MAJOR AROMA COMPOSITION AND COLOR OF ALIGOTE WINES DEPENDING ON THE YEAST STRAINS

COMPUȘII MAJORITARI DE AROMĂ ȘI CULOAREA VINURILOR ALIGOTÉ ÎN FUNCȚIE DE SUȘELE DE LEVURI UTILIZATE

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Abstract: *Must from Aligote grapes was homogenized and divided into nine batches to produce dry wine. The first eight batches were inoculated with different yeast strains in order to study the influence of the yeast strains to the major aroma compounds and color of wines. The ninth batch was left without inoculums for spontaneous fermentation, as control sample. 12 major volatile compounds were quantified by gas chromatograph – flame ionization detector (GC-FID) technique. Color measurements (CIELab parameters: L*, a*, b*,* C^*_{ab}*, and* h_{ab}*) were made in a Perkin Elmer Lambda 25 spectrophotometer (PerkinElmer, CA, USA), using 1 mm path length quartz cells, following the recommendations of the Commission Internationale de L'Eclariage (CIE, 2004). Significant differences in composition of volatile compounds and significant color differences were found depending on the yeast strain applied. The sensorial analysis of the wine samples by a tasting panel performed confirms the analytical results.*

Key words*: aroma compounds, wine color, yeast, sensorial analysis, Aligote*

Rezumat. *Mustul din soiul Aligote a fost omogenizat și împărțit în nouă loturi pentru producerea de vinuri seci. Primele opt loturi au fost inoculate cu diferite sușe de levuri cu scopul de a studia influența sușelor de levuri asupra compușilor de levuri majoritari și a culorii vinurilor. Al noulea lot a fost lăsat fără inoculum pentru fermentația spontană, ca proba martor. 12 compuși volatili majoritari au fost cuantificați cu ajutorul tehnicii gaz-cromatograf cu detector de ionizare prin flacara (GC-FID). Parametrii de culoare (parametrii CIELab: L*, a*, b*,* C^*_{ab}*, și* h_{ab}*) au fost măsurați cu ajutorul unui spectrofotometru Perkin Elmer Lambda 25(PerkinElmer, CA, USA),folosind celule de cuarț de 1mm grosime, urmând recomandările Commission Internationale de L'Eclariage (CIE, 2004). Au fost înregistrate diferențe semnificative de culoare și de compoziție în substanțe de aromă, în funcție de sușa de levuri utilizată. Analiza senzorială a probelor de vin realizată de 15 degustători confirmă rezultatele analitice.*

Cuvinte cheie*: compuși de aromă, culoarea vinurilor, levuri, analiza senzoriala, Aligote*

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INTRODUCTION

Aligoté is one of the grape varieties that experienced a large appreciation in last years in Romania, being used for high quality dry wines. Unfortunately there are not many studies done for this variety.

The quality of any wine is based specially on its color and flavor. Both, the color and the flavor characteristics are the result of complex interactions among different factors, the most important being: grape variety, yeast strain and technical conditions of wine-making (Lilly et al., 2000). Also, the effect of yeast strain on volatile compounds differs according to the original grape must, as the same yeast strain could produce different results (Romano et al., 2003).

The aroma of wine can be classified accordingly to its origin, in varietal aroma, pre-fermentative aroma, fermentative aroma and post-fermentative aroma (Cotea et al., 2009, Moreno and Peinado, 2010). Although a number of flavor components are found in the original grape, the dominant and major compounds contributing to white wine aroma are formed during yeast fermentation (Patel and Shibamoto, 2003; Estévez et al., 2004) and are mainly higher alcohols, fatty acids, acetates, ethyl esters, aldehydes and ketones (Lilly et al., 2000; Estévez et al., 2004). It was demonstrated that not only the yeast species but also the particular strain of the individual species can influence the aroma of wines (Patel and Shibamoto, 2003; Romano et al., 2003).

The aim of this study is to determine the influence of some commercial yeast strains to the color and aroma composition of Aligoté wines from Odobesti vineyard, 2013 vintage.

