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ORIGINAL PAPER

Yeast strain effect on the concentration of major volatile compounds and sensory profile of wines from *Vitis vinifera* var. Treixadura

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Abstract The fermentative ability of five *Saccharomyces cerevisiae* strains and their influence on the aroma and sensory properties of wine from Treixadura were evaluated to determine the most suitable yeast that produces a high quality wine from this grapevine variety. The results indicated that all strains, except T2, were able to lead the vinification process and have good fermentative powers. The chemical composition of wines obtained with resident cellar yeasts consisted of a significant amount of glycerol, a compound that contributes to the structure and smoothness in taste of the wine. In addition, these strains were good producers of acetates, ethyl esters and fatty acids, compounds that positively influence wine aroma. Compounds with a direct contribution to the aroma of Treixadura wines (Odour Activity Value >1) included 2-methyl-1-butanol, 3-methyl-1-butanol, 2-phenylethanol, isoamyl and ethyl acetate and the ethyl esters, ethyl butyrate, ethyl hexanoate, ethyl octanoate and ethyl decanoate. Sensory analysis supported the fact that cellar strains produced more fruity and floral wines than commercial or spontaneous fermentations. We conclude that resident cellar yeasts enhanced sensory quality of wines from Treixadura.

Keywords Treixadura wines · *Saccharomyces cerevisiae* strains · Volatile compounds · Odour activity value · Sensory analysis

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Introduction

Wine aroma depends on a number of factors, including the variety of the grape, vinification techniques and aging (Swiegers et al. 2005; Dubourdieu et al. 2006). Yeasts play an essential role in winemaking because they are responsible for alcoholic fermentation. During the conversion of sugars into alcohol, yeasts also produce other minor metabolites that define the aroma and sensory properties of wine. These minor compounds, which include higher alcohols, esters, carbonyls, volatile fatty acids and sulphur compounds, are derived from sugar and amino acid metabolism, and their production is species- and strain-dependent (Soles et al. 1982; Romano et al. 2003; Swiegers et al. 2005). The influence of the yeast strain leading the fermentation on the aroma and sensory properties of wine have been widely reported (Herraiz et al. 1990; Henick-Kling et al. 1998; Egli et al. 1998; Pérez-Coello et al. 1999; Wondra and Berovic 2001; Nurgel et al. 2002, 2003).

In Galicia (NW of Spain), some studies have been published regarding the influence of different commercial or autochthonous *Saccharomyces* yeast strains on the chemical composition and sensory characteristics of wine, mainly focusing on Albariño variety (Vilanova et al. 2005; Vilanova and Masneuf-Pomarade 2005; Blanco et al. 2006a). However, no information is available concerning the role of yeast strains on the sensory and aromatic characteristics of Treixadura wines.

Treixadura is a traditional white variety of *Vitis vinifera* grown in Galicia, where it is recognised as one of the most important grapevine varieties. The quality of Treixadura grapes is appreciated in winemaking because Treixadura grapes produce monovarietal, young, balanced wines with an important aroma potential (Falqué et al. 2001, 2002). Studies of the compounds that defined the varietal aroma

(terpenes and C_{13}-norisoprenoids) from grapes and must of Treixadura have shown that the majority of varietal compounds are present in a bound form (Cortés 1997; Duran 2003). In addition, results published about secondary aromatic compounds of Treixadura wines (acetates, ethyl esters, acids and higher alcohols) produced by yeasts during alcoholic fermentation documented an important group, both at the qualitative and quantitative levels, that could have a significant contribution to the final aroma of Treixadura wines (Falqué et al. 2002).

In this study, the fermentative ability of five different *Saccharomyces cerevisiae* strains and their influence on aromatic and sensory characteristics of wines made from Treixadura grapes were evaluated to define the most suitable yeast to obtain high quality wines with peculiar properties.

Materials and methods

Yeast strains and culture media

The *Saccharomyces cerevisiae* strains used in this study (T2, T4, T6 and T8) were previously isolated in the experimental cellar of Estación de Viticultura e Enoloxía de Galicia (EVEGA) from spontaneous fermentations of Treixadura (Blanco et al. 2006b). These strains were chosen due to their frequency of appearance in the spontaneous fermentations (Blanco et al. 2006b) and their good oenological traits. The commercial yeast used was D47 from Lalvin. Yeast strains were grown and stored in YPD medium containing the following: 1% (w/v) yeast extract, 2% (w/v) peptone and 2% glucose (w/v).

