Posters with Flash Talks

Parallel SES-02: Innovations in Resistant Grape Varieties

Time: **Wednesday, 25/June/2025: 9:35am - 10:55am**

Location: **Seminar room 1**

Building A1, basement

Session Chair: **Carlo Andreotti**, Faculty of Agricultural, Environmental and Food Sciences, Free University of Bozen-Bolzano, piazza Università 5, 39100 Bolzano (Italy)
Session Chair: **Rocio Gil-Muñoz**, IMIDA

Flash Talk Presentations

10:35am - 10:40am
ID: 194 / Parallel SES-02: 4
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Glycosylated aroma precursors, Terroir, Volatile compounds, Cold-climate viticulture

Exploring aromatic profiles and environmental influences on berry chemistry of V. vinifera Riesling and Vitis sp. L'Acadie blanc in Quebec and Nova Scotia, Canada

Pamela Nicolle, Karine Pedneault
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Wine quality depends on grape biochemical constituents, including sugars, organic acids, amino acids, and bound and free aroma compounds, which are influenced by vineyard location and environmental factors such as temperature and precipitation [1]. However, the impact of these terroir factors on interspecific *Vitis* varieties in Eastern Canada's cold climate remains largely unexplored [2]. Additionally, the interaction between terroir and grape variety in cold-climate viticulture, including *V. vinifera* and interspecific hybrids, requires further study. To address this gap, we analyzed the effects of vineyard location (Quebec and Nova Scotia), meteorological conditions (temperature and precipitation), and berry maturity stage across two vintages (2019 and 2020) on the aromatic profiles of *Vitis vinifera* Riesling and the interspecific hybrid L'Acadie blanc. Berry samples (EL-36 to EL-38) were collected from commercial vineyards in the Gaspereau Valley, Nova Scotia, and Île d'Orléans, Quebec. Bound volatile compounds were analyzed via solid-phase extraction and gas chromatography-mass spectrometry (SPE-GC-MS) [3]. GC-MS data were processed using MZmine 3, with compound identification performed via NIST MS Search and Kovats indexes, and semi-quantification using 2-octanol as an internal standard. Statistical analyses included ANOVA to assess vineyard location, vintage, and maturity effects. Principal Component Analysis (PCA) explored sample clustering, while Partial Least Squares Regression (PLS) examined relationships between environmental factors and aroma composition. Results showed a significant influence of geographical origin on volatile profiles. Riesling from Nova Scotia exhibited higher concentrations of acids, terpenes, and volatile phenols than Quebec Riesling, while L'Acadie blanc from Quebec contained more alcohols and fewer benzene derivatives than its Nova Scotia counterpart, highlighting terroir-driven variations. PLS regression confirmed strong correlations between meteorological conditions and glycosylated aroma compounds, with temperature and growing degree days (GDD) shaping berry aroma profiles. These findings underscore the role of environmental factors in aroma development, providing insights for viticultural practices in emerging cold-climate wine regions such as Quebec and Nova Scotia and for developing new resistant, cold-hardy *Vitis* varieties.

Bibliography

Pamela Nicolle, Ph.D. is a researcher in plant biology and food science with expertise in analytical chemistry, metabolomics, and bioprocess development. Her work focuses on winemaking, sensory analysis, and the chemical profiling of metabolites in viticulture and oenology. She earned her Ph.D. in Food Science and Technology from Laval University and has conducted research in both Canada and France. She has held scientific and engineering roles at renowned institutions such as INRA (Pech Rouge, France) and BNIC (Cognac, France). Currently a Research Associate at the Université du Québec en Outaouais, she works on viticulture and oenology research projects, applying her skills across food and plant science disciplines.

Recent publications:

1. Nicolle, P (co-first author), Delorme, K. (co-first author), Pitre, F.E., Pedneault, K. (2024) Metabolomic response of V. vinifera and interspecific Vitis sp. varieties to heat stress, water deficit and combined stress, using a metabolomic approach. Actes of the 45th Annual Congress of the Organisation Internationale de la Vigne et du Vin.
2. Nicolle, P., Barthe, C., Dorais, M., Dubé, G., Angers, P., Pedneault, K. (2023) Impact of cluster thinning and harvest date on berry volatile composition and sensory profile of Vitis sp. Seyval blanc and Vandal-Cliche. OENO One, 57:4, DOI : https://doi.org/10.20870/oeno-one.2023.57.4.7719
3. Pedneault, K., Pico Carbajo, J., Nicolle, P., Pathak, M., Wilson, N., Campos-Arguedas, F., Sarailhé, G., Dorais, M., Brereton, N.J.B., Castellarin, S. and Pitre, F.E. (2023). Different patterns of temperature impact phenolic derivatives in ripening Vitis sp. berries. Acta Hort. 1370, 61-66. DOI: 10.17660/ActaHortic.2023.1370.9
4. P. Nicolle, A. Gerzhova, A. Roland, L. Dagan, S. Delpech, F. Gagné, K. Pedneault, 2022. Thiol precursors and amino acids content of white interspecific hybrid grape, and impact of foliar urea and sulphur spraying on thiol precursor accumulation in berries, Oeno One, 56 : 3, DOI: https://doi.org/10.20870/oeno-one.2022.56.3.4873 (FI: 3.00).
5. F. Campos Arguedas, G. Sarailhé, P. Nicolle, M. Dorais, N.J.B. Brereton, F.E. Pitre, K. Pedneault, 2022. Increasing temperature during early berry development increases bound volatile phenols in mature berries of Vitis sp. L'Acadie Blanc. Frontiers in Plants Science, 13. https://doi.org/10.3389/fpls.2022.862259 (FI: 5.753).

6. P. Nicolle, K. William, P. Angers, K. Pedneault, 2021. Evaluation of flavan-3-ols and polysaccharides in musts and wines from Vitis vinifera Cabernet Sauvignon and cold-hardy Vitis sp. Frontenac. OENO One, 55:1. https://doi.org/10.20870/oeno-one.2021.55.1.3695 (FI: 3.00)
7. P. Nicolle, C. Marcotte, P. Angers, K. Pedneault, 2019. Pomace limits tannin retention in Frontenac wines. Food Chemistry, 277: 438-447.
8. P. Nicolle, C. Marcotte, P. Angers, K. Pedneault, 2018. Co-fermentation of red grapes and white pomace: A natural and economic process to improve red hybrid wine quality. Food Chemistry, 242: 481-490.

10:40am - 10:45am
ID: 263 / Parallel SES-02: 5
Abstract Submission
Topics: Wine, environment, health and sustainability
Keywords: Grapevine stress responses, Water deficit and recovery, Copper toxicity, Downy mildew susceptibility

Investigating Biotic and Abiotic Stress Responses in Grafted Grapevine Cultivars: A Comparative Study of Cabernet Sauvignon and Cabernet Volos on M4 Rootstock

Roberto Fattorini[1], Talita De Oliveira Caretta[1], Fadwa Benyahia[1], Monica Yorlady Alzate Zuluaga[1], Sonia Monterisi[1], Carlo Andreotti[1], Oscar Giovannini[2], Ilaria Pertot[2,3], Stefano Cesco[1], Pii Youry[1]
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When grapevine plants are transplanted into already established vineyards, they face multiple challenges, including adverse climate, heavy metal accumulation from agronomic practices [1], and pressure from highly adapted pathogens [2]. For this reason, understanding the interactions between soil biota, scion, and rootstock [3] under environmental stressors is essential for improving grapevine resilience. This study investigates the combined effects of water stress, copper-induced toxicity, and Plasmopara viticola infection on the performance of grafted grapevines. Rootstock M4 was grafted with Cabernet Sauvignon and Cabernet Volos and subjected to copper application at the soil level, drought stress followed by heavy rainfall, and pathogen inoculation. Physiological and biochemical data were collected using both traditional methods and smart phenotyping to assess plant responses [4]. Results showed that while both cultivars experienced similar levels of water stress, they successfully restored water balance post-recovery, indicating preserved root functionality. However, photosynthetic rate and transpiration rate declined under drought conditions, with a slower recovery in inoculated plants, suggesting potential impairment of above-ground structures. The severity of *Plasmopara* infection was largely cultivar-dependent, with a noticeable increase in downy mildew incidence in the resistant *Cabernet Volos*, particularly under combined stress conditions. In both cultivars, all stressors led to a minor accumulation of molybdenum in both roots and leaves, while the two cultivars exhibited different behaviours regarding iron content at the root level. These findings highlight the complex interplay between abiotic and biotic stressors and provide insights into the adaptive responses of grapevines, which can inform future vineyard management strategies to enhance plant resilience.

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R-based biofertilizers. Frontiers in Microbiology, 15, 1440978.

10:45am - 10:50am
ID: 142 / Parallel SES-02: 6
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Extractibility, Polysaccharides, Polyphenols, Varietal selection.

Unraveling the Role of Grape Cell Wall in Shaping the fermentation rate, the Polyphenolic Profile and Quality of Red Wines from Disease-Resistant and Drought-Tolerant Grapes in Occitanie varietal selection

Andrea Cesson[1,2], Thierry Doco[1], Bodil Jørgensen[3], Lene Grønne Pedersen[3], Stéphanie Carrillo[1], Damien Flores[1,4], Frédéric Mabille[1], Emmanuelle Meudec[1,4], Stéphanie Roi[1], Amélie Roy[2], Juliette Simon[2], Lucas Suc[1], Frédéric Véran[1], Jean-Roch Mouret[1], Marie-Agnès Ducasse[2], Céline Poncet-Legrand[1]
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Climate change and an evolving environmental and societal context call for the exploration of disease-resistant and/or drought-adapted grape varieties that meet the demands of consumers and society. Integrating data on red wine quality markers (polyphenols and aromas) earlier in the varietal selection process and understanding their extraction and production are major challenges for the wine industry. These efforts aim to identify varieties with desirable oenological properties. Polyphenols are one of the most abundant and important compounds in red wines, since anthocyanins are their main pigments and tannins bring astringency and mouthfeel.

Lots of studies have been conducted on polyphenol profile in red wines from interspecific varieties but also in their associated grapes [1]. Recent studies have demonstrated that the polyphenolic characterization isn't the perfect reflection of the final wine composition [2][3]. They have explained these differences by the difference of extraction, the numerous interactions between polyphenols but also with cell-wall polysaccharides [4]. However, the data on polyphenol composition and extraction through cell-walls in red interspecific grapes and wines has not yet been compared to traditional Vitis vinifera varieties. Moreover, their cell-wall composition and their impact on polyphenol extraction is not fully understood yet and seems to have an significative impact on the wine final quality and needs to be elucidated. On this study, the tannins, anthocyanins and polysaccharides of 32 red grape varieties including 14 *Vitis vinifera* and 18 interspecific hybrids were analysed, as well as in their wines produced by a standard microvinification process. Significant differences have been observed between varieties in anthocyanin content and polysaccharides composition in both grapes and wines. The repartition of anthocyanins into the different families as well as tannin distributions profiles have been characterized in grapes and wines and demonstrate a difference in extraction. Plus, PCA demonstrates a positive link between fermentation rate and polysaccharide composition and a negative relation with polyphenol content. Such results could be explained by the difference in cell-wall compositions and their ability to interact with polyphenolic compounds.

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SES-06: Flash talks 1 - Precision Winemaking

Time: **Wednesday, 25/June/2025: 2:25pm - 3:45pm**

Location: **Seminar room 1**

Building A1, basement

Session Chair: **Panagiotis Arapitsas**, University of West Attica
Session Chair: **Maria Tiziana Lisanti**, Università degli Studi di Napoli Federico II

Flash Talk Presentations

2:25pm - 2:30pm
ID: 291 / SES-06: 1
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Calcium, tartrate, stability, alginic acid sodium salt

An alternative for reducing calcium in wine and lowering the risk of insoluble salt formation

V. Felipe Laurie[1], Bárbara Hormazabal-Moya[1], Ricardo I. Castro[2]
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Wine minerals, including calcium, derive mainly from grape berry extraction, but they could also arise from winemaking additives, processing aids, and other sources [1]. Wine calcium concentration can vary widely (7-310 mg/L [1]), and contents above 60 mg/L for reds and 70-80 mg/L for whites and rose have been linked with elevated risk of calcium tartrate instability [2-3]. The formation of calcium tartrate does not respond to treatments involving low temperatures [1,3], and traditional protective colloids have been found to be either ineffective or to produce inconsistent results [4-5]. Instead, recent research on algae-derived polysaccharides suggests that they should be further studied as potentially effective solutions for calcium tartrate instability [5-6]. In this study, the use of alginic acid sodium salt is proposed as an aid capable of partially removing calcium from wines, thus reducing the risks of calcium tartrate precipitation. So far, alginates have been studied as immobilization matrices for yeast or bacteria during wine production [7-8], but no studies appear to have evaluated sodium alginate for tartrate stability. Therefore, the dose of alginate, contact time, and wine pH were preliminary tested, followed by a series of trials in which white, rosé, and red wines were treated under the optimized conditions. Calcium content was analyzed colorimetrically and with atomic absorption spectroscopy [9], tartrate stability was checked with the method of Abguéguen and Boulton [10], and the wine's general composition (e.g., pH, tartaric acid, free SO2, phenolics, etc.) was characterized with various methods. Depending on the treatment conditions used, calcium concentration reductions ranging from 5 and 25% were observed, leading to enhanced calcium tartrate stability in the samples with the greatest calcium removal, while other compositional parameters analyzed remain constant or showed small variations. The study confirms that this approach effectively reduces calcium levels and potentially minimizes the formation of insoluble salts in wine.

