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Impact of whole bunch vinification on the abundance of sweetening compound astilbin

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Whole-bunch vinification is a practice that can change the sensory properties of wine. Experimental wines resulting from the addition of stems in varying proportions were analyzed to quantify a sweet compound, astilbin. A significant increase in astilbin content was observed in wines made in the presence of stems. Experiments carried out in several winegrowing regions have demonstrated the influence of grape variety on both the astilbin content and its increase.

Introduction

From vineyard management to bottle aging, many parameters can influence the organoleptic properties of a wine. For reds, some winemakers choose to leave all or some of the stems in contact with the juice during maceration. This is referred to as whole-bunch vinification. In general, only a percentage of the stems is retained. This may vary according to grape origin, vintage conditions and grape ripeness. This type of vinification is traditionally practiced in Burgundy, Beaujolais and the Rhône Valley, while grapes in Bordeaux are generally destemmed on arrival in the cellar. The impact of including stems during vinification has been studied, particularly concerning the aromatic component of wines[1 2 3]. In terms of taste, some studies have shown that wines vinified with stems are perceived as significantly more astringent and slightly bitter[4 5 6]. Most of these studies compared wines made from destemmed grapes with wines in which all the stems were retained, without any destemming. The sweet-tasting astilbin has been identified as one of the main phenolic compounds present in stems[7 8]. The aim of this research is to study the effect of vinification with stems on astilbin concentration in wines.

General study of the contribution from stems during vinification

Several experiments were set up under the real-life conditions of conventional vinification. They were conducted on two estates in Bordeaux, two in Burgundy and one in Beaujolais, thus enabling a comparison of different grape varieties, namely Merlot, Gamay and Pinot Noir. The vinification technique and the percentage of stems retained (from 15 % to 50 % of the bunches) were chosen according to the winemaker's judgement. For each tank containing stems, there was a control tank of destemmed grapes of the same origin. The same winemaking protocol was applied to both tanks, with the only difference being the presence or absence of stems.

Mean averages were calculated for the pH, alcohol content and astilbin concentration, measured on samples taken at the end of vinification (Figure 1). Protocols with a percentage of stems have been grouped together under the name "with stems". Wines made from destemmed bunches are referred to as "destemmed".

The application of a statistical test showed no significant difference between the protocols in terms of pH or alcohol content. The addition of 15 % to 50 % stems during vinification does not seem to have any effect on these parameters in these experiments, contrary to what is sometimes heard about a supposed decrease in ABV. In contrast, the astilbin concentration is significantly higher in wines vinified with stems. The mean value calculated for wines vinified with stems is 24.3 ± 12.1 mg/L, higher than the mean concentration of 19.7 ± 10.9 mg/L found in wines made from destemmed grapes.

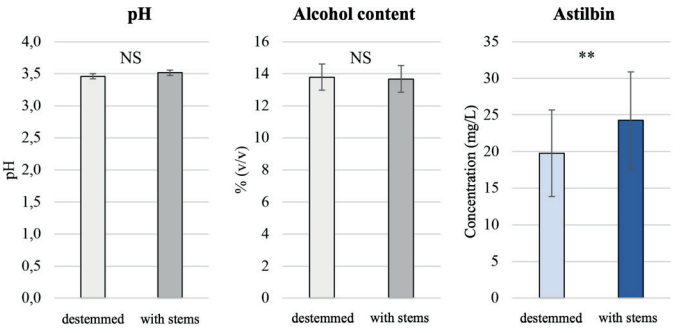


FIGURE 1. Mean pH, alcohol content and astilbin concentration in wines from the 13 experiments.

These results demonstrate that the presence of stems during vinification increases the astilbin concentration. Furthermore, these concentrations are above the taste detection threshold of 5.7 mg/L, measured in a wine model solution. Astilbin may thus contribute directly to the sweet taste of the wines analyzed.

