The compositional basis of the aroma of Riesling and unwooded Chardonnay wine

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ABSTRACT

The aim of this research project was to explore, in detail, the relationship between volatile composition and wine aroma for two white wine varieties, namely Riesling and unwooded Chardonnay, so that the most influential volatile aroma compounds to the aroma of these two varieties could be identified. Twenty Australian commercial wines of each variety were analysed by quantitative sensory descriptive analysis and targeted for the chemical analysis of more than 45 volatile compounds. The compositional and sensory data sets were related using multivariate methods (e.g. PCA and PLS), and aroma volatiles were identified that related to the specific sensory properties of each variety. Most of the Riesling and several of the unwooded Chardonnay sensory properties were well predicted by the compositional data and several compounds were identified as important to the aroma of each variety. The unwooded Chardonnay wines were higher in concentration of various fermentation-derived compounds than were the Riesling wines, and these volatiles played an important role in the sensory properties of this variety. The Riesling wines were higher in concentration of grape-derived compounds including the monoterpenes, norisoprenoids, and dimethyl sulfide. These compounds, and also many of the fermentation-derived compounds, were identified as important contributors to the aroma of the Riesling wines. The results from this study have greatly advanced our understanding of the complex interactions between volatile compounds and the role that they play in the specific aroma nuances of white wines.

The prediction of sensory properties of the Riesling and unwooded Chardonnay wines was investigated using rapid instrumental techniques, namely mass spectrometry based electronic nose (MS Enose) and visible and near infrared (VIS-NIR) spectroscopy. A combination of MS Enose and VIS-NIR gave the best predictive results compared to either method alone. Promising results were achieved for many of the sensory properties indicating that this technique shows good potential for application.

The so-called 'wine lactone' (3a,4,5,7a-tetrahydro-3,6-dimethylbenzofuran-2(3H)-one) is known to be an important white wine odorant. The formation of wine lactone was investigated from two potential precursors, namely (E)-2,6-dimethyl-6-hydroxyocta-2,7-dienoic acid and the glucose ester of this acid, in model wine at room temperature and 45°C. The hydrolytic results show that the rate of formation of wine lactone is too slow for either the acid or the glucose ester to be major precursors to wine lactone in young white wine. Therefore, different precursors are most likely responsible for the formation of wine lactone in young white wine.

DEDICATION

I dedicate this thesis to my Lord God, who made my heart, mind and soul, and who is and forever will be, my only audience.

> *Whatever you do, work at it with all your heart, as working for the Lord, not for men, since you know you will receive an inheritance from the Lord as a reward. It is the Lord you are serving.* Colossians 3:23

DECLARATION

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made.

I consent to this copy of my thesis, when deposited in the University Library, being made available for photocopying and loan.

Signed _____ Date _____

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PUBLICATIONS AND PRESENTATIONS

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Refereed Papers:

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Siebert, T.E.; Smyth, H.E.; Capone, D.L.; Neuwöhner, C.; Pardon, K.; Skouroumounis, G.; Herderich, M.J.; Sefton, M.A.; and Pollnitz, A.P., *Stable Isotope Dilution Analysis of wine fermentation products by HS-SPME-GC-MS.* Analytical and Bioanalytical Chemistry, 2005. 381: 937-947.

Cozzolino, D.; Smyth, H.; and Gishen, M., *Feasibility study on the use of visible and near infrared spectroscopy together with chemometrics to discriminate between commercial white wines of different varietal origins.* Journal of Agricultural and Food Chemistry, 2003. 51: 7703-7708.

Papers and posters presented at conferences:

Cozzolino, D.; Smyth, H.E.; Lattey, K.A.; Cynkar, W.U.; Janik, L.; Dambergs, R.G.; Francis, I.L.; and Gishen, M., *Relationship between sensory analysis and near infrared spectroscopy in Australian Riesling and Chardonnay wines.* Near Infrared Spectroscopy: Proceedings of the 12th International conference, Auckland, NZ Vic, 10 - 15th April 2005. Paper Accepted.

Smyth, H.E.; Cozzolino, D.; Herderich, M.; Sefton, M.A.; Francis, I.L., *Relating volatile composition to wine aroma: identification of key aroma compounds in Australian white wines.* Proceedings of the 12th Australian Wine Industry Technical Conference, Melbourne Vic, 25 - 29th July 2004. Paper presented.

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Lattey, K.A.; Smyth, H.E.; D-Costa, N.E.; Liebich, B.K.; Francis, I.L., *Consumer acceptability and sensory properties of a set of commercial Australian Riesling and unwooded Chardonnay wines.* Proceedings of the 12th Australian Wine Industry Technical Conference, Melbourne Vic, 25 - 29th July 2004. Poster presented.

Smyth, H.E.; Cozzolino, D.; Herderich, M.; Sefton, M.A.; Francis, I.L., *Identification of key aroma compounds in Australian Riesling and unwooded chardonnay wines*. Proceedings of the 7th Wartburg Symposium on Flavor Chemistry & Biology, Eisenach, Germany 21st - 23rd April, 2004. Poster presented.

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Smyth, H.E.; Cozzolino, D.; Francis I.L., *Identification of key aroma compounds in Australian Riesling wines*. Proceedings of the Australian Society of Viticulture and Oenology: Viticulture and Oenology Seminars, Tanunda SA, July 10 - 11th 2003. Paper presented.

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Goodness, does wine really smell like this? Great drop with fine bouquet of kerosene. By Zac Milbank, The Advertiser, Wednesday December 15th 2004, p 33.

On the nose with a hint of bubblegum. By Rebecca DiGirolamo, The Australian, Wednesday February 11th 2004, p 31.

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Sense of smell drives search for key aroma compounds. Australian and New Zealand Wine Industry Journal: September/October 2003 Volume 18, Number 5, p 82.

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