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Clarification of homonymy (misnaming) for a grapevine cultivar in Georgia: the case of 'Moldova' alias 'Aladasturi'

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Summary

Two different grape cultivars are grown in Georgia under the name 'Aladasturi', one in the West and one in the East part of the Country. Investigation of ampelographic and ampelometric parameters and nuclear microsatellite markers demonstrated, that the cultivar from West Georgia is the real Georgian autochthonous wine and table grape cultivar 'Aladasturi', while the cultivar from East Georgia is the table grape cultivar 'Moldova' with high resistance to downy mildew, obtained in the Republic of Moldova in the 1960s. This cultivar was probably introduced to Georgia in the period of 1970-1980s. Similarity of berry and bunch characteristics of 'Moldova' and 'Aladasturi' might be the reason for creation of homonymy, respectively misnaming. The homonymous 'Aladasturi' finally turned out to be a misnomer.

Key words: Ampelography; SSR markers; Agro Census; cultivar identification.

Introduction

Since the end of the 20th century a table grape cultivar, named 'Aladasturi' by local farmers and showing resistance to downy mildew, has become popular and was distributed in backyards of the farmers' houses in Eastern Georgia (Maghradze and Mamasakhlisashvili 2011). At the same time 'Aladasturi' is the name of a Georgian historical autochthonous wine and table grape cultivar, which has been cultivated since ancient times in Western Georgia. According to data of Agro Censuses before 1970 'Aladasturi' was cultivated (60.8 ha) only in Western Georgia. While, according to Census of 1970 and 1985, the majority of territories cultivated with 'Aladasturi' were in Western Georgia (1.4 ha) and only 1.1 ha were planted in Eastern Georgia. Nevertheless, the situation had changed in 2004, when for the first time in the history of the Country the area of 'Aladasturi' cultivar in Eastern Georgia (27.7 ha) became larger than in the western part (24.8 ha) (Maghradze and Mamasakhlisashvili 2011).

In spite of identical names and a few similar ampelographic traits, these two genotypes display evident dissimilar ampelographic characteristics. This was the reason for their detailed study, based on ampelographic, biochemical and molecular investigation.

Material and Methods

Plant material: Two 'Aladasturi' accessions from Baghdati district (Imereti province, Western Georgia), two from Kaspi district, located in the Western part from of the capital Tbilisi (the distance between Tbilisi and the town Kaspi is 61.1 km) and one from Tbilisi (Kartli province, Eastern Georgia) were taken into account.

Ampelographic and phenotyping description: The grapevine morphology, for 2 accessions coming from Western and 3 from Eastern Georgia, was characterized by ampelographic and ampelometric methods based on the study of 78 OIV descriptors (OIV, 2007) and by usage of the software "SuperAmpelo" (Soldavini *et al*. 2006). Polyphenol content was estimated according to Rustioni *et al.* (2014). The analyses were performed during the 2010 and 2013 vintages.

Genotyping: Genetic analysis was done according to Maul *et al*. (2015) for one accession from Western and one from Eastern Georgia. The samples were genotyped by 9 microsatellite markers VrZag62, VrZag79, VVMD5, VVMD7, VVMD27, VVMD28, VVMD25, VVMD32 and VVS2 (Sefc *et al*. 1999, Laucou *et al*. 2011).

Results and Discussion

Ampelographic characterization and phenotyping: Investigation of genotypes by 78 ampelographic OIV descriptors revealed 32 out of 78 similar expressed traits, which can be presented as a ratio of similarities/differences as 41/59 percent (Tab. 1). Differences in studied traits were obtained for all organs of the plant. In addition, the mean value of total polyphenol content for 'Aladasturi' accession from Western Georgia was 1457.8 ± 287.3 mg kg^{-1} of grapes and from the East it was 895.6 ± 120.2 mg kg^{-1} of grapes. These results demonstrated that investigated genotypes are different.

