

ALTITUDE AS A FACTOR ON THE AMPELOMETRIC CHARACTERISTICS OF THE LEAVES OF VRANEC VARIETY

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ABSTRACT

One measure to mitigate the climate change impact in grape production is the selection of a higher altitude location for vineyards. In that direction, the aim of this study was to investigate how does the altitude affects the ampelometric characteristics of the leaves of the wine grape variety Vranec. Findings demonstrate that the terroir of the specific microlocation related to the altitude of the vineyard has a mathematically proven influence on the leaf ampelometric descriptors. This is especially expressed in the vineyard located in Skopje, as a location with highest vineyard altitude among the studied sites. The research included three different vineyards located around Skopje, Veles and Gevgelija. According to the obtained results, the vineyards in Veles and Gevgelija are characterized by relatively similar values and a noticeable tendency of growth in the vineyard located on higher altitude. Comparative statistical analysis reveals that the absolute values of the indicators length of vein N1, N2, N3 and N4 in the vineyard located around Skopje, have higher values compared to the same parameters of the vineyards in Veles and Gevgelija. In addition, the length petiole sinus to upper lateral leaf sinus and length petiole sinus to lower lateral leaf sinus from both halves of the leaf in the vineyard located around Skopje, have higher values compared to the same parameters of the vineyards in Veles and Gevgelija. However, no significant differences between the size of the angles α and β (OIV code 607 and 608) for all vineyard locations were determined in this study.

Key words: Vineyard location, ampelometric characteristics, altitude, Vranec, ampelometric descriptors.

INTRODUCTION

In the ampelographic characteristic of each variety, the botanical description of the leaf takes a central place. It is known that by the morphological characteristics of the leaf, each grape variety which has ever been described can be identified with great accuracy. In distinguishing the vine as a species, the main organ described by Carl Linnaeus in 1753 was the leaf petiole (Kovachev 1982). The size and area of the vine leaves have been determined by a number of authors who consider that its significance as an ampelographic organ is indisputable (Stoev, Raduchev 1942-1943, Galet, 1967, 1968; Klimenko et al., 1997; Slavcheva 1990; Zhenhua, Guoguang, 1991). According to Ortiz et al., (1990) the measurement of selected leaf parameters is an effective method for recognizing Vitis biotypes. In the ampelographic methods, computer systems are increasingly being used to process the obtained experimental data (Schneider, Zeppa, 1988). The problem of recognizing Vitis biotypes in the existing large varietal diversity and polymorphism in the vine is substantiated by Sotes et al., (1986). According to Panarina (1967) the size of the leaves of the same vine varieties varies significantly depending on the place of cultivation and meteorological conditions. Despite this, certain differences between them according to given traits are maintained. Troshin et al., (1998) assessed the taxonomic

relationships between the varieties from *V.v.s.p. balcanica* Negr. and *V.v.s.p. meridionali* – *balcanica* Trosh. based on morphometric characteristics of the leaves and found that there is no differentiation among Macedonian, Bulgarian and Greek varieties in this group. The aim of this study is to establish the influence of altitude on the botanical characteristics of the leaf in the Vranec variety.

MATERIALS AND METHODS

The botanical description of the leaf was carried out over a five-year period with Vranec vines grown in three regions in R. Macedonia at different altitudes: Gevgelija – 50 m, Veles – 280 m, and Skopje – 595 m. The vines were trained by a bilateral guyot system. To avoid inaccuracies in the description of the leaf of the variety Vranec, it is accepted as typical leaves to consider those naturally positioned from the 9th to the 12th node, counted from the base of the cane to the top of the vine shoots (Bulgarian Ampelography 1990; Bozhinović 2010; Roychev 2012). All leaf descriptors were measured, described, and analyzed comparatively according to the published OIV methodologies (OIV April 2001), CODES shown on (Fig. 1). The obtained experimental data were mathematically processed using two-factor dispersion analysis modules and Duncan's criterion with the statistical softer SPSS 17.