MATERIAL AND METHOD

2.1. Wine samples

Wines obtained from Aligote grape variety from Vrancea region, Romania were studied. The wines were produced in the micro winery belonging to the Oenology department of the University of Agricultural Sciences and Veterinary Medicine, Iasi. Healthy ripe grapes of *Vitis vinifera* cv. Aligoté collected at full maturity were destemmed, crushed, and the must was homogenized and transferred to 9 glass containers in equal quantities, for the alcoholic fermentation. Eight different pure cultures of selected yeasts were added to unsterilized must, the 9-th must being left without inoculums, as a control (AV0). The pure yeast cultures were commercial *S. cerevisiae* sold under the name of: Fermol aromatic (AV1), Cross Evolution (AV2), Zymaflore X16 (AV3), Fermol Cryoarome (AV4), Fermactiv Thyol (AV5), Fermactiv AP (AV6), Fermactiv Muscat (AV7), and one *S. cerevisiae* yeast selected from Iasi vineyard by the Research and Development Station for Viticulture and Wine, Iaşi (AV8). The yeast strains selected are the most frequent yeasts used by the wine makers in this region for dry white wines.

2.2. General characteristics analyses

The analysis of pH, reducing sugars, titratable acidity and volatile acidity was performed by the official European Union methods (1990). The ethanol content was quantified by oxidation with dichromate according to Crowell and Ough (1979) and measuring the absorbance at 600nm. The absorbance at 280, 420, 520 and 620 nm was measured in a spectrophotometer Perkin Elmer Lambda 25 using 10 mm path length glass cells, after filtering the samples through a HA-0.45 μm paper (Millipore, Bedford, MA, USA).

2.3. Gas-Chromatographic Quantification of Major Volatile Compounds and Polyols

Considering the most abundant alcohols (methanol, 1-propanol, isobutanol, isoamylic alcohol and 2-phenylethanol), two carbonyl compounds (acetaldehyde, and acetoin), three ethyl esters (ethyl acetate, ethyl lactate and ethyl succinate) and two polyols (glycerol and 2,3-butanediol), twelve wine aroma compounds were quantified by Gas-Chromatographic Analysis (GCA). An Agilent 6890 series plus gas chromatograph (Palo Alto, CA) with a fused silica 60 m long, 0.25 mm diameter and 0.40-μm film thickness CPWAX-57 CB column from Varian (Palo Alto, CA) was used. A quantity of 0.5 μL aliquots from 10 mL of wine or standard samples previously supplied with 0,5 mL of 2 g/L 4-methyl-2-pentanol as internal standard solution were injected into the injector of the GC instrument. The temperature program was as follows: 50 °C for 15 min and then raised to 190 °C at 4 °C/min and held for 35 min. The flow rate of the carrier gas (helium) was held at 0.7 mL/min for 16 min and then raised at 0.2 mL/min^2 to 1.1 mL/min for 52 min. The injector was equipped with an open tubular liner type in borosilicate glass, 4 mm of i.d., using glass wool at the center to ensure repeatability in the injection volume and no tapers for consistent split injection. A 1:30 split ratio and an injector temperature of 275 °C were used. The flame ionization detector temperature was 300 °C, and the hydrogen and air flow rates were 40 and 400 mL/min, respectively. A post run purge program at 200 °C for 25 min and a helium flow rate of 1.3 mL/min were used after the chromatographic peaks of interest were eluted. Each compound was quantified from the response factor provided by standard solutions analyzed as the wine samples. The chemical compounds used, preparation of standards and method validation was detailed by Peinado et al. (2004). Also, each compound was confirmed by using the Willey 7 N spectral library and a Mass Spectrometric detector model HP-5972-A from Agilent Technologies, coupled to the same GC equipment used for the quantification of standards and wine samples.

2.4. Colour measurements

Color measurements were made in a Perkin Elmer Lambda 25 spectrophotometer (PerkinElmer, CA, USA), using 1 mm path length quartz cells. The wine samples were filtered through Millipore- HA-0.45 μm paper filters (Bedford, MA, USA), prior to the spectrophotometric analysis.

The whole visible spectrum (380–770 nm) was recorded ($\Delta\lambda$ = 2 nm) and Illuminant D_{65} and 10º Observer were used in the calculations as standard conditions. The CIE-Lab parameters (L^*, a^*, b^*, C^*_{ab}, h_{ab}) were determined by using the software COLVIN (PerkinElmer, CA, USA), following the recommendations of the Comission Internationale de L'Eclairage (CIE, 1986).

