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Defining vegetal aromas in Cabernet Sauvignon using sensory and chemical evaluations

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• The bell-pepper aroma typical of Cabernet Sauvignon and Sauvignon blanc has been correlated with the corresponding concentration of isobutyl-methoxypyrazine (IBMP). However, the term "vegetal" can include aromas other than bell-pepper. For example, many sulfur-containing compounds can elicit vegetal notes (e.g. asparagus, cooked corn, boxwood, rubber), and so can the norisoprenoid class of compounds (e.g. cut grass). The goal of this study was two-fold: 1) to define the meaning of "vegetal" in quantifiable sensory terms, and 2) to identify the criteria that wine "experts" use to identify a Cabernet Sauvignon wine as "vegetal".

• The authors' approach was to first use *descriptive analysis* to provide an objective description of a collection of potentially vegetal wines. Then, they used expert winemakers/enologists to sort the same wines into *"vegetal" and "non-vegetal"*. This allowed the authors to analyze the relationship between these two classifications. Finally, the authors studied the relationship between the descriptive data and the actual concentration of *pyrazines***.**

• The collection of wines included 16 California Cabernet Sauvignons that represented a wide range of vegetal characters. 1) For the **descriptive analysis**, 15 volunteer judges that had been trained during eight meetings were used. After generating a list of 9 vegetal aroma descriptors, the judges rated the intensity of each descriptor for all of the wines, on a scale from 0 to 9 (anchored in three pla ces with the words low, moderate, and high). Each panelist evaluated 3 replications of each wine.

• 2) For the **sorting trial**, 16 volunteer California winemakers sorted the wines based on aroma only – no tasting. The sorting trial consisted of 3 parts. In the first part, the winemakers were asked to divide the wines in groups based on *"similarity of aroma"* using their own individual/unspecified criteria. In the second part, the winemakers were asked to sort the wines based on *"vegetal character"* into three groups (none, some, or high). In the third part, they were asked the same as in the second part but this time using as criteria *"intensity of sulfur aroma"* (none, some, or high).

• **Descriptive analysis results.** The attributes chosen by the panelists to differentiate the 16 wines included: cherry, dry fruit, vanilla, cocoa, pepper, eucalyptus, bell pepper, olive, and cooked vegetable. The authors used principal component analysis (PCA) to study the relationship between these descriptive terms and the various wines. The first principal component (x-axis of the map) was able to distinguish "vegetal" wines versus "non-vegetal/fruity" wines. The second principal component (y-axis) was able to divide the wines into "high in eucalyptus" and "low in eucalyptus". The wines in the center of the graph could be considered as "more balanced" regarding all of these descriptors. The authors could find no correlation between "vegetal" or "non-vegetal" wines and any particular growing region, vintage, or oak regime.

• **Expert sorting results.** The attributes chosen by the panelists to sort the wines included: bell pepper, green aromas, band aid, pyrazine, green bean, dill, stemmy, herbal, veg, weedy, carrot, old cabbage, asparagus, pickled veg, herbaceous, mushroom, geranium, and olive (some of these terms included a second or third related word in their definition, excluded here for summary reasons). In general, the results of the 3 sorting tests using the various criteria ("similarity of aroma", "vegetal aroma", "sulfur defects") classified the 16 wines into similar clusters, regardless of the sorting criteria. Even though the authors found similarities between the descriptive PCA map and the sorting clusters, they also found a few distinctions in the way the two approaches characterized some of the wines.

• **Relationship between sensory attributes and pyrazines**. The authors quantified 2 types of pyrazines (using gas chromatography/mass spectrography): *isobutyl-methoxypyrazine* (IBMP), with a bell-pepper aroma, and *isopropyl-methoxypyrazine* (IPMP), with a potato/ earthy aroma. They could find **no correlation between pyrazine concentration and the vegetal aroma perception** – as determined by descriptive analysis.

• The authors present an interesting -and highly recommended- discussion. Here are the highlights:
_ panelists distinguished, in general, between a "fresh" vegetal aroma and a "cooked' vegetal aroma; the attribute "olive" was somewhere in the middle;
_ the major factor used by the panelists to distinguish the wines was the contrast between vegetal characteristics and non-vegetal/fruity ones;
_ vegetal aromas may be an important factor in shaping a wine's overall sensory profile *[perhaps by adding complexity?]* and, therefore, in helping distinguish different wines;
_ fruity criteria were not used by the expert panel to sort the wines, but they were used by the descriptive panel to differentiate the wines;
_ other authors have reported that it is very difficult to identify aromas in a mixture when the number of individual aromas increases above three. According to the current authors, there is a chance that the panelists may have grouped the "vegetal" and "sulfur" attributes together.
_ volatiles other than pyrazines are likely to affect sensory perception of "vegetal", including fruity compounds (masking) and sulfur-containing compounds (enhancement). Therefore, even if we optimize viticultural practices to achieve low pyrazine levels, the resulting wines may still be perceived as "vegetal".

In summary, results from descriptive panels and sorting panels gave similar results, independent of sorting criteria. Also, even though the vegetal aroma in Cabernet Sauvignon has been traditionally associated with pyrazines, there was no correlation between their concentrations and the "vegetal" intensity of the wines. Overall, this study shows that the term "vegetal" is very complex, and that we need to link "vegetal" to actual aroma standards in order to reach a terminology agreement among judges and winemakers.

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