

Research Note

Autochthonous Croatian grapevine cultivar 'Jarbola' – molecular, morphological and oenological characterization

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Introduction: Several autochthonous grapevine cultivars have been maintained in ancient winegrowing regions of Croatia. 'Jarbola' is an old and presumed autochthonous grapevine cultivar exclusively grown in the Matulji municipality area situated where Kvarner Bay (northern Adriatic Sea) and the mountainous inland meet, forming a natural connection between the Adriatic Basin and central Europe. Despite the coastline adjacency, this area is characterized by a relative high altitude and mixed Mediterranean and mountainous climate. The origin of 'Jarbola' is unknown and cultivar is not present in national grapevine collections. The oldest record of 'Jarbola' dates back to the 19th century (MATETIĆ 1999) testifying its long winemaking tradition: agriculture at that time was the most important economic activity and 'Jarbola', as a well adapted variety in this region, was cultivated on slope terraces. Nowadays devastated terraces are protected by law as a cultural heritage, but 'Jarbola' is almost extinct. To our knowledge, only 1 red-fruited and 20 white-fruited 'Jarbola' vines survived until 2003 in more than 70 years old vineyards.

With the aim of evaluation, conservation and valorization of 'Jarbola' ampelographic and molecular characterization as well as preliminary wine analyses were performed on this recovered material.

Material and Methods: **Plant material:** Samples were collected between 2003 and 2005 from 1 red-fruited and 20 white-fruited vines of 'Jarbola', coming from more than 70 years old plantations located near Zvoneča (Matulji). They were chosen according to local vine-growers instructions. A further vine selection was performed by visual inspection supported by ELISA test on six grapevine viruses (POLJUHA *et al.* 2004), revealing 1 red-fruited and 7 white-fruited healthy vines.

Microsatellite DNA analysis: Four white-fruited and one red-fruited 'Jarbola' from the eight

virus-free accessions were selected for molecular analyses. DNA was extracted from young leaflets. Ten SSR loci were analyzed: VVS2, VVMD5, VVMD7, VVMD27, VrZAG62 and VrZAG79 (THIS *et al.* 2004); ISV2 (VMC6e1), ISV3 (VMC6f1), ISV4 (VMC6g1) and VMCNG4b9 (CRESPIAN 2003). The analyses were performed using the protocol reported in CRESPIAN and MILANI (2001).

Ampelographic analysis: The white 'Jarbola' was described using the seven virus-free accessions according to the Office International de la Vigne et du Vin descriptors as modified by EU project GENRES 081. Fifty descriptors were used, embracing shoot, leaf, inflorescence, cluster and berry morphology, fruit composition and phenology.

Wine analysis: Grapes from twenty white 'Jarbola' vines were harvested for wine production. Due to the small grape quantity the vinification was performed in a minivinification experimental cellar in the Institute of Agriculture and Tourism in Poreč. Basic physico-chemical wine analyses were performed according to O.I.V. methods (1990) in years 2003 and 2004. Sensory evaluation of wine quality was performed 6 months after the first decantation by the method of 100-point O.I.V. (1994) and descriptive analyses with a panel of 7 judges.

Results and Discussion: Molecular data have been reported in Tab. 1. All four white 'Jarbola' accessions showed the same SSR profile and therefore belong to the same variety. Red 'Jarbola' had a different allelic set and is, as a consequence, another cultivar. A first degree relationship between these two varieties can be excluded due to the lack of allele sharing at three loci.

In order to detect possible synonymies, the 'Jarbola' microsatellite profiles have been compared to the *Vitis* microsatellite databases of Istituto Sperimentale per la Viticoltura (ISV), Conegliano (Italy), University of California, Davis (USA) and University of Crete, Heraklion (Greece, <http://www.biology.uoc.gr/gvd/>) as well as to genotypes from various references in literature; the white 'Jarbola' SSR profile showed to be unique and different from those of all previously described varieties. On the contrary, red 'Jarbola' revealed to be synonymous with the ancient Istriian cultivar 'Hrvatica', previously investigated by MALETIĆ *et al.* (1999).

Local vine-growers think that white 'Jarbola' could be related to the Ribolla varieties group due to its geographical position, morphological resemblance and denomination analogy. From molecular data comparison with the ISV database, it came out that 'Ribolla gialla' cultivated in Friuli Venezia Giulia region (North East Italy) is not a synonym to white 'Jarbola' and also a first degree relationship between the two varieties has been ruled out (data not shown). The same result was obtained by comparing white 'Jarbola' SSR profile with that of 'Robolla' and 'Kokkino Robola' Greek cultivars (COSTACURTA *et al.* 2006). Most likely, 'Jarbola' is an autochthonous Croatian cultivar.

