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AMPELOGRAPHIC EVALUATION OF THE MAIN PHENOLOGICAL, VEGETATIVE AND PRODUCTIVE CHARACTERS OF WHITE SHESH GRAPEVINE CULTIVAR, UNDER TIRANA CLIMATE CONDITIONS

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ABSTRACT

White Shesh is a native (indigenous) cultivar selected and cultivated in centuries from winemakers of Tirana`s Shesh and Ndroq areas, in the middle of Albania, where it gets its name. Study was conducted during three consecutive years, 2019-2021, in a representative sample of 10 vines, in a nine years old vineyard, located in a flat land 76 m above the sea level, in Zallherr, Tirana. Observed results showed that under Tirana climate conditions, bud burst of White Shesh occurred in April 6, full bloom on May 28, berries veraison on August 2, grape maturity on September 27, and natural leaf fall occurred on December 15. Vegetative period extended 244 days and the period from blooming to harvest was 122 days. Three years mean of the sum of active temperatures (>10ºC) was 2196ºC and the sunlight radiance was 1267 hours. Insertion of the first inflorescence starts at 5-th node and each shoot generates 2 inflorescences. The flower type was hermaphrodite (fully developed of male and female organs). Bunches were medium dense, with a conical shape. Length was long 260 mm and weight was 410 g. Yield per vine was 3.1 kg or 117 quintals ha^{-1}. Berries were round and uniform with a mean weight of 3.2 g. Must yield was medium (63 ml juice 100 g $berries^{-1}$), total sugar content of must was medium (19%), and total must acid content (tartaric acid) was medium (6.4 g L^{-1}).

Key words: ampelographic, berries, characters, climate, descriptor, evaluation, flower, phenology, White Shesh.

INTRODUCTION

Albania is considered as one the last grapevine origin (Kullaj E, *et al.*, 2013) from which a huge number of cultivated forms have their origin. Robinson (1974) has written about Albania: "Certainly there are written accounts of the vine being cultivated in Illyria, as it was known in classical times, as early as the eighth century B.C.". White Shesh is a native (indigenous) cultivar selected and cultivated in centuries from winemakers of Tirana`s Shesh and Ndroq areas, where it gets its name. It behaves well in low areas and on the lower part of main river valleys up to 400 m above the sea level White Shesh is one of the most important Albanian autochthonous, white grapevine

cultivars used for white wine production and as a table grape cultivar (Susaj L, 2018). In specific years in highlands, such as Tropoje, Has, Mat, etc., White Shesh doesn't manage to ripen and, for this reason, a matter of attention has to be paid in its spread (Sotiri P, *et al.*, 1972). White Shesh is one of the most spreaded cultivars in the middle Albania because of its adaptability and productive characteristics (Susaj, E, Susaj L, 2018). White Shesh, like several other native cultivars, such as White Pules, Pamid, Serin, Debine, Vlosh, Manakuq, Ceruja, Prokupac, etc, belongs to *Proles Pontica* Center, the Order Vitales (Rhamnales), Family Vitaceae, Genus Vitis, Subgenus Euvitis, Species *Vitis vinifera* L. *ssp. sativa* (Dragusha B, & Susaj L, 2018, Sotiri P, *et al.*,1972; Susaj L, 2018; Susaj L, *et al.*, 2003).

