Managing Brett!

Matthew Parish, Mark Kelly and Gary Baldwin
The Australian & New Zealand Wine Industry Journal
2003 Volume 18 Number 3

Every article you read on "Brett" in wine will probably start off by telling you that the organism involved is *Brettanomyces bruxellensis* and that this is an asporogenic wild yeast isolated from British "stock" beer at the beginning of last century.

While that may be fascinating historically, it doesn't end there. The fact that it was found in high strength "stock" beer indicates that it is fairly alcohol tolerant. The name *Brettanomyces* means "British Fungus" in Latin. The British bit is not so important, but the fungus bit is. Fungi are eukaryotic, meaning that their genetic complement (genome) is much larger than a bacterial (prokaryotic) genome, so the fungus is going to be capable of much more complex metabolism than bacteria.

Brett is capable of using many different carbon sources, including sugars extracted from wood. It is capable of forming many secondary metabolites, including the classic 4-ethyl phenol (Band aids), isovaleric acid (rancid / vomitous) and all three of 2-acetyl-1-pyrroline (ACPY), 2-acetlyltetrahydopyridine (ACTPY) and ethyltetrahydropyridine (ETPY), the mousy off-flavours.

Brett populations have been isolated from vineyard and winery surfaces throughout the world; from vineyard vegetation, winery equipment, musts and wines. As a consequence, logic strongly suggests Brett will play a role in the winemaking process of all wines to some extent. Recent trends in winery practice towards higher must weights (and the consequent higher residual sugar), funky fermentations, lower SO_2 usage and avoidance of filtration are likely to increase the chances of it becoming problematic.

Over the last few years the issue of desirability or otherwise of the Brett character has provoked much discussion and more often than not controversy. Those who support the presence of the character see it as complexing and a legitimate expression of 'natural' winemaking. Others see it simply as a wine taint, undoing the true expression of efforts in the vineyard and winery. For these people it is generally viewed as the result of poor hygiene and winemaking practice. The fact that Brett produces large amounts of acetic acid as a by product of glucose metabolism supports this view.

To make an informed opinion we need to be able to determine its various aroma and flavour characteristics in wine, and then ensure these are in fact directly or indirectly related to the yeast's presence.

A large spectrum of flavours and aromas have been associated with the Brett character including cloves, bready, barnyard, horse hair, horse sweat, antiseptic, plastic, Band-aids, mousey and metallic.

From our experience the more Brett affected a wine the more apparent the latter descriptors, particular the appearance of a strong plastic aroma and metallic finish to the palate.

Research by Licker et al (1999) looking at the odour-active compounds of wines with Brett flavour through sensory assessment and gas chromatography-olfactometry analysis indicated that Brett aroma in wine is a complex mixture of odour active compounds including acids, alcohols, aldehydes, ketones, esters and phenolics. Gas chromatography notes isovaleric acid and a second, as yet unidentified compound as predominant. Guaiacol, 4-ethyl guaiacol (4-EG) and 4-ethyl phenol (4-EP) along with many others will are also found.

With the Australasian industry's success largely founded on the varietal strength and integrity of its wines many argue it is hard to see a place for these dominating aromas. However Brett at low levels is seen by many as an important contributor to a wine's complexity.

What ever your opinion on this topic, the question remains, how do we as winemakers manage Brett?

Strategy

We are often asked to advise on the best strategy for the prevention of Brett spoilage and the improvement of affected wines. Our advice could be summarised under the following headings; Identification, Minimisation and Correction.

Identification

Regular Sensory Assessment of Wines

For most winemakers the first indication of a Brett infection is during sensory assessment, where one or more of the previously mentioned descriptors are noted. Regular assessment of wines is important, and preferably with another experienced winemaker or outside party for a contrast of views.

The Wine Aroma Dictionary by Richard Gawel presents a range of classic Brett aromas and its other variations.

Confirm Suspicions of Brett Infection With Laboratory Analysis

There are 2 main options available to most winemakers:

1. Chemical analysis for 4-EP / 4-EG. A level of 4-EP over 500 ng/l is cause for concern, but it should be noted that levels of 4-EP do not correlate well with perceived "Brett" character, and that the presence of 4-EG will increase the effect of a given level of 4-EP. This test is relatively cheap and available from the Australia Wine Research Institute.

2. Microbiological analysis by membrane filtration of known volumes of wine and culturing the membrane on a selective medium. Plate counts of 300 cfu/ml are a cause for concern. This test is very difficult to perform due to the slow growth of Brettanomyces on the media involved, so it is very expensive.

When taking samples from barrels it is important to remember there can be significant variation barrel to barrel, and concentrated populations exist on and within oak staves (Licker et al; 1999). Therefore ensure a representative sample is collected and ideally after the barrels have been stirred.

Minimisation

Like all organisms Brett does have certain needs. Among them are glucose or ethanol, nitrogen, low levels of oxygen, a temperature between 13° and 30° C, low free SO_2 (under 0.2 mg/l molecular) and time (Fransson, 2001).

Process Fruit Free From Disease

One major source of Brett infection in wine is the fruit. Anecdotal evidence from winemakers suggests certain vineyards carry higher levels of Brett.

