



La Haute Tonnelerie

P A N O R A M A

BRETTANOMYCES

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WHAT IS BRETTANOMYCES? WHERE DOES IT COME FROM?

Brettanomyces (hereafter known as Brett) is a yeast. The Dekkera genus is the sporulated form of Brettanomyces. The yeast, like that of the Saccharomyces genus, can be present on grapes and vinification tools as well as in cellar materials and buildings. It can travel with grapes, animals or insects from one cellar to another, and then contaminate musts and wines in the cellars. As yeast populations are widespread, virtually no winemaking site is exempt.

The presence of Brett is not abnormal. It is, however, very important to limit conditions that promote its development in wine.



WHAT ARE THE NEGATIVE EFFECTS OF BRETT?

When this yeast develops in red wine, it transforms phenol acids into undesirable phenolic compounds such as 4-ethylphenol which confers ink, horse sweat or manure-type aromas to the wine, depending on the concentrations.

In all cases, Brettanomyces growth in wines leads to loss of fruity character and overall dryness on the palate. In a short space of time this yeast can ruin all wine aging efforts by the winemaker and has become the oenologist's bête noire.



WHAT ARE THE FACTORS THAT PROMOTE THE GROWTH OF BRETT?

The factors promoting the growth of Brett are:

- Stuck or sluggish fermentations
- Residual sugars: A 0.5 g/l sugar concentration is sufficient for this yeast to develop and then spoil the wine
- Low degree of alcohol
- SO₂ concentration inferior to 0.4 mg/L
- High pH (>3.65)
- Poor cellar hygiene



WHAT ARE FACTORS THAT INHIBIT ITS GROWTH?

Brett does not develop during alcoholic fermentation (AF), except in the event of severe sanitary problems. On the other hand, a difficult end of alcoholic fermentation in the presence of residual sugars represents a situation favoring its growth.

Brett is quite sensitive to molecular SO₂. A dosage exceeding 0.4 mg/L effectively limits its development, while a dosage superior to 0.6 mg/L rapidly blocks its activity (beware of confusing the dosage of molecular SO₂ with that of free SO₂ and total SO₂- see below).

The period of time during which the wine is insufficiently protected by SO₂, i.e. between the end of alcoholic fermentation and the end of malolactic fermentation (MLF), consequently becomes the principal high-risk period. Sluggish AF with possible stuck fermentation and late and slow MLF are times when the risk of Brett growth is high. This situation also deteriorates in the presence of sugars (stuck or incomplete fermentation). Note: Even a 0.5g/L quantity of fermentable sugar is sufficient for Brett to develop.

Consequently, anti-Brett measures are those that encourage rapid and complete AF, as well as the quickest possible MLF startup and progress.

Important note:

Once MLF is completed and the wine's SO₂ has been adjusted, it is advisable to carry out controls and maintain the SO₂ concentration at a level that is sufficient, so as to avoid the development of yeast.

Other anti-Brett measures:

- Respecting good cellar hygiene
- Eliminating lees. Brett is often concentrated in yeast sediment. As such, the beneficial effects of racking have been proven.



WHY IS THE RISK OF BRETT CONSIDERED HIGHER IN THE CASE OF BARREL AGING THAN THAT OF STAINLESS STEEL TANK AGING?

The risk of contamination is no higher in barrels than in stainless steel tanks. Any badly cleaned or disinfected container can become a potential source of contamination.

In the case of aging in a new barrel, it is not the barrel that contaminates the wine, but the wine that contaminates the barrel. It is consequently highly recommended to control the wine (KitBrett® culture or RT PCR) prior to vatting it, in order to increase barrel shelf life. For "high-risk" cellars, it is recommended to avoid malolactic fermentations in barrels and to vat the sulphured wines after malolactic fermentation.

The barrel itself is not a source of Brett. Wood is a material with little nutritional value and is not particularly attractive to the yeast. Moreover, barrel wood is subjected to high temperature thermal treatment during toasting and coopering, which eliminates all possibility of the presence of Brett on its surface.

A barrel becomes a source of Brett if it is contaminated by an external element. This contamination occurs most frequently when a wine containing Brett is vatted. Whatever the case, once a wine has been contaminated, it is always more complicated to manage when stored in a barrel than in a stainless steel tank.

Barrels are containers that are characterized by a much larger surface of contact with the wine than that of a stainless steel tank and they also have a certain roughness. Consequently Brett colonies are statistically more likely to attach on to the internal surface of a barrel than to that of a stainless steel tank. They penetrate the wood and are more difficult to eliminate by cleaning.

Implementing barrels that have already been used thus requires the use of efficient equipment and/or specific products for eliminating Brett that is potentially present once the barrels have been emptied (steam cleaner, over-pressurized hot water, sulphuring). It should be specified that wood material has high thermal-insulation properties. Consequently, for the treatment to be effective, it is best to choose specific treatment conditions: the temperature must be sufficiently elevated to destroy the yeasts, not only on the internal surface of the barrel but also in the mass of the wood.

In the case of insufficient treatment, the Brett that has colonized the barrel will develop by using the wine inside the wood as a nutritive resource. Furthermore, wine matured in barrels generally has a higher proportion of yeast sediment than wine matured in stainless steel tanks; these sediments become a zone with a high concentration of Brett and the risk of propagation is increased. Racking therefore reduces this risk.

Finally, oxygen supply is higher for barrel aging than for aging in stainless steel tanks, which tends to reduce the wine's SO₂ content due to the formation of acetaldehyde on the sur-

face; the wine is thus more susceptible and exposed to an attack by Brett. This phenomenon is accelerated in new barrels as the SO₂ also combines with the tannins in the new wood. Thus, if the SO₂ concentration is not monitored and adjusted, the same wine matured in new and used barrels will lose its protection more easily in the first case than in the second.