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Bibliography

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2:30pm - 2:35pm
ID: 185 / SES-06: 2
Abstract Submission
Topics: Winemaking processes and oenological practices, Wine, environment, health and sustainability
Keywords: Yeast polysaccharides, Starmerella bacillaris, Protein Stability, Cell wall

Characterization of a Unique Mannan from Starmerella bacillaris for Protein Stabilization in White Wine

Zeno Molinelli[1], Chiara Nadai[1], Simone Vincenzi[1], Alessio Giacomini[1], Paolo Antoniali[2], Daniele Pizzinato[3], Céline Sparrow[3], Cristina De Castro[4], Antonio Molinaro[4], Viviana Corich[1]

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Yeast cell wall components are valuable biotechnological tools with applications in oenology and beyond [1], [2]. *Starmerella bacillaris*, a non-*Saccharomyces* yeast, remains relatively understudied, yet recent discoveries have highlighted distinct metabolic traits among wine yeasts [3] and the promising role of its polysaccharides in winemaking [4].This study investigated different *S. bacillaris* strains alongside *Saccharomyces cerevisiae* as potential sources of functional yeast derivatives for protein stabilization in white wine.

Yeast biomass was cultivated through aerobic fed-batch propagation and mechanically processed to obtain yeast cell walls. To generate distinct polysaccharidic derivatives, yeast cell walls were subjected to various extraction processes. The physicochemical properties of the obtained macromolecular derivatives were characterized using near-infrared (NIR) spectroscopy, HPLC, SDS-PAGE, and high-resolution size-exclusion chromatography (HRSEC). The stabilization efficacy of the obtained derivatives was assessed in white wine through turbidity analysis, identifying a promising product from *S. bacillaris*. Ultrafiltration was then employed to isolate the active polysaccharide fraction, which underwent further characterization through linkage analysis and nuclear magnetic resonance (NMR) spectroscopy. The fraction was identified as a linear mannan, distinguishing it from the typically branched mannoproteins found in *S. cerevisiae*-derived cell wall extracts [5].

These findings reveal the unique structural features of *S. bacillaris* cell walls and their technological potential for alternative protein stabilization strategies in winemaking.

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2:35pm - 2:40pm
ID: 221 / SES-06: 3
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Proteases, chitinases, TLPs, Protein stability

Effect of must temperature and aspergillopepsin-I supplementation on the PR-protein derived peptides

Adelaide Gallo[1,2], Remi Schneider[1], Emilio Celotti[3], Andrea Natolino[3], Nicola Cappello[2], Tomas Roman[2]

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Protein instability in wines is challenging, and despite many efforts to find satisfactory alternatives to bentonite, both in terms of stability and quality, the solutions are limited in the wine industry. Among those proposed, aspergillopepsin-I supplementation (AP-I) completely stabilises wine when combined with the flash heating of musts, without compromising wine quality [1, 2]. However, the pasteurisation of must remains an arduous and economically disadvantaged process. Nevertheless, AP-I supplementation during fermentation has been reported to improve stability indices [3] through a mechanism that is still not fully explained.

This study investigates the effect of AP-I supplementation on the number and concentration of peptides resulting from the degradation of grape-derived proteins and the influence of temperature and reaction time. A Gewürztraminer grape must was heated at 20°C, 30°C, and 40°C in the presence or absence of AP-I (100 µg/L). The temperature was maintained for 1, 180, and 360 min, after which

the musts samples were frozen, until analysis. The peptide composition of the samples was analysed using high-throughput ultra-high pressure liquid chromatography coupled to data-independent acquisition-based ion mobility separation-enabled high resolution mass spectrometry (UPLC-DIA-IMS-HRMS) and peptide mapping was conducted according to [4], [5].

AP-I supplementation significantly increased both the number of individual peptides (up to +51% at 40°C) and the abundance (up to +120% at 20°C) of grape-derived peptides. A statistically significant increase was observed regardless of temperature and was consistent across all analysed protein derivatives (Chitinases, PR-protein, Polyphenol oxidases, and Thaumatin-like proteins). Regarding reaction time, all treatment intervals increased both the number and concentration of grape-derived peptides with respect to the untreated control. However, extended treatment duration did not result in a further increase, potentially indicating an elevated rate of reaction with proteins suspected to be degraded.
The addition of AP-I to grape must, enlarged the peptides pool within the grape juice, also at temperature below 40°C. This new approach in the use of the enzyme is suggesting a proteolytic effect not only when AP-I is coupled with high temperature.

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2:40pm - 2:45pm
ID: 179 / SES-06: 4
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Condensed tannins, oxidation marker, wine closure, metabolomics

Exploring the impact of different closures on tannin evolutions by using metabolomic approach

Lantomalala Elsa Razafindrabenja[1,2,3], Lucas Suc[1], Frederic Veran[1], Arnaud Verbaere[1,2], Emmanuelle Meudec[1,2], Soline Caillet[1], Nicolas Galy[3], Dimitri Tixador[3], Christophe Loisel[3], Nicolas Sommerer[1,2], Laetitia Mouls[1]
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Condensed tannins (CTs), polymers of flavan-3-ols, are a class of polyphenolic compounds that play a significant role in the organoleptic qualities of red wines, particularly influencing color, astringency and bitterness. These properties are highly dependent on size and structure of these compounds. Moreover, from grape harvest to wine consumption, exposure to oxygen induces diverse molecular reactions such as oxidation, increasing molecular diversity and complexity of wine composition, ultimately affecting wine quality. Particularly during aging process, wine undergoes many compositional changes, making its evolution in the bottle a subject of great interest to ensure consistent quality over time. While wine closures are known to regulate oxygen levels[1], the impact of their oxygen permeability on the structural evolution of CTs during bottle aging has yet to be explored.

In this work, a comprehensive analysis of the profile of red wines aged for 17 years was conducted. The aim was to study the impact of closure type on the evolution of tannin structures and to identify oxidation markers associated with wine aging. Wines were produced under same winemaking conditions but sealed with closures characterized by different oxygen permeability (screw cap, synthetic, traditional and agglomerated corks). To conduct this study, due to the difficulty in precisely characterizing tannins, biological triplicates of wine samples were first fractionated[2] to isolate tannins from the matrix. Chemical depolymerization of tannin fractions was then performed using a thioglycolysis reaction[3]. From these depolymerized tannin fractions, an untargeted UHPLC-Q-Orbitrap metabolomic analysis was performed, which compares the wine profiles to discover specific discriminating markers linked to closure permeability.

The obtained results showed that closure oxygen permeability has a significant influence on the evolution of tannin structures during bottle aging, indicating that the selection of wine closures should be considered in preserving wine profile over time. Furthermore, this study showcased the strong potential of advanced analytical tools in characterizing complex metabolites and open new perspectives for research into wine quality.

Bibliography

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2:45pm - 2:50pm
ID: 153 / SES-06: 5
Abstract Submission
Topics: Wine, environment, health and sustainability
Keywords: Silk fibre, wine, colour, oxidized compounds, fining

New use of natural silk fiber as a fining agent in wines

Lucía Osete Alcaraz[1], Encarna Gomez Plaza[1], Antonio Abel Lozano Perez[2], Jose Oliva Ortiz[3], Miguel Angel Camara Botia[3], Ana Belen Bautista Ortin[1]

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Undesirable compounds in wine, like OTA, biogenic amines, and pesticide residues, can negatively affect its quality and pose health risks to consumers. In addition, an excess of tannins can lead to an unpleasant rise in astringency and bitterness, which makes tannins another target of reduction. The primary method used by winemakers to lower these undesirable compounds is fining. However, some commonly used fining agents can trigger allergies or even increase the protein content in the wine, which can increase turbidity. To prevent these issues, the use of plant fibers, such as those from grape pomace, might be a viable alternative[1]. Trying to find other alternatives, the objective of this work was to explore the effect of a natural fiber, the silk fibers obtained from the *Bombyx mori* cocoons, in the reduction of undesirable compounds and in the chromatic profile of a young red wine and an oxidazed white wine. Indeed, this natural biopolymer is not only abundant, due to the large-scale cultivation of silkworms for the textile industry, but also sustainable and can be obtained at reasonable low cost as textile by-product. A fining trial was conducted with the silk fibroin fibres, both in shredded and raw state, at the maximum concentration allowed by OIV (2 g/L) in the wines previously doped with histamine, OTA and several pesticides. After 48 h of contact, wine chromatic parameters and phenolic compound content were measured, along with the concentration of the undesirable compounds in the treated wines. The results obtained showed that the silk fibers were successful at reducing oxidized phenolic compounds in white wine and tannins in red wine, and able to significantly reduce some of the tested pesticides, histamine and OTA, affecting minimally the wine colour in red wine. For that, this fibre may be a very good alternative for obtaining safer and high quality wines.

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2:50pm - 2:55pm
ID: 149 / SES-06: 6
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Fermentation gas, wine aromas, dealcoholised wines, icy shower

Prototype development for the recovery of wine aromas from fermentation gases

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Dealcoholised beverages are trendy. But this market segment is slowed down by flavour losses during dealcoholisation and by the reduced perception of flavours in the absence of alcohol.

Adding foreign flavours distorts the product. One alternative is to add wine aromas that are already lost during alcoholic fermentation through evaporation. They represent a raw material with no additional costs and which is available in abundance. The recovery of volatile wine aromas from the fermentation gases is difficult because tiny amounts of the substance are present in a very large excess of carbon dioxide. Simply cooling the fermentation gases is not enough. In addition, the predominantly lipophilic aromas must be absorbed in a lipophilic, food-grade liquid. This is achieved by 'gas scrubbing' with cold ethanol. The process has been protected by a German [1] and a European [2] patent since 2022. In 2023, the process was published [3] and presented orally at the OIV congress.

In 2024, a first prototype was developed with modest means, which was designed for a must volume of 100 litres. The volatile aromas were captured at approx. -25°C in 100-200 ml of ethanol (96%), which was circulated. A Vigreux column with a mirrored vacuum jacket was used. The alcoholic concentrates obtained show aroma profiles typical of the grape variety, with particularly intense sweet primary aromas. The residual gas escaping from the apparatus is almost odourless. Wine aromas can only be smelled if the flow rate is too high (over 1 l/min). Towards the end of the fermentation, some acetaldehyde can also be detected.

The separation of the aromas from the ethanol used is crucial for the application in dealcoholised wines. A new technique, which is eligible for another patent, was used for this.

In addition to the improvement of dealcoholized wines, other applications are also being considered, such as fortified wines and distilling mashes. If a normal wine is fermented at a reduced pressure, large quantities of aromas and alcohol evaporate. The aromas are recovered using the technology presented, while the alcohol is removed. This is an elegant way to reduce excessive alcohol content. In any case, a valuable additional product is obtained: food-grade carbon dioxide that can be used in the beverage industry.

The process is being developed to market maturity as part of a Franco-German project under the brand 'Montclair Tech'. It is supported by Bernard Magrez Start-Up Win (Strasbourg) and Triathlon, the entrepreneurship ecosystem of Saarland University.

