

SELECTION AND APPLICATION OF MICROBIAL STARTERS (YEASTS AND LACTIC ACID BACTERIA) TO IMPROVE THE ORGANOLEPTIC CHARACTERISTICS AND SAFETY OF WINES



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STATE OF ART Past research has mainly focused on the role of yeasts in the development of wine aromas, not caring about the secondary metabolisms of LAB that could be critical to wine flavor and safety. Up to now, few studies have investigated the role that LAB could play in the definition of wine's aroma. Also, little investigated is the problem related to the presence of biogenic amines in wines due to spontaneous malolactic fermentations poorly managed. Recent studies have shown that the release of important aromas such as ethyl esters, volatile sulfur, and glycosidic aroma compounds are species or strain dependent (Cappello et al., 2016). Although the presence of LAB capable of interacting with thiol compounds, has been documented, limited information exists on the role different LAB might play in increasing the fraction of free thiols in wine. The selection of LAB strains as starter cultures for the wine industry also considers their biogenic amines (BA) production (Brizuela et al., 2018). Different LAB species also have different capacities to metabolize amino acids and produce BA, and in particular some *O. oeni* strains exhibit high BA production. For this reason, the management and control of malolactic fermentation is a fundamental aspect to produce wines with low BA content and great aromatic complexity.

Identifying new strategies for the aromatic enhancement of wine produced from non-aromatic varieties is one of the objectives of research in oenological microbiology. Application of non-conventional yeasts in alcoholic beverages isolated during the spontaneous fermentation of high sugar content products, are a new alternatives to produce a variety of alcoholic beverages (Matraxia et al., 2021). However, fermentative performance and adaptation to stress of yeast strain, during industrial fermentation, is a critical point for quality products. Products with high sugar content, subjected to spontaneous fermentation can be an interesting source of potential starters. Wild *Saccharomyces* and non-*Saccharomyces* species may be producing a new flavor profiles and desirable properties, becoming interesting in industrial applications. Several authors have isolated strains of *Saccharomyces cerevisiae* yeast from sugar matrices (manna, nectar and honey) other than grape musts (Gaglio et al., 2017; Guarcello et al., 2019). In addition to *Saccharomyces*, non-*Saccharomyces* can also modulate different aspects of the fermentation of grapes, influencing the aroma positively or negatively. The metabolic impact of non-*Saccharomyces* yeasts during the early stages of fermentation is sufficient to trigger significant changes to the wine volatile profile; they are suitable for the inoculation as co-starters with strains of *S. cerevisiae*.

OBJECTIVES AND MILESTONES The aims of projects are to examine the link between the diversity of LAB, in terms of species and strains, the winemaking process, the organoleptic quality (secondary metabolites, mainly thiols) and healthiness of wines (biogenic amine amount). In addition, the aptitude of *Saccharomyces* and non-*Saccharomyces* strains, previously isolated from non-conventional niches (manna and honey raw materials) should be investigated.

Table 1 Gantt diagram for this PhD thesis project.

Activity		Month		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A	Selection of LAB																										
B	LAB inoculation systems																										
C	In vitro test of LAB combination																										
D	Scaling-up of best protocols																										
E	Typing and selection of yeasts																										
F	In vitro application																										
G	Scaling-up and application on Sicilian cv.																										
H	Thesis and paper preparation																										

Further information are:

- A. selection of LAB to be used as malolactic starters, which do not produce AB, able to improve the organoleptic characteristics of wines;
- B. development inoculation strategies for malolactic fermentation in pre- and post-alcoholic fermentation;
- C. verification of the impact of different combinations of LAB strains and yeasts on fermentation kinetics through in vitro tests;
- D. application on an industrial scale of the best yeast/LAB starter combinations capable of improving organoleptic characteristics and aromatic longevity, and guaranteeing the wholesomeness of wines;
- E. typing and technological selection of non-conventional *Saccharomyces* and non-*Saccharomyces* yeasts, present in the collection of the SAAF department, to verify their potential use in winemaking processes;
- F. application of yeasts with the best technological characteristics *in vitro* fermentation trials to verify the best inoculation protocol and the production of undesirable compounds;
- G. application in winemaking of the selected strains and inoculation protocols on native Sicilian cultivars, analysis of volatile organic compounds and panel test;
- H. writing and editing of the PhD thesis, scientific papers and oral and/or poster communications.

EXPECTED RESULTS AND SOCIO-ECONOMIC FALLOUT The best vinification protocol for grapes, will be drawn up and transferred to wineries with the aim of creating added value to the production of the territory. Improving the production of Catarratto and Nero d'Avola means enhancing the value of cultivars among the most representative of the Italian wine scene. The results of the research will be of great originality compared to the current international bibliography especially in terms of lactic acid bacteria inoculated in the alcoholic pre-fermentation phase in combination with non-*Saccharomyces* yeasts. The obtained wines could have high aromatic complexity and a low content of biogenic amines, in line with the objectives of the research.

References

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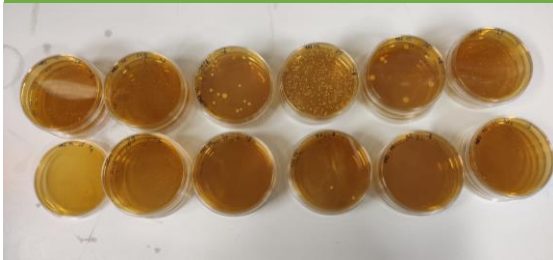
Lactic Acid Bacteria (LAB)

Selection of LAB

Application at laboratory scale



Microbiological and chemical analysis

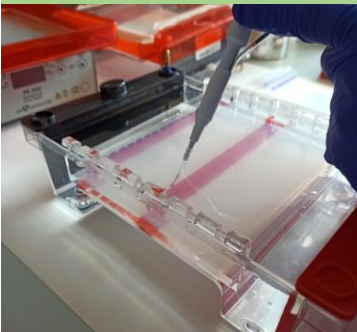


Application at industrial scale



Non-Saccharomyces yeasts

Identification of non-Saccharomyces



Selection of non-Saccharomyces

In vitro vinification



Pilot scale vinification



Volatile Organic Compound Analysis