ANALYSIS OF PRIMARY, SECONDARY AND TERTIARY AROMAS IN *VITIS VINIFERA L.* SYRAH WINES WITH AN EXTEMPORANEOUS PRODUCTION CYCLE IN TWO REGIONS OF SÃO PAULO – BRAZIL, USING GC-MS.

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Abstract:

Context and purpose of the study - The aromatic perception is one of the main factors that influence the consumer when determining the wine's quality and acceptance. Numerous factors (soil, climate, winemaking style, cultivar) can influence the volatile compounds. Some of these compounds are released directly from the grape berries while others are formed during the fermentation and aging processes. However, little is known about the quality and aromatic formation of Syrah variety in the winter cycle cultivated in São Paulo. This study aimed to characterize the primary (originated from the grape), secondary (fermentation) and tertiary aromas (evolution) of these wines, showing the wine potential from new producing regions in São Paulo state.

Material and methods – The microvinifications were made using the traditional method. The Syrah variety (clone 174 ENTAV - INRA ® on rootstock 1103P - clone 768 ENTAV - INRA ®) was conducted in double cordon VSP system, with winter harvest in Indaiatuba (low altitude and hot climate) and São Bento do Sapucaí (high altitude and cold) - Brazil. The analyses of volatile compounds were carried out in the main stages of the vinification process (must extraction, after alcoholic fermentation, after malolatic fermentation, before packaging and after 6 months in bottle). The samples were collected and frozen at -80 ° C until analysis. An Agilent 7890 GC system coupled to 5977 MS detector equipped with a Supelcowax column (30m x 0.25mm x 0.25µm film thickness) was used.

Results – Vines from the Indaiatuba region presented an average production of 7 bunches per plant. The bunches showed average weight of 76.5 g and size of 10.9 cm. Berries had 11 mm diameter and weighed 1.5 g. Must presented total soluble solids of 20ºBrix, total acidity of 105 meq.L^{-1}, pH 3 and 1084 density. 24 primary aromas were found, such as lavender and apricot, 42 secondary aromas such as cooked apple and roses, and 17 tertiary aromas such as butter and honey. The vines of São Bento do Sapucaí presented an average of 9 bunches per plant. Bunches with an average weight of 101.8 g and length of 13 cm. Berries had a diameter of 12.5 mm and a weight of 1.5 g. Must presented total soluble solids of 21.5ºBrix, total acidity of 100 meq.L^{-1}, pH 3 and 1090 density. The must had 29 primary aromas, such as mint and pear, 36 secondary aromas, such as honey and rose-orange, and 20 tertiary aromas such as wintergreen and mint.

Keywords: Grapevine, Syrah, Grapevine cycle modification, Aroma, Cromatography, Brazil.

1. Introduction.

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Introduction & Objectives

The aromatic perception is one of the main factors that influence the consumer when determining wine's quality and acceptance. Numerous factors can influence the volatile compounds. However, little is known about the quality and aromatic formation of Syrah variety in the winter cycle cultivated in two regions of São Paulo-Brazil. This study aimed to characterize the primary (originated from the grape), secondary (fermentation) and tertiary aromas (evolution) of these wines, showing the wine potential from new producing regions in São Paulo state.

Material & Methods

The microvinifications were made using the traditional method. Syrah variety (clone 174 ENTAV - INRA ® on rootstock 1103P - clone 768 ENTAV - INRA ®) was conducted in double cordon VSP system, with winter harvest. This work was carried out in two regions of Sao Paulo – Brazil. Indaiatuba (IN): subtropical-dry winter climate (Cwa), altitude 575m, average temperatures of 21° C and sandy soil. São Bento do Sapucaí (SB): dry winter highland climate (Cwb), altitude 1.200m, average temperatures of 15.1 ° C and clayey soil. For SPME-HS-GC-MS analysis of wine production in different stages, it was used an Agilent 7890 GC system coupled to 5977 MS detector equipped with a Supelcowax column (30m x 0.25mm x 0.25µm film thickness).

