AMPELOGRAPHIC CHARACTERIZATION OF THE AUTOCHTHONOUS GRAPE CULTIVAR "KALLMET" IN MALËSIA E MADHE, ALBANIA

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Abstract

"Kallmet" is one of the most sprout autochthonous wine grape cultivar in the North-western and Central part of Albania. Study was conducted in three consecutive years, 2009-2011, in Malësia e Madhe, 250 m above the sea level, in the North-western part of Albania, in a 10 years old vineyard. For evaluation of the main characteristics the IPGRI Descriptors of Grapevine was used. Form of the new shoot tip of "Kallmet" is half-open, with no anthocianic coloration, and densely prostrate hairs. The upper surface colour of new leaf is green with bronze spots. Flower type is functional female, and the first florescence appears at the 4-5th nodes. Mature leaf size is medium, leaf shape is pentangular, shape of the lateral teeth is convex in both sides, shape of the base sinus is half-open, shape of the upper lateral sinus is closed, and the depth of the upper lateral sinus is 63 mm. Bunch weight is small and bunch density is medium. "Kallmet" has medium-sized spherical deep red to violet berry with soft colourless pulp. Berries are not uniform and there occur a high rate of millerandage because of the lack of pollination during flowering time. Grape yield is 155 kv ha^{-1}, grape must content is 67 ml/100 g fresh grape, sugar content is 21%, total acidity 5.7 g/l. The time of bud break is medium, while the number of inflorescences for fruit-bearing offshoot is 1.7. The annual vegetative growth is 180 cm. "Kallmet" leaves are susceptible to *Plasmopara viticola*, while the berries appear a relatively high resistance to *Plasmopara viticola*, and high resistance to *Uncinula necator* and *Botrytis cynerea.*

Key words: autochthonous, bio-morphological characteristics, cultivar, "Kallmet", high production rate.

1. Introduction

"Kallmet" is one of the oldest autochthonous grape cultivar which is being used through centuries as one of the most widespread red wine cultivar, especially in the North and North-west Albania, occupying over 35% of the area under vineyards, or about 9% in the national level. The other known names of "Kallmet" are "Kadarka", "Scadarka", "Nero di Scutari", etc, and it is sprout from Albania and cultivated since in the Roman Empire in Hungary, Croatia, Austria, and Rumania [10, 11]. Due to the high environmental adaptability and its typical wine, which is very popular, "Kallmet" continues to dominate the variety structure of new vineyards in Albania and it is planned to occupy of 20% of the red wine cultivars [8].

Annual vine grape cycle pass through some stages which follow and overlap each-other regularly every year, but the time and way of these stages depend on agro technical practices and climate factors, which affect on productivity indicators [10]. Phenological stages of grapevine such as liquids movement, bud break, starting and ending of blooming, grape growth, grape maturity, and leaves falling, both of which are included on active vegetative growth period, followed by winter dormancy period. Active vegetative growth period starts over the minimal biological temperature (^{o}C), or so called biological zero, which for grapevine is 10^{o}C [13]. Falling of the air temperature under 10^{o}C is followed by leaves falling and winter dormancy. Determination of the most suitable grape cultivars for a specific region can be done knowing the length of active vegetative growth, ripening time and climogram data [2, 10].

Archival and archaeological data show that for grapevine characterisation is written by Greek and cartagenous autors such are Democrit (460-375 B.C), Aristotel (384-322 B.C), Virgil, Columela, Plini, etj [2].

Ampelographers think that it is impossible and, in general, unnecessary, the assessment and evaluation of 105 characters per cultivar [5, 10]. Full

evaluation of characters must be done by grapevine collections and Genetic Bancs for fulfilling of cultivar passport, while the studies focused on identification and evaluation of the main characters can be taken into consideration a limited number of characters [12].