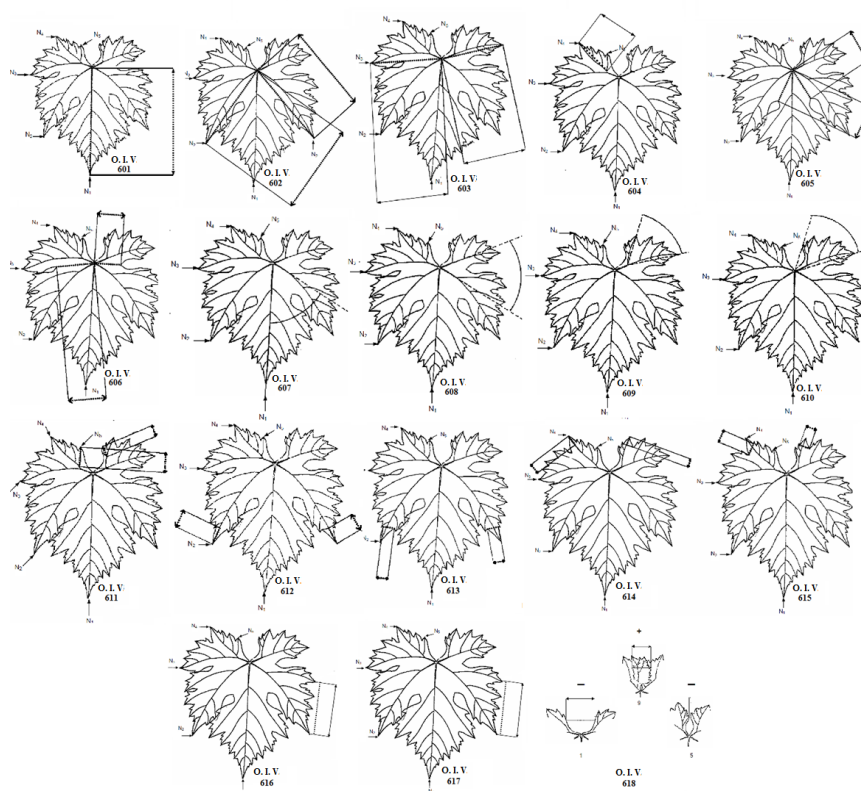


Figure 1. OIV Code for leaves ampelographic description.

RESULTS AND DISCUSSION

The multipoint comparative analysis of the ampelometric indicators of the leaf in the better-developed part of the Vranec variety shows that the length of vein N1 (CODE 601) is proven to be the longest in the Skopje area – 121.4 mm, compared to Veles – 105.5 mm and Gevgelija – 100.9 mm (Table 1). Two groups of significance were formed – a and b. The same applies to the length indicators of petiole sinus to upper and lower lateral leaf sinus (CODES 605 and 606) and the length of vein N4 (CODE 604). The differences in their values are significant. The trend is also maintained in the length petiole sinus to upper and lower lateral leaf sinus

(CODES 605 and 606), with their absolute values being closer. No significant differences were found between the sizes of angles α and β between N1 and N2 (CODES 607 and 608), as only one group of statistical significance was found.

Table 1. Multipoint Comparative Analysis of Ampelometric Descriptors of the Better-Developed Part of the Leaf in the Vranec Variety

O.I.V. CODE N° and Descriptor								
Variants	601	602	603	604	605	606	607	608
	Mature leaf: length of vein N1	Mature leaf: length of vein N2	Mature leaf: length of vein N3	Mature leaf: length of vein N4	Mature leaf: length of petiole sinus to upper lateral leaf sinus	Mature leaf: length of petiole sinus to lower lateral leaf sinus	Mature leaf: angle between N1 and N2 *measured at the first ramification. *Code Nos OIV 601 and OIV 602	Mature leaf: angle between N2 and N3 measured at the first ramification
Gevgelija	100.9 b	89.3 b	63.6 b	39.4 b	46.2 b	43.7 b	55.7 a	59.8 a
Veles	105.5 b	92.2 b	64.3 b	39.2 b	53.4 a	44.3 b	54.1 a	61.0 a
Skopje	121.4 a	112.0 a	80.1 a	50.4 a	55.2 a	54.2 a	55.6 a	63.0 a

Some variety in variants is observed in the variation of the next two indicators: the γ angle between N3 and N4 (CODE 609) and the angle between N3 and the tangent between petiole point and the tooth tip of N5 (CODE 610), shown in Table 2. In the first case, leaves from vines in Skopje and Gevgelija are in one group of significance (a), and in the second – Veles and Skopje. For the length of vein N5 (CODE 611), the length of tooth of N2, the length of tooth of N4, and the width of tooth N4, the leaves from the vineyard around Skopje have proven to have the highest values. Only for the width of tooth N2 there are no significant differences between the three locations (variants). The leaves in the vineyard around Gevgelija have relatively more tooth between the tooth tip of N2 and the tooth tip of the first secondary vein on N2 including the limits (CODE 616), but the length between the tooth tip N2 and the tooth tip of the first secondary vein of N2 (CODE 617) is longer in the leaves samples from Skopje (Table 3). The Opening/overlapping of petiole sinus of the leaves are predominantly closed in the leaves from Gevgelija, while in Skopje and Veles, they are mostly open.