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2:55pm - 3:00pm
ID: 188 / SES-06: 7
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Wine fermentation, bioprotection, Metschnikowia, diversity

Unveiling Metschnikowia spp.: Mechanisms and Impacts of Bioprotection in Winemaking

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Bioprotection, leveraging beneficial microorganisms, has emerged as a sustainable approach to modern winemaking, minimizing reliance on chemical preservatives like as sulfur dioxide (SO_2). Among these microorganisms, non-*Saccharomyces* yeasts, particularly *Metschnikowia pulcherrima* (MP), have garnered significant attention. By establishing a favorable microbial environment during the early stages of fermentation, MP reduces the risk of undesirable fermentations and spoilage caused by lactic acid bacteria, *Brettanomyces bruxellensis*, or acetic acid bacteria (AAB). Pulcherriminic acid, an iron-chelating compound responsible for the red pigment, pulcherrimin, has long been considered the key mediator of MP bioprotection through iron deprivation. This yeast species also plays a dual role in shaping microbial dynamics and enhancing wine quality. This study explored the broader bioprotective potential of *Metschnikowia* species, including those other than MP, against a model AAB.

In a first step, forty-six strains of *Metschnikowia* spp. were co-inoculated with the AAB *Gluconobacter oxydans* (Go), responsible for acetic souring in commercial grape juice. Monitoring bacterial growth over time revealed three distinct yeast BP profiles. Only one strain (*M. reukaufii*) exhibited no BP capacity. The majority of *Metschnikowia* strains (43) significantly delayed Go growth, but resulted in only a modest reduction in bacterial population after 7 days of incubation. Two strains (MP) demonstrated highly effective BP capacity, with minimal bacterial growth observed even after 7 days.

In the last phase of the study, we quantified pulcherrimin in the medium by its absorbance (550 nm) and of pulcherriminic acid precursor by LC-MS/MS, and no significant correlation between the presence of these compounds and the BP capacity of *Metschnikowia* strains against Go was detected. To further evaluate alternative mechanisms, we assessed the influence of nutritional limitation (nitrogen sources, sugar, oxygen and iron), inhibitory compounds production and cell-cell contact, using differential bacterial growth media. Interestingly, Go growth was inhibited only in the presence of MP cells, regardless the medium composition, suggesting a key role of cell contact in the BP capacity of MP. These findings provide new insights into the efficient use of *Metschnikowia* as a natural alternative to sulfite addition for controlling specific spoilage microorganisms in winemaking.

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3:00pm - 3:05pm
ID: 228 / SES-06: 8
Abstract Submission

Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact, Wine, environment, health and sustainability

Keywords: Metabarcoding, microbial terroir, wine fermentation, sensory analysis, co-inoculation

Unveiling the fungal diversity of Falanghina grapes and the role of autochthonous Saccharomyces and non-Saccharomyces yeasts in wine fermentation

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Falanghina, a typical wine from the Sannio (Campania region, Italy), hosts a complex fungal microbiota that significantly influences both fermentation dynamics and sensory characteristics. This study aimed to compare different metabarcoding markers for profiling fungal communities and to characterize the diversity and role of non-*Saccharomyces* yeasts in natural fermentations. To assess fungal diversity, three DNA barcode markers (ITS1, ITS2, and D1/D2 of 26S rDNA) [1, 2, 3] were evaluated across six Falanghina grape samples and their corresponding musts at different fermentation stages. ITS2 provided the most comprehensive taxonomic resolution, identifying 63 fungal genera, whereas ITS1 and 26S revealed 20 and 17 genera, respectively. The predominant mycobiota included *Metschnikowia*, *Hanseniaspora*, *Saccharomyces*, *Pichia*, *Aureobasidium*, and *Starmerella*. However, culture-based methods enabled the identification of additional genera, such as *Candida*, *Wickerhamomyces*, *Rhodotorula*, and *Sarocladium*, reinforcing the importance of integrating molecular and traditional approaches. A complementary study focused on the isolation and characterization of non-*Saccharomyces* yeasts from these fermentations. Fifty-seven biotypes were distinguished based on morpho-physiological traits and enzymatic activities, including β-glucosidase production and ethanol tolerance. ITS sequencing (ITS1-5.8S-ITS2 rDNA) [4] of strains confirmed the presence, in addition to *Saccharomyces (S.) cerevisiae,* of 13 non-*Saccharomyces* species, with *Metschnikowia (M.) pulcherrima* and *Hanseniaspora guilliermondii* being the most frequently occurring. Notably, microbial composition varied according to the grape's terroir. Autochthonous selected strains of *M. pulcherrima* (MP12 and MP24) and *S. cerevisiae* (BIO3) in 120L vinification trials were tested. Sensory analysis revealed distinct aroma profiles: wines fermented with BIO3 alone exhibited pronounced banana notes, while MP12+BIO3 enhanced pear and exotic fruit aromas, and MP24+BIO3 contributed citrus, grapefruit, floral, and vegetal nuances. These findings highlight the value of ITS2 as a metabarcoding marker for fungal diversity analysis in wine and underscore the potential of non-*Saccharomyces* yeasts in modulating sensory attributes. Co-inoculation strategies with *S. cerevisiae* offer promising applications to improve fermentation performance and enhance the aromatic complexity of Falanghina wines.

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3:05pm - 3:10pm
ID: 222 / SES-06: 9
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Tartaric acid, stabilization, gels, mini-contact test

Wine tartaric stability based on hydrogel application

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Tartrates are salts of tartaric acid that occur naturally in wine and lead to sediments that cause consumers' rejection [1]. There are currently different treatments to prevent its occurrence, with cold stabilization being the most traditional and well-known method [2]. Other ways to prevent the formation of these crystals consist of the addition of stabilizing agents such as metatartaric acid, capable of binding to the nucleation sites and preventing crystal structure expansion, thus increasing the solubility of these salts [3].

The aim of this work was to compare different tartaric stabilization treatments (cold stabilization and metatartaric acid) with the application of hydrogels (three-dimensional polymers capable of responding to different stimuli of the medium [4]) made with maleic and hyaluronic acids, which possess ion-exchange properties. Wine tartaric stability was tested by the mini-contact test [5]. In addition, the main physicochemical and colorimetric parameters were determined to evaluate the influence of the different treatments on wine quality [6].

The results showed that maleic and hyaluronic acid hydrogels were efficient stabilisers of red and white wines with tartrate instability due to the ion exchange properties of these materials, removing potassium from wines and obtaining similar stabilization results to those of metatartaric acid and cold treatments in a shorter period of time. In general, no significant changes were observed between wines treated with hydrogels and the other tartaric stabilization treatments in the physicochemical and chromatic characteristics. However, lower pH values were determined in wines treated with hydrogels, that may be attributable to the ion exchange mechanism.

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3:10pm - 3:15pm
ID: 147 / SES-06: 10
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: grape maturity, polysaccharides, enzymes, wine quality

Effect of pre-fermentative cold soaking and use of different enzymes on the chemical and sensory properties of Catarratto wines

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The wine industry widely recognizes that early-harvested grapes or those with uneven ripeness at harvest can produce wines with an "unripe fruit" mouthfeel [1,2]. Despite this, it is still unknown which compounds cause these sensory flaws or the most effective winemaking techniques to address them. This study evaluates the impact of pre-fermentative cold soaking (PCS) and the addition of enzymes during must fermentation on the chemical composition and sensory characteristics of *Catarratto* wine, a variety frequently linked to these issues, when early harvested [2]. The research hypothesis suggested that grape polysaccharides released during PCS, along with yeast polysaccharides released during alcoholic fermentation, would result in smoother wines by the end of fermentation [3]. Two winemaking approaches were compared: non-prefermentative cold soaked (NPCS) wines followed traditional white winemaking, while PCS wines underwent a 48-hour skin contact at 4°C. Five trials were conducted for each group, including a control, three pectolytic enzymes with secondary activities, and a β-glucanase enzyme inoculated with fermenting yeast. Alcoholic fermentation kinetics, chemical-physical parameters, volatile organic compounds, and sensory profiles were analyzed. PCS treatment increased grape polysaccharide release, doubling total colloids, and the wine's volatile profile improved, increasing aromatic complexity. Enzyme treatments further enriched yeast-derived polysaccharides, with β-glucanase showing the greatest effect, raising mannose levels. Addition of enzymes before alcoholic fermentation boosted yeast polysaccharide levels without altering sugar

fermentation kinetics. Sensory analysis confirmed that enzyme-treated wines reduced “unripe fruit” flavors and enhanced smoothness by the end of the fermentation. These findings demonstrate for the first time the potential of these techniques to refine the overall quality of *Catarratto* wines from early harvested grapes.

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3:15pm - 3:20pm
ID: 135 / SES-06: 11
Abstract Submission

Topics: Chemical and biochemical reactions, including grape and wine microorganism’s impact, Wine, environment, health and sustainability

Keywords: side stream valorisation, spent yeast, mannoprotein, yeast beta-glucan, fermentation lees

Exploiting the diversity in spent yeast for its valorisation towards producing yeast-derived processing aids.

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In view of sustainability and zero-waste initiatives, the valorisation of sidestreams is a key emerging topic in the wine industry. Spent yeast (SY), usually found in the fermentation lees, is the second largest sidestream in wineries, accounting for approximately 25% of the total sidestreams, amounting to approximately 2.5 million tonnes worldwide[1,2]. Today, SY is mainly either processed as waste, which is associated with a high cost, or used for low-value applications such as bioenergy or compost[1,3]. However, several high-value applications are on the rise where specific yeast-derived components are used for functional purposes in food or feed. Within the wine industry, several of these yeast-derived products are already used to improve wine quality. For example, mannoprotein isolates can be used to protect against tartrate precipitations or protein haze and to accelerate the effects on on-lees ageing [1,4]. However, these products are usually derived from baker’s yeast instead of using the spent yeast already available. To accommodate the use of SY for such high-value applications, it is important to understand yeast properties to allow for an efficient production of these yeast-derived components. Therefore, we set out to investigate the effect of fermentation on yeast by examining a wide variety of SY samples to evaluate their potential for valorisation towards functional yeast-derived components.

To achieve this, 30 spent yeast samples were collected from various wineries and breweries. These samples were analysed for a set of chemical (e.g. cell wall composition, protein content, polyphenol content) and physiological characteristics (e.g. cell size, cell wall hydrophobicity, cell surface charge). In these samples, a large variability in cell wall compounds (β-glucan 8-14% and mannoprotein 7-15%) was observed. To investigate the impact of this variability on the isolation of yeast-derived components, SY was autolysed and the amount of cell wall material in the isolates was determined. It varied between 22 and 87%. In addition, the assimilable nitrogen content in yeast extracts varied by a factor of 5 depending on the specific SY sample. Using this information, specific recommendations can be made on the suitability of an SY stream for valorisation purposes.

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3:20pm - 3:25pm
ID: 150 / SES-06: 12
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices

Keywords: permeation, closure, dimethylsulfide, aroma transfer

Dimethyl Sulfide Transfer Through Wine Closures During Bottle Aging: Implications for Wine Aroma Management

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Dimethyl sulfide (DMS) is a volatile sulfur compound with a complex role in wine aroma, contributing both desirable and undesirable sensory characteristics depending on its concentration (1). While DMS is known to accumulate during bottle aging through the degradation of precursors such as S-methylmethionine (SMM) (2), this study provides the first demonstration that DMS can also be lost through wine closures *via* permeation mechanism. This phenomenon, previously unreported, highlights the critical role of closure permeability in shaping the aromatic profile of aged wines.

In practice, we used 3 different experimental designs:

- Set 1: a model wine solution was prepared, with 3 bottles spiked with DMS and 3 left as controls, all sealed with 4 different closures and equipped with tenax tubes to capture volatiles **at the top of the bottles.** The bottles were aged vertically at 35°C, with GC-MS analysis performed on the tenax tubes after one month.

- Set 2: model wines were prepared with controlled SMM concentrations and sealed with 4 closures of varying oxygen transfer rates (OTR). Accelerated aging experiments were conducted at 35°C for 4 months.

- Set 3: To validate findings, similar analyses were performed on Syrah wines aged 2 years in standard cellar conditions with closures of varying OTR.

The results obtained in the set 1 demonstrated DMS permeation through closures, as DMS was detected only in Tenax tube placed on the top of the bottles containing the spiked solution. In the set 2, accelerated aging experiments revealed that up to 12% of DMS in model wine was lost through micro-agglomerated closures. Finally, in Syrah wines, DMS concentrations increased during bottle aging due to SMM degradation. However, wines sealed with higher-permeability closures showed reduced DMS levels compared to those with low-permeability closures, corroborating findings from model wine studies.