If diseased fruit is harvested, your minimisation strategies may have to be adjusted; e.g. sulphur levels should be increased above 50 mg/l.

Maintain a High Level Of Hygiene

Properly sanitised front end processing equipment, hoses, pumps, valves, drains, barrels and bottling equipment all minimise the spread of Brett. Insects such as the fruit fly are also potential vectors of infection (Licker et al; 1999).

It is now widely appreciated that the trade of second hand barrels between wineries is one of the main vehicles for wine contamination. Brett cells can survive deep in the structure of the oak making it very difficult to combat. Hot water, sulphur, antimicrobial and ozone washes have all been employed to either manage or kill Brett populations. In our experience leaving barrels filled with 70°C or higher hot water for a 6 hour period provides the best result. Compared to the other treatments which are mostly surface washes we believe the key difference with this technique is penetration deep into the stave.

Two other methods which appear to be very interesting include:

1. A combined chemical and microwave barrel cleaning system operated in France by Thales. Set up as a conveyor, it involves a hot water pressure clean, rinsing with proprietary chemicals followed by microwaving.

2. The microbial control agent Dimethyldicarbonate (DMDC) has been shown to be effective in preventing renewed growth of Brett for up to 20 months (Fugelsang, 1997). Under current regulations microbial control agents such as DMDC are not permitted for use in Australia and New Zealand.

Use Commercial Yeast Preparations and Check Residual Sugar Levels

Although Brett is known to utilise low levels of glucose and even cellobiose and other sugars found in new barrels it still makes sense to minimise the availability of grape derived glucose in the finished wine (ideally<1 g/L) (Fugelsang, 1997). A check on the completion of fermentation should be made by enzymatic glucose + fructose analysis.

Sulphur At Crushing and At Regular Intervals During Maturation

Studies have shown that low concentrations of molecular SO_2 (0.625 mg/L) were toxic to Brett (Licker et al; 1999). Based on this we would recommend a sulphur addition of at least 50 mg/L at crushing to minimise the initial Brett concentrations. If there is a history of Brett in the winery then a free SO_2 level of at least 25 mg/L should be maintained during the maturation and bottling process.

Monitor pH Closely

The importance of wine pH control for chemical and microbial stability is widely understood. It remains unclear how pH affects Brett development. What is understood is that a low pH results in higher molecular SO_2 levels.

Ensure Good Temperature Control During Maturation

The temperature range favoured by Brett is between 13° and 30°C, and ideally over 20°C. Although temperatures below 13°C will significantly inhibit the growth of Brett, other issues such as the increased solubility of oxygen in wine need to be taken into account (Franson, 2001). We therefore recommend storage of wine at between 15 and 18°C.

Keep Dissolved Oxygen Levels Low

In aerobic conditions metabolism of glucose produces ethyl alcohol, carbon dioxide and considerable volumes of acetic acid, on the contrary under anaerobic condition this is not the case (Licker et al, 1999). It is recommended that dissolved oxygen levels in wines are monitored and maintained below 0.25 mg/L.

Sterile Filter If Concerned

Sterile filtration remains the most effective technique of removing Brett from wine and is strongly recommended in wineries with a history of Brett infection. If the decision is made not to sterile filter it is importance to monitor the growth of Brett, remembering that it tends to have a long lag phase with a growth peak approximately 6 to 10 months after fermentation (Olsen, 2003).

Correction

Prevention is the best cure!

We are not aware of any process which will remove Brett character from wine. Until such time as a process becomes available the only option for a winemaker faced with a Brett taint is to mask the character. This may be achieved by blending with other wine, maturation with oak, or bottling with higher levels of residual sugar.

Summary

If one of the main reasons for strong wine industry growth in Australasia has been wines with varietal strength and integrity, Brett taint appears to have little to offer the wine consumer. Hence winemakers should use all the tools at their disposal to minimise the opportunity for this organism to grow.

Matthew Parish, Mark Kelly and Gary Baldwin are consultants with Wine Network, Australia's leading consultancy group in winemaking, viticulture and wine business advice. For further information, please contact:

+61 (0)3 9819 6544 | **winenet@winenet.com.au** | **www.winenet.com.au**

This article is sourced from the Australian & New Zealand Wine Industry Journal 2003, Vol.18, No.3.

References

Franson, P. The Threat of Brett. Vineyard and Winery Management Vol 27 No. 5 (2001).

Fugelsang, C.K. Wine Microbiology, Chapman & Hall, New York (1997).

Gawel, R. Brettanomyces Character in Wine. Website feature; www.aromadictionaryt.com/brettanomyces_article.thml (accessed 2003)

Licker, J., T.E. Acree, and T. Henick-Kling. Sensory analysis and gas chromatography olfactometry (GCO) of wines with 'Brett' flavor. Abstracts of papers of the ACS 213:147 AGFD. American Chemical Society, Washington, DC (1997).

Olsen, E. Brettanomyces: Occurrence, Flavour Effects and Control. Website feature; www.makewine.com/makewine/brett.html(accessed 2003).

Smith, C. Winemaking at High pH. Website feature; www.vinovation.com/ArticleWinepH2.htm (accessed 2003).