

Origin and characterization of Montenegrin grapevine varieties

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Summary

Viticultural tradition in Montenegro dates back before the Roman period. Viticulture and winemaking of Montenegro is still mainly based on autochthonous grapevine varieties ('Vranac', 'Kratošija', 'Krstač' and 'Žižak'). Relevant historical data concerning the origin of Montenegrin grapevine varieties, as well as Montenegrin germplasm characterization reviews are reported in this paper. The available literature data indicate a long tradition and an important breeding history of grapevine evaluation in Montenegro, especially concerning 'Vranac' and 'Kratošija'. Through international projects, by ampelographic analysis and DNA profiles, the originality of 'Vranac', 'Žižak' and 'Krstač' varieties was confirmed, while it was found that 'Kratošija' has the same genetic profile as 'Primitivo', 'Zinfandel' and 'Crljenak Kaštelanski'. According to the literature and to the exploration in vine growing regions, it can be concluded that Montenegro has a very rich grapevine germplasm, yet not investigated enough. Further works on Montenegrin germplasm will contribute to the better evaluation of the grapevine genetic resources of Montenegro, and, therefore, to the enrichment of grapevine diversity in Europe.

Key words: Montenegro; grapevine origin; characterization; germplasm.

Introduction

It is well known that breeding programs in grapevine are based on territory, history and tradition. Thus, it is finalized to emphasize the grape origins and the importance of terroir aiming at the express of the product best features. Montenegrin grapes and wines have been known since ancient times. Numerous artifacts indicate intense winemaking activities since the III and II century BC till the modern era in Montenegro. During Slavs colonization in the Balkans (XI-XIV centuries), grape growing and wine production in Montenegro was especially outstanding in the surrounding of monastic buildings (SAVIĆ 2010). More organized works concerning viticulture in Montenegro began in the reign of King Nikola (1860-1918). In particular he set up the first vine nurseries and set the first regulation in the production of grape and wine. In that period, in Montenegro, the varieties for red wine productions were mainly 'Vranac' and 'Kratošija', while for white wines they used 'Krstač' and 'Žižak' (PLAMENAC 1891, MIJUŠKOVIĆ 1948).

The current viticulture and wine production in Montenegro are based on the same cultivars. Thus, these autochthonous grapevine varieties, grown for centuries in Montenegro, represent the main expression of viticulture and winemaking of this country.

The aim of this manuscript is to describe grapevine germplasm in Montenegro and to present its autochthonous cultivars in a short review.

Literature survey of viticulture in Montenegro: The earliest reference to the Montenegrin variety 'Kratošija' is reported in the Budva's medieval statute (LUKETIĆ and BUJKLIĆ, 1988), dated 1426-1442 and translated from the Italian language. In particular, it mentioned the "Kratošija's vineyards", indicating the importance of the 'Kratošija' variety in that time in Budva (Montenegro).

PLAMENAC (1891) states that the varieties 'Vranac' and 'Kratošija' were used for red wine production during centuries. The first more significant description of these varieties was given by PLAMENAC in the *Ampelography* "VIALA and VERMONEL" (1910).

All authors from the former Yugoslavia (STOJANOVIĆ 1929, BULIĆ 1949, ULIČEVIĆ 1959, 1966, NASTEV 1967, ČETKOVIĆ 1978, ZIROJEVIĆ 1979, AVRAMOV 1988, PEJOVIĆ 1988, Burić 1995, BOŽINOVIĆ 1996, MARAŠ 2000, MARAŠ *et al.* 2004, MILOSAVLJEVIĆ 2008) report 'Vranac' and 'Kratošija' as Montenegrin autochthonous grapevine varieties. Moreover, they state that 'Vranac' and 'Kratošija' were grown only in Montenegro. From there, they were spread to Macedonia (NASTEV 1967) and Dalmacia (BULIĆ 1949) and to other countries in the former Yugoslavia. The Macedonian professor NASTEV (1967) states that 'Vranac' is a Montenegrin autochthonous grapevine variety mostly cultivated in the Skadar lake region (Crmnica), but also on the Montenegrin seacoast. This author declares that 'Vranac' has been transferred in the 1950s in Macedonia (experimental field Butel), from where it has been spread out through the former Yugoslavia.

The quality of wines produced by 'Kratošija' in Montenegro was mentioned in old national songs collected by VUK KARADŽIĆ (1787-1864). According to ULIČEVIĆ (1959), 'Kratošija' is the main and probably the oldest Montenegrin variety. It is dominant in all vineyards older than 60-70 years. Moreover, often it represents about 90 % of grapevine assortments in the viticultural areas of Skadar subregion and it is even more present in the coast area. In the same paper, author identified (by ampelographic analysis) that the oldest and the most represented Californian variety 'Zinfandel' is identical with our 'Kratošija' and that probably originates from this region from where it has been

spread out by our immigrants. Later on, CALÓ *et al.* (2008), confirmed by genetic analysis that 'Kratošija' has the same genetic profile as 'Zinfandel'/'Primitivo'/'Crljenak kaštelanski'. The Dalmatian ampelographer BULIĆ (1949) described 'Kratošija' (also considering the synonyms 'Gartošija', 'Grakošija', 'Kratkošija') from nine municipalities of the Montenegrin coast (Budva, Grbalj, Luštica, Krtole, Kotor, Paštrovici, Prčanj, Tivat, Herceg Novi). Moreover, the author stated that this variety was rarely found in the Dalmatia region and that it was most likely spread over there from Montenegro. This could be supported by the fact that until 2001, only about twenty living vines of 'Crljenak Kaštelanski' ('Kratošija'/'Primitivo'/'Zinfandel') had been found in Dalmatia (MALETIĆ *et al.*, 2009), confirming that this cultivar was not widespread in over there in the 19th and 20th century (SAVIĆ 2003).