2. Material and methods

The study for characteristics evaluation of grape cultivars was conducted in a 10 years old vineyard in Malësia e Madhe, 250 m above the sea level, in the North-western part of Albania, during 2009-2011 on a representative sample constituted by 15 plants selected randomly [5, 10]. The vineyard was situated in an uniform hill with a sloping gradient of 3 to 4% and a planting density of 3330 plants ha^{-1} (2.5 m x 1.2 m). Observation, measurement and evaluation of characters were based on the codes and levels of the International Descriptors of Grapevine [5, 4, 9].

Characterization of "Kallmet" grapevine cultivar was focused on 33 main characters, from which four characters of new shoot and leaf (form of the tip of new shoot, anthocianic coloration of the tip, density of prostrate hairs on tip, colour of the upper surface of young leaf) evaluated on 15 plants, one flower character (flower type) evaluated on 15 inflorescences, six mature leaf characters (leaf size, shape of the blade, shape of the lateral teeth, shape of the base (petiole) sinus, shape of the upper lateral sinus, depth of the upper lateral sinus) measured on 15 leafs/plant; three bunch characters (bunch weight, length and density) measured on 5 kg grape; seven berry characters (size, weight, shape, integument color, pulp mellowness, uniformity) measured on 100 berries taken randomly from the middle part of the 5 kg bunches, and grape maturity period) (days from blooming to the harvest when berries are totally colored and the sugar content is around 21%), three productivity characters [grape must content (ml/100 g fresh grape), sugar content of the must (%), total acidity content of the must (g/liter)] measured on the must of 5 kg grape, two vine characters [(degree of vine maturity (% of annual vegetative growth), average length of internodes (cm)] measured after leaf falling in November, and seven biological characters (time of bud opening, number of inflorescences for fruit-bearing offshoot, annual vegetative growth (cm), and resistance or susceptibility to biotic factors such as *Plasmopara viticola* on the leaves and on the berries, and *Uncinula necator,* evaluated during intensive growth of the berries, and *Botrytis cynerea* on the berries evaluated during fruit ripening period on all sample plants [5]. Characterization of the features of the tip of new shoot growth was performed in the period 10-20 April, when the new branches are not dendriformed yet, and have a length 5-15 cm.

Characterization of the floral features was performed at full blooming period. The observation was carried out on fully opened flowers, formed in the middle part of the inflorescence. "Kallmet" blooming in Zagora occur normally in the period 22-29 May.

Characterization of the mature leaf features was performed in the period 1-20 August, which consist with the starting time of the appearance of red color on the berries integument. For each plant were taken randomly 10 fully developed leaves in the middle part of the cane.

Characterization of the bunch's features and berries was performed during in the period 1-15 September at the full-ripening time of grape, 2-3 days prior to harvest [3].

Characterization of chemical and technological indicators of production was based on data analysis on the contents of must, and sugar and total acidity content in must, which were conducted at the "Zadrima" Factory Laboratory in Hajmel, Lezhë, at the full-ripening time of grape.

Three-year study period (2009-2011) was considered sufficient to reach the right conclusions about unchanged characters and the average level of the appearance of other characters that vary depending on the condition of plants and specific environmental conditions (evaluated by descriptive and dispersive analysis).

3. Results and discusion

The study for characteristics evaluation of "Kallmet" was conducted in a 10 years old vineyard in Zagora, Malësia e Madhe, 250 m above the sea level, in the North-western part of Albania, during 2009-2011 on a representative sample constituted by 15 typical plants (IPGRI, 1997; Susaj, 2009) marked with plastic labels that indicated the number for each plant (01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14 and 15).

Phenological stages of "Kallmet" cultivar under Koplik climate conditions do not show any obvious difference compare to other local grapevine cultivars [7], 1983). Data of mean longeval monthly temperature [6] show that the minimal biological

temperature (>10°C) in Malësia e Madhe, starts in the third decade of March and ends at the third decade of December (Table 1), and, the active vegetative growth of "Kallmet" continues for a period of 260 days (days with mean temperature over 10°C), while the sum of active temperatures is about 1796 °C (from blooming to harvest) [1, 10, 13]. The active vegetative growth starts at the begining of April until the end of November). Data of the table 1 show the correlation between mean monthly temperature (MMT) and minimal biological temperature (MBT) in terms of Malësia e Madhe.