In Albania, have been several studies of grapevine cultivars characterization, such as Kallmet (Susaj E, *et al.*, 2013; Susaj L, *et al.*, 2012/a), Cardinal (Susaj L, *et al.*, 2013/a), "Queen of the Vineyards" (Susaj L & Susaj E, 2014), etc. According to different studies, the cluster (bunch) of White Shesh has a long conical shape with branches and average tightness. The berry has a medium size, spherical shape and easy detachable. The skin is white with light bronze shades and very weak coat on its surface. Flesh is soft, juicy and colorless, with a specific flavor (Susaj L, 2018). It is a medium-ripening grapevine cultivar when it gathers 19-21% sugar and 6.4-7.5% total acidity. White Shesh wines are sensitive and well balanced wines with a fragrance of forest fruits. They have a pleasant sourness and contain tannins, which cause a slight twist of mucus. The taste last for a relatively long time. Wines contain 10-13% vol alcohol and ≈ 6 g L^{-1} total acidity (expressed as tartaric acid content) (Zigori V, & Kongoli R, 2004). White Shesh grapevine likes well drained soils with a gradient slope of 5-25%. It can be cultivated in pergolas or in vineyards, in vertical espaliers, planted in distances 2.2-2.4 m x 1-1.2 m, providing 3800-4000 vines ha^{-1} (Susaj L, 2012). Grape ripening and harvest normally occurs in the period 25 September – 10 October, and provide a yield of 3-5 kg $vine^{-1}$ (Fiku H, 2011). According to Coombe & Dry (2005 & 2007) and Maracchi (1993), the period from bud burst to blooming seems to be the same for all grapevine cultivars in specific climatic conditions, while there very clearly expressed differences for the period from blooming to grape maturity and harvest. Duration of this period depends on the sum of active temperatures (SAT >10^{o}C) and sum of sunlight radiance (SSR-hours). SAT must be 900^{o}C for early ripening grape cultivars, 1500^{o}C for medium ripening grape cultivars, and 2000^{o}C for late ripening grape cultivars, while the sunlight radiance is 1000 hours for early ripening grape cultivars, 1500 hours for medium ripening grape cultivars, and 1800 hours for late ripening grape cultivars.

Studies of the evaluation of the expression level of the observed and measurable and/or quantitative characters of a specific grapevine cultivar must be carried out based on codes and evaluation levels of the International Descriptors of Grapevine (IPGRI, 1997; OIV, 2001; UPOV, 2008). Observations, biometrical measurements and evaluation of vegetative and productive characters of grapevine cultivars reach out 3 years in a representative sample constituted by 10 typical plants (OIV, 2001; Susaj L, 2009; Çakalli D and Susaj L, 2004).

MATERIALS AND METHODS

Study for the evaluation of the main ampelographic characters of White Shesh grapevine cultivar was conducted in a vineyard of 2.4 ha, under ownership of Haxhi Xhixha, in Zallherr, Tiranë, located in a flat land 76 m above the sea level. Study was carried out during three consecutive years, 2019-2021, on a representative sample, chosen randomly, constituted by 10 vines, 9 years old, planted in distances of 2.2 m x 1.2 m, or 3780 vines ha^{-1}. Observations, measurements and evaluations of characters were based on codes and levels of the International Descriptors of Grapevine (OIV, 2001) and the experience of the Albanian and foreign researchers (Susaj L, 2009; Gjermani T, 2001).

Thirty-year mean data of temperature and sunlight radiance of Tirana were collected from the Albanian Hydro Meteorological Institute Bulletin (AHMI, 1981), and recorded daily data over three last years in the field. Evaluation of sunlight and solar radiance requests and time ripening of White Shesh was based on (SAT > 10^{o}C) and (SSR - hours) under climatic conditions of the lowland and hilly regions of Tirana. Sample vines were marked with plastic labels over from 1 to 10, which were unmoved over the study period (Susaj L, 2018).

Ampelographic characterization of White Shesh grapevine cultivar was focused on 74 main characters. Characterization of the young shoot, young leaf and flower characters was performed in the period May 20-25, each year. Young shoot and young leaf were evaluated for the form of tip, anthocyanin coloration of tip, density of prostrate hairs on tip and shape; young leaf upper surface color, etc, while the flower was evaluated for the flower type, node were inserts the first inflorescence and the number of inflorescences for shoot, etc.

Characterization of the mature leaf features, such as mature leaf shape, number of lobes, length of petiole, main veins lengths (N_1, N_2, N_3, N_4), length of upper and lower lateral sinuses, shape of lateral teething, etc., was

performed in the period July 15-20, each year, in a representative sample of 10 intact mature leaves, taken from the first node over last bunch of shoot for each vine.
Characterization of the bunch characters (shape, weight, length, width, etc.), was performed in the full ripening period (September 20-30), in a representative sample of 5 kg bunches, at the full grape maturity, 2-3 days prior to harvest. Characterization of the berries characters (shape, weight, skin color, number and seeds dimensions, etc) was performed in a representative sample of 100 berries taken randomly form the middle part of bunches (OIV, 2001; UPOV, 2008; Çakalli D, and Susaj L, 2004; Susaj L, 2018; Susaj L, 2012/b).
Ampelographers think that it is impossible and, in general, unnecessary, the assessment and evaluation of 105 characters per cultivar (OIV, 2001; UPOV, 2008). 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.
Characterization of chemical and technological characters of grape was based on data analysis of the must yield (ml 100 g fresh grape^{-1}), and sugar content (%) and total acidity content (g L^{-1}) in must, and was performed on a sample of 30-50 kg fully-ripen grape without pedicels, crushed and centrifuged at 3000 rpm, and was carried out at the Viticulture Lab of the Agricultural University of Tirana.