This study highlights the dual role of closures in managing oxygen ingress and volatile compound retention. Low-permeability closures can help preserve DMS in wines where it enhances aromatic complexity, while higher-permeability closures might mitigate reductive off-flavors in wines prone to sulfur compounds. These findings may account for the reductive notes empirically observed in red wines sealed with highly impermeable closures compared to those bottled with more permeable alternatives. The latter could be advantageous by facilitating the permeation of light volatile sulfur compounds, such as H_2S, MeSH, or EtSH.

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3:25pm - 3:30pm
ID: 106 / SES-06: 13
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Quercetin precipitation, Material other than grapes (MOG), Polyphenols, Fermentation

Effects of Non-Grape Materials on Wine Quercetin Composition: Insights from Synthetic and Merlot Grape Juice Fermentation

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Quercetin precipitation is an increasingly common problem in red wine in recent years. Sediment formation occurs even a couple of years after bottling, indicating a slow and unpredictable process. This instability results in the formation of amorphous sediment, which is visually unpleasant and leads to substantial product depreciation. Mechanical grape harvesting, which is being increasingly adopted, often introduces material other than grapes (MOG), such as leaves and stems, which may contribute to increased quercetin content in finished wine and therefore favoring precipitation, exacerbating a problem already intensified by climate change. Additionally, MOG can also alter the sensory and chemical properties of wine [1, 2]. This study investigated the effects of addition of grape leaves and stems in three different concentrations (1%, 2% and 3%) on quercetin content during fermentation in Merlot wines. Synthetic grape must was additionally used as a simplified model to better study the impact of MOG. Grape stems were rich in total polyphenols and catechins, while leaves contained higher concentrations of quercetin derivatives, particularly quercetin glucuronide. During fermentation, the addition of leaves and grape stems significantly influenced quercetin glucuronide, total polyphenols, and catechins, showing a clear dose-dependent relationship (3% > 2% > 1%). Leaves promoted a steady accumulation of quercetin glucuronide in both matrices, whereas grape stems exhibited a rapid initial release followed by a decline, which was more pronounced in the chemically complex environment of Merlot grape juice. Both leaves and grape stems significantly increased total polyphenol content, with grape stems having a stronger effect on catechin levels than leaves. In synthetic grape juice, the increase in polyphenols was more prominent due to the simpler matrix, while in Merlot grape juice, the high baseline polyphenol level caused a reduced accumulation. Furthermore, wines with higher percentages of grape stems were the only ones showing increased yellow color intensity and clarity. This study reveals how MOG, such as leaves and stems, influence wine polyphenol composition in a dose-dependent manner. In particular, the increase in quercetin, coming from grape leaves, might increase the risk of quercetin precipitation in the finished wine. Therefore, machine harvesting of grapes requires a careful evaluation of possible introduction of MOG in grape must, especially in regions already experiencing higher risks of quercetin precipitation and variability in wine quality due to climate change.

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3:30pm - 3:35pm
ID: 154 / SES-06: 14
Abstract Submission
Topics: Winemaking processes and oenological practices, Wine, environment, health and sustainability
Keywords: Chitosan, rosé wine, sulphurous, malolactic fermentation

Exploring the inhibitor effect of different commercial chitosan-based preparations on malolactic fermentation in rosé wine

Lucía Osete Alcaraz[1], Francisco Lopez Galvez[1], Encarna Gomez Plaza[1], Ricardo Jurado Fuentes[2], Ana Belen Bautista Ortin[1]
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Chitosan is a natural polymer of β-D-linked N-acetyl-D-glucosamine units (1,2), that has only recently been approved by OIV for its use in winemaking to help with microbial control, metal chelation, clarification, and reducing contaminants[1]. Beyond wine, it has also been shown to exhibit other beneficial properties, such as antioxidant and antiradical effects, in various foods. However, the full extent of its actions in must and wine has yet to be thoroughly explored. For microbial control, sulphurous is usually used in wine industry, but this compound has some risks and inconveniences that make it necessary to look for alternatives to its use, even though it is cheap and very practical. The main issue with sulphites is that they are allergenic compounds that can cause severe reactions in sensitive populations or in high concentrations they modify the sensory properties of the wine[2].

In this study, we aimed to test four commercial chitosan-based preparations to inhibit malolactic fermentation in a rosé wine produced in our experimental winery and compared them to sulphurous treatment. Microbiological analysis of lactic and acetic bacteria, together with the determination of malic, lactic and acetic acid concentrations were carried out in the wine for 45 days. Furthermore, the composition of the chitosan samples was analysed by mass spectrometry. The results showed that only two of the quitosan treatments were able to effectively inhibit the malolactic fermentation, while the other treatments, including the sulphurous treatment, were only capable of delaying it. Among the chitosan treatments that inhibit the fermentation, one, which managed to reduce the CFU/mL to zero in only seven days, was a preparation that also contained small amounts of fumaric acid in the formulation, while the other treatment, where the formulation was composed only of a yeast extract and chitosan reduced the CFU/mL more slowly until after about 30 days reached zero. These results allow us to correlate the composition of the different chitosan preparations with their effectiveness, as well as to show that certain chitosan combinations can inhibit malolactic fermentation more effectively than a sulphurous treatment.

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ID: 189 / SES-06: 15
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Pinot noir, stems, maceration, tannin

Experiments with the use of stems in Pinot noir winemaking

Danila Chiotti, Ulrich Pedri, Eva Überegger
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Vinification trials were carried out between 2018 and 2021 in the experimental winery at Laimburg Research Centre, Alto Adige, to test the effect of grape stem inclusion during fermentation of Pinot Noir. In 2018 and 2019, grapes were harvested at two different moments during the vintage. In the subsequent two vintages, there was only one moment of harvest. The experimental design compared a fully destemmed control (0% stems) with trials adding 25%, 50%, 100% and 200% stems. In all trials, the presence of stems was observed to have an impact on both the chemical and sensory aspects. With increasing percentage of stems used during maceration, the alcohol and total acidity decreased while pH increased. Anthocyanin concentration remained almost unchanged, whereas dry extract and total polyphenols increased. At tasting, wines with 0-50% stalks retained fruity aromas, harmony and typicity. Beyond this percentage, notes of herbs and leather were more expressed. In addition, bitterness and astringency increased. The presence of stalks (in percentages of 25% and sometimes 50%) made the wines more interesting and appreciated than the control.

Bibliography

Experiments with the use of stems in Pinot noir winemaking

SES-07: Flash talks 2 - Instrumental Analysis and Profiling

Time: **Wednesday, 25/June/2025: 4:10pm - 5:10pm**

Location: **Seminar room 1**

Building A1, basement

Session Chair: **Aurélie Roland**, Institut Agro Montpellier
Session Chair: **Peter Robatscher**, Laimburg Research Centre

Flash Talk Presentations

4:10pm - 4:15pm
ID: 207 / SES-07: 1
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Press wines ; Aromatic composition ; Phenolic composition ; Vintage

Chemical composition of press and free-run wines from three vintages and Bordeaux grape varieties. A Comprehensive Analysis.

Margot Larose[1,2], Vincent Decup[2], Michael Jourdes[1], Stéphanie Marchand[1]
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Press wines play a crucial role in red winemaking, representing up to 15% of the final blend [1]. Optimizing their value is essential both economically and for maintaining wine identity, especially given evolving climatic and societal challenges. However, little recent research exists on their composition. This study provides an initial assessment of press wines' chemical characteristics.

A total of 262 press wines and their corresponding free-run wines were analyzed from Cabernet-Sauvignon and Merlot across three vintages (2021–2023). General parameters, including pH, total acidity, volatile acidity, and total alcohol (TAV), were measured alongside color analysis. Volatile compounds (dimethyl sulfide, its precursor, and 32 esters) were analyzed via SPME-GC-MS. Phenolic content, including total tannins, total anthocyanins, anthocyanin monomers, and flavanols, was determined using spectrophotometry, HPLC, and UPLC techniques.

Results revealed significant compositional differences between press and free-run wines, influenced by grape variety and vintage. Principal Component Analysis confirmed distinct chemical profiles.

For Merlot, press wines had higher pH and lower TAV across all vintages. Esters were more abundant in free-run wines, while pDMS levels varied depending on the year. Press wines contained more tannins and flavanols, but total anthocyanin levels showed no significant differences.

For Cabernet-Sauvignon, trends were similar: press wines had higher pH and lower TAV, and free-run wines had higher ester concentrations. Press wines exhibited greater tannin and flavanol content, with no significant anthocyanin variation. Unlike Merlot, pDMS concentrations in Cabernet-Sauvignon remained stable in 2021 and 2022 but were significantly higher in free-run wines in 2023.

This study provides a foundational database on the aromatic and phenolic composition of press wines over three vintages. The findings challenge assumptions about their role, revealing significant chemical differences.

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4:15pm - 4:20pm
ID: 266 / SES-07: 2
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Valpolicella, aging, withering, geographical origin

Classification of "Valpolicella Superiore" wines in relation to aromatic composition: influence of geographical origin, vintage and aging

Benedetta Melloni, Giacomo Cristanelli, Giovanni Luzzini, Davide Slaghenaufi, Maurizio Ugliano
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The Valpolicella appellation, mainly known for Amarone and Ripasso, is experiencing growing interest in Valpolicella Superiore (VS), a lighter red wine aligning with consumer demand. However, anecdotal evidence suggests different stylistic interpretations of VS, potentially causing consumer confusion. This study aimed to assess how vintage, grape origin, aging, and post-harvest withering influence VS aromatic composition and to identify vinification styles within the sample set.

Seventy commercial VS wines, differing in vintage, grape origin, and post-harvest withering, were analyzed. The volatile chemical profile was assessed via GC-MS coupled with SPE and SPME techniques, while enological and phenolic parameters were determined through spectrophotometric analysis. These data were compared to sensory evaluations from a wine competition panel. Multivariate analysis classified VS wines based on volatile profiles, with vintage/aging and grape origin being key differentiators, mainly affecting terpenes, norisoprenoids, esters, lactones, benzenoids, and fatty acids. Grape withering also influenced certain subsets, impacting benzenoids, norisoprenoids, terpenes, and esters.

Complex interactions emerged between grape origin and vintage, particularly in norisoprenoid and terpene content, distinguishing VS wines from those of the Classico sub-region. In VS wines from the Classico sub-region, older vintages (2017–2018) exhibited

higher levels of norisoprenoids such as β-damascenone, TPB, and TDN, alongside linear terpenes like β-citronellol and geraniol. More recent vintages (2019–2020) were richer in norisoprenoids such as β-ionone and β-damascone. In VS wines, cyclic and bicyclic terpenes were found in higher concentrations: older vintages contained greater levels of α-phellandrene, limonene, and terpinolene, as well as β-damascenone, β-ionone, and β-hydroxy-damascone. More recent vintages were distinguished by higher concentrations of TPB, vitispirane, 3-hydroxy-β-damascone, linalool oxide, and 1,4-cineole.

Sensory evaluation categorized the wines into seven stylistic groups with distinct organoleptic traits. The analysis underscored the aromatic complexity of each style, with alcohol content and compounds such as dimethyl sulfide, various terpenes, trans-3-esen-1-ol, ethyl butanoate, 3-methylbutanoic acid, and furfural contributing to the sensory heterogeneity of the examined wines

Bibliography

N/A

4:20pm - 4:25pm

ID: 210 / SES-07: 3

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Wine oxidative stability, Peptides, SPE, LC-MS

Elucidating white wines peptides: An Analytical Breaktrough

Julie Gisquet[1,3], Florian Bahut[1,2], Nathalie Sieczkowski[2], Régis Gougeon[1], Maria Nikolantonaki[1]

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The chemistry of wine is particularly complex due to biochemical and chemical interactions that significantly modify its organoleptic characteristics and stability over time. Aging on lees is a well-known practice during which various compounds are released, ensuring wines oxidative stability and its overall sensory quality [1,2]. Peptides are key compounds extractible from wine lees known for their tensioactivity [3], antimicrobial [3] and their antioxidant activities [4,5], however their chemical diversity is poorly studied. Our research team is interested in characterizing and evaluating the evolution of wine peptidic fraction during aging on lees, to determine how their different physico-chemical properties (polarity and size) influence the overall quality of the wine. In that respect, we have developed a combined SPE / LC-MS analytical methodology for overcoming the challenges associated with peptides separation and detection. Method optimization was carried out using a rich pool of peptides generated after BSA enzymatic digestion in model wine solution. Two SPE cartridges, a reversed-phase and a cation-exchange, were tested after adapting elution conditions. Results show that the extraction efficiency varied between the two approaches. The cation-exchange cartridge provided higher overall recovery and helped to overcome some limitation of reversed-phase cartridge, related to the loss of hydrophilic and small peptides. Five different LC columns were compared, including reverse phase (RP) and hydrophilic interaction (HILIC), with different gradient conditions (solvent pH and composition in ACN, elution time) as well as sample solubilization conditions. The results show that one of the columns, combined with specific conditions, including elution gradient for RP and elution gradient, mobile phase composition, and pH for HILIC, demonstrated superior performance. The separation performance was characterized by an increased number and a better distribution of detected features throughout the analysis time. In detail, in a total of respectively 4308 and 2964 detected features for RP and HILIC columns, only 1475 (34.24%) were in common. These results show a good complementarity between RP and HILIC separation modes indicating the use of both for a more complete description of wines peptidic fraction. To conclude, the proposed analytical approach shall allow complete description of peptide composition with highly repeatable annotations and quantification of peptides even in mixed hydrolysates.

