Botrytis cinerea in Winemaking

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Botrytis cinerea is a mold responsible for fruit rot in many fruit plants. Grapes are susceptible to this fungus. Generally it causes bunch rot commonly known as botrytis rot or grey rot. It also creates conditions favorable for the growth of other spoilage organisms. Botrytis and a mix of other microorganisms including yeast, mold, and bacteria are involved in miscellaneous fruit rots.

Under certain ideal microclimatic conditions the fungus causes noble rot, which is responsible for the production of some of the world's finest sweet white wines. It is important to realize that the same fungus (botrytis) can cause noble rot or ignoble rot depending on the conditions of development.

Development of Noble Rot

Temperature and humidity are the two critical factors influencing the development of noble rot. During the infection phase, a temperature of 20-25°C and a relative humidity of 85-95% for a maximum of 24 hours are considered desirable. Once the infection has occurred the relative humidity should drop below 60%. This drop in humidity is a key factor in dehydration of the infected berries.

During the course of development the mold mycelium penetrates the grape skin. The skin becomes permeable but does not split. This condition facilitates drying of the berries. The loss of water from the berries leads to the concentration of sugar and other constituents. The osmotic pressure inside the berry increases, consequently the metabolic activity of the fungus decreases. The limited activity of this mold causes certain changes in the fruit which enable vintners to produce unique and prestigious sweet white wines.

Development of Vulgar or Sour Bunch Rot

Following infection by *Botrytis*, if the relative humidity remains high, and drying of the berries does not occur, the fungus continues to grow and produce certain undesirable changes in the fruit. The berries swell and burst. This splitting of the berry makes it susceptible to attack by other spoilage organisms, especially molds and acetic acid bacteria. This condition is often called vulgar rot or sour bunch rot.

Changes in Fruit Composition Induced by *Botrytis cinerea*

Grapes infected by *Botrytis cinerea* show significant changes in their composition. These changes largely depend on the nature and degree of rot. Some of the important changes in fruit composition, when noble rot is present, are given below.

1. During the course of development the mold consumes 35-45% of the sugar present in the berry. However, an increase in sugar concentration occurs due to dehydration of the berry.
2. Organic acids such as tartaric and malic are metabolized and this action consequently reduces the amount of these organic acids. The reduction in acidity leads to an increase in must pH.
3. Activity of *Botrytis cinerea* is associated with the formation of gluconic acid and glycerol. About 1-5 g/L gluconic acid and 1-10 g/L glycerol are formed when noble rot occurs. It should be noted here that the amount of gluconic acid is

significantly higher when the fruit is invaded by *Gluconobacter* as in the case of sour bunch rot.

4. Complex polysaccharides are produced. These include high molecular weight glucans which can cause filtration problems, and heteropolysaccharides which appear to exert an inhibitory influence on the alcoholic fermentation. Ribereau-Gayon (1988) suggested that the action of heteropolysaccharides on yeast activity may be responsible for higher acetic acid and glycerol levels in wine.

5. Aroma components such as terpenes are destroyed, and other odorous compounds which give the characteristic *Botrytis* aroma are formed.

6. The enzyme polyphenol oxidase (present in healthy grapes) is destroyed and another powerful oxidizing enzyme called laccase is produced. Laccase is more stable in wine, oxidizes a broader range of phenolic compounds and is relatively resistant to sulfur dioxide. It is detrimental to red wine because it degrades anthocyanis and procyanidins which are important red wine phenolics.

7. Available nitrogen is reduced.

Some of the compositional changes require special vinification techniques to handle grapes with noble rot.

Reference

Ribereau-Gayon, P. 1988. Botrytis: Advantages and Disadvantages for Producing Quality Wines. Proceedings of the Second International Cool Climate Viticulture and Oenology Symposium. Auckland, New Zealand, pp. 319-323.