Fermentations

Grapes from *Vitis vinifera* var. Treixadura were harvested at optimum maturity during the 2004 vintage in the experimental vineyard of EVEGA. Grapes were crushed and 50 mg l^{-1} of SO_2 was added. After pressing, the juice was allowed to settle, separated from the lees and randomly distributed into twelve 35 l stainless steel tanks. Six microvinifications were performed in duplicate using standard protocols for white wines: (W-Sp) Spontaneous fermentation carried out by the native yeasts present in the must, W-D47 (inoculated with commercial yeast) and W-T2, W-T4, W-T6 and W-T8 inoculated with strains T2, T4, T6 and T8, respectively. Clarified Treixadura juice, with a minimum of 25 mg l^{-1} of free SO_2, was inoculated with each yeast strain. D47 was added as suggested by the manufacturer. Strains T2, T4, T6 and T8 were previously grown in YPD medium at 28°C for 24 h; following this, the cells were recovered by centrifugation, washed with sterile water and added to the must at 10^6 cells ml^{-1}. No yeasts were added to the spontaneous process. All fermentations were conducted at 18°C in a cold room. The normal development of alcoholic fermentation was checked by daily monitoring of the temperature and density values. A decrease in density is directly proportional to the decrease of sugar in the must during the fermentation and its consequent conversion into ethanol. In addition, a representative number of yeast colonies (ten) were isolated at middle fermentation (density 1,030–1,040 g l^{-1}) to control if the inoculated strain had led the fermentation (Santamaría et al. 2007). Yeast strains were characterised by mtDNA restriction profiles as described by Querol et al. (1992).

At the end of the alcoholic fermentation, all wines were racked off gross lees and sulphur dioxide was added to yield a free SO_2 of 25 mg l^{-1}. After this, the wines were bottled and stored at 13–18°C until analysis.

Chemical analysis

General wine parameters (volumic mass, alcohol content, residual sugars, pH, titratable and volatile acidity, tartaric, malic and lactic acids, glycerol and free and total sulphur dioxide) were determined following the official methods of analysis (Anonymous 1993).

The concentration of volatile compounds was determined by gas chromatography. For determining the major volatile compounds (methanol, aldehydes and higher alcohols), 1 ml of an internal standard solution (1 g of 4-methyl-2-pentanol per 1 l of ethanol) was added to 10 ml of a wine sample. A total of a 2 µl aliquot was injected directly into the chromatograph and split 1:20. The analyses were conducted using an Agilent Technologies 6890 N Gas Chromatograph equipped with a 7683 Series Automatic Injector and a flame ionisation detector. The compounds were separated on a CHROMPACK CP-WAX 57CB (polyethylene glycol stationary phase; 50 m × 0.25 mm id with 0.25 µm film thickness) fused silica capillary column. Instrumental conditions were as follows: injector temperature of 250°C, detector temperature of 260°C, H_2 as carrier gas at 1.5 ml min^{-1}; nitrogen as make-up gas at 30 ml min^{-1}. The detector gas flow rates included hydrogen at 50 ml min^{-1} and air at 400 ml min^{-1}. The temperature program of the oven was as followed: initial temperature of 40°C (isotherm for 5 min); ramp at 3°C min^{-1} to 220°C; post run of 40°C during 1 min with a total run time of 57.43 min.

Acetates, ethyl esters and fatty acids were determined according to the method described by Bertrand (1981) where 2 ml of 3-octanol (50 mg l^{-1}) and 2 ml of heptanoic acid (70 mg l^{-1}), both used as internal standards, and 1 ml of sulphuric acid (1/3) were added to 50 ml of wine. Each sample was extracted three times with 4, 2 and 2 ml of diethyl ether-hexane (1:1, v/v). A total of 1 µl of the

organic extract was injected into the chromatograph in the splitless mode (30 s). The analyses were conducted using an HP 5890 gas chromatograph and a flame ionisation detector. The compounds were separated on a FFAP (polyethylene glycol stationary phase; 50 m × 0.2 mm id with 0.33 μm film thickness) fused silica capillary column. Instrumental conditions were as follows: injector temperature at 220°C, detector temperature at 250°C, H_2 as carrier gas at 1.3 ml min^{-1}; nitrogen as make-up gas at 30 mL min^{-1}. The detector gas flow rates were hydrogen at 50 ml min^{-1} and air at 400 ml min^{-1}. Temperature program was as follows: initial temperature at 50°C; ramp at 3°C min^{-1} to 200°C after which the temperature was held constant for 25 min for a total run time of 75 min. All volatile compounds were identified by comparing retention times with those of pure standards. The internal standard method was used for quantitative purposes.

