Modulation of ‘fruity’ thiol release during fermentation of red musts by wine yeast

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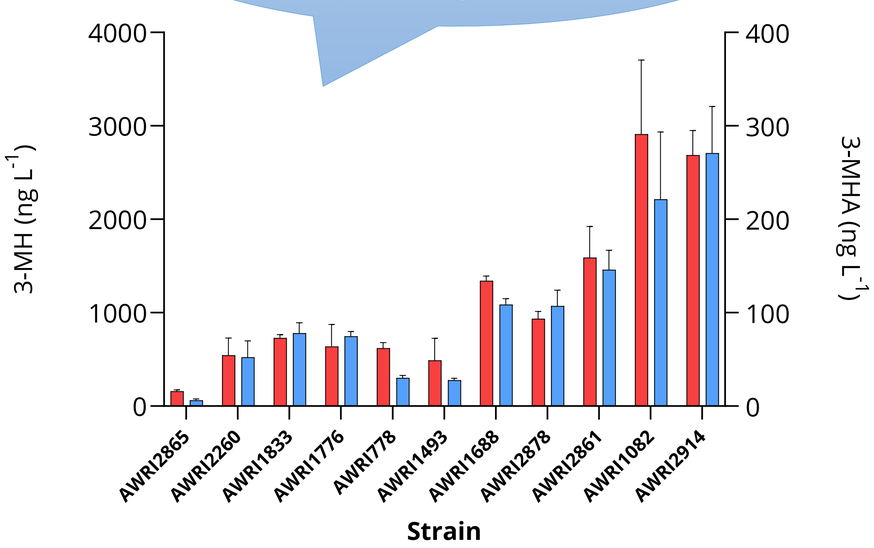
Background

During the alcoholic fermentation of grape sugars, wine yeast play a critical role in determining the aroma profile of wines, through production of secondary metabolites and modification of grape-derived compounds. One of the most impactful yeast-modified compound families, due to their very low perception thresholds, are the ‘fruity’ thiols, which include 3-mercaptohexan-1-ol (3-MH), 3-mercaptohexyl acetate (3-MHA) and 4-mercapto-4-methylpentan-2-one (4-MMP). While the formation and stylistic contribution of these thiols have been extensively researched in white wines, particularly in Sauvignon Blanc, little is known about the conditions leading to their formation in red wines. In this study, we have explored the ability of yeast strains to modulate the release of these aroma compounds during fermentation of two red grape cultivars: Pinot Noir and Grenache. A detailed sensory analysis of the Grenache wines was also conducted to elucidate the potential impact of thiols in red wine aroma.

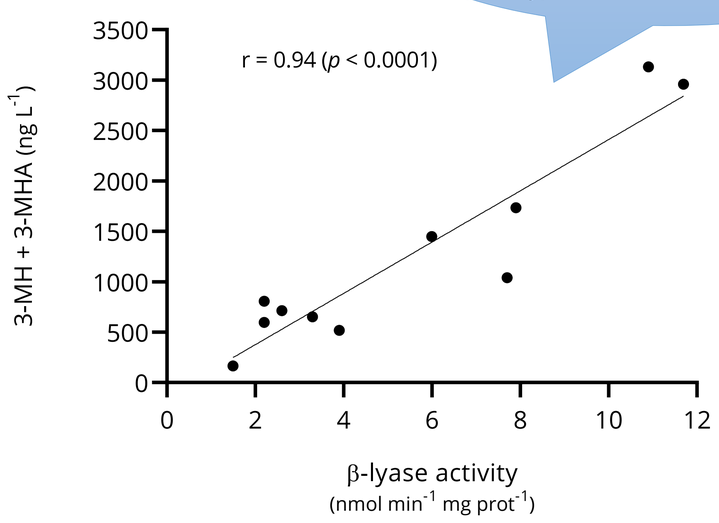
Modulation of thiol release by yeast during laboratory-scale Pinot Noir fermentation

Eleven wine strains assessed for their ability to release thiols in Pinot Noir. At the end of fermentation, the 3-MH and 3-MHA concentrations varied 18-fold and 43-fold, respectively, depending on the yeast strain.



