YEAST DIVERSITY IN WINEMAKING IN ROMANIA AND ABROAD: A REVIEW

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Abstract

Nowadays, the most important aspect of viniculture is alcoholic fermentation. Most of the wine-growing countries are searching new ways to isolate and select local yeast strains. Using native yeasts in oenological practice is essential in orde to maintain the defining and authenticity aromatic profile, therefore improving the quality of wine. In this review are highlighted the results of various researches regarding the identification of yeast strains from the indigenous flora and their influence in enhancing winemaking technologies. The publications selected from electronic databases were reported between 1980 and 2021. Thus, in this article, the main yeasts encountered in winemaking centers and their importance in optimizing winemaking technologies have been highlighted and presented.

Key words: indigenous yeasts, selected yeasts, alcoholic fermentation

Microorganisms - yeasts and bacteria play an important role in the transformation of grapes and must into wine. Besides two important fermentation processes, which are alcoholic fermentation and malolactic fermentation, microorganisms can produce a wide range of transformations in must and wine, most of them with negative effects. In the vineyard, the microflora on the grapes is extremely rich and varied, and in the processing processes the microorganisms whose populations are more numerous and which have the ability to eliminate the competition quickly take over the environment, without having an adequate alcoholic strength, so that there is high risks of fermentation disorders and compositional deviations. The risks are different from one year to another.

MATERIAL AND METHOD

The aim of this study is highlighting the results of 45 researches presented in books and journals between 1980 and 2021 regarding the identification of indigenous yeast strains and their influence enhancing winemaking technologies.

Thus, in this article, the main yeasts encountered in vineyard and their importance in optimizing winemaking technologies have been presented. Also, it showed that from all 45 publications reviewed in this paper only 15 % were reported in Romania while the abroad publications had a share of 85 %.

The publications were collected from electronic databases (Research Gate and Science Direct).

RESULTS AND DISCUSSIONS

Evolution of indigenous yeasts during alcoholic fermentation

The must is rich in indigenous yeasts, most of them belonging to the genera *Pichia*, *Hanseniaspora*, *Saccharomyces*, *Candida* and *Kluyveromyces.* (Romano P. *et al.*, 2003). Also, other several yeast species from the genera *Schizosaccharomyces*, *Dekkera*, *Torulospora* and *Saccharomycodes* were isolated from vineyards (Fleet G.H., 2007).

Many studies carried out in various countries have highlighted the importance of non-*Saccharomyces* species (*Candida¸ Hanseniospora, Pichia)* in the alcoholic fermentation process and their ability to lead the incipient stage of this process. The non-*Saccharomyces* yeast species have the ability to start the pre-fermentating and the tumultuous phases but are quickly exceeded by *Saccharomyces cerevisiae*. The *Saccharomyces* yeasts genera lead the last part of tumultuous phase and also the fermentation and post-fermenting phases (Fleet G.H., Heard G.M., 1993; Fleet G.H.,2003).

The influence of indigenous yeast strains on phytochemistry of wine

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The quality properties of wine are characterized, in large part, by the yeasts metabolic compounds encountered during the alcoholic fermentation. These by-products are influencing the chemical diversity and the sensory characteristics of the obtained wines (Fleet and Heard, 1993; Ancuța V., 2009, Ale C.E. *et al*., 2014, Renault P. *et al.*, 2015).

The higher alcohols represent a minor factor on the wine quality due to their small amounts compared to the diversity of total substances found in wine. These higher alcohols found in a quantity less than 300 mg/l have an important role on wine bouquet as such as esters, acetals and melanoidin compounds (Pretorius I.S., 2000; Romano P. *et al.*, 2003).

The most common higher alcohol is isoamyl alcohol wich represents almost 50% of the total alcohols found in wine. Among oenological yeasts, *Saccharomyces cerevisiae* species has the ablity to produce large doses of isoamyl alcohol.

Using non-*Saccharomyces* yeast strains the level of higher alcohols is lower than *S. cerevisiae* yeasts. (Moreira N. *et al.*, 2008, Viana F. *et al*, 2008,2009).

Another important group of sensory properties factors are the sulfur compounds. These can influence positively the wine aromatic properties giving some fruity notes.