Results & Discussion

CAS	Compound	Description	Process: Must	A.F	M.F	Bottling 24 weeks
	ALCOHOLS					
3391-86-4	1-Octen-3-ol	Mushroom	SB-IN	-	-	-
928-96-1	3-Hexen-1-ol, (Z)-	Herbaceous	SB	-	-	-
60-12-8	Phenylethyl Alcohol	Spices	SB-IN	SB-IN	SB-IN	SB-IN
78-83-1	Isobutanol	Wine Like	-	SB	SB	SB
64-17-5	Ethanol	Alcohol	-	SB-IN	SB-IN	SB-IN
111-27-3	1-Hexanol	Fresh Herbaceous	SB-IN	SB-IN	SB-IN	SB-IN
111-87-5	1-Octanol	Orange-Rose	SB	SB-IN	SB-IN	SB-IN
143-08-8	1-Nonanol	Floral	-	-	-	SB
818-49-5	4-Methyl-1-hexanol	Sweet	-	IN	IN	IN
	TERPENES					
562-74-3	Terpinen-4-ol	Spices	IN	-	-	-
555-10-2	beta.-Phellandrene	Mint terpentine	SB	-	-	-
527-84-4	o-Cymene	Citrus	SB	-	-	-
99-83-2	.alpha.-Phellandrene	Spices	SB	-	-	-
	ESTER					
123-66-0	Ethyl hexanoate	Red Fruits	SB-IN	SB-IN	SB-IN	SB-IN
110-38-3	Ethyl Decanoate	Cognac	IN	SB-IN	SB-IN	SB-IN
111-11-5	Methyl octanoate	Citrus Fruits	SB	SB-IN	SB-IN	SB-IN
142-92-7	Hexyl acetate	Red Fruits	SB-IN	SB-IN	SB-IN	SB-IN
106-32-1	Ethyl octanoate	Floral	SB-IN	SB-IN	SB-IN	SB-IN
105-54-4	Ethyl butanoate	Ripe Fruit	-	SB	SB	SB
123-92-2	Isoamyl acetate	Red Fruits	-	SB-IN	SB-IN	SB-IN
106-30-9	Ethyl Heptanoate	Cognac	-	SB-IN	SB-IN	SB-IN
123-25-1	Diethyl succinate	Fruity	-	SB-IN	SB-IN	SB-IN
141-78-6	Ethyl Acetate	Fruity	-	IN	IN	SB-IN
2035-99-6	Isoamyl Octanoate	Green Fruit	-	IN	IN	IN
103-45-7	Phenethyl acetate	Sweet Floral	-	SB-IN	SB-IN	SB-IN
78-36-4	Linalyl butanoate	Honey	-	-	-	IN
76649-16-6	Ethyl trans-4-decenoate	Citrus Fruits	-	SB-IN	SB-IN	SB-IN
2198-61-0	Isopentyl hexanoate	Green Fruit	SB	SB-IN	SB-IN	SB-IN
118-61-6	Ethyl salicylate	Wintergreen	-	IN	IN	IN
628-97-7	Ethyl Palmitate	Creamy	-	IN	IN	IN
638-11-9	Isopropyl butyrate	Ripe Pineapple	-	-	-	IN
141-16-2	Citronellyl butyrate	Rose	-	-	SB	SB
124-06-1	Ethyl tetradecanoate	Lily	-	SB-IN	SB-IN	SB-IN
106-73-0	Methyl Heptanoate	Lily	-	SB	SB	SB
119-36-8	Methyl salicylate	Mint	-	IN	IN	IN
106-33-2	Ethyl Dodecanoate	Floral	IN	SB-IN	SB-IN	SB-IN
	ALDEHYDE					
110-62-3	Pentanal	Dry Fruit	SB-IN	-	-	-
6728-26-3	2-Hexenal, (E)-	Green Banana	SB	-	-	-
100-52-7	Benzaldehyde	Cherry	SB	-	-	-
66-25-1	Hexanal	Herbaceous	SB	-	-	-
124-19-6	Nonanal	Floral	SB-IN	SB-IN	SB-IN	SB-IN
	KETONES					
110-93-0	5-Hepten-2-one, 6-methyl-	Citrus Fruits	SB	-	-	-
23726-93-4	Beta-Damascenone	Tobacco	-	-	-	IN
14073-97-3	l-Menthone	Deep Menthol	SB	-	-	-
	FURANOIDE					
67-47-0	5-Hydroxymethylfurfural	Buttery / Caramel	SB	-	-	-

Table: Analysis results of volatiles compounds during the winemaking process (Must, A.F., M.F., Bottling, 24 weeks)
A.F.: Alcoholic Fermentation; M.F.: Malolatic Fermentation; SB: São Bento do Sapucaí region
IN: Indaiatuba region All compounds obtained were confirmed by the Kovats index by literature

- The wines from SB, region with clayey soil, present a higher concentration of floral esters, such as Citronelil butyrate and Methyl Heptanoate. While the wines from IN, region with sandy soil, present more esters of the green series, such as Salicylate of Ethyl and Octanoate of Isoamyl (Gomez-Miguez et al, 2007);
- Tertiary compounds (post-fermentations) with 24 weeks after bottling in IN present complex aromas such as Honey (Linalyl butanoate), Ripe Pineapple (Isopropyl butyrate), Mint (Methyl salicylate) and Tobacco (Beta-Damascenone). SB presents more fresh aromas like Floral (1-Nonanol) and Lily (Methyl Heptanoate). This difference can be due to the hottest temperatures in Indaiatuba favoring the formation of compounds such as Beta-Damascenone (Sabón et al, 2002);
- SB presented higher amounts of terpenes such as beta-Phellandrene (Mint terpentine), o-Cymene (Citrus) and .alpha.-Phellandrene (Spices), whereas IN only Terpinen-4-ol (Spices). In the wines from both regions no terpenes were found in the other stages of winemaking.


São Bento do Sapucaí


Indaiatuba

Conclusions

Although the studied varieties have the same clone, same rootstock, and same conduction system, it was possible to point out some differences in relation to the aromatic composition. This can be due to the different "terroir" of each region. The extemporaneous cycle Syrah in the two regions presents aromatic complexity.

References

Sabon, I.; De Revel, G.; Kotseridis, Y. and Bertrand, A. Determination of volatile compounds in Grenache wines in relation with diferent terroirs in the Rhone Valey. J. Agric. Food Chem. 50:6341-6345, 2002.
Gómez-Míguez, M.;Gómez-Míguez, J.; Vicario, I. M.;Heredia,F. J. Assessment of colour and aroma in white wines vinifications: Effects of grape maturity and soil type. J. of Food Engineering. 79. 758-764. 10.1016, 2007.

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