To evaluate the contribution of a volatile compound to the aroma, the odour activity value (OAV) was calculated as the ratio between the concentration of each compound and the perception threshold in a specified matrix found in the literature (Swiegers et al. 2005; Francis and Newton 2005).

Statistical analysis

Statistical analysis of the wine volatile compounds was performed using an analysis of variance (ANOVA) and the least significant difference (LSD) test to determine statistically different values at a significance level of $\alpha \leq 0.05$. The statistical analyses were performed using *Statistica* for Windows (1995), version 5.1.

Sensory analysis

Wines were evaluated by a panel of seven trained judges, including enologists, winemakers and laboratory personnel, all with extensive wine tasting experience. Panellists were selected based on interest and availability. A simple scorecard was used to evaluate the wine samples. The aspects included were the visual phase, aroma (floral, fruity, spicy and faulty), and mouthfeel (sourness, bitterness, roundness, persistence, palate weight), which were rated on a scale from 1 (not present) to 5 (most intense). Samples of wine (30 ml) coded with random numbers were served in clear tulip-shaped glasses.

Results and discussion

In this study, the fermentative behaviour of different *S. cerevisiae* strains and their influence on aromatic and sensory characteristics of wines made from Treixadura grapes were evaluated. Four yeasts (T2, T4, T6 and T8) that had been previously isolated from the experimental cellar of EVEGA (Blanco et al. 2006b) were compared to commercial yeasts and spontaneous fermentations using Treixadura must.

Fermentation ability and microbiological control

All strains showed a normal fermentation curve (Fig. 1). Cellar strains that were added from fresh cultures started fermentation faster (day 1) than the commercial strains (day 2) and the spontaneous process (day 3). Fermentation speed was similar for all inoculated strains but slower in the spontaneous vinification. The study of the yeast colonies isolated from spontaneous fermentation revealed the existence of at least six different mtDNA profiles (i.e., six different strains). From all of them, strain 1 was dominant and appeared at a frequency of 50%. However, all colonies analysed from inoculated vinifications showed the same pattern, indicating that inoculated strains of *S. cerevisiae* were able to control the fermentations and dominate over the indigenous yeasts present in the must.

Chemical composition of wine

The basic composition of wines is summarised on Table 1. The results showed that all wines were fermented to dryness except W-T2, which had a high amount of reducing sugars, indicating that fermentation was not complete. Fermentations with yeast strains isolated in the EVEGA cellar produced higher values of volatile acidity although within the range legislated for white wines. Important differences were also found in the glycerol content, which is a relevant compound in wine technology due to its contribution to the smoothness, and thus, its ability to improve the sensory quality of the wine (Kukec et al. 2003; Gawel et al. 2007). Glycerol concentration in wine depends

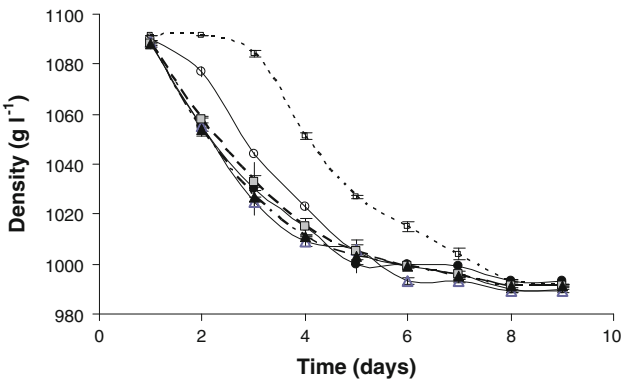

Fig. 1 Fermentation curves of *S. cerevisiae* strains (*open circle*) D47, (*filled circle*) T2, (*open triangle*) T4, (*filled square*) T6, (*filled triangle*) T8 and (*open square*) spontaneous fermentation. Fermentations were conducted in duplicate at 18°C in a cold room

