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CHARACTERIZATION OF AUTOCHTHONOUS AND LOCAL GRAPEVINE GERMPLASM IN REPUBLIC OF MACEDONIA

Abstract: Most of grapevine growing area in Republic of Macedonia is cultivated with local and autochthonous varieties. Twenty five varieties from according to the OIV grape descriptors list were characterized.

According to the ampelographic characteristics, with the accent of the phyllometric descriptors, great differences were observed among the studied varieties. The relationships between the cultivars were further accessed by phyllometric dendrogram analysis. Analyses of the ampelographic features showed that autochthonous and local studied varieties are characterized by polymorphism of the clusters, berries, as well as by some agro biological and technological characteristics.

The diversity of germplasm represents an important source for the future genetic improvement, the attractiveness of local products and the creation of the sustainable viticulture.

Key words: *grapevine germplasm, macedonian, stanushina, ampelographic characteristics*

INTRODUCTION

As a part of a regional projects (see Acknowledgements), ampelographic characterization of Macedonian autochthonous and local grapevine varieties was performed.

The correct differentiation and identification of grapevine varieties is very important for *Vitis* germplasm maintaining institutions, legislation and for wine industry. Nowadays, three different methods exist for characterization and identification of cultivars: morphological description of the plant, usage of isoenzyme and microsatellite markers [1]. Description of the plant

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using morphological parameters is simple, not expensive and applicable on the field or in the laboratory [10, 5]. Methods of traditional ampelography are based on the description of vine different organs, often using biometry combined with the visual observation. Identification of grapevine variety using a leaf parameters are some of the most important targets of ampelometry [3, 4]. According to this, the leaf measurements have the high discriminating power.

MATERIAL AND METHODS

The 14 examined varieties belongs to the *Convarietas Pontica Negr.*, *Subconvarietas Balcanica*, from which 10 are red varieties ('Blatina', 'Vranec', 'Kratoshija', 'Teran', 'Prokupec', 'Kadarka', 'Stanushina', 'Melnik', 'Mavrud' and 'Plovдина') and 4 are white varieties ('Sipon', 'Zilavka', 'Zupljanka' and 'Smederevka'). Some of these cultivars are autochthonous and have been cultivated since long ago in the Macedonian vineyards ('Stanushina') while others have been introduced to our vineyards after the phylloxera crisis ('Prokupec', 'Teran',). 'Vranec' (synonym 'Vranac') was transferred in Macedonia in 1950 [8] and 'Kratoshija', that are Montenegrin autochthonous grapevine varieties [8, 2]. The varieties are located in Skopje and Tikvesh vineyard area. Mature leaves are collected in August, at least one leaf was taken between the 8th and 12th node of main shoot. Ten leaves were placed in the herbarium before being analyzed for phyllometric parameters. We used 19 phyllometric descriptors from the GENRES List of primary descriptors, part II (601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 612, 613, 614, 615, 616, 617, 066–4, 066–5, 079–1) and the parameters from the "leaf method" [10]: length of vein N1; distance between petiol sinus and lower sinus; distance of N3/distance of N1; length of peduncle/length of N1; length of N2/length of N1; length of N3/length of N2; distance between petiole sinus and lower sinus/length of N3; angle N1/N2; angle N2/N3; width of leaf/length of N2; leaf area/length of N1; length of N4/length of N1; angle between N1 i N2; angle between N1 i N3. The parameters were processed by Cluster Analysis using computer program STATISTICA 10.0. The leaf area is calculated by computer program IMAGE J. According to the method of Martinez and Grenan [7] we made average leaf reconstruction of each cultivar.

Four OIV ampelographic descriptors were used to complement this study: OIV 225 (berry color), OIV 223 (berry shape), OIV 204 (bunch density) and OIV 204 (ripening — OIV 304), out of twenty-four ampelographic descriptors relative to young shoots, young leaves, mature leaves, shoots, inflorescences, bunches and berries. Ten readings per each descriptor were taken. Following autochthonous and local varieties were included in this description

and characterization: Ohridsko crno, Ohridsko belo, Chaush, Belo zimko, Vranec, Stanushina, Begljarka crna, Kratoshija, Bojanka, Crven valandovski drenok, Crn valandovski drenok, Manastirsko belo, Begljarka bela and Belovina.