Brettanomyces survive more easily in zones that are poorly protected by SO₂- around the bung hole, in the pores of the wood, on the wine-air contact surface. Frequent topping up and cleaning the bung hole area help reduce the risks of contamination.



IS CELLAR HYGIENE CONTROL AN ESSENTIAL AND SUFFICIENT CONDITION FOR AVOIDING THE DEVELOPMENT OF BRETT?

Poor hygiene is the principal factor for sustaining contaminants in cellars from one year to the next.

Controlling cellar and barrel hygiene is an essential condition for preventing the risk of Brett development, but it is not sufficient. For this reason, it is possible to find extremely clean cellars with Brett problems, especially those in which the wines contain residual sugars (nutrients for the yeasts) and/or that are exposed to long periods of poor SO₂ protection (between AF and MLF for example).

In these cases, the solution is to review the vinification strategy, aiming to:

- Ensure complete alcoholic fermentation
- Reduce the time lapse between AF and MLF, as well as the duration of MLF



CERTAIN PEOPLE BELIEVE THAT NEW BARRELS CAN RELEASE NUTRITIONAL ELEMENTS THAT ACT AS A POTENTIAL HOST FOR BRETT DEVELOPMENT, AND CONSEQUENTLY INCREASE THE RISK OF DETERIORATING THE WINE. IS THIS TRUE?

This idea is indeed conveyed among winemakers. Certain specialists refer to cellobiose, one of the sugars in the wood that can potentially be released during wine-wood contact. According to them, this sugar is extracted by the wine and represents a nutritional source for Brett- it thus promotes its growth.

We have carried out research analyses on cellobiose and other sugars from wood that can potentially be extracted by the wine on toasted and untoasted woods. The results obtained using ionic chromatography (LAREAL laboratory) indicate that the quantity of releasable cellobiose does not permit the concentration of this compound to increase by more than 5 mg/L. Analysis of the other sugars shows similar results (<10-20 mg/L). This quantity of sugars supplied by the wood is thus minimal in comparison to the quantity of sugars naturally present in the wine.

We know that even a “very dry” wine (total alcoholic fermentation with complete sugar depletion, which is actually very difficult to obtain in practice) contains at least 100mg/L of sugars (trehalose derived solely from yeast autolysis). In the most realistic cases of well-controlled alcoholic fermentation, wines contain between 300 and 500 mg/L of residual sugars, while in cases of stuck or incomplete/slow fermentations, this amount can attain 2 to 5 g/L of sugars in the wine.

We can conclude that the quantities of sugars supplied by the wood are insignificant in comparison to the sugars in the wine, and therefore cannot represent a triggering factor for Brett development. Furthermore, these sugars from the wood are not present in sufficient quantities for the yeast that would metabolize them to produce a sufficiently large quantity of ethyl phenols to be sensorially perceived.



ARE BARRELS WITH BLISTERS ON THE INSIDE OF THE STAVES “HIGHER RISK” THAN BARRELS WITHOUT THEM?

A new barrel cannot be a source of wine contamination by Brett, or even a source of nutrition that can promote its development. This applies to all new barrels, with or without blisters, so the risk is no higher from one case to the other.

On the other hand, it is a different matter for a barrel of one or two uses that has previously contained wine contaminated by Brett. The inside surface of a blistered barrel is larger than that of an unblistered barrel, and can thus host the yeast more easily. This being so, if hygiene regulations are respected, notably during cleaning procedures, blistered barrels are no more problematic than those with no blisters.



ON THE SUBJECT OF BRETTANOMYCES CONTAMINATION, IS TODAY'S SITUATION DIFFERENT COMPARED WITH THAT OF 20 YEARS AGO?

It is common to hear winemakers/oenologists say that they work in the same way as in the past, even increasing the standard of hygiene requirements, but that they are still confronted with Brettanomyces contaminations as frequently as in the past, or even more so.

What is the answer to this? The first point to take into consideration is that yesterday's wine was very different from that of today. Indeed, average grape maturity has increased in the last twenty years. The quantity of sugars has increased, as well as must and wine pH (acidity has decreased). Wines with an alcohol content superior to 14% and a pH close to 4 are thus common these days, including in northern regions; in the past these values were around 12-13% for alcohol and 3.5 – 3.6 for pH.

A large quantity of sugar increases the risk of slow, incomplete or even stuck fermentation. At the end of fermentation, the yeast are confronted with conditions that are more hostile than before. Moreover, the lack of acidity reduces the effectiveness of SO₂ protection. Only the molecular form of SO₂ is effective against Brett. In fact, molecular SO₂ is in balance with the ionic forms, SO₃²⁻ and HSO₃⁻ and this balance depends considerably on the pH: the higher the pH, the less molecular SO₂ is present.

For example, for a wine titrating 12.5% alcohol with a pH of 3.3, the percentage of molecular SO₂ present is 3%, while this drops to 1% for the same wine with a pH of 3.8. Thus, for an identical 25 mg/L dosage of free SO₂, the molecular SO₂ concentration is 0.75 mg/L for a pH of 3.3, while it is 0.25 mg/L for a pH of 3.8. In the first case the wine is extremely well protected, in the second it is in high risk conditions.

In view of the contextual changes and their consequences on wine composition, it appears evident that measures taken in the past are no longer valid today. The oenologist must take these new conditions into consideration and adapt oenological protocols and practices accordingly.



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