Identification of cultivars: Verification of Western Georgia 'Aladasturi' identity was carried out with ampelographic descriptions of this cultivar (Ketskhoveli *et al*. 1960, Ramishvili 1963) and through comparison of morphology with 'Aladasturi' accessions present in the grape repositories of "Kindazmaraulis Marani" (Kvareli district, Georgia) and "National Center of Grapevine and Fruits Plant Material Propagations" (Mtskheta district, Georgia). Western Georgia 'Aladasturi' turned out to be the true to type Georgian autochthonous wine and table grape

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Table 1

Ampelographic description of the 'Aladasturi' cultivars from Georgia

OIV Descriptor	Characteristic	Aladasturi from Imereti[1)]	Aladasturi (Moldova) from Kartli[2)]
Young shoot:			
001	opening of the shoot tip	5	5
003	distribution of anthocyanin coloration on prostrate hairs of tip	3	1
004	density of prostrate hairs on tip	9	5
006	attitude (before tying)	3	3
007	color of dorsal side of internodes	2	2
008	color of ventral side of internodes	1	1
016	number of consecutive tendrils	1	1
Young leaf (4th leaf):			
051	color of the upper side of blade	3	4
053	density of prostrate hairs between main veins on lower side of blade	9	3
Mature leaf:			
065	size of blade	7	9
067	shape of blade	2	4
068	number of lobes	2	3
070	area of anthocyanin coloration of main veins on upper side of blade	4	1
072	goffering of blade	1	1
074	profile of blade in cross section	2	3
075	blistering of upper side of blade	7	1
076	shape of teeth	3	3
077	size of teeth in relation to blade size	3	5
078	length of teeth compared with their width	3	5
079	degree of opening / overlapping of petiole sinus	7	3
080	shape of base of petiole sinus	3	1
081-1	teeth in the petiole sinus	9	1
081-2	petiole sinus base limited by veins	1	1
083-1	shape of base of upper lateral sinuses	2	1
083-2	teeth in the upper lateral sinuses	2	1
084	density of prostrate hairs between the main veins on lower side of blade	9	1
085	density of erect hairs between the main veins on lower side of blade	1	1
086	density of prostrate hairs on main veins on lower side of blade	5	1
087	density of erect hairs on main veins on lower side of blade	1	1
088	prostrate hairs on main veins on upper side of blade	1	1
093	length of petiole compared to length of middle vein	1	1
094	depth of upper lateral sinuses	7	1
Flower and Inflorescence:			
151	sexual organs	3	3
155	fertility of basal buds (buds 1-3)	5	5
Bunch:			
202	length (peduncle excluded)	5	3
203	width	5	5
204	density	7	5
206	length of peduncle of primary bunch	5	5
208	shape	2	3
209	number of wings of the primary bunch	2	2
Berry:			
220	length	5	7
221	width	3	5
223	shape	7	7
225	color of skin	6	5
229	hilum	2	1
231	intensity of the anthocyanin coloration of flesh	1	1
232	juiciness of flesh	3	2
233	must yield	4	3
235	firmness of flesh	2	3
236	particularity of flavor	1	1
238	length of pedicel	3	3
240	ease of detachment from pedicel	1	1
241	formation of seeds	3	3
242	length of seeds	7	5
243	weight of seeds	5	5
244	transversal ridges on dorsal side of seeds	1	1

Tab. 1 continued

OIV Descriptor	Characteristic	Aladasturi from Imereti[1)]	Aladasturi (Moldova) from Kartli[2)]
Productivity:			
304	Time of physiological stage of full maturity of the berry	7	7
351	Vigor of shoot growth	5	5
501	Bunch: weight of a single bunch	5	5
503	Berry: single berry weight	5	5
504	Yield per m²	3	5
505	Sugar content of must	7	5
506	Total acid content of must	5	3
508	Must specific pH	7	3
Mature leaf:			
601	length of vein N1	7	5
602	length of vein N2	9	7
603	length of vein N3	7	7
604	length of vein N4	9	9
605	length petiole sinus to upper lateral leaf sinus	7	7
606	length petiole sinus to lower lateral leaf sinus	9	7
607	angle between N1 and N2[3)]	5	7
608	angle between N1 and N3[3)]	5	5
609	angle between N1 and N4[3)]	5	7
610	angle between N3 and the tangent between petiole point	7	9
612	length of tooth N2	1	5
613	width of tooth N2	5	7
614	length of tooth N4	1	3
615	width of tooth N4	5	5

[1)] Ampelographic expression level of 2 accessions from Western Georgia.
[2)] Ampelographic expression level of 3 accessions from Eastern Georgia.
[3)] Measured at the first ramification.

cultivar 'Aladasturi', historically cultivated in Imereti and Guria provinces of Western Georgia.