RESULTS AND DISCUSSION

According to the closeness of phyllometric characteristic with processing their statistical data 14 cultivars in clusters was classify. Two cluster analyses are made. For the first cluster analyse we used 19 phyllometric descriptors from the GENRES list of primary descriptors, part II [6]. From the obtained results, if we make a diversion of cultivars at level of distance $v=60$ than we get two clusters (Figure 1). In the cluster I belong following cultivars: 'Zilavka', 'Smederevka', 'Blatina', 'Melnik' and 'Kadarka'. All this cultivars has a closed petiole sinus (OIV 079-1) and this descriptors is a discriminant factor for level $v=60$. All resting cultivars ('Zupljanka', 'Shipon', 'Teran', 'Prokupec', 'Stanushina', 'Mavrud', 'Plovdina', 'Kratoshija' and 'Vranec') belong to the second cluster. They have the open petiolar sinus. At the lower level of distance $v=28$, according to the leaf characteristics, the cultivars 'Zilavka' and 'Smederevka'; 'Melnik' and 'Kadarka'; 'Shipon' and 'Teran'; 'Mavrud' and 'Plovdina' and 'Kratoshija' and 'Vranec' are the most linked.

For the second cluster analyze the parameters from the "leaf method" are used. Beside the parameters from the first cluster analyze in this method are