Table 1. Mean longeval monthly temperature (°C) and correlation with vegetative growth of grapevine cultivars

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
MMT (°C)	4.7	6	9.4	14	18	22.2	24.9	25.2	21.4	16.1	11.2	6.8
MBT (°C)	10	10	10	10	10	10	10	10	10	10	10	10

3.1 Morphological characteristics

New shoot and leaf characters

Form of the tip of new shoot (Code 001) is half-open in a position of 55-60 degree on its top, with no anthocianic coloration, and densely prostrate hairs. The colour of the upper surface of new leaf is green with bronze spots. The most intensive growth occurs during the period May 20-July 15th.

Flower characters

Flower type (flower sex) is functional female, and because of the lack of pollination, there is a high rate of millerandage. The first florescence appears at the 4-5th nodes.

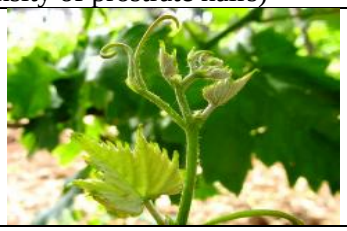
Mature leaf characters

Mature leaf size (the main vein length, N1) is medium (153 mm), leaf shape is pentangular, shape of the lateral teeth is convex in both sides, shape of the base (petiole) sinus is half-open, shape of the upper lateral sinus is closed, and the depth of the upper lateral sinus is medium (62 mm).

Bunch characters

Mean bunch weight is small (230 g), bunch length is long (257 mm), and bunch density is medium

Table 2. Evaluation of new shoot characters, mature leaf characters and berries characters

r	Characters	Code (IPGRI)	Evaluation
1	**New shoot characters** (Anthocianic coloration and density of prostrate hairs)		
		001 003 004	Form of the new shoot tip - Half-open Anthocianic coloration of the tip – Absent Density of prostrate hairs on tip – Densely
2	**Mature leaf characters**		
		065 067 076 079 082	Leaf size – Medium, 153 mm Shape of the blade - Pentangular Shape of the lateral teeth - Convex Shape of the base (petiole) sinus - Half-open Shape of the upper lateral sinus - Closed
3	**Berries characters**		
		221 503 223 225 222	Berry size – Medium, 16 mm Berry weight- Medium, 3.4 g Berry shape – Medium, 67 ml/100 g Berry integument color - Deep red to violet Berries uniformity- High rate of millerandage

Berries characters

Berry size of "Kallmet" is medium (16 mm), berry weight is medium (3.4 g), berry shape is spherical with deep red to violet. Berries are juicy, with soft colourless pulp. Berries are not uniform and there occur a high rate of millerandage because of the lack of cross pollination during flowering time "Kallmet" have to be cultivated with pollinator

