ± 0.5 c	2.1	22.8 ± 1.7 a	4.9	4.4 ± 0.9 c	12.9
Galbenă de Odobești	300.7 ± 102.7 a	22.3	33.9 ± 10.1 b	19.4	17.8 ± 2.1 b	7.7	17.5 ± 1.7 b	6.4	17.4 ± 1.6 b	5.8	4.6 ± 0.7 b	9.3
Grasă de Cotnari	285.8 ± 87.9 a	20.1	41.1 ± 7.3 a	11.5	19.8 ± 1.8 a	5.9	18.5 ± 1.1 a	4.0	21.4 ± 4.4 a	13.4	5.3 ± 0.5 b	6.3
Tămâioasă românească	229.9 ± 61.7 b	17.5	25.9 ± 4.2 c	10.7	16.3 ± 0.8 c	3.1	15.8 ± 0.8 c	3.2	23.5 ± 2.6 a	7.2	4.2 ± 0.9 c	13.2
Zghihară de Huși	219.1 ± 75.2 b	22.4	24.7 ± 6.1 c	16.0	16.1 ± 1.5 c	6.0	15.6 ± 1.3 c	5.5	17.8 ± 0.6 b	2.3	5.9 ± 0.6 a	6.6
Chardonnay	140.6 ± 33.3 c	15.5	17.0 ± 1.5 d	5.7	14.3 ± 0.6 d	1.8	14.1 ± 0.6 d	2.7	23.6 ± 2.2 a	5.9	4.5 ± 0.8 c	11.9

Different letters within a row show significant differences among varieties, according to Duncan test.

tal specific responses to particular pedoclimatic conditions, the greatest variations were also recorded. For instance, in the case of varieties adapted for red and rose wines production, 'Busuioacă de Bohotin' and 'Băbească neagră' were identified by the berry weights, and 'Fetească neagră' was distinguished by heavier bunches. In comparison to 'Cabernet Sauvignon' which expressed normal values for all features, the data from autochthonous varieties showed the possibility to obtain good quality wines, starting from a sugar juice content higher than 21 °Brix and a titratable acidity ranging between 4.0 ('Busuioacă de Bohotin') and 6.7 ('Băbească neagră').

Among white grape varieties, the autochthonous ones yielded heavier bunches with bigger berries in comparison to 'Chardonnay'. The grape juice characteristics revealed a high to very high sugar content for 'Fetească regală', 'Grasă de Cotnari' and 'Tămâioasă românească'. During the three years, 'Fetească albă' was distinguished by the constancy of yield and low titratable acidity of must, and 'Zghihară de Huși' stood out by constancy in sugar content and titratable acidity of must.

The values of each variety obtained for different traits, estimated as percentage of the confidence interval (% CI) of mean value, confirms the accuracy of sample collection and measurement methods applied in the three years. According to standardized methods (RUSTIONI *et al.* 2014) and considering 15 % as threshold of accurate work, the data showed that most of the presented parameters were correctly estimated. Similar to the mentioned document, the percentage of confidence interval for bunch weight exceeded the threshold in the case of most varieties, excepting 'Busuioacă de Bohotin', 'Băbească neagră', 'Fetească albă' and 'Fetească regală'. The highest values of the % CI calculated for the berry weight were obtained for the same varieties having the heaviest bunches ('Galbenă de Odobești', 'Grasă de Cotnari', 'Tămâioasă românească' and 'Zghihară de Huși'), both characters being strongly related to genotype response to different climatic conditions during the three years.

Conclusions

The aim of the present work was to provide an ampelographic description of nine Romanian varieties which could be considered as valuable source for the wine market. All these autochthonous grapevines proved to be as valuable as the reference varieties, ensuring grape yield and/or quality of wines.

While the ampelographic characteristics (the numerical evaluations) of the varieties were the same over the three years of investigation, the agronomic characteristics and their degree of variation were influenced by the climatic conditions of each year.

Acknowledgements

Joint publication of the COST Action FA1003 "East-West Collaboration for Grapevine Diversity Exploration and Mobilization of Adaptive Traits for Breeding".

donnay'). Most of the mean values of analyzed parameters were included in the ranges evaluated for each variety in different vineyards (ROTARU 2009). As a result of the varie-

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