2.5. Sensory analysis

The wines were assessed for color, aroma and flavor acceptability by 15 tasters in a panel in accordance with ISO 8586-1:1993. The tasting room was kept at 20 ºC and wines served in tasting glasses certified and coded. Evaluation of the quality of the wines was made using the method according to ISO 4121:2003, with options of desirable (7–9), acceptable (4–6) and undesirable (1–3). The final punctuations were calculated as the mean, taking into account the evaluation of each taster.

RESULTS AND DISCUSSIONS

The general characteristics of wines are presented in tab.1. As it can be seen, the volatile acidity differs between 0,3 and 0,66 g acetic acid/L; ethanol between 10,82 and 12,38 %v/v, all the wines being semidry to semisweet wines.

Table 1.

Physical-chemical parameters (mean and standard deviation, n=3) of wines made with different yeast strains.

	pH	Volatile acidity (g/L Acetic acid)	Total acidity (g/L Tartaric acid)	Ethanol (%v/v)	Density	Reducing sugars (g/L)
AV0	3,09±0,02	0,47±0,02	6,2±0,1	11,05±0,1	0,996±0,005	20,6±0,1
AV1	3,24±0,01	0,49±0,02	6,7±0,09	10,89±0,07	0,987±0,001	24,99±0,01
AV2	3,22±0,005	0,45±6,8	7,1±0,04	10,82±0,02	1,004±0,0001	25,2±0,2
AV3	3,19±0,005	0,35±0,02	7,4±0,04	11,35±0,02	0,995±0,0004	19,7±0,01
AV4	3,28±0,005	0,66±0,01	6,8±0,09	12,38±0,3	0,975±0,003	6,5±0,05
AV5	3,25±0,005	0,52±0,02	7,1±0,01	12,33±0,08	0,973±0,001	8,98±0,01
AV6	3,18±0,005	0,37±0,02	7,5±0,04	10,94±0,08	0,9867±0,0006	23,56±0,01
AV7	3,2±0,01	0,3±0,01	6,9±0,04	11,73±0,31	0,9803±0,0008	14,15±0,01
AV8	3,23±0,01	0,35±0,02	6,7±0,04	11,33±0,03	0,992±0,001	14,4±0,01

Fig. 1 shows the major volatile compounds quantified in our samples. Regarding the content in alcohols, the highest values were registered at AV3 followed by AV6 and AV0, the lowest values being registered at the variant coded AV4. The highest concentration in polyols was registered at AV4 and AV2, AV2 and AV3 having the highest concentration in ethyl esters. AV1 is the sample that registered the highest concentration in carbonyl compounds which means that the yeast strain sold under the name of Fermol aromatic is the most suitable for obtaining wines rich in carbonyl compounds under the given experimental conditions. The most pleasant odor given by the ethyl esters was found in the wines fermented with the yeast strains sold under the name of Cross Evolution (AV2) and Zymaflore X16 (AV3). Also, high quantities of ethyl esters were registered at the blank sample, which means that the yeasts that are present in the must can be used to obtain wines with floral and fruity characteristics.

The chromatic parameters analyzed by CIELab method are presented in table 2. The lightness (***L****) parameter has values that varies between 92.8 and 99.5, with higher values registered at AV1 and AV5, indicating that the wines tend towards transparency. Four samples (AV1, AV3, AV5 and AV7) have negative values for coordinate a*, meaning that these wines have a greenish color; the other four samples registered positive values. It has to be mentioned that the differences between these values are small, all values being close to 0.