Table 2. Multipoint Comparative Analysis of Ampelometric Indicators of the Better-Developed Part of the Leaf in the Vranec Variety

O.I.V. CODE N° and Descriptor							
Variants	609	610	611	612	613	614	615
	Mature leaf: angle between N3 and N4 measured at the first ramification	Mature leaf: angle between N3 and the tangent between petiole point and the tooth tip of N5	Mature leaf: length of vein N5	Mature leaf: length of tooth of N2	Mature leaf: width of tooth of N2	Mature leaf: length of tooth of N4	Mature leaf: width of tooth of N4
Gevgelija	60.6 a	79.6 a	19.9 b	11.4 b	13.8 a	8.8 c	12.1 b
Veles	54.3 b	69.3 b	19.0 b	13.2 ab	14.7 a	9.9 b	12.0 b
Skopje	60.6 a	72.5 b	24.7 a	14.2 a	14.4 a	11.9 a	14.3 a

Table 3. Multipoint Comparative Analysis of Ampelometric Indicators of the Better-Developed Part of the Leaf in the Vranec Variety

O.I.V. CODE N° and Descriptor			
Variants	616	617	618
	Mature leaf: number of teeth between the tooth tip of N2 and the tooth tip of the first secondary vein of N2 including the limits	Mature leaf: length between the tooth tip of N2 and the tooth tip of the first secondary vein of N2	Mature leaf: opening/overlapping of petiole sinus
Gevgelija	4.5 a	51.7 b	-1.8 b
Veles	4.1 b	50.9 b	9.1 a
Skopje	4.3 ab	59.9 a	13.4 a

The obtained results show that the studied ampelometric indicators of the leaves from the vineyard in the Skopje area differ from those in the other two regions. Their absolute values are most often greater and form a separate group of significance. The multipoint comparative analysis of the ampelometric indicators of the less developed part of the leaf in the Vranec variety entirely repeats the outlined trends in their variation depending on the location of the vineyard (Table 4, Table 5). Some differences in the formed groups and the statistical significance of the differences are observed only in the depth of the lower lateral incision, the γ angle between the main veins, the length of notch No. 4, and the number of notches between the lateral main vein and secondary vein No. 2.

Table 4. Multipoint Comparative Analysis of Ampelometric Indicators of the Less-Developed Part of the Leaf in the Vranec Variety

O.I.V. CODE N° and Descriptor								
Variants	602	603	604	605	606	607	608	609
	Mature leaf: length of vein N2	Mature leaf: length of vein N3	Mature leaf: length of vein N4	Mature leaf: length petiole sinus to upper lateral leaf sinus	Mature leaf: length petiole sinus to lower lateral leaf sinus	Mature leaf: angle between N1 and N2 *measured at the first ramification *Code Nos OIV 601 and OIV 602	Mature leaf: angle between N2 and N3 measured at the first ramification	Mature leaf: angle between N3 and N4 measured at the first ramification
Gevgelija	84.1 b	63.3 b	38.9 b	46.1 b	11.0 a	55.2 a	63.3 a	58.3 a
Veles	91.5 b	64.9 b	39.1 b	50.5 ab	10.0 a	52.6 a	60.7 a	53.8 a
Skopje	115.5 a	80.0 a	49.7 a	56.0 a	10.0 a	55.7 a	63.4 a	60.5 a

Table 5. Multipoint Comparative Analysis of Ampelometric Indicators of the Less-Developed Part of the Leaf in the Vranec Variety