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4:25pm - 4:30pm

ID: 157 / SES-07: 4

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Aroma precursors, acid hydrolysis, phenolic aromatic fraction, glycosides

Identification of novel aromatic precursors in winemaking grapes using an optimized fractionation and UHPLC-MS analysis

Belén González-Martínez, Arancha de-la-Fuente-Blanco, Vicente Ferreira

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Winemaking grapes contain a diverse array of non-volatile precursors that become noticeable only after hydrolysis reactions or molecular rearrangements, during which aroma compounds are generated and released [1]. Among these, glycosidic precursors are the most abundant and play a key role in the development of wine aroma [2]. Although direct determination of these molecules is possible using UHPLC-MS [3], it remains challenging due to the lack of commercial standards, the wide variety of precursors associated with the same aroma, and their typically low concentrations. This study aims to identify the largest possible number of

aroma precursors through an optimized fractionation approach [4], involving a sequence of semi-preparative chromatographies, first by size exclusion and then by normal phase fractionation. This method is designed to reduce the excessive complexity of grape samples in UHPLC-MS analyses, thereby facilitating precursor identification.

For this purpose, a phenolic-aromatic fraction from Garnacha grapes was subjected to silica gel fractionation, improving a previously established protocol by increasing the sample size and adjusting the polarity of the mobile phases. A total of 96 fractions were obtained, 92 of which released aroma upon hydrolysis. These fractions were analysed using SPME-GC-MS to identify where the precursors of key varietal aromas -such as terpenes, norisoprenoids, phenols, vanillins, and cinnamates- were located. The hydrolysates from 55 of these fractions contained aroma molecules of interest and were subsequently analysed by UHPLC-MS to detect potential precursors. The identification process was based on three criteria: a) the expected molecular mass of the precursor, b) the presence of fragments in the MS/MS spectrum that were consistent with the precursor's structure, and c) the correlation between the precursor signal in UHPLC-MS and the corresponding aroma signal in GC-MS for the same fractions.

As a result, 175 precursors were identified, including 67 novel compounds not previously reported in the literature. Among these, 54 precursors were confirmed based on all the three identification criteria. The majority of the identified precursors were disaccharides (79) and monosaccharides (63), with a smaller proportion of trisaccharides (33). Noteworthy among them were 54 terpene precursors, 24 phenol precursors, 22 vanillin derivatives, and 14 cinnamate derivatives. This represents both a quantitative and qualitative advancement in the evaluation of the potential aromatic quality of winemaking grapes using UHPLC-MS.

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4:30pm - 4:35pm
ID: 173 / SES-07: 5
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Metabolomics, grape must, Muscat of Alexandria, peptides

Metabolomic fingerprint changes during the alcoholic fermentation at industrial level of Muscat of Alexandria grape must

Maria Marinaki[1,2,3], Panagiotis Arapitsas[4,5], Christina Virgiliou[2,3,6], Georgios Theodorodis[1,2,3]
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Muscat of Alexandria is one of the oldest cultivars still existing, globally recognized for its distinctive aroma, and the primary grape variety cultivated in the Greek Island of Lemnos, yielding various white wines with designated origins [1,2]. On the other hand, understating the changes occurring during alcoholic fermentation is of paramount importance in wine science and wine making, and untargeted metabolomics, which enable the registration of thousands of metabolites in a single analysis, could serve as a valuable tool for the comprehensive study of these changes.
The aim of this study was to track the metabolomic profile of Muscat of Alexandria grape must during the industrial-level alcoholic fermentation. For this purpose, numerous samples were collected from eleven tanks originating from three wineries on Lemnos Island across two vintages (2019 and 2020) and analysed using ultra-high pressure liquid chromatography coupled to time-of-flight mass spectrometry in both positive and negative electrospray ionization modes (UPLC-QTOF-MS). The data processing and analysis divided the annotated metabolites into different categories based on the behaviour. Between others, the tentative biomarkers included sugars, organics acids, vitamins, amino acids, peptides, flavonoids, nucleosides and terpene glycosides. Notably, small peptides exhibited analogous trends with amino acids, indicating rapid consumption similar to the amino acids. This peptides consumption potentially elucidated the observed proline increase, which is not preferrable by the yeasts. Additionally, some peptides exhibited increased concentrations towards the end of fermentation. Furthermore, the hydrolysis of terpenes and phenolic glycosidic bonds, alongside the release of nucleic acid building blocks into the must during fermentation, were highlighted. Overall, this comprehensive analysis enhances understanding of how alcoholic fermentation influences wine quality under realistic conditions.

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4:35pm - 4:40pm
ID: 245 / SES-07: 6
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Cineoles, DMS, Whitered grapes, typicality

Novel insights into Passito wines aroma typicality. Rationalizing the markers of varietal and geographical origin of Amarone DOCG.

Giovanni Luzzini[1], Davide Slaghenaufi[1], Jessica Anahi Samaniego Solis[1], Giacomo Cristanelli[1], Alessia Ercolini[1], Riccardo Tedeschi[2], Aldo Neil Mendoza[1], Maurizio Ugliano[1]

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Valpolicella is a famous Italian wine-producing region (Paronetto & Dellaglio, 2011), whose main characteristic is the extensive use of the post-harvest withering technique, which takes place in naturally ventilated rooms called '*fruttai'* (Bellincontro et al., 2016). With this technique, three PDO red wines are produced: '*Ripasso della Valpolicella',* '*Recioto della Valpolicella'*, and the most famous '*Amarone della Valpolicella'*. The withering process involves a range of physical, physiological, and biochemical changes that significantly impact the final quality of the grapes and the consequently wine (Barbanti et al., 2008; Zenoni et al., 2016).The aim of this study was to identify chemical volatile patterns of varietal and geographical typicality of Amarone wines. This study considers different sample sets: a set of experimental wines produced from withered grapes of different origins and vintages (2017-2019), a large dataset of 45 commercial Amarone wines from different vintages (2015, 2016, and 2019), and a data set of 33 samples from two commercial Amarone labels of the same winery from old vintages (1974 to 2016). An accelerated aging treatment protocol was employed: samples were stored at 40°C and 16°C for 30 days. Free volatile compounds and glycosidic precursors were analysed with different GC-MS techniques. Enological parameters of wines were analyzed by the mean of multiparametric analyzer with specific enzymatic kits. Sensory characteristics of the wines have been investigated through sorting tasks performed with semi-trained panel.

This study highlighted the importance of certain volatile compounds of different biochemical origins, including fermentative and varietal origins such as 1,4- and 1,8-cineole, norisoprenoids, esters and DMS. The occurrence of these compounds has been attributed to specific compositional parameters of grapes and wine, such as terpinen-4-ol, pH, and PAN (Primary Amino Nitrogen).

Concerning geographical typicality, application of multivariate data analysis techniques allowed to identify volatile chemical profile representing the chemical signature of the geographical origin. Main drivers of the geographical pattern were norisoprenoids and terpenes. The latter, showed different patterns of typicality according to wine aging periods. Also, Amarone wines from older vintages (1974-2016), despite the impact of different vintages and aging periods, showed specific volatile chemical patterns for each wine, even after major chemical modifications due prolonged aging treatments.

Azienda Agricola F.lli Tedeschi is acknowledged

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4:40pm - 4:45pm

ID: 294 / SES-07: 7

Abstract Submission

Topics: Vine science and link with grape and wine quality

Keywords: Volatile phenols, smoke taint, translocation, wildfires-climate change

New insights of translocation of smoke-related volatile phenols in vivo grapevines

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The increasing frequency of wildfires in grape-growing regions is seen as a significant risk for the grape and wine industry. Volatile phenols (VP) are taken up by grapevines during wildfires and contribute to the perception of smoke taint in wine. Seven VPs -guaiacol, 4-methylguaiacol, *o*-, *p*-, *m*-cresol, syringol and 4-methylsyringol- have been identified as the main predictors of smoke taint development in wine. A previous study using an isotope tracer technique with guaiacol and d_3-guaiacol demonstrated that it is possible for this compound to be absorbed by the leaves and transported to the bunches [1]. However, the mechanism of translocation of other VPs have not been extensively investigated. The aim of this study was to investigate VP absorption into bunches and leaves and their potential translocation to grape berries.

Leaves and berries of potted grapevines were placed in contact with an aqueous mixture of deuterated VPs (d_3-guaiacol, d_7-*o*-cresol, d_3-syringol and d_6-4-methylsyringol at 24 mg/L) at two different phenological stages (pre-*veraison* and post-*veraison*). Leaves, bunches, or leaves and bunches of one shoot were treated, while the second shoot was isolated with plastic bags and left untreated. Grape samples (exposed and non-exposed to the labelled volatile phenols) were taken after 1 and 7 days of treatment, as well as at ripeness (20º Brix) in triplicated. The free plus bound forms of VPs in grape were analyzed by GC-MS.

Data showed that not only guaiacyl type VPs can translocate from leaves to berries, but also *p*-coumaryl and syringyl type VPs. This process can occur from leaf to grape and even from bunch to bunch to a very limited extent. The concentration of deuterated VPs was higher in the grapes untreated at the post-*veraison* stage. However, the concentration of labeled VPs was higher in the grapes treated at the pre-*veraison* stage, which is in agreement with what other researchers have found [2].

Levels of labeled VPs decrease with sampling time in both pre-*veraison* and post-*veraison* samples. This may be due to multiple factors, from degradation-evaporation of the compounds remaining in the grape skin, translocation to other parts of the plant, dilution, and/or inclusion in metabolomic pathways to form more stable compounds. This study confirmed that several types of VPs can be translocated from leaves to berries as well as from bunch to bunch. Although translocation is fast (1 day), it was also limited with only very low quantities observed in non-exposed grape berries.

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4:45pm - 4:50pm
ID: 290 / SES-07: 8
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Wine oxidation, preformed α-dicarbonyls, Strecker aldehydes, key formation parameters, sacrificial amino acids

On the impact of preformed α-dicarbonyls in the production of Strecker aldehydes. Exploring the addition of sacrificial amino acids as a tool to reduce Strecker aldehydes production

Mónica Bueno[1], Ángel Manuel Aragón-Capone[2], María José Gómez-Cruz[1], David Marzo-Méndez[1], Laura D. Aguerri-Fernández[1], Ana Escudero[1], Vicente Ferreira[1]
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The reaction between Strecker amino acids and α-dicarbonyls is a key pathway in the formation of Strecker aldehydes (SA), which are crucial oxidation-related odorants in wine [1]. While most α-dicarbonyls result from phenolic compound oxidation, others, such as diacetyl and methylglyoxal, are present in wine regardless oxidation and their role in SA production is not well understood. Additionally, the influence of specific metal ions on SA production via these preformed dicarbonyls remains unclear. Meanwhile, strategies to reduce SA formation based on the addition of naturally-occurring amino acids in wine that could deplete those α-dicarbonyls reacting in Strecker reaction would be promising which is particularly relevant in the context of the growing demand for minimal-intervention wines.

For this purpose, several accelerated oxidation procedures were applied in both synthetic and real wine matrices to analyse the reaction rates of diacetyl and methylglyoxal in anoxic conditions, evaluate the impact of Mn^{2+}, Cu^{2+} and Fe^{2+} on their reactivity as well as to compare them with quinones formed from 4-methylcatechol and gallic acid. In the meanwhile, the reduction of SA by the addition of sacrificial amino acids was explored for alanine, tyrosine, aspartic acid, glutamic acid, serine, glycine, and threonine.