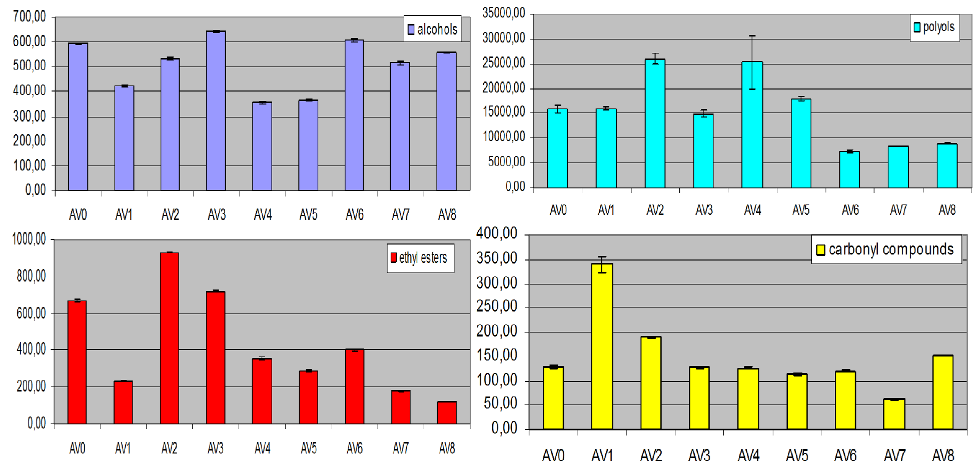

Fig. 1 - Major volatile compounds (mean of n=3 (mg/L) and standard deviation) quantified in wines made with different yeast strains

Regarding the chromaticity +b*/-b*, all the samples have positive values (yelow nuances prevail against the blue ones) with higher values for AV2 and AV4. Also, these two samples registered the highest color intensity out of all the 9 samples studied (Tab. 2).

Table 2

Chromatic parameters of wines made with different yeast strains

Sample	Luminosity L*	Chromaticity +a*/-a*	Chromaticity +b*/-b*	Saturation C*	Tonality H*	Intensity	Color hue
AV0	96,07	0,05	6,57	6,58	91,09	0,20	2,93
AV1	99,13	-0,25	2,77	2,78	95,06	0,06	3,82
AV2	92,80	0,43	10,65	10,66	87,68	0,36	2,18
AV3	97,45	-0,21	3,91	3,92	93,14	0,13	2,34
AV4	93,73	0,43	10,32	10,33	87,61	0,32	2,27
AV5	99,48	-0,32	3,31	3,32	95,47	0,05	5,63
AV6	94,51	0,13	9,73	9,73	89,26	0,29	2,44
AV7	98,57	-0,19	3,48	3,49	93,17	0,08	2,85
AV8	92,88	0,39	8,38	8,39	87,31	0,33	1,95

The sensorial analysis carried out by 15 tasters confirms the analytical results. Samples AV2 and AV7 were mostly appreciated by the majority of the tasters (fig. 2).

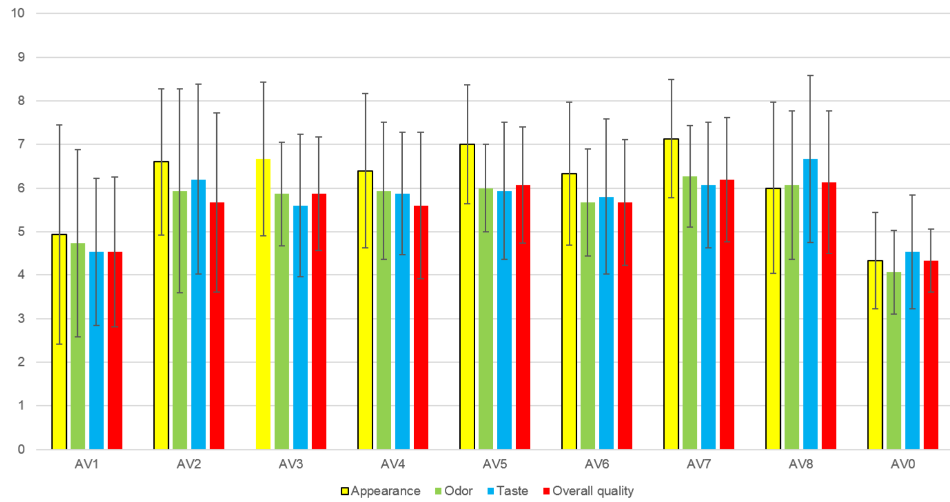

Fig. 2 - Sensorial analyses of wines made with different yeast strains

CONCLUSIONS

The yeast strains used influence the general characteristics of wines.

1. 12 major volatile compounds have been quantified, grouped in four chemical groups (alcohols, polyols, ethyl esters and carbonyl compounds). The quantity of each compound varied depending on the yeast strain used.
2. There are color differences between the studied wines.
3. The sensorial analysis carried out confirms the analytical results.

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