O.I.V. CODE N° and Descriptor								
Variants	610	611	612	613	614	615	616	617
	Mature leaf: angle between N3 and the tangent between petiole point and the tooth tip of N5	Mature leaf: length of vein N5	Mature leaf: length of tooth of N2	Mature leaf: width of tooth of N2	Mature leaf: length of tooth of N4	Mature leaf: width of tooth of N4	Mature leaf: number of teeth between the tooth tip of N2 and the tooth tip of the first secondary vein of N2 including the limits	Mature leaf: length between the tooth tip of N2 and the tooth tip of the first secondary vein of N2
Gevgelija	79.8 a	19.1 b	10.9 b	13.7 a	8.8 b	12.0 b	4.7 a	51.0 b
Veles	69.7 b	18.9 b	12.4 ab	14.6 a	9.7 b	12.1 b	4.2 a	50.7 b
Skopje	72.4 b	24.2 a	13.8 a	14.2 a	11.7 a	13.9 a	4.2 a	

CONCLUSION

Soil and climatic factors related to the altitude of the terrain have a mathematically proven influence on the ampelometric characteristics of the leaf of Vranec variety, manifested by an increase in their size in the Skopje area. In the vineyards around Gevgelija and Veles, they are characterized by relatively close values and a noticeable trend of increase in higher-altitude terrain.

According to the multipoint comparative analysis, the absolute values of the indicators such as the length of vein N1 (CODE601), the length of vein N3 (Code 603), the length of vein N4 (CODE 604), the length of petiole sinus to upper and lower lateral leaf sinus (CODE 605,606) on both halves of the leaves in the vineyard around Skopje, have higher values for the same parameters measured for the leaves in the vineyards in Veles and Gevgelija. There are no significant differences in the size of the angles between N1 and N2 (CODE 607) and angle between N2 and N3 (CODE 608).

REFERENCES

- Bozinović Z., 2010. Ampelografija. Vtoro preraboteno izdanie. Skopje, 318 (106) s.
- Bulgarska Ampelografija, 1990. Obshta Ampelografija, Sofia, tom I, 296 s.
- Klimenko V. P., M. V. Melkonyan, L. P. Troshin, 1997. Identificirovannye geny vinograda. Vinograd i vino Rossii, 1, 20-21.
- Kovachev I., 1982. Opredelitel na lozovite sortove, podlozhki i divi lozi. Plovdiv, Hristo G. Danov, 77 s.
- Panarina A. M., 1967. Izuchenie izmenchivosti priznakov lista s tsel'yu vyyavleniya ikh tsennosti dlya ampelograficheskikh issledovaniy. Trudy VNIIV i V "Magarach", tom XVI, Moskva, Izdatelstvo "Pishchевaya promyshlennost", 160-175.
- Roychev V., 2012. Ampelografiya. Akademichno izdatelstvo na Agraren Universitet-Plovdiv, 574 s.
- Slavcheva T., 1990. Statisticheska otsenka na nyakoi metodi za opredelyane na listnata povrshnost pri lozata. Rastenievadni nauki, 5, 27, 87-91.
- Stoev K., Raduchev S., 1942-1943. Ampelometricrchno opisanie na listata na nyakoi balgarski sortove lozi. Godishnik na universiteta Sv. Kliment Ohridski - Sofia. Agronomo-lesovaden fakultet, tom XXI, kniga 1 - Zemedelie, 177-205.

Troshin L. P., A. A. Polulyakh, V. I. Risovannaya, 1998. Otsenka taksonomicheskikh otnosheniy sortov V. v. s. p. balkanica Negr. i V. v. s. p. meridionali-balcanica Trosh. po morfologicheskim priznakam lista. Vinograd i vino Rossii, 3, 41-42.

Galet P., 1967. Recherches sur les methodes d'identification et de classification des Vitacees des zones temperees. Doctoral Thesis, Montpellier, I, 311 pp.

Galet P., 1968. Précis d'ampélographie pratique. Ed. 2. Montpellier, P. Dehan, 230 pp.

Ortis J. M., F. Cabello, H. Altude, V. Sotes, 1990. Multifactorial análisis of leaf parameters for identification of Vitis cultivars. Riv. Vitic. Enol., 1, 3-8.

Schneider A., Zeppa G., 1988. Biometria in ampelographia. L'uso di una tavoletta grafica per effettuare rapidamente misure fillometriche. Vignevini (9); 37-40.

Sotes V., J. R. Lissarrague, M. A. Mendiola, 1986. Identificacion de variedades de vid. Agricultura (1,4); 638-641.

Zhenhua D., Guoguang L., 1991. Methods of estimating leaf area of grapevines. Acta agricultural Universitatis Pekinensis, vol. 17, N 2, 103-10.

OIV, April 2001. 2nd edition of the OIV descriptor list for grape varieties and Vitis species.