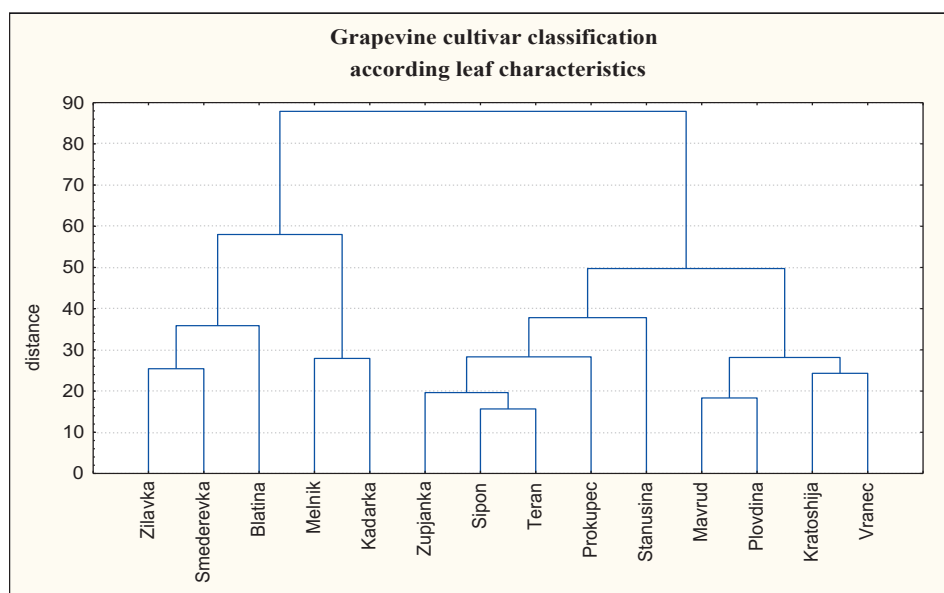


Figure 1. Grapevine cultivar classification according leaf characteristics

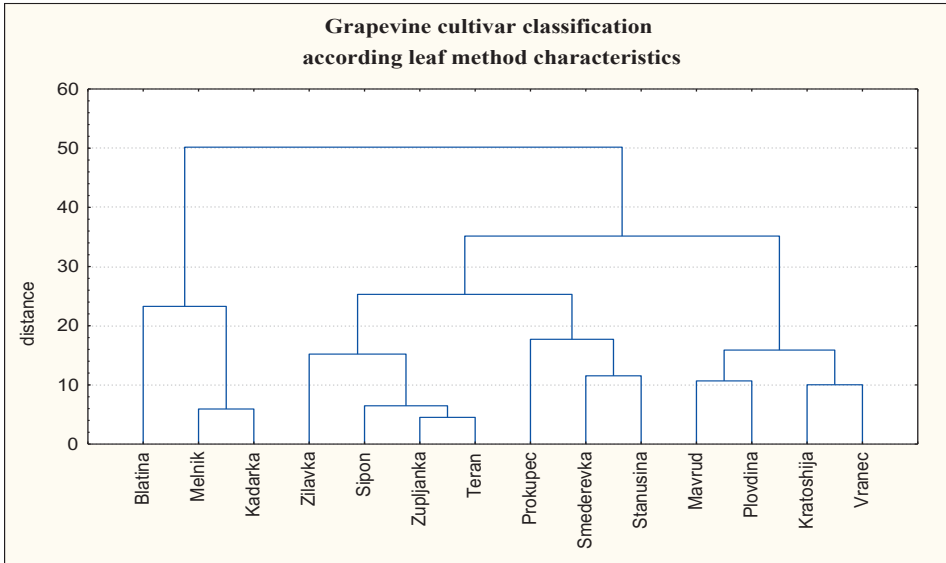


Figure 2. Grapevine cultivar classification according leaf method characteristics

also included the following parameters: leaf area, length of peduncle and width of leaf. Cluster analyze will be comment only at level $v=26$ where again we have division in 4 classes (Figure 2). In the cluster I belongs cultivars: ‘Blatina’, ‘Melnik’ and ‘Kadarka’; in cluster II: ‘Zilavka’, ‘Shipon’, ‘Zupljanka’ and ‘Teran’; in cluster III: ‘Prokupec’, ‘Smederevka’ and ‘Stanushina’ and

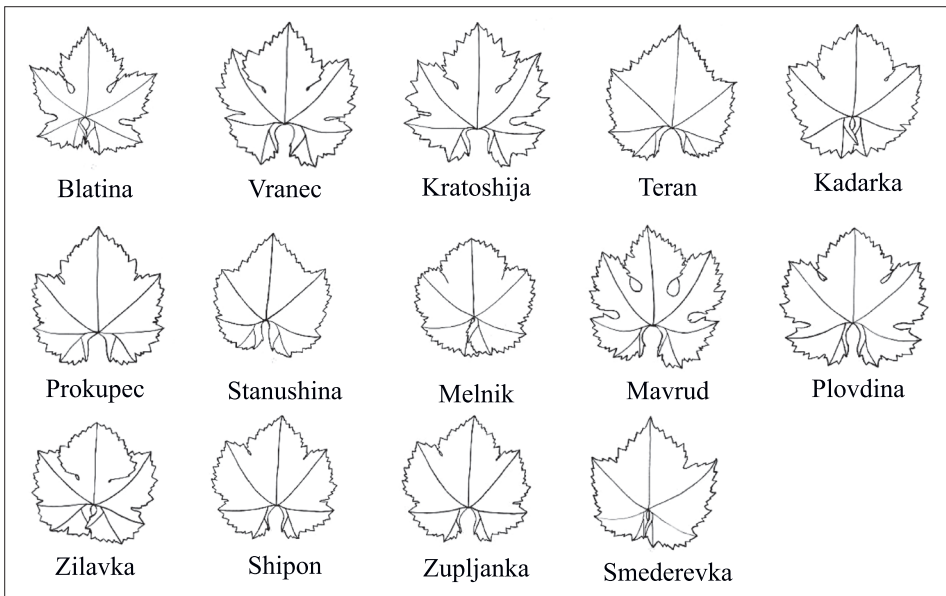


Figure 3. Graphic reconstruction of an average leaf of each cultivar

Table 1. Frequency of SEE grapevine cultivars (%) according to particular ampelographic

