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Exploration and revaluation of old autochthonous varieties in the Republic of Moldova

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Summary

In the Republic of Moldova during the last 40-50 years the quota of old autochthonous varieties in industrial vineyards permanently decreased and nowadays the majority of these varieties are present only in the Institute's Collection. During this time only an insignificant part of these resources were included in the research projects and, thus, their potential value for viticulture requires insights. The aim of the present work was the preliminary diversity evaluation of these varieties. Thirty-six cultivars were described according to the primary and secondary ampelographic descriptors, and to the phenotyping protocols for eno-carpological characterization. Based on the obtained data and on literature, some characteristics were established such as classification into Negrul's eco-geographical proles, berry colour, agro-biological properties and resistance to abiotic factors and pathogens.

K e y w o r d s : grapevine; biodiversity; assortment; *Vitis vinifera* L.

Introduction

According to literature (Constantinescu *et al.* 1959, 1960, 1962, Ivanova 1976), the old Moldavian autochthonous grapevine assortment included about 50 varieties, representing, by ecological and geographical origin, both the areas of origin Proles *pontica* (subproles *balcanica* Negr. and subproles *georgica* Negr.) and Proles *orientalis* (subproles *antasiatica* Negr. and subproles *caspica* Negr.). Until the mid of XIX century these varieties were widely present in vineyards. Local assortment was severely affected by the spread of phylloxera and diseases, and by the introduction into Europe of American species and hybrids (Pelyakh 1970). In the transition period before the establishment of grafting in viticulture, new vineyards were usually planted with introduced varieties. Then, the presence of old autochthonous cultivars over the years continued to decrease: in 1949 16 % of the varieties were old native cultivars, in 1964 this percentage decreased to 10 % and, in 1980, to 4-5 %. Currently standard assortment includes only three old varieties: 'Coarnă neagră', 'Fetească albă' and 'Băbească neagră' ('Rară neagră') (Savin 2012 b). The missing knowledge concerning old autochthonous varieties and their absence in the territory is a gap for sustainable viticulture improvement. The biodiversity, as well as the productive and qualitative potential of these autochthonous cultivars, was not involved in breeding programs, although some of these resources possess high adaptability to local soil and climatic factors, such as cold and drought tolerance and resistance to pathogens (Constantinescu *et al.* 1959, 1960, 1962; Savin 2012a). The growing success of each variety is determined by the appropriate choice of the cultivation place, often reported into the name of the variety ('Negru de Akkerman', 'Negru de Căuşeni', 'Grasă de Cotnari' etc.). According to Ungureanu (1962), the varieties 'Fetească albă' and 'Fetească neagră', depending on the pedo-climatic growing area, are adapted to produce the full range of wine products - quality wines, table wines, sparkling wines, sweet and semi-sweet and dessert wines, spirits, juices etc. Thus conservation, exploration and utilization in breeding programs of autochthonous genetic resources could provide diversification and improvement of the viniculture of Republic of Moldova. Autochthonous grapevine assortment could increase the distinctiveness, originality and attractiveness of wines creating basis for a sustainable vitiviniculture (Savin 2014).

In the Republic of Moldova, revaluation of autochthonous varieties, in order to disclose and use their potential, started in the frame of regional and international projects. The main results concerned: the inventory and the description of existing *ex situ* resources (Savin *et al.* 2008, Savin *et al.* 2012a); the evaluation of varieties grown on farm (Savin *et al.* 2010); the description, the diversity assessment, the documentation, the identification (including the use of molecular genetic methods) of these cultivars (Zulj Mihaljevic *et al.* 2013). This revaluation, in an European context, continued recently in the frame of the project COST FA1003 applying phenotyping protocols (Rustioni *et al.* 2014a and b) and molecular genetic methods (De Lorenzis *et al.* 2014). In this paper only some results are presented, focusing on general aspects of the diversity of old autochthonous varieties preserved in the Institute's Collection.

