ProSENSORIAL POTENTIAL OF NEW FUNGI-RESISTANT VARIETIES IN MODERN OENOLOGY

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Abstract:

Context and purpose of the study – The introduction into the Italian wine supply chain of the latest generation of fungi-resistant grapevine varieties, endowed with a greater or lesser strong resistance to downy and powdery mildews, represents a valid tool of making viticulture more sustainable, particularly in northern regions of the peninsula, where climatic conditions accentuate the pressure of fungal diseases However, the affirmation of resistant varieties is a function of their agronomic value, as well as of their oenological and sensorial value. The purpose of this study was to evaluate in detail the sensory potential of the new resistant varieties, in order to understand their real possibility of inclusion in the modern global enological context.

Material and methods – The research involved the sensory analysis of 29 resistant wines from two vintages (2019 and 2020), plus 2 control wines (Pinot bianco and Pinot noir), carried out by a trained panel. Samples were anonymized with numerical codes, to ensure anonymous evaluations, and randomized. Additionally, a replicate sample was introduced into each block. The work plan envisaged a first step in which a special file was created to identify the salient qualitative and quantitative characteristics of wines from resistant grape varieties. The descriptors usually used in the sensory cards have been integrated with the dominant descriptors identified by the panelists, in particular floral, fruity, vegetable, spicy and the foxy note characteristic of the non-noble breeding parent. The sensory analysis data were processed with descriptive and parametric techniques in order to identify specificities with significant and potentially usable differences for the creation of new brands or blends with traditional varieties.

Results – An analysis of the sensory characteristics of wines obtained from the latest generation of resistant varieties was carried out. The general characteristics typical of each resistant wine have been highlighted, yet interesting sensory potential for both white and red wines was found, at any rate variability between varieties arose. In general, results obtained are promising and can be used to define the criteria for a gradual diffusion of these new varieties. In particular, the identification of some dominant descriptors for the olfactory part will be used to manage the viticultural and oenological techniques, in order to optimize the most interesting sensory characteristics of the resistant varieties, limiting the perception of the Volpino flavour, that has been perceived. The sensory data can also be used to define the possibilities of vinification in purity, or in blends, of the new generation resistant varieties. in general, the results confirm the possibility of using the new resistant varieties as a tool for a real low-impact viticulture.

Keywords: resistant vines, sustainability, sensory analysis, wine quality, low impact viticulture

1. Introduction

In recent years, viticulture has become increasingly focused on the sustainability of the supply chain. In this context, resistant grapevine varieties developed by various research centers have been tested in different vineyard areas with the aim of significantly reducing the environmental impact caused by pesticide treatments (Bellin et al., 2009; Nesselhauf et al., 2019; Salmon et al., 2018; Casanova-Gascon et al., 2019; Intrieri, 2023). The abundance of these new cultivars has allowed for the selection of the best resistant varieties in various vineyard areas with good productivity and interesting qualitative characteristics, which are often comparable to traditional *Vitis Vinifera* cultivars (Pedneault and Provost, 2016; Vezzulli et al., 2019; Teissedre, 2018; Escudier et al., 2017; Bavaresco, 2019; Borrello et al., 2021).
Several studies have been carried out, and the results confirm the good enological potential of some resistant varieties, even when elaborated in purity (Testolin et al., 2018; Di Gaspero et al., 2013). While the significant reduction of pesticide treatments for downy mildew and powdery mildew has been confirmed, and guarantees minimal environmental impact, the sensory aspect of wines in purity or blends requires further investigation (Celotti et al., 2020). This is necessary to identify, for each vineyard area, the resistant variety or combination of varieties that best adapt to the specific microclimate to ensure optimal wine quality.
The purpose of this study is to test different resistant crosses from different breeding projects in a vineyard area in the Veneto region of North Eastern Italy. This area has high downy mildew pressure, and the study aims to evaluate the productive and sensory performance of the crosses (Pacifico et al., 2013; Marcuzzo et al., 2023). The study seeks to produce quality wines without perceiving the characteristic notes of non-noble parent of the crosses.

2. Materials and Methods

The vineyard was planted in 2016 at the Cà Tron Roncade winery in the vineyard area between Treviso and Venice, in Northeastern Italy. It hosts a total of 60 resistant varieties (both white and black berries) from all over Europe. The vineyard is trained on trellis with spur and Guyot pruning, the planting density is 2.5 m X 0.83 m, for a total of 4819 plants/ha. The measurements were taken on the plants trained on spur pruning and grafted on SO4 rootstock.
Agronomic operations (fertilization, anti-parasitic treatments, under-row and inter-row management, etc.) were conducted identically in all cultivated plants. The vineyard is located in a totally flat area, on an alluvial soil. The grapes were harvested at technological ripeness and microvinified at the VCR microvinification center in Rauscedo (Italy). The white grapes were vinified without maceration of the skins, while for the red grapes, maceration was performed according to the phenolic maturity characteristics of each variety. Minimal interventions with adjuvants and additives were used in order to evaluate the enological potential of the individual varieties. This study was carried out by analyzing the sensory aspect of wines from resistant vine varieties of the 2019 and 2020 vintages.
The evaluation of the wines was carried out at the sensory analysis laboratory of the CIRVE (Interdepartmental Center for Research in Viticulture and Enology) at the University of Padova in Conegliano (TV, Italy) using a trained panel according to the procedures indicated by ISO Standards (ISO 8586. 2014). The following descriptors were considered: smell intensity, smell quality, noble parent variety descriptor (if known), dominant descriptor (floral, fruity, vegetable, spicy, other), after taste (fox, strawberry: non-noble parent), taste intensity, and overall judgment. Using the above-mentioned descriptors, a point test with unstructured scale was carried out. In each session, a replicate and a control sample, a Pinot Bianco and a Pinot Nero, were included.
The results obtained were processe by analysis of variance (One Way-ANOVA) and principal component analysis (PCA) to verify the correlations between variables and any significant differences between samples.