In synthetic wine under anoxic conditions, the reaction rates of diacetyl and methylglyoxal are significantly enhanced by Mn^{2+} ($p<0.05$), while Cu^{2+} has no effect. However, the production of SA from these compounds is still 2-3 orders of magnitude lower compared to phenolic-derived α-dicarbonyls, even when reactivity is higher in real wine. The addition of specific sacrificial amino acids to real wine results in small, but significant ($p<0.05$), changes in SA production.

Key findings of this research on SA production by preformed α-dicarbonyls include: first, these dicarbonyls are less reactive than those formed from phenolic compounds; secondly, their reactivity increases significantly in real wine, indicating substantial SA production even under anoxic conditions; finally, their reactivity can be influenced by metal ions in ways that differ from phenolic compounds.

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4:50pm - 4:55pm
ID: 191 / SES-07: 9
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Acetaldehyde, Aging, Oxidation, Polyphenols

Separation and elucidation of ethylidene-bridged catechin oligomers using preparative-HPLC and NMR

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During wine aging, small amounts of oxygen are absorbed and initiate a cascade of oxidation reactions. These aging reactions create many products including ethylidene-bridged oligomers and polymers of endogenous polyphenols, like flavan-3ols. This bridging is believed to reduce bitterness and astringency while enhancing color stability in aged wine [1]. The elongation reactions are products of interaction of flavonoids with acetaldehyde, an oxidation product of ethanol. While studies have been conducted confirming the reaction between acetaldehyde and various flavan-3-ols, there has not been research elucidating the structure of individual ethylidene-bridged flavan-3-ols. Previous acetaldehyde-flavan-3-ol nuclear magnetic resonance (NMR) experiments have either been conducted using the entire reaction mixture [2], or of the total amount of precipitates, which would include all of the polymers from the reaction. The goal of this experiment was to isolate various ethylidene-bridged catechin oligomers (dimer, trimer and tetramer) and confirm their proposed structure and yield using NMR. To investigate this, exogenous acetaldehyde and catechin (both 500 mg/L) were added to model wine (12.5% EtOH, pH 3.5), and incubated at 35°C for 7 days to allow for sufficient reaction. Using reverse-phase preparative-high-performance liquid-chromatography (RP-prep-HPLC) affixed with a diode array detector (DAD), the individual ethylidene-bridged catechin oligomers were isolated. Ethylidene-bridged oligomer purity and stability were determined using previously created liquid-chromatography mass-spectrometry (LC-MS) methods. After 10 hours of incubation at 20°C, the signal of the ethylidene bridged dimer was 23.3% of the initial isolate signal, demonstrating degradation after removal from the model solution. Isolates were dried using a freeze-dryer to preserve purity and stability. Interestingly, the ethylidene-bridged oligomers are stable

prior to isolation from the reaction mixture. These products could potentially be in equilibrium with the reactants. All isolates (ethylidene-bridged dimer, trimer, tetramer) were redissolved in methanol-d_4 and measured using both ^{1}H and ^{13}C NMR for elucidation of structure. NMR characterization of these compounds has increased our understanding of LC-MS data conducted on actual wine investigating the fate and kinetics of acetaldehyde mediated bridging of flavonoids.

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Bibliography

N/A

4:55pm - 5:00pm
ID: 267 / SES-07: 10
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Malvasia di Candia Aromatica, volatile organic compounds (VOCs), shelf-life, white wine

Study of Malvasia di Candia Aromatica shelf-life: effect of time and temperature on aroma compounds through an HS-SPME GCxGC-Ms approach

Leonardo D'Intino[1], Matteo Gatti[2], Andrea Bassani[1], Milena Lambri[1], Mario Gabrielli[1]

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Young white wines should be consumed within a short time after bottling to avoid loss of their fresh, fruity attributes. Shelf-life of white wines can be extended if they are stored under suitable conditions of time and temperature prior to consumption[1]. The acidic environment of wine plays a major role on the evolution of wine bouquet, promoting a variety of chemical reactions such as formation and hydrolysis, oxidation and cyclization. The aim of this study was to evaluate the effect of time and temperature on the aromatic composition of white wines (Malvasia di Candia Aromatica) coming from different vigor zones (High (HV); Low (LV) and control) of the same vineyard.

After the vigor determination by MECS-VINE sensor along the season[2], a prescription map was used for a mechanical selective harvesting. For each vigor zone, three bulks of 30 kg of grape were sampled from the harvester tanks, stored in cool anoxia until processing. At the end of alcoholic fermentation, the wines were stored for 12 months at 5, 15, 25°C and sampled at 0, 3, 6, 9 and 12 months. The analysis of VOCs was performed by a SPME-HS-GC×GC system coupled with a MS detector (Shimadzu, Italy). The volatiles were quantified against internal standard. The data analysis was performed by MetaboAnalyst 6.0.

A pool of 78 volatile compounds were quantified. The LV wines showed higher concentrations of terpenes respect to HV and Control wines[3]. To evaluate the effect of time and temperature, OPLS-DA models were applied, then the VIPs compound behavior was defined with FC analysis. For the time of storage, the most characterizing compounds were terpenes that were mainly down-accumulated over the time (e.g., a-Terpineol, Geraniol, Linalool). On the other hand, 1,3,8-p-Menthatriene, p-Mentha-1,5,8-triene and b-Myrcene were up-accumulated over time. For the temperature of storage, more heterogenous results were obtained: both terpenes and esters characterized the modification of aromatic profile and both down and up-regulated compounds were recorded. Among terpenes, a general reduction of these aromatic compounds (e.g., Linalool; Geraniol; b-Myrcene) coupled with the increase of their oxidated and derivates forms (e.g., trans-Anhydrolinalool oxide; Nerol oxide; cis-Linalool oxide) was recorded. The obtained preliminary data confirmed the expected differences in aroma composition among wines coming from different vigour zone, especially for terpenes.[1] According to the data, the aroma compounds follow literature available patterns, especially when stored for a long time at higher temperatures.[4]

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5:00pm - 5:05pm
ID: 272 / SES-07: 11
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Nero d'Avola grape, spontaneous fermentation, vine age, terroir

Characterisation of Sicilian Nero d'Avola grape and wine: a preliminary study

Iklima Odabaşı[1], Carmen Cris De Oliveira Nobre Bezerra[2], Denis Allieri[1], Alessio Altomare[1], Giulio Staffieri[1], Marta Baviera[1], Gvantsa Shanshiashvili[1], Nicholas Bonacina[2], Stefano Ferrari[3], Francesca Borghini[3], Ileana Vigentini[2], Daniela Fracassetti[1]

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The chemical composition and the sensory characteristics of wine result from dynamic interactions between several factors including grape variety, soil, viticultural techniques, climate conditions, yeasts metabolism, oenological approaches. Recently, Grigg et al. [1] described the vine age is commonly attributed to superior vine performance affecting the wine quality. Moreover, spontaneous fermentations can preserve the aromatic varietal character allowing the implementation of the link between the wine and the *terroir*.

This study aimed to evaluate the composition of Nero d'Avola grapes from vineyards of different age as well as that one of wines also obtained with spontaneous fermentation. *Vitis vinifera* L. cv. 'Nero d'Avola' samples were collected in 8 vineyards, 4 of them being 10-years old (10Y) and 4 being 20-years old (20Y), located in 3 different areas of Sicily. Grapes were characterised for average berry weight, must yield, general chemical composition (sugars, titratable acidity, pH, readily assimilable nitrogen), total and extractable flavonoids and anthocyanins, and microbiota. Triplicate microvinification trials with maceration were performed considering inoculated and spontaneous fermentations. For the latter, the microbial population was assessed during the fermentation. Once the alcoholic fermentations were completed, the wines were racked, stabilized and bottled. The wines were characterised for general chemical parameters, phenol-related indexes and aroma profile. The must yields were lower for grapes from 10Y vineyards than those from 20Y vineyards in most of the cases. No clear vineyard-age trends were observed for pH and titratable acidity maybe due to the vine irrigation. Little differences were found for total and extractable flavonoids and anthocyanins in grapes collected from the same area. However, the phenolic compounds seemed to be affected by the growing area of grapes with the higher altitude positively affecting their content. Relevant differences were detected for microbial populations on grapes that were found even in the first three days of fermentations. Nonetheless, minor changes in general chemical composition were observed in wines from inoculated and spontaneous fermentations, and from vineyards of different age. The phenolic compounds were higher in wines from 20Y vineyards as well as the colour index suggesting the role that the vineyard age could play on wine features. The study provides preliminary evidence of the impact of vine age on wine composition for an important grape variety for the Sicilian wine industry.

Bibliography

Funding

InnoNDA project is funded by Regione Sicilia, PROGRAMMA DI SVILUPPO RURALE SICILIA 2014-2022, SOTTOMISURA 16.1 "Sostegno per la costituzione e la gestione dei gruppi operativi del PEI in materia di produttività e sostenibilità dell'agricoltura"

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5:05pm - 5:10pm
ID: 104 / SES-07: 12
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Esters, metal ions, hydrolysis, matrix effect.

Revisiting esters hydrolysis in young white wines

Diana Alexandra Martin Rojas[1], Tatjana Radovanović Vukajlović[1], Martin Šala[2], Vid Selih[2], Ahmad Hosseini[1], Melita Sternad Lemut[1], Guillaume Antalick[1]

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Esters play an essential role in the young white wines' fruity expression, particularly the groups of ethyl esters of fatty acids (EEFAs) and higher alcohol acetates (HAAs) [1]. However, generally, these groups of esters decrease relatively fast during the first two years of ageing [1, 2]. Ester hydrolysis naturally occurs during wine maturation and bottle ageing [3]. Some authors suggested that the rate of esters hydrolysis could be affected by other factors such as the presence of metal ions or antioxidants [4, 5]. However, in wine, this has been poorly reported.

Thirty-three one-year-old commercial white wines, made from Chardonnay and Welschriesling varieties from different Eastern European countries, were subjected to accelerated ageing, all the samples in triplicate. Basic wine parameters were characterised and 17 esters were quantified by HS-SPME-GCMS before and after the forced ageing process. Additionally, the metal ion content (K, Ca, Na, Mg, Cr, Mn, Fe, Co, Ni, Cu and Zn) was measured using ICP-MS. EEFAs and HAAs concentration decreased with ageing as reported in the literature [1, 2]. However, an important matrix effect on the hydrolysis rate was observed between wines, particularly in the case of HAAs. Contrary to our expectations, there was no link between the hydrolysis rate and the initial concentration of esters. Interestingly, iron concentration was positively correlated (Spearman's correlation) with the loss of HAAs and EEFAs with the longest carbon chains (C10 and C12), suggesting that in real wine conditions metal ions could potentially favour ester hydrolysis. These results are in accordance with a previous study performed on white wines artificially spiked with metal ions and esters that showed that iron, manganese and copper increased the loss of esters during forced ageing irrespective of oxygen level [6]. Conversely, some varietal differences were observed with regard to the impact of metal ions on ester evolution during artificial ageing. This suggests that the role of metal ions in ester hydrolysis is matrix-specific. The present study demonstrated that ester hydrolysis is significantly affected by wine chemical components that differ from initial ester concentration and pH which were so far known as the most influential chemical factors on ester hydrolysis. Metal ions and particularly iron can potentially favour faster ester hydrolysis but the important matrix effect on ester hydrolysis rate observed in this study is overall driven by other factors, excluding pH, that still need to be investigated.