| OIV characteristic | Macedonia n=14 | Montenegro n=16 | Total (AL, BIH, RS, MO, RO) n=122 |
|--------------------------------|-------------------|--------------------|--------------------------------------|
| Berry color — OIV 225 | | | |
| 1 — green yellow | 42.9 | 6.3 | 41.8 |
| 2 — rose | 0 | 6.3 | 4.9 |
| 3 — red | 7.1 | 6.3 | 4.1 |
| 4 — grey | 0 | 6.3 | 0.8 |
| 5 — dark red violet | 0 | 12.5 | 7.4 |
| 6 — blue black | 50.0 | 62.5 | 41.0 |
| Berry shape — OIV 223 | | | |
| 1 — obloid | 7.1 | 0 | 1.6 |
| 2 — globose | 50.0 | 0 | 50.8 |
| 3 — broad ellipsoid | 14.3 | 6.3 | 16.4 |
| 4 — narrow ellipsoid | 7.1 | 37.5 | 16.4 |
| 5 — cylindric | 0 | 6.3 | 0.8 |
| 6 — obtuse ovoid | 21.4 | 0 | 1.6 |
| 7 — ovoid | 0 | 43.8 | 9.8 |
| 8 — obovoid | 0 | 0 | 0.8 |
| 9 — horn shaped | 0 | 6.3 | 1.6 |
| 10 — finger shaped | 0 | 0 | 1.6 |
| Bunch density — OIV 204 | | | |
| 1 — very loose | 0 | 0 | 0.8 |
| 3 — loose | 0 | 0 | 19.7 |
| 5 — medium | 64.3 | 12.5 | 29.5 |
| 7 — dense | 35.7 | 68.8 | 41.0 |
| 9 — very dense | 0 | 18.8 | 9.0 |
| Ripening — OIV 304 | | | |
| 1 — very early | 0 | 0 | 0 |
| 3 — early | 0 | 0 | 3.3 |
| 5 — medium | 50.0 | 93.8 | 59.0 |
| 7 — late | 21.4 | 6.3 | 32.0 |
| 9 — very late | 28.6 | 0 | 5.7 |

in cluster IV: 'Mavrud', 'Plovdina', 'Kratoshija' and 'Vranec'. At this method in the frame of the first three clusters we have cultivars crossing from one to other cluster and new diversion of cultivars. Cluster IV stay unchanged only, which means that the cultivars 'Mavrud' and 'Plovdina' and 'Kratoshija' and 'Vranec' have very high closeness in leaf characteristics.

Average leaf reconstruction of each cultivar is presented in Figure 3.

Ampelographic characterization of Macedonian autochthonous and local grapevine varieties in comparison with varieties of SEE region countries was performed (Figure 5).

Among the countries the most common berry color is green-yellow (41.8%) followed by blue black color (41.0%) and other minor colors like dark red violet or rose. Between countries in the region blue black color is predominant in accessions from Albania, Macedonia and Montenegro, meanwhile green yellow color is predominant in accessions from B&H RS, Croatia, Moldova and Romania.

The most frequent berry shape is globose (50.8%). This is common in most of the partners (B&H RS, Croatia, Macedonia, Moldova and Romania).

Most of the varieties have dense (41.0%) to medium (29.5%) bunches. These types of bunches are frequent in accessions from B&H, B&H RS, Macedonia, Moldova and Montenegro.

A high percentage of the accessions studied have the ripening in the medium time (59.0%). There are also many of them, which ripening in late time (mainly in Albania, B&H and Moldova).

CONCLUSIONS

From the obtained results we made following conclusions:

— The established basic leaf characteristics of grapevine cultivars of Balkan subgroup has the practical meaning in the description and differentiation of eventual biotypes and clones in the population of this cultivars through the clonal selection;

— According to the closeness of phyllometric characteristics the cultivars are classified in clusters from which can determine the differences or similarities between examined cultivars;

— According to the phyllometric characteristics in the both cluster analysis very close linkage have the cultivars 'Mavrud' and 'Plovdiva', and 'Kratosija' and 'Vranec';

— Correct grouping between cultivars confirm the high discriminant power of used phyllometric parameters;

— The both methods are complementary and shown satisfying results in determination of grapevine cultivars of Balkan subgroup;

— According to the ampelographic characteristics the most common berry color at Macedonian autochthonous and local varieties is green-yellow (42.9%), the most frequent berry shape is globose (50.0%), bunch density is mainly medium (64.3%) and half of the varieties have the ripening in the medium time (50.0%).