Comparison of astilbin concentration according to grape variety

The experimental results can be broken down by grape variety (Figure 2A). Mean levels were higher in Gamay and Pinot Noir wines than in Merlot wines, in line with the findings of a previous study[8]. Conversely, the increase in astilbin concentration due to stems was greater in relative terms for Merlot than for Gamay and Pinot Noir. The presence of stems during vinification resulted in a 36 % average increase in astilbin concentration for Merlot, compared with 21 % for Pinot Noir and 12 % for Gamay (Figure 2B).

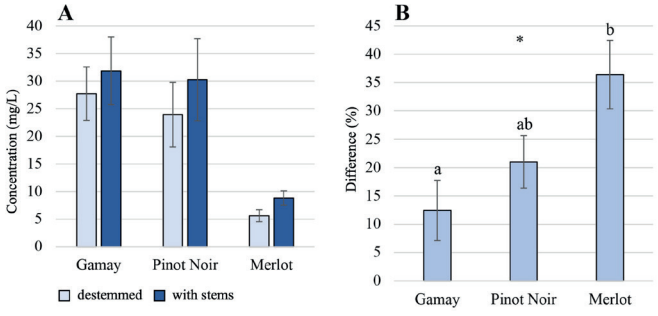


FIGURE 2. A: Mean astilbin concentration by grape variety. B: Calculated difference (%) between the two protocols.

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Localization of astilbin in different bunch components according to grape variety

The method for quantifying astilbin in wine was adapted to study its presence in the various bunch components, namely pulp, seeds, skins and stems. Ten bunches of Pinot Noir, Merlot and Gamay grapes were analyzed. Overall, the amount of astilbin contributed by stems at bunch level (5.6 ± 1.2 µg/g fresh extract) was close to that contributed by skins (6.3 ± 2 µg/g fresh extract). However, this proportion may differ depending on the grape variety studied (Figure 3). The proportion of astilbin found in the skins was 59% for Pinot Noir and 52% for Gamay, compared with 34% for Merlot. The proportion found in Merlot stems (65%) was significantly higher than for Gamay (45%) and Pinot Noir (38%). For pulp and seeds, the proportions of astilbin were less than 3%. This means that for a bunch of Gamay or Pinot Noir, half the astilbin comes from the stems and half from the skins, whereas for Merlot, two-thirds of the total astilbin in a bunch is found in the stems. These results help explain the previous observations, namely that the difference in astilbin concentration between destemmed vinification and vinification with stems was lower for Pinot Noir and Gamay than for Merlot. Nevertheless, in absolute terms, wines made from Pinot Noir and Gamay show higher astilbin concentrations than Merlot wines, whether vinified with or without stems.

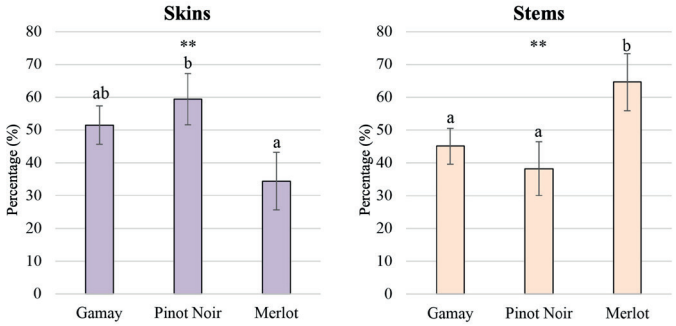


FIGURE 3. Proportion of astilbin in skins and stems for different grape varieties.

Conclusion

These various studies have shown that the addition of stems during vinification yields a sweet-tasting phenolic compound, astilbin. Furthermore, the increase in its concentration varies according to the grape variety. The influence of whole-bunch vinification on the sensory properties of wines, particularly sweetness, should be clarified in order to determine its effect on taste. Indeed, stems can also release bitter and astringent compounds, as well as adding herbaceous nuances. They should thus be used with reason, and there is a need for deeper knowledge of the sapid and aroma compounds associated with their presence. ■

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Sources : *Sourced from the research article: "New insights about sensory contribution of grape stems during winemaking: role of astilbin, a sweet polyphenol" (OENO One, 2024).*

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