Brettanomyces, wine and control

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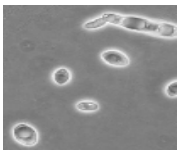
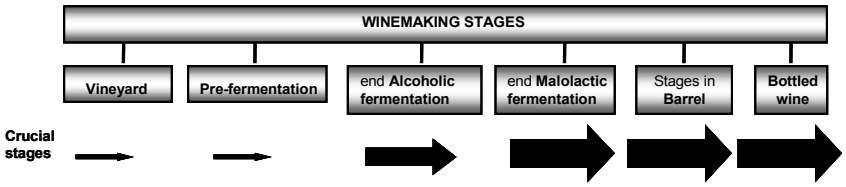
Several factors throughout the winemaking process can influence wine quality: viticultural practices, harvest conditions, cellar hygiene, barrel ageing and bottling. The microbiology behind the wine is also crucial because this is one of the parameters often neglected as a quality control constraint. The presence of many wild yeasts, fungi and bacteria is complex and can be detrimental to the sensorial quality of wine under uncontrolled conditions. Spoilage yeasts, such as *Brettanomyces,* have been and still are regarded as a global concern, especially regarding phenolic off-flavours. With increasing consumer awareness world-wide about wine defects, wine producers are forced to give specific attention on how to control *Brettanomyces* incidences.

BRETTANOMYCES OCCURRENCE

The detection of this yeast is typically associated with stages after alcoholic fermentation, especially during malolactic fermentation (MLF) and barrel ageing, although they have been isolated from stages throughout the winemaking process.





BRETTANOMYCES SPOILAGE

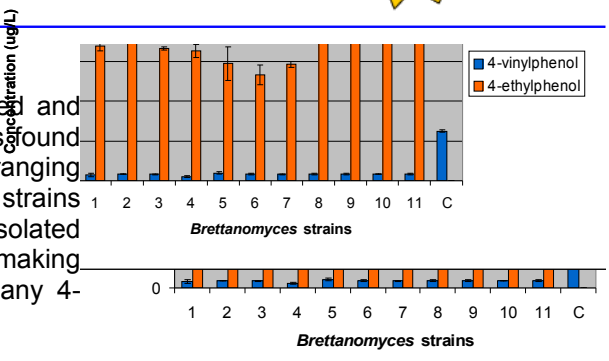
The survival and growth of these yeasts in wine have been associated with various forms of spoilage. It is specifically the volatile phenol production by *Brettanomyces* that is the largest concern. The grape derived hydroxycinnamic acid precursors is metabolised in a two-step method. It is the ethyl derivatives that are typically associated with "Bretty character", as the vinyl derivatives can be produced by many other wine microbes. *Brettanomyces* spoilage includes:

- volatile phenols e.g. 4-ethylphenol (4-EP), 4-ethylguaiacol, 4-ethylcatechol (typically barnyard, spicy-cloves, medicinal aromas).
- tetrahydropyridines (reminiscent of mouse-urine / bitter metallic aftertaste).
- acetic acid (contributing to wine's volatile acidity).
- isovaleric acid (a rancid cheesy aroma).

SOUTH AFRICAN RESEARCH FINDINGS

Volatile phenol production by *Brettanomyces* strains

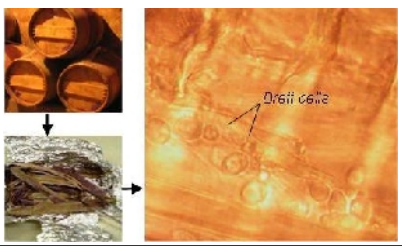
Genetically different *Brettanomyces* strains have been isolated and evaluated for volatile phenol production and compared. It was found that all the strains could produce high levels of 4-ethylphenol (ranging from *5 000 - 8 000 µg/L) within 3 weeks. The *Brettanomyces* strains were tested in a Shiraz wine after MLF and all were originally isolated from various red wines and from different stages of the winemaking process. The control wine without any Brett didn't contain any 4-ethylphenol.



* Sensory threshold range of 4-EP (450 - 625 µg/L).

Brettanomyces detection in barrels

Used barrels that are infected with *Brettanomyces* can be a major source of wine contamination or spoilage. Therefore, methods for *Brettanomyces* detection in barrels are required. For this purpose, shavings from barrels are investigated and this approach shows great potential for Brett identification.



BRETTANOMYCES CONTROL

As first step to control ***Brettanomyces*** problems it is important to have good winemaking practices, but a holistic approach is required as wine parameters such as, grape quality, sulphur dioxide (SO_2), pH, wine temperature, residual nutrients, O_2, barrel condition and oenological practices are interdependent. Good cellar hygiene along with correct SO_2 usage greatly minimises the risk of microbial spoilage problems from the onset of alcoholic fermentation. So the question is:

Q: What can the winemaker do to limit *Brettanomyces* yeasts spoilage?
A: Control the primary factors involved (numbers 1, 2 and 3 below).

Primary factors		Result
1) Precursors for volatile phenols		
+		
2) *Brettanomyces* yeast growth	**=**	**Spoiled wine**
+		**Volatile phenols**
3) Favourable conditions		**(4-EP, 4-EG)**

Points for *Brettanomyces* control

The aspects listed are only some of the very important factors that should be carefully considered to minimise the *Brettanomyces* spoilage:

Practices	Problem	Risk
Wine type and style (red wine vs. white wine)	Mainly red wine	*Brettanomyces* problem mainly associated with red wine, although they do occur in some white wine. Largely due to higher levels of SO_2, lower pH and fewer pre-cursors in white wine. Lighter style wines (less complex, less oak) can exhibit phenolic off-flavours at lower concentration levels.
Vineyard	Damaged grapes (higher microbial load)	Precursors can already be transformed to volatile phenols from a very early stage of winemaking. Do not take unnecessary risks by using low SO_2 levels and spontaneous fermentations in such cases.
Poor cellar hygiene	Improper cleaning of winery equipment	*Brettanomyces* can be one of the dominant spoilage microbes in the cellar and can be costly to treat and rectify problems.
Maceration style	Extensive and long	This can lead to increased amounts of substrates and precursors available for *Brettanomyces* off-flavours.
Sulphur dioxide & pH	Poor management and application	Antimicrobial properties of SO_2 lies in the molecular form - more is available at lower pH values. Maintain molecular SO_2 > 0.5 ppm and low pH ~ 3.6 (red wine). Also, the ratio of 0.4 of free to bound/total SO_2 is more ideal to ensure general microbial stability.
Oxygen	Oxidative conditions	Excessive amounts of oxygen will enhance the growth and consequent acetic acid production by Brett. Keep containers topped and full.
Malo-lactic fermentation (MLF)		Wine is at its highest risk of Brett spoilage from the beginning of MLF and ageing. Free available SO_2 are very low, the antimicrobial potential of the wine is also low.
Racking	Delayed racking	During this time the levels of free SO_2 is very low. Add SO_2 and clarify the wine soon after MLF.
Barrel hygiene	Poor management Contaminated wine	Improper sanitation. Contamination of entire batches. Shorten barrel life-time.

CONCLUDING REMARK

There is no better control for *Brettanomyces* spoilage than ensuring good winemaking practices!