According to N. Jibladze (personal communication, Agricultural University of Georgia) in some cases, the Eastern Georgia cultivar 'Aladasturi' was called 'Moldovanka' or 'Moldova'. Identification of the samples by ampelographic descriptors confirmed that 'Aladasturi', cultivated in Eastern Georgia, is the cultivar 'Moldova', which was obtained by crossing 'Guzal Kara' ('Katta Kurgan' x 'Dodreliaby') and 'Villard blanc' at the Institute of Horticulture, Viticulture and Winemaking in Chisinau, Moldova, in 1961 (Zhuravel and Gavrilov 1986). The cultivar 'Moldova' displays high resistance to downy mildew which was inherited from 'Villard blanc'. This trait became one of the main reasons for its popularity in the East of Georgia.

The period of 'Moldova' introduction into Georgia can be dated back to the 1970s and 1980s: i) by the personal communication of N. Jibladze indicated that the cultivar 'Moldova' was introduced by him from the breeding institute of Chisinau with permission of the local researcher B. A. Ivanova in 1972-1973; ii) by the pers. comm. of V. Kvaliashvili (former vice-director of the Institute of Horticulture, Viticulture and Oenology, Georgia) - according to him, this cultivar was introduced by R. Kikacheishvili (Head of the Department of Grape Breeding of the same institute) in the 1980s. Furthermore, according to the records of Taralashvili *et al.* (1989), in the grapevine collection of the Telavi Testing Station (Georgia) in 1982-1983, the cultivar 'Moldova' was also available. Introduction time, thus, corresponds to the increase of 'Moldova' area in Eastern Georgia between 1980 and 2004.

Genetic characterization: Two representative 'Aladasturi' accessions - one from Western Georgia and one from Eastern Georgia - were genotyped at 9 SSR loci. Comparison of the accessions allelic profiles revealed different fingerprints, having only two allele sizes in common (Tab. 2). Distinctness was thus confirmed. The allelic profile of the true to type 'Aladasturi' matched to the fingerprint given by Vouillamoz *et al*. (2006). Regarding the misnamed 'Aladasturi', identity with the Moldavian cultivar 'Moldova' was assumed. But no profile was published so far. Nevertheless, microsatellite profiles already available for 'Guzal Kara' (Lacombe *et al*. 2012) and 'Villard Blanc' (Riaz *et al*. 2013) confirmed the parental genotypes indicated by the breeder (Zhuravel and Gavrilov 1986). Comparison of marker data (Tab. 2) proved that 'Moldova' is the offspring of 'Guzal Kara' and 'Villard Blanc', sharing at each locus an allele with one of its parental genotypes. Trueness to type of 'Moldova' and the pedigree given by the breeder were confirmed.

Conclusions

The two 'Aladasturi' cultivars were clearly differentiated by ampelography, biochemical and molecular characteristics. The accession from the West of Georgia corresponds to the autochthonous Georgian 'Aladasturi', while the cultivar from the East of Georgia is the downy mildew resistant Moldavian table grape cultivar 'Moldova'. Some similarities in the berry and bunch characteristics of 'Moldova' and 'Aladasturi' might be the cause of homonymy and re-

spectively misnaming. The homonymy 'Aladasturi' finally turned out to be a misnomer.

Table 2

Size of the alleles (bp) of the nine microsatellite loci for cultivars with references for proving the parentage and identity.

Cultivar and reference	VVS2		VVMD5		VVMD7		VVMD27		VrZag62		VrZag79		VVMD28		VVMD32		VVMD25	
Aladasturi from Imereti, (GEO036-IX-19b, Vouillamoz *et al.* 2006)	133	145	234	234	233	249	186	190	200	204	251	251	234	236	246	246	239	267
Aladasturi (Moldova) from Kartli	133	135	238	242	243	251	182	195	188	194	255	257	228	236	252	256	241	255
Guzal Kara (DEU454, Lacombe *et al.* 2012)	133	151	228	242	243	247	186	195	188	204	251	257	228	234	252	272	249	255
Villard Blanc (DEU098, Riaz *et al.* 2013)	133	143	234	238	237	251	182	190	180	194	255	261	234	236	240	256	241	255

DEU098 - Institut für Rebenzüchtung Geilweilerhof, Germany.
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