Table 1 Chemical composition of wines from Treixadura must obtained from different *S. cerevisiae* strains

Parameters	Spontaneous fermentation *W-Sp*	Commercial yeasts *W-D47*	Cellar yeasts			
			W-T2	*W-T4*	*W-T6*	*W-T8*
Volumic mass (g ml^{-1})	0.98978	0.98956	0.99193	0.98931	0.98992	0.99027
Alcohol (%v/v)	13.1	13.0	12.7	13.1	13.1	13.0
Residual sugars (g l^{-1})	3.3	1.3	7.0	2.5	3.5	3.8
Titratable acidity (g l^{-1}) as tartaric acid	5.7	6.1	5.8	5.4	5.8	5.7
Volatile acidity (g l^{-1}) as acetic acid	0.17	0.11	0.32	0.32	0.49	0.30
pH	3.33	3.29	3.29	3.37	3.34	3.33
Tartaric acid (g l^{-1})	1.8	1.6	1.7	1.6	1.5	1.7
Malic acid (g l^{-1})	2.8	2.8	2.9	2.6	2.7	2.9
Lactic acid (g l^{-1})	0.4	0.4	0.4	0.4	0.4	0.4
Free SO_2 (mg l^{-1})	6.0	12.0	7.0	6.0	10.0	6.0
Total SO_2 (m l^{-1})	59	66.0	77.0	77.0	74.0	72.0
Glycerol (g l^{-1})	6.5	7.8	7.7	8.2	8.8	10.4

on the yeast strain, medium and vinification conditions; the average value is 7 g l^{-1} (Karasu Yalçin and Yesim Özbas 2006). In this study, cellar strains (especially T8) produced wines with higher glycerol concentrations than the spontaneous and commercial yeasts.

In regards to the aroma composition, 12 from a total of 43 volatile compounds determined had significant differences between the wines studied (Table 2).

The content of higher alcohols, which play an important role in the quality of white wines, ranged from 210.87 to 260.91 mg l^{-1}. These values were lower than 300 mg l^{-1} in all cases, a rate that can be considered to cause undesirable aroma in wine (Rapp and Versini 1991). Wines from commercial and spontaneous fermentation presented higher concentration and thus significant differences in propanol, butanol and 2-phenylethanol when compared to wines elaborated with the cellar strains. The later compound, 2-phenylethanol, may cause sweet and flowery notes in wines, which are considered as positive aroma characteristics. No significant variation was obtained for the remaining higher alcohol contents. However, it is notable that the highest content of isoamyl alcohols (2-methyl-1-butanol and 3-methyl-1-butanol) was found in the wine elaborated with the strain T2. The latter compounds are related to the fine, fruity character of wine (Wondra and Berovic 2001).

Among acetates, only the isoamyl and ethyl acetate showed significant differences between the wines analysed. Acetates and short-chain fatty acid esters are relevant for sensory characteristics of white wines because they provide floral and fruity notes (Soles et al. 1982). Ethyl acetate, the main ester occurring in wine, positively contributes to the quality of wine in low concentrations; however, when its concentration is greater than 150–200 mg l^{-1}, impart spoilage character to the wine (Majdak et al. 2002). The concentration of ethyl acetate is strongly influenced by acetic acid content. According to this observation, T6 was the yeast strain that produced the significantly highest amount of both compounds, although at concentrations below those values considered to spoil the wine. The concentration of isoamyl acetate was significantly higher for wines elaborated with cellar strains (T4, T6 and T8) and contributed to fruity notes (banana) of the wine aroma as shown in the sensory analysis. The most efficient acetate producers also synthesised the highest content of short chain fatty acid esters (ethyl hexanoate, ethyl octanoate and ethyl decanoate), which has relevance to the global wine aroma (Table 2).

Total ester concentrations ranged from 7.78 mg l^{-1} in W-T4 wine that was fermented with the selected T4 strain to 10.11 mg l^{-1} in wines from spontaneous fermentation (Table 2). Differences in ethyl ester content were mainly due to ethyl lactate; however, only the concentration of ethyl mirystate showed a significant difference between the wines, although the level of this compound were so low that it did not contribute to the sensory profile. Because no malolactic fermentation occurred, all ethyl lactate was due to yeast activity, and the commercial yeast the best producer of this compound.