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SES-10: Flash talks 3 - Sensory Profiles and Consumer Acceptance

Time: **Thursday, 26/June/2025: 1:35pm - 2:35pm**

Location: **Seminar room 1** Building A1, basement

Session Chair: **Simone Giacosa**, Università degli Studi di Torino
Session Chair: **Edoardo Longo**, Free University of Bozen/Bolzano

Flash Talk Presentations

1:35pm - 1:40pm
ID: 257 / SES-10: 1
Abstract Submission
Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Wine complexity, peptides, kokumi, sensomic

Investigating kokumi flavour oligopeptides in wine

Paola Piombino[1], Elisabetta Pittari[1], Daniele Perenzoni[2], Urska Vrhovsek[2], Raffaele Guzzon[2], Luca Dellafiora[3], Florinda Perugino[3], Gianni Galaverna[3], Luigi Moio[1], Fulvio Mattivi[2]
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Kokumi is a complex sensation perceived as enhanced palatability. Under the influence of kokumi substances, foods/beverages tastes become more flavorful with increased intensity, spread, continuity, richness, harmony, and punch which are the six related characteristics corresponding to the Kokumi sensory concept [1]. Kokumi active peptides are distributed in many foodstuffs and relevant in fermented ones due to yeasts derived oligopeptides. Kokumi peptides identified from yeast extract showed diverse sensory features tested by sensomic approach: five leucyl dipeptides, γ-glutamyl dipeptides and the well-known kokumi-active glutathione (GSH) a tripeptide (γ-Glu-Cys-Gly) also present in grape and wine [2] [3].
Wine likely is the fermented beverage for which the sensory features represent one of the main quality characteristic driving appreciation and purchase. Among the most worldwide renowned wines, sparkling ones produced with Champenoise method, involve a second fermentation of the base wine in the bottle followed by aging in contact with yeast lees. Despite these premises, the presence and the sensory impact of kokumi substances in wine has been poorly explored. It has been stated that koku for wine is customarily expressed as “body” [4] but no evidence is reported and the kokumi sensory dimension in wine is currently unknown. This gap of knowledge has been addressed in a series of metabolomic, molecular docking and sensory analysis experiments. The kokumi sensory effects of Glycyl-L-Valine (Gly-Val), a dipeptide identified in sparkling wines among 11 putative kokumi oligopeptides activating CaSR (in-silico modelling) was shown [5]. Detection thresholds of Gly-Val, estimated by 3-AFC, ranged from 15 to 60 mg/L in wine, while no threshold was determined in model wine. These results show that Gly-Val is discernible in complex wine matrices but not model wine suggesting for the first time that it is a kokumi active compound. Based on these results, further 6 dipeptides are currently being studied to test their potential kokumi flavour in wine, according to the detected compositional patterns.

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Recent publications by the first author:

1) Piombino P., Lisanti M.T., Pittari E., Gambuti A., Moio L.(2025) Journal of the Science of Food and Agriculture, 105 (2), pp. 901 - 912
2) Perenzoni, D., Dellafiora L., Perugino, F., Vrhovsek, U., Piombino, P., Pittari, E., Guzzon, R., Moio, L., Galaverna, G., Mattivi, F. (2024). J. Agric. Food Chem. 72 (47), 26189-26208.
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1:40pm - 1:45pm
ID: 283 / SES-10: 2
Abstract Submission

Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences, Wine, environment, health and sustainability

Keywords: Sustainability, consumer research, wine packaging, bottle weigh.

Consumer Perception of Wine Bottle Weight and Its Impact on Sustainability

Natalia Santamaría-López[1], Alejandro Suárez[1], Anna Claret[2], Luis Guerrero[2], Anna Gomis-Bellmunt[3], Joan-Miquel Canals[4], Enric Nart[1]

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In the context of sustainability, this study evaluated consumer perception regarding the impact of glass bottle weight on wine valuation. One of the key factors to address in oenology, from a more sustainable perspective and in alignment with Sustainable Development Goals (SDGs), is the reduction of the carbon footprint [1]. Within the viticultural production process, the glass used in wine bottles is a significant contributor to CO2 emissions [2]. Reducing the amount of glass in bottles is technologically feasible; however, the challenge lies in aligning this technological viability with consumer acceptance [3].

The research aimed to understand if lighter bottles are associated with greater environmental benefits and how bottle weight influences consumer expectations of wine quality and price. An online survey was conducted with 232 participants, alongside an in-person tasting session involving 93 consumers.

The online questionnaire included a Likert scale to assess different statements related to sustainability and bottle weight, as well as bipolar linear scales with "Light Bottles" on one end and "Heavy Bottles" on the other [2][3]. In the in-person test, a realistic purchasing and consumption scenario was recreated by presenting consumers with an industrial-style shelf containing 80 nearly identical bottles—40 lightweight and 40 heavier. Their selections were analysed based on purchase intention, perceived price, and wine quality.

The results indicate that while consumers do not directly associate a lower glass weight with greater sustainability, heavier bottles are generally perceived as indicative of higher quality and price. Consumers were mostly "neither agree nor disagree" or only "somewhat agree" when asked if lighter bottles were associated with greater sustainability, a higher environmental contribution, or the requirement for eco-labelling. A slight positive correlation was found between heavier bottles and the perception of more expensive, higher-quality wines. However, the in-person test revealed that these perceptions did not significantly influence purchase decisions or hedonic evaluations of the wine.

Overall, consumer perception of lighter bottles in relation to sustainability remains ambivalent. While heavier bottles are seen as a marker of premium wines, this perception does not necessarily translate into purchasing behaviour. The acceptance of lighter bottles may require additional marketing and communication strategies to help shift consumer attitudes and align perceptions with sustainable practices in the wine sector.

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1:45pm - 1:50pm
ID: 110 / SES-10: 3
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Disease-resistant grape cultivars (DRHGCs), white wine, sensory analysis, chemical profiling, South Tyrol

Convergence and Divergence in Chemical and Sensory Profiles of Disease-Resistant and Vitis vinifera White Wines from South Tyrol: Addressing strategies for Market Adoption

Gavin Duley, Adriana Teresa Ceci, Edoardo Longo, Aakriti Darnal, Emanuele Boselli

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This study investigates the chemical and sensory profiles of white wines produced from disease-resistant hybrid grape cultivars (DRHGCs) compared to traditional *Vitis vinifera* L. cultivars in South Tyrol, Italy. Using advanced metabolomic approaches, including liquid chromatography-mass spectrometry (LC-MS) and comprehensive gas chromatography-mass spectrometry (GC×GC-MS), alongside sensory analysis techniques (modified rate-all-that-applies, mRATA, and projective mapping), the research reveals unexpected similarities between DRHGC and *V. vinifera* wines. While significant differences were observed in specific sensory attributes, such as olfactory notes of 'honey' and 'pineapple,' and volatile compounds like 1-hexanol and limonene, these differences were insufficient to clearly differentiate the wine types.

The findings challenge the traditional perception of DRHGC wines as fundamentally distinct from *V. vinifera*, suggesting that market resistance may stem more from consumer unfamiliarity than from intrinsic quality disparities. These results underscore the potential of DRHGCs as sustainable alternatives, providing high-quality wines with reduced environmental impact. Emphasizing the environmental benefits and addressing consumer perceptions could play a pivotal role in enhancing market acceptance.

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Poggesi, S., et al., 2022. Fusion of 2DGC-MS, HPLC-MS and sensory data to assist decision-making in the marketing of international monovarietal Chardonnay and Sauvignon Blanc wines. Foods 11, 3458. https://doi.org/10.3390/foods11213458

1:50pm - 1:55pm
ID: 248 / SES-10: 4
Abstract Submission
Topics: Winemaking processes and oenological practices, Sensory properties: psychophysics, experimental economy, connections with neurosciences, Wine, environment, health and sustainability
Keywords: PIWI, sustainable winemaking, wine quality, market adaptation

Enhancing Sustainability in Winemaking: The Role of PIWI in South Tyrol

Emanuele Boselli[1,2], Federica Viganò[3], Guido Orzes[4], Stefano Cesco[1], Edoardo Longo[1], Pasqualina Sacco[1], Gavin Duley[1], Alessandra Piccoli[3]
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The adoption of PIWI (*Pilzwiderstandsfähige*) grape cultivars, bred for resistance to fungal diseases, is a transformative step towards sustainable winemaking[1]. In South Tyrol, where mountainous landscapes make vineyard work demanding, PIWI cultivars benefit wineries by reducing pesticide treatments, labor intensity, and environmental impact.

This study, part of the *Sustainable Wine Production with Innovative Resistant Varieties (SUWIR)* interdisciplinary project at the Free University of Bozen-Bolzano, uses a holistic approach to evaluate the environmental, economic, and social impact of PIWI wine production. PIWI cultivars require fewer treatments than *Vitis vinifera* cultivars[2]—often fewer than conventional organic farming—leading to healthier soils, cleaner water, and lower CO_2 emissions. However, the adoption of PIWI cultivars does not always imply organic practices, though it generally aligns with organic principles by reducing synthetic treatments.

For small wineries, especially in mountain regions like South Tyrol, PIWI cultivars offer an economically and environmentally sustainable option. Small wineries struggle to find laborers to work in isolated, steep, and difficult terrains. Since PIWI vines demand less manual intervention than conventional organic viticulture, they offer an advantage by reducing reliance on seasonal labor while ensuring quality.

PIWI wines are gaining traction with consumers who value sustainability. A survey conducted among 1,500 wine enthusiasts across Italy, Germany, and Austria showed growing curiosity and appreciation for PIWI wines. However, their market presence faces challenges, particularly due to regulatory restrictions. To overcome these, education and storytelling will be key, highlighting the ecological benefits of PIWI and their unique sensory profiles.

To establish PIWI wines in the mainstream, collaboration between researchers, policymakers, and the wine industry is essential. Restaurants and wine bars can participate by adding PIWI wines to their wine lists, allowing consumers to discover them in different gastronomic settings. Increasing their presence in dining establishments will not only enhance familiarity but also foster greater consumer trust and enthusiasm, increasing market acceptance.

PIWI grape varieties are not just a technical innovation; they symbolize a new philosophy in winemaking—one that balances sustainability, economic resilience, and quality. By integrating PIWI wines into gastronomy, competitions, and wine education, the industry can make a lasting impact on the future of winemaking.

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1:55pm - 2:00pm
ID: 227 / SES-10: 5
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Withering process, polyphenolic profile, sensory analysis, reinforced wine

Influence of harvest time and withering length combination on reinforced Nebbiolo wines: phenolic composition, colour traits, and sensory profile

Camilla De Paolis, Giulia Scalzini, Maria Alessandra Paissoni, Susana Río Segade, Gaetano Pio Liscio, Domen Škrab, Lorenzo Pizzini, Simone Giacosa, Vincenzo Gerbi, Luca Rolle
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Sforzato di Valtellina DOCG is a reinforced dry red wine produced in the mountain area of Valtellina alpine valley (North Italy), using 'Nebbiolo' grapes that undergo a withering process [1]. This process impacts on the grape composition due to a sugar concentration and changes in secondary metabolism influencing volatile organic compounds (VOCs) and polyphenols [2]. The ripeness degree of the grapes at the harvest time and the withering process length are key factors in modulating these changes. Therefore, the aim of this work was to evaluate the combined effects of these two variables on phenolic components, colour features, VOCs composition and sensory profile of wines produced with 'Nebbiolo' withered grapes. During three consecutive vintages (2019, 2020 and 2021), grapes were harvested from two vineyards, then three different binomials were tested: early harvest/long withering (EL), medium-term harvest/medium-term withering (MM) and late harvest/short withering (LS). The end of withering was set at 1st December of the harvest year for all conditions, and the grapes were subjected to winemaking in two independent replicates each. Basic wine

parameters, total phenolic compounds (TPI), colour traits [3, 4] and VOCs were determined [5]. The results were supported by sensory analysis. LS samples, in both vineyards, had higher pH and lower acidity values compared to an earlier harvest. In addition, LS samples showed more stress compounds such as volatile acidity. In most cases, a reduction of TPI was observed in LS samples, specifically in 2019 for both vineyards. EL and MM wines displayed the darkest colour, with lower orange components compared to the LS. EL samples, in most years, showed highest content of terpenes, resulting in higher sensory perceived *fruity* and *flower* characters on average. LS samples presented a higher content of total benzenoids and lactones, that may have contributed to the lower liking of these samples, in which jam, *hay*, *leather* and *caramel* notes were perceived. Moreover, in some of LS sample a high concentration of N-(3-Methylbutyl)acetamide was detected, presumably influenced by a low grape health status [6]. A vintage effect was registered in mouth-feel sensations, in accordance with phenolic composition. In conclusion, EL and MM wines resulted in a higher phenolic content, with positive colour characters, and they were more appreciated by sensory analysis. Indeed, LS combination did not give advantages on final wine, particularly in total VOCs, and in some samples, it caused a decrease in health grape status.

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2:00pm - 2:05pm
ID: 302 / SES-10: 6
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Phenolic composition, polysaccharide fractions, anthocyanins, color intensity

Market analysis of Chilean Pinot Noir, Carménère, and Cabernet Sauvignon wines: A comparative study of chemical parameters across low, medium, and high price segments

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Wine quality is a complex concept determined by multiple factors, including vineyard management, winemaking operations, and the sensory perception of key attributes. Phenolic compounds and polysaccharides play a fundamental role in the expression of these attributes, as they directly influence characteristics such as color, flavor, and texture [1, 2]. In this context, recent studies have focused on the identification and quantification of these compounds to establish relations between chemical analyses and sensory perceptions, in an approach to quality concept. This approach helps expand the understanding of wine commercial categories in the Chilean market, such as varietal (young), reserve, and gran reserve, by providing a general profile of the composition of the country's main red wine varieties.

