

## RESEARCH NOTE

# Sensory Impact of 2-Methoxy-3-Isobutylpyrazine and 4-Mercapto-4-Methylpentan-2-One Added to a Neutral Sauvignon blanc Wine

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**2-Methoxy-3-isobutylpyrazine (ibMP) and 4-mercapto-4-methylpentan-2-one (MMP) are considered amongst the most important Sauvignon blanc impact aroma components. These two components were added, separately and in combination at increasing concentrations, to different media, i.e. deionised water, a neutral non-Sauvignon blanc white wine and a neutral Sauvignon blanc wine. The media were then sensorially evaluated. The nuances perceived, varied from dusty, grassy to green pepper for ibMP and from guava, sulphur-like to cat urine or "conifer" for MMP. It was confirmed that ibMP and MMP are important impact components and that their contribution, either positive or negative, varied according to medium type and composition, as well as to the concentration levels of the components. This may be ascribed to the combined synergistic action of these two components. Other typical Sauvignon blanc aroma nuances, such as asparagus, gooseberry, passion fruit and fig were not detected and the relationship between these aromas and other Sauvignon blanc aroma impact components needs to be further investigated.**

The typical cultivar aroma of *Vitis vinifera* L. cv. Sauvignon blanc is described as vegetative, grassy, herbaceous, gooseberry-, asparagus- and green pepper-like. These nuances are mainly caused by a specific group of chemical components, namely methoxypyrazines. The most important contributor appears to be 2-methoxy-3-isobutylpyrazine (ibMP), which normally occurs in much higher concentrations in Sauvignon blanc grapes and wines than other methoxypyrazines, such as 2-methoxy-3-isopropylpyrazine and 2-methoxy-3-sec-butylpyrazine (Allen *et al.*, 1988; 1991; Lacey *et al.*, 1991). Other components of special importance to the typical Sauvignon blanc aroma are a group of sulphur-containing components, namely 4-mercapto-4-methylpentan-2-one (MMP) (Dubourdieu, Darriet & Lavigne, 1993; Darriet *et al.*, 1995), 3-mercaptohexyl acetate (Tominaga, Darriet & Dubourdieu, 1996), 4-mercapto-4-methylpentan-2-ol and 3-mercaptohexan-1-ol (Tominaga *et al.*, 1998b). Depending on the concentration level of MMP, it can present a box tree or cat urine aroma (Darriet *et al.*, 1995). This component is formed during fermentation from a cysteine precursor (Tominaga, Peyrot des Gachons & Dubourdieu, 1998a) and does therefore not occur in grapes and juice. Some of the above-mentioned components have extremely low threshold values, i.e. ibMP: 2ng/L in water (Buttery *et al.*, 1969) and 1 ng/L in wine (Allen *et al.*, 1988), and MMP: 0,1 ng/L water and 3 ng/L in wine (Dubourdieu *et al.*, 1993).

In previous studies, a correlation between ibMP levels and the perceived typical Sauvignon blanc aroma was not always found (Marais, Hunter & Haasbroek, 1999). Naturally, the complexity and nuances of Sauvignon blanc aroma will depend on the presence of all impact and other components, and whether they occur at levels above their threshold values. Furthermore, synergism probably plays an important role and the same component can manifest differently in different media. Maga (1989) demonstrat-

ed that methoxypyrazine nuances varied according to concentration level and medium. Since ibMP and MMP are widely considered as the most important contributors to Sauvignon blanc aroma, it was decided to investigate the combined synergistic action of these two components. The purpose of this investigation was therefore to determine the effect of added ibMP and MMP, separately and in combination, on the aroma of a neutral Sauvignon blanc wine. In an effort to detect synergistic effects, a neutral non-Sauvignon blanc white wine and water were included as additional evaluation media.

## MATERIALS AND METHODS

**Material:** Two components, ibMP and MMP, were added to 250 mL lots of deionised water, a neutral non-Sauvignon blanc white wine and a neutral Sauvignon blanc wine. Both wines were from the 1998 vintage and locally produced. The components were added at the following concentrations: 0, 2, 4, 8, 16, 24 and 30 ng/L for ibMP, and 0, 0,2, 1, 5, 10, 15 and 20 ng/L for MMP. The ibMP was prepared by making a stock solution in ethanol from the pure substance, and MMP by making a stock solution in ethanol from a 0,4% MMP in polyethyleneglycol solution. This exact percentage was confirmed before use by gas chromatographically-determined peak areas. The concentration levels selected, correspond to actual wine values reported in the literature (Lacey *et al.*, 1991; Allen, Lacey & Boyd, 1994; Tominaga, Murat & Dubourdieu, 1998c). The two components were also added in different combinations (see Table 1). The samples were stored in the dark at 18°C under N<sub>2</sub> for one day prior to sensory evaluation.

**Sensory evaluation:** A panel of eight judges evaluated the samples. Five members of the panel were well-experienced in the evaluation of Sauvignon blanc aroma, while the rest was fairly experienced. No training was done and the judges were allowed

to express their own opinions of the aroma nuances perceived. The common, well-known aroma descriptions, such as grassy, green pepper, guava and cat urine were, however, mentioned to the judges. The occurrence of the aroma of a conifer shrub (probably *Juniperus sabina*) (Bloom, 1994), which resembles that of cat urine when the foliage is crushed or when it is exposed to full sunlight, was demonstrated. This particular aroma will be referred to as "conifer". Each description of each aroma was firstly individually given on a blank evaluation form without any indicated wine terms. The three media were presented to the judges in sequence of increasing concentrations of the added components (see Table 1). Each sample was discussed afterwards to obtain a uniform description. Written comments were also studied later to confirm the outcome of the discussions.