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BIBLIOGRAPHY

- [1] Asensio M. L., Valdes E. and Cabello F. (2002): Characterization of some Spanish white grapevine cultivars by morphology and aminoacid analysis. *Scientia Horticulturae* 93. p. 289–299.
- [2] Bozinovic Z. (2010): *Ampelografija*. Skopje.
- [3] Campostrini F. et al. (1993): Application de l'analyse phyllometrique a la classification géographique de la population italienne de la vigne sauvage (*Vitis vinifera* L. ssp. *Silvestris* Gmel.). *Journal International des Sciences de la vigne et du vin*. 27 255–262. p. 313–314.
- [4] Camussi A. et al. (1990): Model of discriminant analysis on the basis of descriptor variables for the ampelography of *Vitis* sp. *Proceeding of the 5th International Symposium on Grape Breeding, Vitis*. Special Issue. 29–36.
- [5] Carneiro L. C., Lima M. B. (1989): Comparison of fresh and dried leaves of grapevine for ampelographic purposes using numerical taxonomy. *Rivista di Viticoltura e di Enologia*. Conegliano. Italy. 42 (1). p. 53–58.
- [6] IPGRI, UPOV and OIV (1997): *Grapevine descriptors (Vitis spp.)*.
- [7] Martinez M. C., Grenan S. (1999): A graphic reconstruction method of an average vine leaf. *Agronomie*. Paris. France. 19 (6) p. 491–507.
- [8] Nastev D. (1967): *Ampelografija*. Skopje.
- [9] Schneider A., Zeppa G. (1988): Biometria in ampelografia: l'uso di una tavoletta grafica per effettuare rapidamente misure filometriche. *Vignevini*. 9 p. 37–40.
- [10] Schneider A. (1996): Grape variety identification by means of ampelographic and biometric descriptors. *Rivista di Viticoltura e di Enologia*. Conegliano. Italy. 49 (1) p. 11–16.
- [11] Žulj Mihaljević M., Šimon S., Pejić I., Carka F., Sevo R., Kojić A., Gaši F., Tomić L., Jovanović Cvetković T., Maletić E., Preiner D., Božinović Z., Savin G., Cornea V., Maraš V., Tomić M., Botu M., Popa A., Beleski K. (2013): Molecular characterization of old local grapevine varieties from South East European countries. *Vitis* 52 (2) p. 69–76.
- [12] Štajner N., Tomić L., Ivanišević D., Korać N., Jovanović Cvetković T., Beleski K., Angelova E., Maraš V., Javornik B. (2013): Microsatellite inferred genetic diversity and structure of Western Balkan grapevines (*Vitis vinifera* L.). *Tree Genetics & Genomes* DOI 10.1007/s11295-013-0670-4.

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KARAKTERIZACIJA AUTOHTONE I LOKALNE GERMPLAZME
VINOVE LOZE U REPUBLICI MAKEDONIJI

Sažetak

U makedonskim vinogradima se uglavnom gaje lokalne i autohtone sorte vinove loze. Karakterizacija dvadeset pet sorti vinove loze izvršena je u skladu sa OIV listom deskriptora.

Prema ampelografskim karakteristikama, sa akcentom na filometrijske deskriptore, zapažene su velike razlike među proučavanim sortama. Odnosi među sortama su dalje ispitivani na osnovu analize filometrijskog dendrograma. Analize ampelografskih svojstava su pokazale da ispitivane autohtone i lokalne sorte karakteriše polimorfizam grozdova, bobica, kao i neke agrobiološke i tehnološke karakteristike.

Raznovrsnost germplazme predstavlja važan izvor za buduće oplemenjivanje, atraktivnost lokalnih proizvoda i stvaranje održivog vinogradarstva.

Cljučne riječi: germplazma vinove loze, makedonske, stanušina, ampelograske karakteristike