No significant differences were found in the concentration of fatty acids, except for acetic acid, which showed a significantly higher concentration in the must fermented with the T6 cellar yeast.

Finally, the results obtained for other volatile compounds showed that benzaldehyde, acetaldehyde, acetoin, 2-furaldehyde and 2,3-butandiol had significant differences between the wines (Table 2). Of these, acetaldehyde is the main aldehyde formed during winemaking as a normal by-product of alcoholic fermentation and its production can be

Table 2 Mean concentration (mg l^{-1}) and analysis of variance of the volatile compounds determined in this study

Compounds	Spontaneous fermentation	Commercial yeasts	Cellar yeasts				LSD	
	W-Sp	*W-D47*	*W-T2*	*W-T4*	*W-T6*	*W-T8*	*F*	*p*
Methanol	19.84	19.96	23.29	20.92	22.18	18.66	0.836	0.412
Higher alcohols								
1-propanol*	29.85	52.80	20.12	18.39	18.17	16.87	10.44	0.032
2-methyl-1-propanol	30.53	14.94	30.52	31.47	38.49	33.39	3.853	0.121
1-butanol*	1.42	1.13	1.06	0.84	0.89	0.90	9.559	0.037
2-methyl-1-butanol	39.37	36.37	40.49	33.35	33.90	35.19	0.668	0.46
3-methyl-1-butanol	148.69	105.63	168.72	155.89	132.19	154.18	2.159	0.216
Σ Higher alcohols	*249.86*	*210.87*	*260.91*	*239.94*	*223.64*	*240.53*	–	–
trans-3-hexenol	0.07	0.05	0.04	0.03	0.03	0.07	1.281	0.321
cis-3-hexenol	0.22	0.26	0.28	0.25	0.26	0.25	1.524	0.285
Hexanol	1.17	1.37	1.41	1.23	1.23	1.11	0.051	0.833
Benzyl alcohol	1.32	1.40	1.55	1.10	1.32	1.24	0.161	0.709
2-phenylethanol*	35.84	45.16	30.66	29.25	21.35	28.44	9.581	0.036
1-nonanol	5.51	3.51	7.35	4.65	9.32	7.01	2.715	0.175
Acetates								
Isoamyl acetate*	1.65	0.93	1.50	1.94	1.98	2.38	8.587	0.031
Hexyl acetate	0.08	0.05	0.06	0.08	0.08	0.07	0.414	0.555
2-phenylethyl acetate	0.02	0.02	0.04	0.04	0.02	0.01	0.444	0.541
Ethyl acetate*	28.09	16.09	33.71	29.34	36.42	27.81	9.244	0.018
Σ acetates	*29.84*	*17.09*	*35.31*	*31.4*	*38.5*	*30.27*	–	–
Esters								
Ethyl butyrate	0.55	0.56	0.62	0.31	0.40	0.43	1.382	0.305
Ethyl hexanoate	0.68	0.44	0.50	0.67	0.61	0.58	0.11	0.757
Ethyl heptanoate	0.01	0.01	0.08	0.01	0.01	nd	0.293	0.617
Ethyl lactate	6.65	7.43	6.61	4.21	5.47	6.16	3.03	0.157
Ethyl octanoate	1.11	0.55	0.66	1.16	1.01	0.87	0.165	0.706
Ethyl nonanoate	0.01	0.02	0.02	0.02	0.02	0.01	0.267	0.633
Ethyl decanoate	0.34	0.12	0.21	0.42	0.01	0.24	0.005	0.948
Diethyl succinate	0.74	0.88	0.87	0.95	0.71	0.68	0.005	0.947
Ethyl dodecanoate	0.02	nd	nd	nd	0.01	nd	1.091	0.355
Ethyl myristate*	nd	nd	0.05	0.03	0.02	0.03	11.86	0.026
Σ esters	*10.11*	*10.01*	*9.62*	*7.78*	*8.27*	*9.0*	–	–
Fatty acids								
Acetic acid*	43.55	21.92	79.37	49.28	116.60	64.35	8.89	0.012
Propionic acid	1.39	3.80	3.34	2.29	1.61	1.12	0.24	0.65
Isobutyric acid	1.18	1.69	2.21	2.25	3.01	1.88	5.327	0.082
Butyric acid	0.40	0.42	0.53	4.18	3.28	1.56	2.561	0.185
Isovaleric acid	1.18	1.96	1.62	1.77	1.71	1.04	0.01	0.925
Valeric acid	0.12	0.11	0.45	0.48	0.22	0.12	2.364	0.199
Hexanoic acid	3.10	2.43	2.30	2.94	2.80	2.80	0.035	0.861
Octanoic acid	5.07	3.48	4.23	5.55	4.96	4.42	0.609	0.479
Dodecanoic acid	nd	7.71	2.45	nd	nd	nd	1.638	0.27
Σ fatty acids	*55.99*	*43.52*	*96.5*	*68.74*	*134.19*	*77.29*	–	–
Other compounds								
Benzaldehyde*	0.15	1.95	1.70	2.20	1.69	2.99	9.332	0.020