Concentrations of 3-MH (red) and 3-MHA (blue) after fermentation of a Pinot Noir must by 11 wine yeast strains with different thiol-releasing abilities

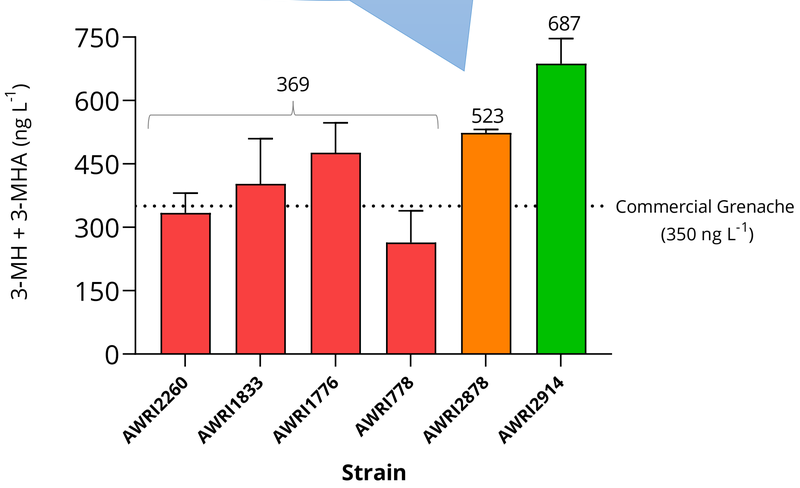
Strong positive correlation between thiol concentrations in the wine and the thiol-releasing ability of the individual yeast strains (measured as β-lyase activity).



Correlation between yeast β-lyase activity and thiol concentrations after fermentation of a Pinot Noir must by 11 wine strains

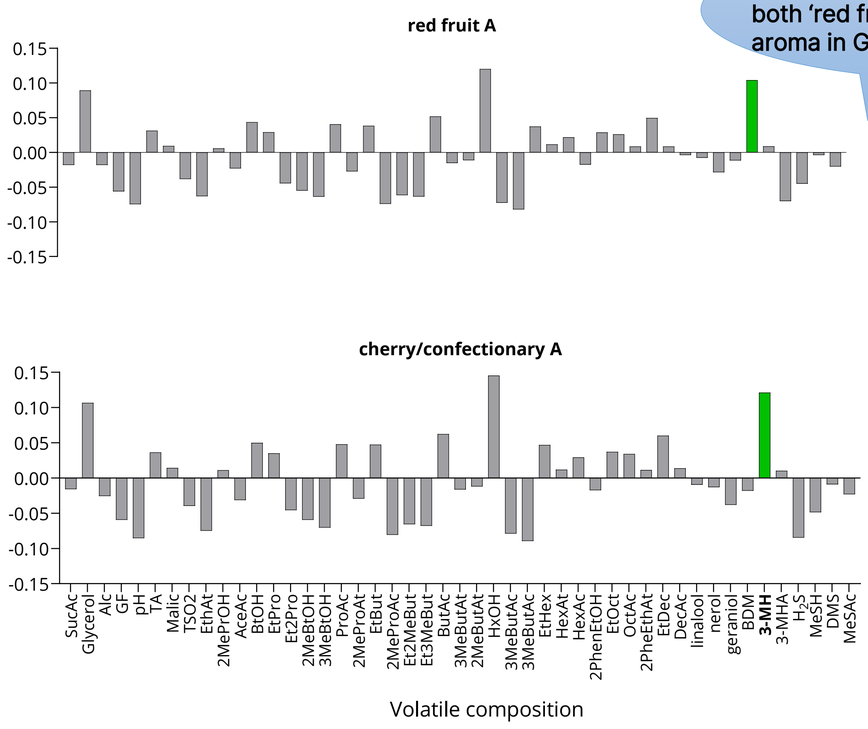
Small-scale winemaking of Grenache: compositional and sensory analyses

Six strains assessed in Grenache (50 kg) ferments. The strong thiol releaser strain, AWRI2914, exhibited the highest thiol concentrations, almost double the average concentrations produced by the four low thiol-releasing yeast.



Thiol concentrations in Grenache wines after nine months in bottle. Four low (red), one moderate (orange) and one strong (green) thiol-releasing strains were chosen as starter cultures.

3-MH was positively associated with both ‘red fruit’ and ‘cherry/confectionary’ aroma in Grenache.



Regression coefficients from a partial least squares (PLS) model generated to relate chemical composition for the Grenache wines with aroma (A) attributes. The thiol 3-MH is highlighted in green.

Summary

We have comprehensively demonstrated the vast range of thiol-releasing capacities across a large number of wine yeasts after fermentation of two red grape cultivars. Sensory analysis of the Grenache wines revealed a potential role of thiols as enhancers of ‘fruity’ aromas in red wines. This knowledge will guide the choice of yeast to balance these flavour impacts and help inform strain development.

Wine Australia

The AWRI is a member of the Wine Innovation Cluster.