3. Results and Discussion

The white and red hybrid grapes resistant to fungi, considered in this study, were tested in a vineyard in the Northeast of Italy, in order to verify their productivity and sensory characteristics of the wines produced in small quantities under cellar conditions in a significant viticultural area of Veneto. **Table 1** shows the productivity data obtained during the 2019 harvest. As observed, there are interesting yields, particularly for some varieties, confirming that the production is guaranteed and absolutely comparable to that obtained from traditional cultivars of *Vitis vinifera*. This data is significant and has also been confirmed by the productions obtained during the 2020 harvest. While the environmental aspect is generally the most considered in terms of sustainability, we must not neglect the qualitative and quantitative level of the production, which must guarantee the economic sustainability of viticulture. Since the introduction of new resistant varieties, the main problem has been the elimination of the foxy-strawberry aroma characteristic of American hybrids (non-noble parents of the crossing). For this evaluation, the present work focused on the creation of a well-trained sensory panel, which was used for the detailed evaluation of the sensory characteristics of all the wines produced in purity. In the case of white hybrids, the floral and vegetal characteristics are significantly higher compared to the control Pinot Bianco. The after taste note of foxy strawberry is practically not perceived when compared to the Pinot Bianco reference, and it is also non-significant in the ANOVA test, confirming the absence of the non-noble parent descriptor. This is further supported by the data from wineries in the area that have vinified these resistant varieties, obtaining excellent results in terms of enological and sensory quality. The sensory validity of pure white resistant white hybrids is confirmed by the results of the multivariate PCA analysis. The figure 1 shows no correlation between the foxy strawberry descriptor and any of the tested varieties. Additionally, the distance on the plane from all other perceived descriptors specific to Vitis vinifera wines is significant. The 2020 harvest data confirms the findings from the 2019 harvest, suggesting that the foxy strawberry note is not affected by vintage, but rather remains on the limits of organoleptic perception and is stable as a genetic characteristic, despite the limited data from only two years of harvest.

The results for red resistant varieties are also noteworthy (Fig. 2), showing high variability in the foxy strawberry note, which remains without significant differences among the theses, as indicated by the ANOVA test. In terms of the dominant descriptor, the fruity note is prevalent compared to Pinot Nero, with a prominent spicy note, both showing high variability among different resistant hybrids. The vegetal note is highly pronounced compared to Pinot Nero, but it is a characteristic that can be managed during grape ripening and winemaking. The multivariate analysis shows a greater dispersion of sensory characteristics in the wines, with the aromatic note of the non-noble parent sufficiently separated from the most important descriptors. However, it is more present than in white wines, as indicated by the multivariate analysis graph, where the distance from noble descriptors is lower than that observed in white wines. In the vinification of wineries in the study area, similar to white wines, the sensory validity of some pure red resistant varieties is evident.

Generally, it is clear that the aromatic note of the non-noble parent can manifest itself, even if not sensorially perceived. There is also significant variability among the different varieties vinified in purity. Therefore, the possibility of blending different varieties with the aim of obtaining wines with sensory characteristics very similar to traditional *Vitis vinifera* varieties, and therefore suitable for the modern target of consumers, should not be overlooked. If the production level allows for economic sustainability, the sensory aspect is manageable given the variability highlighted in experimental tests. Furthermore, it is confirmed that the foxy strawberry note of the non-noble parent, even if sometimes perceived, can be managed below the sensory threshold with a reasoned blend of several resistant varieties. In addition to the significant technical aspects that contribute to the sensory characteristics of the wine, adequate regulations are also needed for the introduction of these resistant varieties in different appellsation and terroirs. However, we are still waiting for vines obtained with new genetic technologies such as cisgenesis and genome editing (Intrieri, 2022), which are still considered GMOs and therefore not available in the medium-short term.