'Hrvatica' was already morphologically described (MIROŠEVIĆ and TURKOVIĆ 2003) and its origin is unknown, without relation assumptions. Thus, ampelographic evaluations have been undertaken only for up to now not de-

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Table 1

Allele sizes in base pairs at each of ten SSR loci of white and red 'Jarbola', plus three reference varieties profiles

Variety	White Jarbola	Red Jarbola	Cabernet Sauvignon	Moscato bianco	Sultannina
VVS2	143 155	151 153	139 151	133 133	145 151
VVMD5	236 240	226 238	232 240	228 236	234 234
VVMD7	247 249	239 247	239 239	233 249	239 253
VVMD27	179 181	179 179	175 189	179 194	181 194
VrZAG62	201 203	187 203	187 193	185 195	187 187
VrZAG79	242 258	250 250	246 246	250 254	246 258
ISV2	143	151	141	141	143
(VMC6e1)	165	165	165	143	143
ISV3	133	133	133	133	133
(VMC6f1)	139	139	139	139	139
ISV4	177	177	169	169	191
(VMC6g1)	197	187	191	187	193
VMCNG4b9	158 166	158 172	168 176	158 166	138 158

scribed white 'Jarbola'. White 'Jarbola' is characterized by very late bud burst, late flowering and veraison. Its main ampelographic characteristics are as follows. Young shoot tip is opened, with weak anthocyanin coloration and medium density of prostrate hairs. Young leaves are yellow/bronze at the upper side, with medium density of prostrate hairs between veins at the lower side. Flowers are hermaphrodite. Adult leaves are wedge shaped or circular with three lobes, folded at mid vein, with weak goffering of the upper side and mixed shaped teeth. Petiole sinus is U-shaped and slightly overlapping, without teeth. Clusters are medium sized, conical without wings, with medium to compact density. Medium sized berries are roundish, with green-yellow skin and uncolored flesh.

'Jarbola' wines produced in two climatically different years were characterized by high total acidity and high dry extract content (Tab. 2). The total scores obtained by sensory evaluations were 78/100 and 79/100, in years 2003 and 2004, respectively. According to descriptive sensory analyses, both wines were characterized by intensive persistent variety aroma (white flower and citrus) and markedly sour and inharmonious taste. Based on the physico-chemical and sensory analyses, both wines were categorized as quality wines, and potentially suitable for sparkling wine production or blending with semi aromatic and aromatic white wines of lower acidity. Optimization of vine growing management and vinification technology has begun.

Table 2

Physico-chemical composition of 'Jarbola' wines

	Year 2003	Year 2004
Alcohol (vol. %)	11,6	11,6
Total acidity (as tartaric acid) g/l	8,8	7,4
Volatile acidity (as acetic acid) g/l	0,50	0,29
Reducing sugars (g/l)	2,1	1,0
Total dry extract (g/l)	20,5	23,1
Ash (g/l)	1,6	3,4
pH	2,8	3,77
Free SO ₂ (mg/l)	27,63	25,6
Total SO ₂ (mg/l)	104,8	106,6

Presented results enabled 'Jarbola' to be included in the Croatian National Catalogue of Varieties as recommended cultivar named 'Jarbola bijela', for Istria and Kvarner Region. Propagation material production has been initiated and from 2004, new plantations are raised each year. The revival of 'Jarbola' and its preservation gave a valuable contribution to a general region recovery.

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- COSTACURTA A.; GIANNETTO, S.; MENEGHETTI, S.; CRESPIAN, M.; 2006: Does it exist a Greek ampelographical heredity in South Italy? SSR profiles comparison of cultivars growing in both countries. In: G. KOTSERIDIS (Ed.): Proceedings of Ampelos 2006, 2nd International Symposium on the Evaluation and Exploitation of Grapes of Corresponding Terroir through Winemaking and Commercialization of Wines, 9-14. Santorini, Greece.
- CRESPIAN, M.; 2003: The parentage of Muscat of Hamburg. *Vitis* **42**, 193-197.
- CRESPIAN, M.; MILANI, N.; 2001: The Muscats: A molecular analysis of synonyms, homonyms and genetic relationships within a large family of grapevine cultivars. *Vitis* **40**, 23-30.
- MATEIĆ, F.; 1999: Zvoneča svojni. Adamić d.o.o. Rijeka.
- MALETIĆ, E.; SEFC, K. M.; STEINKELLNER, H.; KONTIĆ, J. K.; PEJIĆ, I.; 1999: Genetic characterization of Croatian grapevine cultivars and detection of synonymous cultivars in neighboring regions. *Vitis* **38**, 79-83.
- MIROŠEVIĆ, N.; TURKOVIĆ, Z.; 2003: Ampelografski atlas. Tehnička knjiga, Zagreb.
- O.I.V.; 1990: Compendium of International Methods of Analysis of Wine and Musts. OIV, Paris.
- O.I.V.; 1994: Norme des Concours Internationaux des Vins. Resolution OENO, 2/94, Paris.
- POLJUHA, D.; SLADONJA, B.; PERŠURIĆ, Đ.; 2004: Survey of five indigenous Istrian cultivars for the presence of six grape viruses. *Am. J. Enol. Vitic.* **55**, 286-287.
- THIS, P.; JUNG, A.; BOCCACCI, P.; BORREGO, J.; BOTTA, R.; COSTANTINI, L.; CRESPIAN, M.; DANGL, G.S.; EISENHELD, C.; FERREIRA-MONTEIRO, F.; GRANDO, S.; IBÁÑEZ, J.; LACOMBE, T.; LAUCOU, V.; MAGALHÃES, M.; MEREDITH, C. P.; MILANI, N.; PETERLUNGER, E.; REGNER, F.; ZULINI, L.; MAUL, E.; 2004: Development of a standard set of microsatellite reference alleles for identification of grape cultivars. *Theor. Appl. Genetics* **109**, 1448-1458.

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