Material and Methods

The studies were carried out in 2012 and 2013 in the Ampelographic Collection of the Research and Practical Institute for Horticulture and Food Technologies, Re-

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public of Moldova, located in the south of Chisinau city (46° 58'39.65" N and 28° 46' 21.68" E, elevation 201 m). In the Institute's Collection 40 old autochthonous varieties (Tab. 1) are grown. In this study, only 36 varieties were involved, due to methodology requirements (10-15 plants per accession) and biological status. The training system is a horizontal bilateral cordon; the planting distance is 3.0 x 1.25 m; and the used rootstock is 101-14. The vineyard was managed according to the technological recommendations for commercial vineyards. Passport data and ampelographic description was performed according to the protocols adopted in the frame of the project GENRES 081 (http://www.eu-vitis.de/docs/descriptors) and phenotyping was carried out according to the protocol proposed in the

Table 1

List of old autochthonous grapevine varieties registered in the Ampelographic Collection of Research and Practical Institute for Horticulture and Food Technologies

Variety number *V*IVC[1)]	Variety name[2)]	Accession name	Source of initial material[3)]	Number of synonyms (*V*IVC)	Number of holding institutions (*V*IVC)
	Table grapes				
2724	Coarnă albă B	Puhleakovskii	UKR_1, ROM	125	28
2726	Coarnă neagră RgV	Coarnă neagră	MDA_1	49	32
2728	Coarnă roşie Rg	Coarna rozovaia	ROM	47	21
16449	Ţâţa căprii B	Ţâţa căprii	UKR_2	28	10
	Wine grapes				
843	Băbească neagră N	Băbeasca; Serecţia ciornaia	ROM	109	27
1022	Băşicată B	Băşicată de Dealul Mare	ROM, MDA_1	7	10
1042	Bătută neagră N	Akkermanskii ciornâi	MDA_2, UKR_2	39	12
21920	Brează N	Brează	MDA_2	1	1
8252	Busuioacă B	Busuioacă	MDA_1, ROM	13	21
1922	Cabasmă albă B	Cabasma belaia, Cabasma	MDA_1	15	8
5891	Cabasmă neagră N	Cabassia	MDA_1	59	13
2674	Cioinic B	Ciainac verde	ROM	7	7
2116	Ciorcuţa neagră N	Ciorcuţa neagră	MDA_1	8	1
2617	Ciorcuţa roză RgV	Ciorcuţa rozovaia	MDA_1	8	1
6397	Copciac N	Copciac	UKR_1	19	11
3327	Crâmpoşie B	Crâmpoşia	MDA_2, UKR_1, ROM	15	14
22239	Damaşin galben B	Damaşin galben	ROM	1	1
4119	Fetească albă B	Fetească albă	UKR_1, MDA_1, ROM	58	38
4120	Fetească neagră N	Fetească neagră	MDA_1	33	26
4221	Francuşe B	Francuşa	UKR_1	20	14
5544	Iordan B	Iordan, Zemoasa	ROM	56	20
4319	Galabura B	Galabura	UKR_2	5	2
4121	Galbenă de Ardeal B	Galbena de Ardeal, Fetească regala	UKR_1, ROM	33	30
4320	Galbenă de Odobeşti B	Galbena	MDA_1, UKR_1	44	18
4901	Gordin B	Gordin	MDA_2	62	21
4903	Gordin gurguiat B	Pticie	UKR_1, ROM	7	5
4948	Grasă de Cotnari B	Grasă de Cotnari	ROM	18	19
7138	Maischii ciornâi N	Maischii ciornâi	UKR_2	16	8
8461	Negru de Căuşeni N	Kausanskii ciornâi	MDA_1	1	6
8464	Negru moale N	Seina	MDA_1, ROM, UKR_1	19	11
9553	Plăvaie B	Plavai	MDA_1	81	19
41441	Roşioară B	Roşioara	MDA_1	0	1
12025	Strugure călugăresc B	Strugure călugăresc	ROM	0	6
8193	Tămâioasa albă românească B	Tamaioza	UKR_1	280	62
8248	Tămâioasă de Bohotin Rg	Tămâioasă de Bohotin	ROM	65	32
17117	Tidveasca B	Tidveasca	MDA_1	24	7
17114	Tigvoasa B	Tigvoasa	ROM	24	7
12727	Turba plotnaia belaia B	Turba plotnaia belaia	MDA_1	7	2
12728	Turba râhlaia belaia B	Turba râhlaia belaia	MDA_1	2	1
13436	Zghihară B	Sghigarda	UKR_2	29	12

[1)] Variety number, number of synonyms and number of holding institutions - according the *Vitis* International Variety Catalogue (*V*IVC, http://www.vivc.de/index.php). [2)] Berry colour: green yellow (B), rose (Rs), red (Rg), grey (G), dark red violet (RgV), blue black (N). [3)] MDA_1- Collection of Moldavian Research Institute for Pomiculture, Viticulture and Oenology; MDA_2- Collection of Moldavian Branch of the Institute Magaraci; UKR_1- Collection of Institute Tairov, Ukraina; UKR_2 - Collection of Institute Magaraci, Ukraina; ROM - Collection of Institute Valea Calugareasca, Romania.

project COST FA1003 (Rustioni *et al*. 2014a and b). Evaluations concerning tolerance to abiotic and biotic stress factors were based on literature (Constantinescu *et al.* 1959, 1960, 1962; Ivanova 1976; Savin 2012a) and confirmed by visual observations.