'Kratošija' has a very heterogeneous population in Montenegro. It is represented by a large number of biotypes. ULIĆEVIĆ (1959) mentioned three types of 'Kratošija': 'Obična Kratošija', 'Slaborodna Kratošija' and 'Rehuljava Kratošija'.

BOŽINOVIK *et al.* (1998) state that 'Kratošija' has a high number of biotypes and describe three of them ('Kratošija standard', 'Kratošija rehuljava' and 'Kratošija neoplođena').

The variability of the population of the 'Kratošija' variety in Montenegro was also studied by PEJOVIĆ (1988) and MARAŠ (2000). Ampelographic analyses (MARAŠ 2000) were done on 17 biotypes of 'Kratošija' which are known under different names in viticultural areas in Montenegro: 'Velja Kratošija', 'Velji Vran', 'Crni Krstač', 'Vrančina', 'Bikača', 'Vran', 'Srednja Kratošija', 'Kratošija' or 'Vran', 'Srednji Vranac', 'Vrančić', 'Ljutica', 'Kratošija', 'Čestozglavica', 'Kratošija mala', 'Kratošija sa dubokim urezima' and 'Rehuljača'. All the 17 biotypes of 'Kratošija' were confirmed genetically identical to 'Zinfandel'/'Primitivo'/'Crljenak kaštelanski' (MARAŠ *et al.* 2014). The extremely heterogeneous population, the high number of biotypes, the high viral infections and the wide spread presence in all viticultural areas in Montenegro are indicators of the long presence and the growing tradition of this variety in Montenegro.

'Krstač' is considered a homogenous variety. By ULIĆEVIĆ (1959) it is the most represented cultivar in the Podgorica subregion in the locality of Doljani, Beri and in lesser extend in Lješanska nahija. ULIĆEVIĆ (1966) stated that in Doljani it is called 'Krstača bijela', while in Vražegrmcima 'Bijela krsta' and in Beri 'Bijela vinogradarska'. ULIĆEVIĆ (1959) also described 'Žižak' as an important variety from which, in some places in Boka, dessert wines called Prošek are produced. BURIĆ (1995) stated that this variety gives quality refreshing white wines from Montenegro.

Genetic identification of the main Montenegrin grapevine varieties: In cooperation with Italian partners (Istituto Sperimentale per la viticoltura), the genetic identification of the Montenegrin grapevine varieties was done. Original DNA profiles have been confirmed concerning 'Vranac', 'Krstač' and 'Žižak' while it was found that 'Kratošija' has the same genetic

profile as 'Zinfandel' from California, 'Primitivo' from Italy and 'Crljenak kaštelanski' from Croatia (CALÓ *et al.* 2008). Genetic analysis revealed a close relationship between 'Kratošija' and 'Vranac' and suggested a first degree of relation between these two varieties.

In joint international projects, the genetic identification of Montenegrin germplasm of grapevine was successively done. 20 genotypes were identified and 2 accessions remained unknown (188 samples were analyzed).

As a result of the SEEDNET project, 6 different genotypes were identified (16 samples considered) (ŽULJ MIHALJEVIĆ *et al.* 2012), 3 of them were already known Montenegrin varieties ('Vranac', 'Kratošija' and 'Krstač') and 3 were new identified accessions - 2 of them having original SSR profile ('Čubrica' and 'Lisičina') and 'Razaklija' (having identical SSR profile as 'Drenok crveni' from Macedonia).

Within SEE.ERANet project from a total of 96 investigated samples, 15 genotypes were confirmed. Some of them are already known ('Vranac', 'Kratošija', 'Krstač', 'Žižak', 'Čubrica', 'Lisičina') and another ones revealed to have original SSR profile ('Kovačka bijela', 'Zadrimka' and 'Sijer') (unpublished results). Out of the 6 remaining samples, 3 accessions were found to be a misnomers and to belong to a group of synonyms from other countries; 1 coincides with a previously identified variety in another country; and 2 accessions were also mislabeled, showing the original SSR profile which did not match any of the known varieties, and, therefore, they remain unknown and they require further research (unpubl. results).

In cooperation with Italian partners, the analysis of 70 samples revealed 14 different genotypes: the already identified varieties - 'Vranac', 'Kratošija', 'Krstač' 'Žižak', 'Čubrica', 'Lisičina', 'Razaklija' and the additional varieties 'Kadarun', 'Crna loza', 'Razaklija crna', 'Trojka', 'Muškaćela', 'Plavina' and 'Bioka' (Maraš *et al.* 2014). Analysis suggest that 'Crna loza', 'Čubrica', 'Lisičina' and 'Razaklija Crna' are likely originated from Montenegro, while for 'Trojka' and 'Muškaćela' were found to be 'Muscat rouge de madera mutant' ('Trojka') and 'Muscat blanc a petits grains' ('Muškaćela'). 'Bioka', 'Francavidda' and 'Zlatarica Vrgorska' were demonstrated to be a new group of synonyms. Also all 17 biotypes of 'Kratošija' were confirmed to have the same genetic profile as 'Zinfandel'/'Primitivo'/'Crljenak kaštelanski' (MARAŠ *et al.* 2014).

In order to preserve and improve autochthonous grapevine varieties in Montenegro, work on cultivars clonal selection was initiated. In 2014, 7 clones of 'Vranac' were already identified and they demonstrated to surpass the population standards.

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