Volatile aroma compounds related to ‘stone fruit’ aroma in Viognier and Chardonnay wines

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Background

The compounds that give rise to the important ‘stone fruit’ aroma characters in white wine are not well understood. Relating the compositional differences among wines to their sensory attributes can help determine if sensory difference is due to variation in concentrations of aroma compounds, an absence/presence of certain aroma compounds or an additive effect of several aroma compounds. This study focused on Viognier and Chardonnay wines from France and Australia with differing levels of ‘stone fruit’ character, ranging from low to high.

Sensory analysis

A set of 18 commercial wines (six wines each of: Australian Chardonnay, Australian Viognier and French Viognier) were selected for descriptive sensory analysis.

Reference standards used to define the aroma attributes

Aroma attribute | Standard added to wine
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Passionfruit | passion fruit pulp, tinned
Pineapple | pineapple pieces, fresh; pineapple juice, tinned
Apricot | apricot pieces, tinned
Pink | white peach pieces, fresh, no skin
Lemon | lemon slice with rind, fresh
Rice | rice slice with rind, fresh
Floral | linalool solution; 2-phenylethanol solution
Grassy | grass, fresh; green bean, chopped; no wine
Vegetal | asparagus juice, tinned
Box hedge | box hedge leaves; no wine
Honey | honey
Nutty | mixed nuts; no wine
Flint | benzzenemethanethiol solution
Sweaty/cheesy | hexanoic acid + 3-methylbutanoic acid solutions
Pungent | ethanol
Kerosene | 1,1,6-trimethyl-1,2-dihydronaphthalene solution

A sensory panel training session

Radar plot of the mean aroma sensory data of four different wines

The descriptive sensory analysis data showed the 18 selected wines had widely differing ratings of ‘apricot’ and ‘peach’ aroma attributes and the two attributes were not closely correlated.

Chemical and statistical analysis

Volatile compounds were measured in the wines using previously published and in-house methods. The wines were also analysed for standard chemical parameters. The sensory attribute ratings were related to volatile composition by partial least squares regression (PLSR).

PLSR of chemical composition and sensory aroma attributes

Important volatile compounds to explain ‘apricot’ and ‘peach’ aroma attributes.

<table>
<thead>
<tr>
<th>Aroma attributes</th>
<th>Significant aroma compounds</th>
<th>Lactones (µg/L)</th>
<th>Dairy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>γ-Nona</td>
<td>γ-Deca</td>
<td>0.01 - 0.06</td>
</tr>
<tr>
<td>Overall</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
<tr>
<td>Passionfruit</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
<tr>
<td>Pineapple</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
<tr>
<td>Apricot</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
<tr>
<td>Peach</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
<tr>
<td>Grassy</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
<tr>
<td>Nutty</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
<tr>
<td>Floral</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
<tr>
<td>Kerosene</td>
<td>0.50 - 0.54</td>
<td>0.41 - 0.53</td>
<td>0.03 - 0.04</td>
</tr>
</tbody>
</table>

Of the 109 targeted wine aroma compounds, 79 were detectable and quantified in the 18 wines. γ-Nonalactone, γ-decalactone and the previously little studied and potent ‘dairy lactone’ were associated with the ‘apricot’ sensory attribute, together with the monoterpenes linalool, geraniol and nerol, and the compounds E-2-hexenal and E-2-hexenol. The polyfunctional thiol 3-mercaptopropyl acetate (3MHA) and ethyl cinnamate were negatively related to the apricot attribute. The ‘peach’ aroma attribute was also associated with the ester 2-methylpropyl acetate.

Conclusions

The n-alkyl γ-lactones are impact aroma compounds in actual stone fruit and γ-nonanalactone and γ-decalactone plus dairy lactone were associated with apricot aroma in the wines studied, together with several monoterpens and aldehydes. While the lactones were present below reported aroma threshold values, it may be that a combination of compounds give rise to the ‘stone fruit’ flavour. Further work will include reconstitution, addition and omission studies to confirm the importance of these compounds to ‘stone fruit’ aroma in wine.

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