RESULTS AND DISCUSSIONS

Temperature and sunlight radiation conditions of Tirana (30 years mean)

Thirty years mean climate data of temperature and sunlight radiance were collected from the Albanian Hydro Meteorological Institute Bulletin (AHMI, 1981) and the direct measurements in the field during three years of study (Table 1).

Table 1. Thirty years mean of temperature and sunlight radiance of Zallherr, Tirana

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Temperature (ºC)												
First decade	7.2	6.7	8.6	12.8	16.1	**20.1**	**23**	**24.4**	**22.4**	17.7	13.5	9
Second decade	6.4	8.1	9.4	13	**17.6**	**21.4**	**24.2**	**24.3**	**22**	16.2	12.5	8.5
Third decade	5.8	8.2	11.5	14.5	**19**	**23**	**24.2**	**23**	**19.4**	14.7	9.9	8.2
Sunlight radiance (SR) (hours)												
First decade	36.7	49.7	48.1	67.3	78.4	**91.4**	**112.3**	**114.5**	**89.7**	73.9	47.2	37.1
Second decade	40.1	42.1	50.1	66.3	**85.9**	**97.5**	**115.9**	**109.6**	**81.8**	67	42.3	37
Third decade	56.7	43.7	65	70.8	**102**	**115.5**	**125.5**	**108**	**80.8**	74	44.4	38.9

Under climatic conditions of Tirana, the white wine grapevine cultivar White Shesh starts the vegetative period on 6 April, when the air temperatures reach over 10ºC.

Phenological characters

At the "White Shesh" cultivar, the natural fall of the leaves occurs on December 15. The duration of the vegetation period (from bud burst to natural leaf fall) is 244 days (Table 2).

Table 2. Results of evaluation of phenological characters (White Shesh cultivar)

№	Phenophases	Code	Period	Assessment Level
1	Beginning of bud opening	301	6 April	5
2	Full flowering time	302	28 May	5
3	Beginning of grape ripening	303	2 August	5
4	Ripening and harvesting period	304	27 September	5
5	Beginning of the wooding the shoots	305	3 July	5
6	The color of the leaves in autumn	306	yellow	1
7	Duration of the vegetation period		6 April -15 December	244 days
8	Duration of the Flowering-Maturing period		28 May-27 September	122 days
9	Sum of the Active Temperatures for 122 days (SAT >10ºC)			2196ºC
10	Hours of sunlight radiance for 122 days (SSR – hours)			1267 hours

White Shesh blooms on May 28, with a duration 7-8 days, which is being considered as a normal duration (Maracchi, 1993), grape maturity and harvest occur on September 27, and the duration of the period from flowering to full maturity is 122 days. The sum of active temperatures (SAT >10°C) for the period May 28 to September 27 (from blooming to grape maturity) reached 2196°C, and the sunlight radiance (SSR - hours) reached 1267 hours. Based on the OIV (2001), Code 304, White Shesh belongs to medium-ripening grapevine cultivars.

Evaluation of vegetative and productive characters

The results of the study and ampelographic evaluation of the vegetative and productive characteristics of the cultivar White Shesh are reflected in the following table (Table 3).