Results and Discussions

In the Institute's Ampelographic Collection a significant part of the old autochthonous varieties cited in literature are grown (Tab. 1). According to the Vitis International Variety Catalogue (http://www.vivc.de/index.php) the distribution of these resources among other European collections was evaluated. Only one or few holding institutes contain the varieties 'Brează', 'Ciorcuţa neagră', 'Ciorcuţa roză', 'Damaşin galben', 'Turba râhlaia belaia', 'Turba plotnaia belaia', 'Galabura', 'Gordin gurguiat', and 'Negru de Căuşeni'. Some cultivars are preserved only in our collection. Therefore, these resources are under the threat of extinction. However, varieties which have a relatively significant or important quota in industrial vineyards ('Fetească albă', 'Fetească neagră', 'Galbenă de Ardeal', 'Tămâioasă românească', 'Băbească neagră', 'Coarnă albă', 'Coarnă neagră', etc.) are present in a large number of collections. Their wide distribution also results in a large number of synonyms (e.g. 'Tămâioasă Românească' – 280 synonyms, 'Coarnă albă' – 125, 'Băbească neagră' – 109). However, it should be noted that in some cases the number of synonyms increases due to different transliterations of the same name (for ex. synonyms 'Rara neagra', 'Rara niagra', 'Rara nyagra' for the variety 'Băbească neagră').

Nowadays, the Ampelographic Collection gather all the old autochthonous varieties transferred from the "Old Collection" founded in 1956 (Savin 2012a). The initial biological material was collected from 5 different sources: two institutions from Moldova, two collections from Ukraine and one collection from Romania. Obviously, this movement of germplasm, that began about 100 years ago, might be accompanied by some mistakes or ambiguities, therefore, in some cases, the varietal identification is necessary. In order to confirm the identity of well known cultivars or to identify the questionable varieties, thirty-six of them were described according to primary and secondary ampelographic descriptors (data not shown). Together with the molecular genetic analysis performed in partners' laboratories, the accumulated data will definitely identify these resources.

The old autochthonous varieties' general characteristics were classified according to: ecological and geographical origin, grape use, berry colour, tolerance to abiotic factors and pathogens (Tab. 2). Table varieties 'Coarnă neagră', 'Coarnă roşie', 'Ţâţa caprei', 'Damaşin galben' show oriental characters (Proles *orientalis* Negr.), and the cultivars 'Coarnă albă' and the majority of the wine varieties originates from the Black Sea region (Proles *pontica* Negr.) (Constantinescu *et al* 1959, 1960, 1962). Although traditional old autochthonous assortment comprises mostly wine grapes, another specific feature of local varieties is the mixed use (table and wine) ('Damaşin galben', 'Crâmpoşie', 'Strugure călugăresc' etc.).

Including old native varieties in breeding programs as sources of adaptability to environmental conditions, advantages, due to their tolerance to unfavorable weather conditions (cold, frost, drought) and resistance to pathogens (powdery and downy mildew, grey mould), could be obtained. The table varieties 'Coarnă neagră', 'Coarnă albă', and 'Coarnă roşie' showed resistance to frost, wintering,

Table 2

Old autochthonous varieties general characterization

Evaluated characteristics	Gradation, value	Number of varieties
Ecological – geographical origin	Proles *pontica* Negr.	24
	Proles *orientalis* Negr.	12
	Proles *occidentalis* Negr.	1
Utilization of grapes	Table grape	4
	Wine grape	31
	Mixed utilization	5
Source of initial biological material	Moldavian Research Institute for Pomiculture, Viticulture and Oenology (MDA_1)	17
	Moldavian Branch of the Institute Magaraci (MDA_2)	2
	Institute Tairov, Ukraine (UKR_1)	8
	Institute Magaraci, Ukraine (UKR_2)	6
	Institute Valea Calugareasca, Romania (ROM)	14
Berry colour	Green yellow (B)	26
	Red (Rg)	2
	Dark red violet (RgV)	2
	Blue black (N)	10
Resistance to	Frosts	9
	Drought	5
	Grey mould	4
	Powdery mildew	9
	Downy mildew	2