Table 3. Evaluation of the main characteristics of "Kallmet" cultivar

Nr	Characters	Code	Evaluation Levels	Evaluation
I	**New shoot and leaf characters**			
1	Form of the new shoot tip	001	1, 3, 5	3
2	Anthocianic coloration of the tip	003	0,1, 3, 5, 7, 9	0
3	Density of prostrate hairs on tip	004	0,1, 3, 5, 7, 9	7
4	Colour of the upper surface of new leaf	051	1, 2,3,4, 5, 6, 7	2
II	**Flower characters**			
5	Flower type (flower sex)	151	1, 2, 3, 4, 5	5
III	**Mature leaf characters**			
6	Leaf size	065	1, 3, 5, 7, 9	5
7	Shape of the blade	067	1, 2, 3, 4, 5	3
8	Shape of the lateral teeth	076	1, 2, 3, 4, 5	3
9	Shape of the base (petiole) sinus	079	1 2, 3, 4, 5…9	3
10	Shape of the upper lateral sinus	082	1, 2, 3, 4	2
11	Depth of the upper lateral sinus	605	1, 3, 5, 7, 9	5
IV	**Bunch characters**			
12	Bunch weight	502	1, 3, 5, 7, 9	3
13	Bunch length	U-39	1, 3, 5, 7, 9	7
14	Bunch density	204	1, 3, 5, 7, 9	5
V	**Berries characters**			
15	Berry size	221	1, 3, 5, 7, 9	5
16	Berry weight	503	1, 3, 5, 7, 9	5
17	Berry shape	223	1, 2, 3, 4, 5 .. 9	4
18	Berry integument color	225	1, 2, 3, 4, 5, 6	5
19	Berry pulp mellowness (liquidity)	232	1, 2, 3	3
20	Berries uniformity	222	1, 2	2
21	Grape maturity (days)	304	1, 3, 5, 7, 9	5
VI	**Productivity characters**			
22	Yield (kv ha^{-1})	504	3, 5, 7	5
23	Grape must content (ml/100 g fresh grape)	233	1, 2, 3, 4, 5	
24	Sugar content of the must (%)	505	1, 3 ,5, 7, 9	5
25	Total acid content of the must (g/liter)	506	1, 3, 5, 7, 9	3
VI	**Vine characters**			
26	Degree of vine maturity (% of annual vegetative growth)	352	1, 3, 5, 7, 9	7
27	Average length of internodes (cm)	353	1, 3, 5, 7, 9	5
VII	**Biological characters**			
28	Time of bud break	301	1, 3, 5, 7, 9	5
29	Number of inflorescences for fruit-bearing offshoot	153	1, 2, 3, 4	2
30	Annual vegetative growth (cm)	202	1, 3, 5, 7, 9	5
31	*Plasmopara viticola* on the leaves	452	1, 3, 5, 7, 9	5
32	*Plasmopara viticola* on the berries	453	1, 3, 5, 7, 9	3
33	*Uncinula necator* on the berries	456	3, 5, 7	3
34	*Botrytis cynerea* on the berries	459	3, 5, 7	3

cultivars such as “Vranac”, “Cabernet Sauvignon”, etc which bloom in the same time and have hermaphrodite flowers with normal functions of both flower sexual organs. Grape maturity occurs 165 days after bud break.

Productivity characters

Three years mean grape yield is 155 kv ha^{-} or 4.65 kg per plant, grape must content (Code 233) is medium (67 ml/100 g fresh grape), sugar content of the must (Code 505) is high (21%), and total acid content (Code 506) of the must is low (5.7 g/l).

Biological characters

The time of bud break (Code 301) is medium, while the number of inflorescences for fruit-bearing offshoot or Absolute Productivity Coefficient (APC) is 1.7. Mean annual vegetative growth is 180 cm. “Kallmet” leaves are susceptible to *Plasmopara viticola*, while the berries appear a relatively high resistance. At the same time, berries appear a high resistance to *Uncinula necator* and *Botrytis cynerea,*as well (Table 2 and 3).

4. Conclusions

“Kallmet” is the most sprout autochthonous red wine grape cultivar which appears the highest levels of productivity characters in Zagora and Koplik, in the North-western part of Albania.

New shoot of “Kallmet” has no anthocianic coloration, but it has densely prostrate hairs. The new leaf is green with bronze spots, flower type is functional female, and the first florescence appears at the 4-5th nodes.

Mature leaf size is medium, leaf shape is pentangular, shape of the base sinus is half-open, and shape of the upper lateral sinus is closed.

“Kallmet” forms 1.7 bunches per fruit-bearing offshoot. Bunches are small (230 g) long conic and not uniform because of high rate of millerandage. Mean grape yield is 155 kv ha^{-1}, grape must content is 67 ml/100 g fresh grape, sugar content is 21%, total acidity 5.7 g/l.

“Kallmet” leaves are susceptible to *Plasmopara viticola*, while the berries appear a relatively high resistance to *Plasmopara viticola*, and high resistance to *Uncinula necator* and *Botrytis cynerea.*

“Kallmet” grape cultivar has female functional flower therefore it needs association with pollinator cultivars such as “Shesh i Zi”, “Vranac”, “Cabernet Sauvignon”, etc which bloom in the same time and have hermaphrodite flowers with normal functions of both flower sexual organs.

5. References

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