Table 3. The level and form of appearance of some of the main characters

№	The main characters	OIV	Visual appearance *(display form)*	Assessment level
I	***Young shoot and leaf characters***			
1	Anthocyanin coloration of tip	002		2
2	Color intensity at the top	003		3
4	New shoot growth position	006		3
5	Color of the dorsal side of the internode	007		1
6	Color of the ventral side of the internode	008		2
7	The color of the nod on the back	009		1
8	Anthocyanin color of the bud	015-1		1
9	Color upper side of blade (4th leaf)	051		3
10	Insertion of 1st inflorescence	152		2
11	Number of inflorescences per shoot	153		2
II	***Mature leaf characters***			
12	Shape of blade	067		3
13	Number of lobes	068		3
14	Color of the upper side of blade	069		5
15	Anthocyanin coloration of main veins	070		3
16	Shape of teeth	076		5
17	Degree of opening/overlapping of petiole sinus	079		9
18	Length of petiole compared to vein (N1)	093		5
19	Depth of upper lateral sinus	094		7
20	Main vein length, N1	601		7
21	Length petiole sinus to upper lateral sinus	605		7
III	***Bunch and berries characters***			
22	Percentage of berries formed	501		5
23	Average weight of the bunch	502		5
24	Average weight of the berries	503		5
25	Color of skin	225		1
26	Average yields (kv ha^{-1})	504		5
27	Sugar content in must	505		5
28	The acidity content in must	506		3

Young shoot and young leaf characters. Density of prostrate hairs on tip of the young shoot (Code 004) was dense, giving the young shoot a grey color. Color of dorsal side of internode (Code 007) was green, color of upper surface (Code 051) was bronze.

Flower characters. Flower sexual organs (Code 151) was fully developed stamens and fully developed gynoecium (hermaphrodite), insertion of the first inflorescence starts at 5^{-th} node, and each fruit shoots generates 2 inflorescences (Tables 3).

Mature leaf characters. White Shesh, formed medium size mature leaf, with a main vein (N_1) length of 167 mm. Length of petiole compare to middle vein (Code 093) was much shorter (167 mm>129 mm). Shape of blade (Code 067) was pentagonal, number of lobes (Code 068) was five, color of upper side of blade (Code 069) was green, profile of blade in cross section (Code 074) was V-shaped, and degree of opening/overlapping of petiole sinus (Code 079) was closed. Shape of base of petiole sinus (Code 080) was V-shaped, length petiole sinus to upper lateral leaf sinus (Code 605) was 90 mm, long, length petiole sinus to lower lateral leaf sinus (Code 606) was 78 mm.

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Bunch and berry characters. Under climatic conditions of Tirana, was observed that the White Shesh grapevine cultivar expressed high productivity characters. Bunch length (Code 202) was very long, 260 mm. Cluster (bunch) width (Code 203) was 194 mm. Single bunch weight (Code 502) was 410 g, and bunch density (Code 204) was lose, and length of peduncle of primary bunch (Code 206) was 53 mm. Three years mean yield was 3.1 kg vine^{-1} or 117 quintals ha^{-1}. Berries were round and uniform. Single berry weight (Code 502) was 3.2 g. Berries color skin (Code 225) was green yellow, and uniform. Juiciness of flesh (Code 232) was medium juicy, without any special aroma, and firmness of flesh (Code 235) was slightly firm. Must yield (Code 233) was medium (63% or 63 ml juice/100 g berries). Sugar content of must was medium (19%, 5), and tartaric acid content of must was low (6.4 g L^{-1}). Each berry contains 2-3 medium size well-developed seeds (5.8 mm x 4 mm) without transversal ridges on side (Table 3).

CONCLUSIONS

- In the climatic conditions of Tirana, the period from full blooming to harvest of autochthonous table and white wine grapevine cultivar White Shesh was 122 days, and this period provided 2196^{o}C SAT (>10^{o}C) and 1267 SSR hours. In these specific conditions, White Shesh behaved as a medium to late ripening grapevine cultivar and expressed high vegetative and productive characters. Color of the upper side of blade young leaf (4th leaf) was bronze with very high density of prostrate hairs on between main veins on lower side. Mature leaf size was medium and the length of petiole compare to middle vein was much shorter (167 mm > 129 mm).
- Flower type was hermaphrodite with normal functions of both flower sexual organs, and insertion of 1st inflorescence occurred at the 5th node, and each fruit shoots generates 2 inflorescences.
- Bunch weight was 410 g and bunch density was medium. Years mean yield was 3.1 kg vine^{-1} or 117 quintals ha^{-1}. Single berry weight was 3,2 g, and berries color skin was green yellow and uniform
- Must yield was medium (63% or 63 ml juice/100 g berries). Sugar content of must was medium (19%), and tartaric acid content of must was low (6.4 g L^{-1}).
- White Shesh cultivar, grows and produces very well in the vineyards of the hilly and plain area of Tirana. The creation of new vineyards should be stimulated with this autochthonous cultivar, much preferred for the production of white wine of the White Shesh brand.

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