Table 2 continued

Compounds	Spontaneous fermentation *W-Sp*	Commercial yeasts *W-D47*	Cellar yeasts				LSD	
			W-T2	*W-T4*	*W-T6*	*W-T8*	*F*	*p*
Acetaldehyde*	23.18	46.45	18.28	27.34	22.43	20.63	8.707	0.017
1,1-diethoxyethane	2.46	3.17	2.43	3.26	4.02	2.24	0.07	0.804
Acetoin*	3.90	5.39	3.57	3.02	3.17	3.27	8.072	0.047
Acetol	24.89	24.91	37.68	49.45	76.97	79.62	5.413	0.081
2-furaldehyde*	107.41	55.32	192.57	180.37	289.99	193.01	10.24	0.033
γ-butyrolactone	22.48	14.93	21.54	16.79	23.52	19.40	0.257	0.639
2,3-butandiol* (l + m)	451.22	564.71	382.84	328.48	322.15	314.96	16.7	0.015

nd not detected

* Significant differences at $p \leq 0.05$

influenced by a yeast strain. At low levels, acetaldehyde contributes to fruity notes; however, at high concentrations (>200 mg l^{-1}), this compound negatively influences the wine aroma (Gil et al. 2006). In this sense, all wines elaborated in this study can be considered as good quality wines because their content of acetaldehyde was lower than 200 mg l^{-1}. Additionally, the commercial yeast produced wines with significantly greater amounts of acetaldehyde and 2, 3-butandiol than the cellar strains but the commercial yeast's content in 2-furaldehyde was the lowest of all the wines studied. Concentrations of acetoin were low in all wines analysed and were within the range described by Gil et al. (0–35 mg l^{-1}). This result was expected because the content of acetoin, as well as ethyl acetate and acetic acid, increases with the malolactic fermentation, which has not been carried out in this study.

In addition to the significant differences in the concentration of the volatile compounds, the contribution of those compounds to the global aroma of the wines was calculated using the odour activity value (OAV). The results indicated that nine compounds had significant relevance (OAV > 1) (Table 3). Among them, ethyl octanoate, ethyl hexanoate and isoamyl acetate can be considered as the most influential determinants for the secondary aromas of these wines from Treixadura. The remaining compounds determined had concentrations under their odour thresholds (OAV less than 1; i.e., without direct sensory significance for the global aroma of these wines). However, these compounds might contribute to the wine aroma due to synergic effects with other compounds.

Sensory evaluation

The chemical composition of wines influenced their sensory properties. The results of the sensory analysis (Fig. 2) confirmed that the mouth and aroma of Treixadura wines depended on the inoculated yeast strain. Thus, Treixadura wines elaborated with cellar yeasts (T2-T8) showed more intensity in the attributes of mouth in concordance with their higher content of glycerol. Wines obtained with T4 were more appreciated due to their roundness, high palate weight and their low sourness and bitterness. Strain T6

Table 3 Odour threshold and quality of odorants found in the Treixadura wines with odour activity values (OAV) greater than one