4. Conclusions

The cultivation and winemaking experiences with resistant grape varieties reported in this study have confirmed their technical and economic sustainability. Some of these varieties can even be vinified also on purity to produce wines that are equivalent in sensory terms to those traditionally obtained from Vitis vinifera.
If present, the non-noble parent's aromatic note, with hints of foxy and strawberry, is in low quantities and does not significantly influence the other sensory notes of the wine. The vegetal notes that are often highlighted during tasting are, however, present to varying degrees in all the varieties. It is up to the winemaker to manage this aspect during grape maturation and winemaking using the various technological options available.
In modern viticulture, these resistant varieties could be reasonably integrated with traditional Vitis vinifera, ensuring the characteristic sensory quality of wines from different terroirs. However, in some viticultural areas, their use is not allowed for specific appellations, which is why these resistant varieties have not been widely used.
The interesting result that emerges from this research is the substantial validity of various resistant grape varieties. We suggest to manage them in blends to obtain wines with sensory characteristics suitable for different markets. Considering the manageable sensory variability with different vinification options, the significant potential of these varieties in the context of modern viticulture is evident, guaranteeing sustainable and low-impact viticulture.

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Interspecific crossing (white)	Parent 1 (Vinifera)	Parent 2 (Non vinifera)	sugar (°Brix)	Acidity as tartaric acid (g/L)	pH	cluster wheight (g)	production / plant (Kg)
SAUVIGNON 30-080	Sauvignon blanc	Kozma 20-3	18,9	5,8	3,22	143,7	3,4
SAUVIGNON KRETOS	Sauvignon blanc	Kozma 20-4	19,0	6,7	3,18	109,7	3,3
SAUVIGNON NEPIS	Sauvignon blanc	Bianca	19,8	9,7	3,23	146,7	3,6
SAUVIGNON RYTOS	Sauvignon blanc	Bianca	19,9	9,1	3,15	70	1,7
JOHANNITER	Riesling weiss	Freoburg 589-54	19,5	8,2	3,16	204,7	6,1
FLUERTAI	Tocai friulano	Kozma 20-3	19,1	5,4	3,31	254,2	7,2
KERSUS	Pinot bianco	SK-00-1/7	22,7	8,2	3	179,8	5,3
PINOT ISKRA	Pinot bianco	SK-00-1/7	18,5	8,1	3,08	166,7	6,3
PINOT BIANCO ID 156-1017	99-1-48	Pinot nero	15,5	11,9	2,9	142,9	4,3
PINOT BIANCO UD 156-869	99-1-49	Pinot nero	22,5	9,6	3,2	205,9	2,3
Interspecific crossing (red)							
IULIUS	Regent	Kozma 20-3	23,8	6,8	3,34	255,7	5,4
MERLOT KANTHUS	Merlot noir	Kozma 20-3	19	7,8	3,18	210,2	5,1
PRIOR	Freiburg 4-61	Freiburg 236-75	20,2	7,6	3,22	277	5,3
MERLOT KHORUS	Merlot noir	Kozma 20-3	24,7	6,7	3,36	150,7	3,6
MONARCH	Solaris	Dornfelder	21,5	7,3	3,15	190,5	2,1
SANGIOVESE 72 096	Sangiovese	Bianca	21,2	9,9	3,3	222,7	6,3
PINOT NERO UD 156-680	99-1-48	Pinot noir	19,8	12,4	2,89	238	3,1
VOLTURNIS	99-1-48	Pinot noir	21,2	8,5	3,13	213,7	3,3
PINOT KORS	99-1-48	Pinot noir	20,6	8,7	3,18	274,5	7,4

Table 1. Production and quality parameters of some of the resistant varieties tested

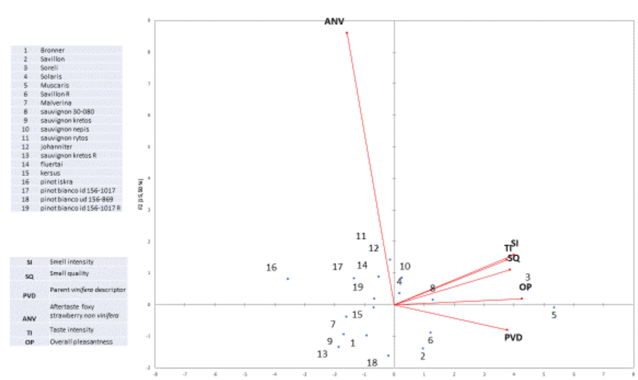

Figure 1. PCA analysis for white resistant varieties

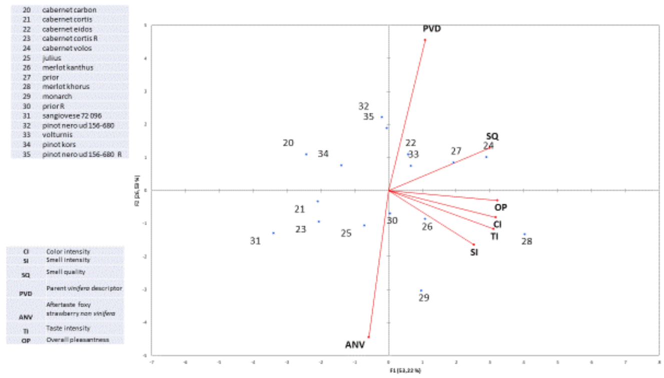

Figure 2. PCA analysis for red resistant varieties