## RESULTS AND DISCUSSION

The aroma descriptions of the three media to which ibMP and MMP were added separately and in combination, are presented in Table 1. Although a neutral Sauvignon blanc wine was chosen, it can be assumed that it contained minute amounts of at least ibMP, which could have affected the outcome of the results. Generally, ibMP caused dusty, grassy, herbaceous and green pepper nuances, and MMP, "conifer", guava, sulphur-like and cat urine nuances.

TABLE 1

Aroma descriptions of 2-methoxy-3-isobutylpyrazine (ibMP) and 4-methyl-4-mercaptopentan-2-one (MMP) added to different media.

Component	Concentration (ng/L)	Aroma description and medium		
		Deionised water	Neutral non-Sauvignon blanc wine	Neutral Sauvignon blanc wine
Control	0	None	Only wine aroma/fruity	Only wine aroma/fruity
ibMP	2	Dusty	Only wine aroma/fruity	Only wine aroma/fruity
	4	Dusty/grassy	Grassy/green pepper/fruity	Grassy/fruity
	8	Dusty/grassy/green beans/herbaceous	Grassy/green pepper/fruity	Grassy/fruity
	16	Grassy/green beans/herbaceous	Grassy/green pepper/fruity	Green pepper/grassy
	24	Green pepper/green beans/herbaceous	Green pepper/fruity	Green pepper/grassy
	30	Green pepper/herbaceous	Green pepper/fruity	Green pepper/grassy
MMP	0,2	None	Only wine aroma/fruity	Sulphur-like/fruity
	1	Guava/cat urine/sulphur-like	Only wine aroma/fruity	Sulphur-like/fruity
	5	Cat urine/"conifer"	Guava/fruity/cat urine	Sulphur-like/fruity
	10	Cat urine/"conifer"	Fruity/cat urine	Sulphur-like/fruity
	15	Cat urine/"conifer"	Cat urine/guava	Sulphur-like/fruity/"conifer"
	20	Cat urine/"conifer"	Cat urine/guava/fruity	Sulphur-like/"conifer"
ibMP/MMP	2/0,2	Dusty/grassy/herbaceous	Fruity	Fruity
	4/1	Dusty/grassy/herbaceous	Fruity/grassy	Fruity/herbaceous
	8/5	Cat urine/grassy/herbaceous	Grassy/greenpepper	Grassy/herbaceous
	16/10	Grassy/herbaceous/sulphur-like/green pepper	Grassy/green pepper/quava	Green pepper/grassy/fruity
	24/15	Grassy/herbaceous/sulphur-like/green pepper	Grassy/green pepper/quava	Green pepper/grassy/fruity
	30/20	Herbaceous/green pepper/cat urine	Grassy/guava/cat urine	Green pepper/grassy/fruity
	2/20	Cat urine/"conifer"	Grassy/guava/cat urine/sulphur-like	Sulphur-like/fruity/grassy
	4/15	Car urine/guava/fruity	Grassy/fruity/guava/sulphur-like	Sulphur-like/fruity/grassy
	8/10	Grassy/green pepper	Grassy/green pepper/sulphur-like	Grassy/green pepper/fruity
	16/5	Grassy/herbaceous/dusty	Grassy/green pepper/sulphur-like	Grassy/green pepper
	24/1	Grassy/dusty	Grassy/green pepper	Grassy/green pepper
30/0,2	Grassy/dusty	Grassy/green pepper	Grassy/green pepper	

Prior to additions, the aroma of each wine was mainly detected as fruity nuances, which complemented the perceived ibMP and MMP aromas. Aroma descriptions varied between media, as well as with increasing concentrations. Aroma nuances also became stronger with increasing concentrations. When aroma descriptions between media were compared, some interesting differences became apparent. For example, the dusty nuances of ibMP at low levels occurred in water only. When MMP was added separately, guava and cat urine nuances were apparent in the water and neutral non-Sauvignon blanc wine, while sulphur-like/fruity nuances manifested stronger in the neutral Sauvignon blanc wine. Guava aroma was previously reported when MMP was added to Chenin blanc and Colombar wines (Du Plessis & Augustyn, 1981).

Generally, both ibMP and MMP, depending on their concentration levels, presented aromas, which could be perceived as positive or negative. In combination with ibMP, MMP added to the complexity of the wine, which is in agreement with findings of French researchers, namely that MMP in low concentrations plays a positive role in the characteristic aroma of Sauvignon blanc wine (Darriet *et al.*, 1995). Other typical Sauvignon blanc nuances, such as asparagus, gooseberry, tomato leaf, passionfruit and fig were not detected and can therefore not be ascribed to

either ibMP or MMP. Asparagus aroma may be ascribed to 2-methoxy-3-isopropylpyrazine (Allen *et al.*, 1988), and passion-fruit aroma to 3-mercaptohexyl acetate (Tominaga *et al.*, 1996), 4-mercapto-4-methylpentan-2-ol and 3-mercaptohexan-1-ol (Tominaga *et al.*, 1998b). The above-mentioned components have to be further investigated. In addition, other possible contributors to the typical Sauvignon blanc aroma have to be identified and evaluated.

## CONCLUSIONS

Specific impact components, namely ibMP and MMP affect Sauvignon blanc aroma. Depending on the nature and composition of the medium, as well as the concentration levels of ibMP and MMP added, different aroma nuances are perceived, which may be ascribed to the combined synergistic action of these two components. Synergism is an important aspect in the evaluation of aroma and further investigations are needed to determine the relationship between typical Sauvignon blanc impact components and aroma.

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