This research aimed to quantify the phenolic and polysaccharide composition of Chilean Pinot Noir, Carménère and Cabernet Sauvignon wines from three different commercial price segments. A total of 45 wines (15 per variety) were analysed, assessing pH, titratable acidity, total phenols, tannins, anthocyanins, color intensity, hue, anthocyanin profile (according to OIV protocols [3]), and the total content of polysaccharide fractions from different mass by using HPLC-IR [4].

Overall, differences in the concentration of these compounds were observed across the commercial price segments for all varieties. In Carménère, higher-priced wines showed the highest values for color intensity and total polysaccharide concentration. In Cabernet Sauvignon, higher concentrations of phenols and total tannins were observed as commercial price increased, whereas in Pinot Noir, the trend was completely opposite.

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2:05pm - 2:10pm
ID: 276 / SES-10: 7
Abstract Submission
Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Wine oxidative aroma, Quantitative Descriptive Analysis, sensory patterns, attributes ratio

Sensory patterns observed towards the oxidation of white, rosé and sparkling wines: an exploratory study

Ángel Manuel Aragón Capone[1], Arancha de la Fuente Blanco[2], Vicente Ferreira[2], Mónica Bueno[2]
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Oxygen management is crucial in terms of wine quality. Even more for white and rosé wines, which are less protected against oxidation than reds due to the lower levels of antioxidant polyphenols. This need is due to the existence of equilibria between chemical forms depending on the redox potential. These equilibria lead to the varying impacts of certain molecules on wine's aroma [1] and are essential to preserve positive sensory attributes related to white, yellow or tropical fruit [2,3].

The present work performs an exploratory study of the aromatic evolution of white, rosé and sparkling wines through their exposure to different doses of O_2 (0, 6, 12 and 35 mg/L over the stoichiometric to consume total SO_2). Therefore, it aims to assist the winemaking industry in understanding the aromatic impact of different O_2 doses on the decrease or development of specific notes related to wine quality.

Results outline different capabilities of O_2 consumption, being Verdejo (white) the most and Cava (sparkling) and Rosé the least. Furthermore, these consumption capabilities are related to redox potential measurements and robustness towards sensory changes; in other words, the higher the oxygen consumption, the smaller the sensory change.

A common sensory pattern was observed: firstly fruity notes decrease; then, “cooked vegetables” emerge; and finally “honey” and “cider/overriped apple” increase in detriment of the “cooked vegetables” note. Hence, sensory ratios related to the oxidation process were calculated from the quotient (tropical fruit + yellow fruit) / (honey + cider) showing a significant decrease (p<0.05) as oxidation progressed. Notably, the higher the O_2 consumption was, the greater the dose required to significantly reduce this quality-related ratio. Last, a remarkably significant correlation (p<0.001) was observed between preference and this sensory ratio, implying that preference might be considered as a relation of attributes.

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2:10pm - 2:15pm
ID: 171 / SES-10: 8
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism’s impact
Keywords: Resistant grape variety, yeast, thiol, aromatic profile

How can yeast modulate Divona’s aromatic profile?

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Volatile thiols play a key role in the aromatic expression of white wines, contributing to notes such as passion fruit, grapefruit, and herbal nuances [1]. These compounds, present as non-volatile precursors in grapes, require enzymatic activation to be released and realize their aromatic potential. The enzymatic activity of yeast during fermentation influences the release and transformation of thiol precursors, thereby modulating their final concentration in wine [2]. Divona is a new Swiss grape variety with quantitative trait loci for resistance to fungi: R*pv*10, R*pv* 3.3 (mildew), *Ren*3, *Ren*9 (powdery mildew), *Rgb*1 (black rot) and average susceptibility to grey rot (*Botrytis cinerea*) [3]. It produces wines with a fruity bouquet of exotic fruit and citrus, with occasional floral and mineral notes. The aim of this work is to see how the use of thiol-releasing yeasts can influence the composition and aromatic profile of Divona wines. In 2020, 2 thiol- revealing yeasts were compared with a control yeast on a Divona must from the experimental vineyard in Pully, VD, Switzerland. The presence of aromatic precursors in the must was measured by LC-MS. The wines were vinified at the Changins experimental winery, VD, Switzerland. Classical wine parameters were analysed by WineScan©, FOSS, thiols were measured by UHPLC-MS/MS and terpenes by GC-MS. The wines were also subjected to a sensory profile analysis. The results obtained with Divona were compared with similar trials on Sauvignon blanc carried out at the Wädenswil experimental estate. The results show that the Divona grape variety has thiol precursors in the must and the use of special yeasts can influence the final quantity of 3MH. The quantity of 4MMP is very low compared with the quantities found in Sauvignon blanc wines. Terpene concentrations are below the perception threshold. The sensory analyses showed that the general appreciation is not linked solely to the quantity of 3MH in the wine and takes into account the overall balance of the wine. The use of such thiol-releasing yeasts can influence the aromatic expression of the new Divona grape variety. Improving our knowledge of resistant grape varieties such as Divona will help to integrate them into the wine industry.

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2:15pm - 2:20pm
ID: 258 / SES-10: 9
Abstract Submission
Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Sparkling white wines, second-fermentation, MCRS (Mosto Rettificato Concentrato Solido), sensory quality

Solid Rectified Concentrated grape Must (SRCM) in sparkling wines production: studying the sensory impact of an innovative sugar substrate

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The production of sparkling wines requires sugars for the second fermentation. The Solid Rectified Concentrated Must (SRCM) is a water free crystalline form of grape sugar, offering a purer, more stable, and easier-to-use alternative to the liquid Rectified Concentrated Must (RCM). RCM is a grape must that has been stripped of all components except sugars and then concentrated.

However, it is still not considered as pure, stable, or practical to use as crystalline sucrose, which is permitted for sparkling and enrichment practices, but in the latter case, only in certain countries, excluding Italy and other major Mediterranean wine-producing nations. EU Regulation n. 1308/2013 allows the use of SRCM in winemaking under the same conditions as RCM. Previous experiments [1-2] have assessed the microbial stability and fermentation performance of SRCM in sparkling wine production. However, its impact on the sensory characteristics of wines needs to be further explored in depth, in different types of wines. This study investigated the sensory quality of 3 sugar substrates - SRCM, RCM, and sucrose, the latter in white (WS) or raw cane (CS) form - and six sparkling wines obtained from two different grape varieties (W1 and W2), each re-fermented with the 3 sugar substrates. The different matrices (water solutions of sugar substrates and sparkling wines re-fermented with them) were analysed by sensory analysis to compare and describe the respective sensory characteristics (smell/aroma, taste, mouthfeel). Significant differences and peculiarities were evaluated through discriminant (triangular test: TT) and descriptive (quantitative descriptive assessment: QDA) sensory methods [3-4] by a panel composed of 25 wine experts. Preliminary results show that no olfactory and taste significant differences exist between water solutions of sugar substrates. Results on wine differed depending on the wine type. The odour of W1 re-fermented with SRCM was significantly different ($\alpha<<0.001$) compared to that of W1 re-fermented with CS. Preliminary descriptive results suggest that W1 treated with SRCM was fresher and fruitier. Differently, W2 re-fermented with SRCM showed significant differences ($\alpha<0.05$) compared to W2 re-fermented with RCM, mostly due to acidity and more intense and persistent in-mouth effervescence. Further ongoing experiments will be useful to deepen these preliminary evidences, necessary to optimize oenological applications of this innovative and sustainable product.

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Recent publications by the first author:

1) Piombino P., Lisanti M.T., Pittari E., Gambuti A., Moio L.(2025) Journal of the Science of Food and Agriculture, 105 (2), pp. 901 - 912
2) Perenzoni, D., Dellafiora L., Perugino, F., Vrhovsek, U., Piombino, P., Pittari, E., Guzzon, R., Moio, L., Galaverna, G., Mattivi, F. (2024). J. Agric. Food Chem. 72 (47), 26189-26208.
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2:20pm - 2:25pm
ID: 202 / SES-10: 10
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Wine oxidative aroma, Olfactoscan, RATA, perceptual interactions

The impact of selected odorant combinations in wine oxidative aroma and their interactive role on the olfactory perception

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It is widely known the impact that oxidation has on wine sensory degradation and eventually, in the shortening of its longevity. To date, several molecules emerging through oxidation have been identified as potentially responsible for certain aromatic deviations (ADs) provoking in the wine notes of "dried fruit", "cooked vegetables" or "spirit-like alcohol". However, their combined role remains unexplored, not only for the expression of these notes but also for the omission of other positives such as "red fruit" or "spicy". Meanwhile, recent chemo-sensory advancements suggest that perception is determined by odorant interactions (creative, associative, competitive or destructive), merging in different aromatic vectors [1], and that it is also influenced by the aromatic context [2]. Hence, the main objective of the work is to evaluate different combinations of these odorants and their impact on the expression of certain attributes in different aromatic contexts of red wine.

The analysis is based on a systematic chemo-sensory study conducted on red wines. Eight combinations of the odorants prompted to play a major role in oxidative aroma (acetaldehyde, 2,4,5-trimethyl-1,3-dioxolane, diethyl acetal, 3-methylbutanal, methional and phenylacetaldehyde), were selected through multivariate analysis (PCA, ANOVAs, and k-means clustering). These combinations as well as the impact of the omission of each odorant on the expression of certain notes were evaluated using the Olfactoscan. The stimuli were assessed for aromatic contexts representing the aroma of young red wine, oak-aged and Cabernet Sauvignon.

This study determines the relationship that the selected odorants have in the development or inhibition of certain attributes. Besides, it is observed that the influence of the aromatic buffer is crucial for the aromatic robustness of the wine. Proof of this is that large compositional changes generate minimal impact on Cabernet Sauvignon, probably due to the differential role of its pyrazines, which act as aromatic suppressors.

Finally, results reveal the existence of certain “key” combinations triggering great aromatic changes, indicating the existence of configurational-type interactions.

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2:25pm - 2:30pm
ID: 114 / SES-10: 11
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Asymmetrical Flow Field-Flow Fractionation, Flash Profile, proteins, mannoproteins, white wine

Cross analytical and sensory differentiation of monovarietal white wines from 4 autochthonous grape varieties: focus on macromolecules

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White wines contain macromolecules such as proteins, phenolic compounds and polysaccharides. On a sensory level, these compounds contribute to the 'mouthfeel' that differentiates the white wines worldwide. Separation methods such as Size Exclusion Chromatography (SEC) or High-Performance Liquid Chromatography (HPLC) are commonly used to analyse the macromolecular composition of wines; However, macromolecular complexes can be denatured with these techniques, a barrier to evaluate precisely the contribution of macromolecules to wine properties. Asymmetrical Flow Field-Flow Fractionation (AF4) is an alternative promising separation technique to study wine macromolecules since it allows sample compounds separation by size with no stationary phase. Collected fractions integrity is thus preserved.

In France, 10 varieties of Vitis vinifera, out of around 250 listed, represent 75% of the national wine production. French Southwest region has a real singularity with nearly 120 autochthonous varieties. In this study, 69 monovarietal white wines from four indigenous varieties (Colombard, Gros Manseng, Mauzac and Len de l’El) renowned for their specific taste properties were selected in different wineries from Tarn and Gers. Wines were analysed by Fourier Transform Infrared Spectroscopy to determine the conventional oenological parameters (alcohol content, titratable acidity, assimilable nitrogen, pH, residual sugars…). Then, their macromolecular profile was studied using AF4.

After statistical analysis, 3 wines were selected for each variety. A sensory Flash Profile test was set up using a trained panel to differentiate the 12 white wines according to their mouthfeel. Wines that stood out from the other wines on account of their sensory characteristics were analysed with the AF4. More specifically, the bitter flavour perception for Mauzac and Colombard wines differed strongly. The AF4 results highlighted different macromolecular profiles for these two varieties in terms of proteins, polysaccharides, and phenolic compounds. An SDS-page gel electrophoresis confirmed the observations for proteins, mannoproteins and polysaccharides.

Finally, the wines from Colombard and Mauzac were ultrafiltered at three different cut-off thresholds (100 kDa, 50 kDa and 30 kDa). The three collected fractions were tasted by the sensory panel and analysed thanks to the AF4. The expert panel could identify differences between the fractions for each variety, these results providing a new insight on the impact of macromolecules on white wines gustative properties.

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