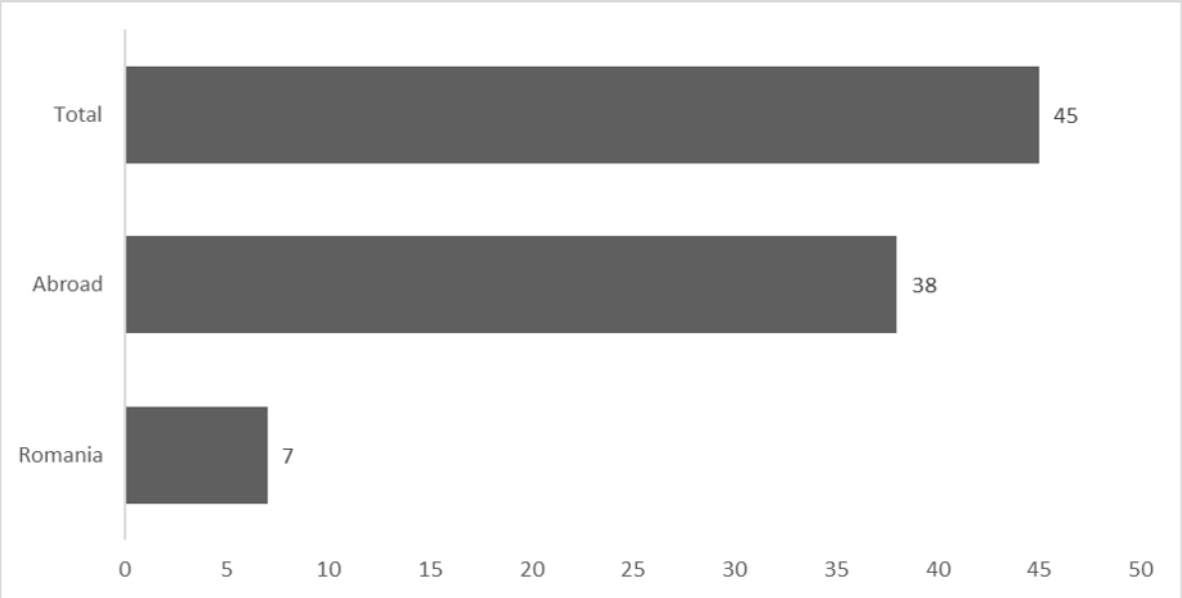

Figure 1 **Publications (Romania and Abroad) collected from electronic library**

The winemaking requires selection yeast strains capable to fermenting under specific conditions without producing the hydrogen sulphide which influences the organoleptic properties.

A group of volatile compounds that impress a pleasant smell are esters. These compounds are coming from yeast metabolic process. The most common esters (isopenthyl acetate, ethyl hexanoate and isoamyl acetate) are produced by *S. cerevisiae* in high quantity compared to *S. uvarum* species (Lambrechts M.G., Proterius I.S., 2000).

Likewise, oenological yeast species must present the *Neutral* phenotype, that are resistant in the presence of *Killer* strains and also do not suppress the activity of *Sensitive* phenotype strains (Taran N. and Soldatenco O., 2016)

Indigenous yeast strains and their importance in optimizing winemaking

Using the indigenous yeast strains from local vineyards is an opportunity to enrich the levurian diversity regarding the fermentative capacity and the advantages of a specific terroir.

Of all the indigenous yeasts, the non-*Saccharomyces* strains have been highlighted in various researches regarding the advantages and

disavantages of using this group of yeasts in the oenological process.

In Table 1 are reported the main positive and negative factors of non-*Saccharomyces* strains regarding the oenological importance.

Table 1

Principal non-*Saccharomyces* yeasts with oenological importance

Yeast genera	Oenological properties	The share in vineyard	Fermentation rate	References
Torulospora	Low concentration of acetic acid	Low	High	Bely *et al*. (2008), Azzolini *et al*. (2015)
Candida	Low concentration of acetic acid	High	Medium	Ciani and Maccarelli (1998), Sadoudi *et al*. (2012), Jolly et al. (2014)
Pichia	Increased concentrations of volatile compounds	Low	Low	Clemente-Jimenez et al. (2004), Domizio *et al*. (2011)
Schizosaccharomyces	Low concentration of acetic acid	Very low	Low	Benito *et al*. (2013)
Hanseniospora	Increase several higher alcohols	High	Low	Caruso *et al*. (2002), Rojas *et al*. (2003), Angioni *et al*. (2007), Viana *et al*. (2009), De Benedictis *et al*. (2011), Jolly *et al*. (2014)
Metschnikowia	Increase wine flavor and aroma	Medium	Low	Rodriguez *et al.* (2010), Sadoudi *et al*. (2012), Oro *et al.* (2014) Increase

CONCLUSIONS

The biodiversity of grapes, must and winery environment, iscorrelated to a specific terroir, have a unique structure and is a significant potential to winemaking. Properly, indigenous yeasts are better adapted to the "biochemical environment" of the must which are representative for aspecific wine area and they are capable to afford definite local characteristics to wines.

In conclusion, the oenological significance of the wine yeasts constituents and the biodiversity of non-Saccharomyces population related with local wine fermentation process, emphasize the significance of a decisiveintegration of non-Saccharomyces .

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