Table 3

Diversity of some bunch and berry characteristics of old autochthonous varieties

Characteristic	Year	Varieties for table grapes		Varieties for wine grapes	
		min	max	min	max
Average bunch weight, g	2012	89.4	387.5	66.4	408.1
	2013	223.9	773.9	116.0	602.8
Sugar content, °Brix	2012	18.3	23.3	13.0	27.4
	2013	14.2	17.9	12.0	23.4
Titrable acidity, mg·L^{-1} tartaric acid	2012	3.5	6.7	3.35	9.20
	2013	3.9	7.1	5.75	11.0
10 berry weight, g	2012	24.8	32.2	7.10	41.6
	2013	33.8	48.7	14.8	39.1
Berry length/width ratio	2012	1.1	1.6	0.97	1.15
	2013	1.0	1.6	0.93	1.15

drought, grey mould. The wine grape varieties 'Băşicata', 'Galbenă de Ardeal', 'Francuşe', 'Galbenă de Odobeşti', 'Fetească neagră', 'Negru vârtos', 'Roşioară', 'Negru de Căuşeni' and 'Zghihară' show resistance to Powdery mildew. 'Galbenă de Ardeal', 'Grasă de Cotnari', 'Fetească albă', 'Fetească neagră', and 'Băbească neagră' seems to be adapted to frost, while 'Bătură neagră' and 'Iordan' demonstrated drought tolerance (Constantinescu *et al.* 1959, 1960, 1962, Savin 2012a). The cold tolerance and resistance to pathogens were confirmed, at this stage of evaluation, by field visual observations.

The agrobiological diversity was estimated applying the phenotyping protocols proposed in the framework of the COST Action FA1003 (Tab. 3). Studying years (2012, 2013) were characterized by contrasting weather conditions, especially considering rainfall and maximum temperatures recorded in the summer period. 2012 was a dry year, with rainfall below the climatic multiannual norm, setting some records for the maximum temperatures and their duration. In the terms of thermal regime 2013 was closer to the normal temperatures, but with abundant rainfall, especially during grape ripening and at harvesting time (in September). These conditions caused, in 2013, yield loss for some varieties. In these conditions some characteristics (average bunch and berry weight, sugar and acidity content) generally had a pronounced variability over the years. According to the OIV descriptors, the single bunch weight (OIV 502) and the single berry dimension (OIV 503) are low-medium for the majority of table grapes (except 'Tâţa căprii', with high bunch weight - 400-770 g). In both the studied years table varieties reached a sugar/acidity ratio favorable for consumption (3-6). Wine grape varieties had less pronounced diversity concerning size and shape of the berries (OIV 220, 221, 223) - most of them have small berries with globose or broad ellipsoid shape, but for the bunch weight, it was attested a wide variability – from very small (60-110 g) to medium and large bunches (400-600 g).

Conclusions

There are 40 old autochthonous varieties registered in the Institute's Collection of Republic of Moldova that represent a significant part of the total number of cultivars cited in bibliographic sources. The varieties 'Breazǎ', 'Damaşin galben' and 'Turba râhlaia belaia', according to the *Vitis* International Variety Catalogue, are present only in this collection, 'Turba plotnaia belaia' and 'Galabura' in two collections, and 'Gordin gurguiat' and 'Negru de Căuşeni' in 5-6 collections. Therefore these resources are under the threat of extinction.

Specific characters were found concerning some general characteristics: geographical origin, berry colour, resistance to abiotic factors and pathogens, agrobiological properties. Proles *pontica* Negr. and Proles *orientalis* Negr. are represented both by varieties for table and wine grapes, as well as for mixed utilization. Concerning the studied cultivars, varieties with green-yellow and blue black colours of berry skin are predominant. Berry and bunch weights for table varieties are low or medium, except for 'Ţâţa căprii' (with large bunch). The majority of wine grape varieties have globose or broad ellipsoid berry shape and low-medium weight of bunch.

About a half of the old autochthonous varieties are tolerant to unfavorable conditions of the environment (frosts, drought) and pathogens and represent a valuable sources of adaptability to local environmental conditions for breeding programs.

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