Compound	Odour threshold (mg l^{-1})	Odour quality	Spontaneous fermentation *W-Sp*	Commercial yeasts *W-D47*	Cellar yeasts			
					W-T2	*W-T4*	*W-T6*	*W-T8*
2-methyl-1-butanol	30[a]	Harsh, nail polish	1.31	1.21	1.35	1.11	1.13	1.17
3-methyl-1-butanol	30[a]	Harsh, nail polish	4.96	3.52	5.62	5.20	4.41	5.14
2-phenylethanol	10[b]	Honey, spice, rose	3.58	4.52	3.07	2.93	2.14	2.84
Isoamyl acetate	0.03[b]	Banana	55.00	31.00	50.00	64.67	66.00	79.33
Ethyl acetate	7.5[a]	Nail polish, fruity	3.75	2.15	4.49	3.91	4.86	3.71
Ethyl butyrate	0.02[b]	Apple	27.50	28.00	31.00	15.50	20.00	21.50
Ethyl hexanoate	0.005[b]	Apple, peel, fruit	136	88	100	134	122	116
Ethyl octanoate	0.002[b]	Fruit, fat	555	275	330	580	505	435
Ethyl decanoate	0.2[b]	Grape	1.70	<1	1.05	2.10	<1	1.20

[a] Swiegers et al. (2005)

[b] Francis and Newton (2005)

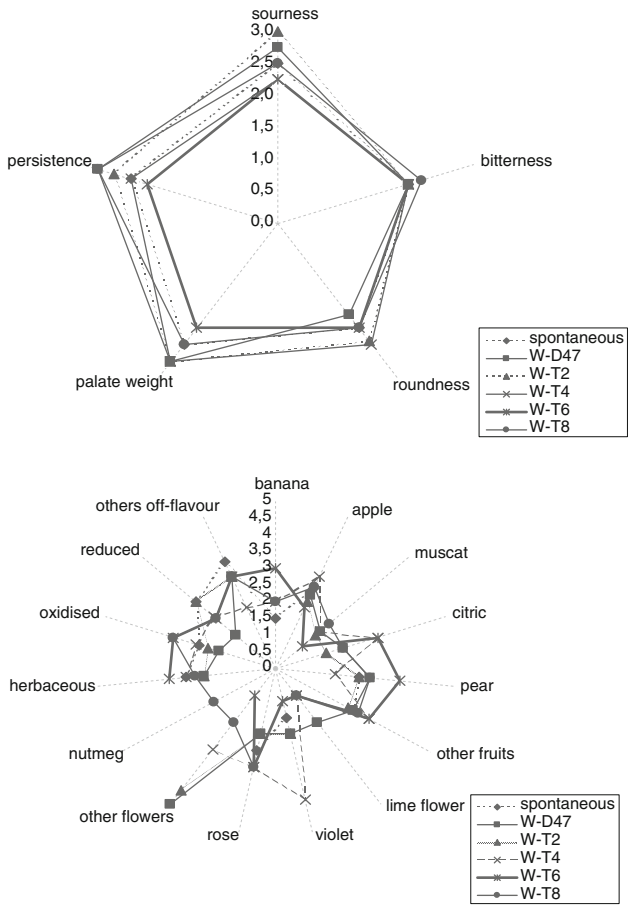

Fig. 2 Sensory profile in taste and aroma phases for the wines of Treixadura elaborated with different yeast strains

produced lighter wines, and the wines elaborated with commercial yeast had a more persistent taste in the mouth.

In terms of aroma, T6 produced wines that had more fruity flavour (banana, apple, muscat, citric, pear) than the others. It is important to note the floral contribution to the aroma of strains T2, T4, T6, especially with violet notes. The spontaneous fermentation produced more neutral wines and those with an unfavourable, off flavour.

Conclusions

In consideration of these results, we can conclude that the strains isolated in EVEGA cellar allowed us to elaborate wines with a high quality from both the chemical and sensory point of view. Higher alcohols were the most quantitatively important group of volatile compounds, while ethyl esters, acetates and fatty acids were the qualitatively important ones. Wines elaborated from commercial yeast had a higher concentration of fusel alcohols, whereas wines obtained from cellar yeasts had higher contents of ethyl esters, acetates and fatty acids. Nine compounds showed odour activity values higher than one, meaning that they directly contributed to the aroma of Treixadura wine. These compounds were mostly ethyl esters and acetates with fruity notes. Sensory data were in agreement with the chemical composition. Although the commercial yeast allowed us to obtain a high quality wine, the possibility of employing local yeasts is more attractive based on these results. These yeast strains are well adapted to grape varieties and winery conditions while producing wines with a peculiar quality.

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