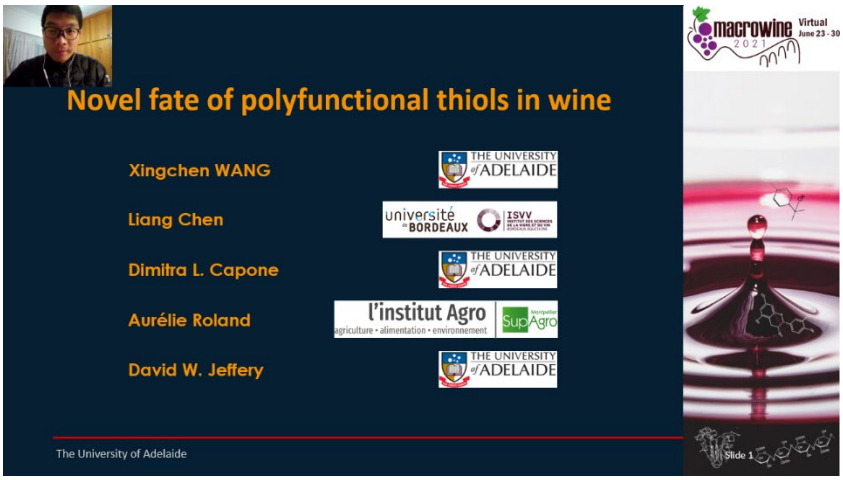
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Presentations at MacroWine 2021 virtual and In Vino Analytica Scientia 2022 conferences



REPORT TO WINE AUSTRALIA FOR TRAVEL OR VISITING SCHOLAR BURSARY

Project Number: **WAT 2006**

Principal Investigator: **Xingchen Wang**

Research Organisation: **The University of Adelaide**

Date: **15/08/2022**

Project Title:
Participation at MacroWine2021 virtual and In Vino Analytica Scientia 2022 conferences

Project No: WAT 2006
Author: Xingchen Wang
Date: August 2022
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Wine Australia travel grant 2019-2022 awarded to Mr Xingchen Wang

Aim

This travel grant was initially applied for to attend MacroWine 2020 conference in Verona, Italy to deliver an oral presentation on the reactivity of varietal thiols in wine. Due to the impact of COVID-19 pandemic, the conference was postponed to 2021 and then organised in virtual format. Aside from attending the online MacroWine 2021 conference, the remainder of the Wine Australia travel grant was used for participation at In Vino Analytica Scientia 2022 conference in Neustadt an der Weinstraße, Germany, where a poster was presented.

Background

Varietal thiols are a group of volatile compounds playing an important role in the 'passionfruit' and 'grapefruit' sensory notes of Sauvignon blanc wine. One of the most important examples is 3-sulfanylhexan-1-ol (3-SH). Furthering the understanding of the reactivity of varietal thiols and exploring various practices to enhance their production during winemaking have always been of interest to academics and industry. Part of Xingchen's PhD project explores the properties of a novel sulfur-containing volatiles originating from the reaction between 3-SH and acetaldehyde, offering potential protocols to preserve 3-SH in wine (outcomes presented at MacroWine 2021). Another part of the project explores the impact of accentuated cut edges grape-crushing technique on the chemical and sensory profiles of wines, particularly in the release of varietal thiols and their precursors (outcomes presented at IVAS 2022).

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Outcomes

1. Macrowine 2021 - Virtual



- The Macrowine 2021 conference was held online from 23rd to 30th June, 2021 and the conference gathered over 400 researchers from 23 countries.
- The conference comprised 65 oral presentations and 280 posters, with presentations delivered across 6 plenary sessions and 5 round table flash talks.
- The conference covered six topics including grapevine diversity and viticultural practices for sustainable grape growing, microbial ecology from vineyard to consumption, novel tools and strategies for precision and sustainable varietal and regional enology, wine longevity and shelf-life, chemical diversity of 'special' wine styles: fortified wines, and sensory science. Xingchen's presentation occurred in a round table session addressing "advances in vinification processes, novel compounds and novel reactions".

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- Xingchen's presentation described the evaluation of the stability of a newly identified volatile compound in wine, namely tropathiane, during ageing under various storage conditions and its correlation with 3-SH and acetaldehyde in wine. It also reported the identification of a second volatile compound in wine, illustrating a newly discovered pathway explaining partial loss of varietal thiols. The presented research outcome has been published in two publications.
- Several research presentations could potentially be interesting to the industry.
- Firstly, the influence of foliar spray of several different components (i.e. inactivated yeast, urea) on the concentrations of wine aroma compounds or their precursors can be grape variety dependent, for example inactivated yeast spray can increase aroma compounds precursors in Traminer grapes, urea application can increase aroma compounds in Tempranillo.
- Secondly, using different proportions of whole bunch in wine fermentation can alter wine styles by either increase complexity or simply add 'green' attributes.
- For the amelioration of smoke tainted wines, fining with activated carbon or molecular imprinted polymers, reverse osmosis and spinning core techniques could reduced both the concentrations of free volatile phenols and the bond precursors. Benchtop trials should be conducted before applying to larger scale due to the non-specific removal of volatile compounds that could impact the pleasant notes in wine.
- The conference provided a great opportunity for Xingchen to discuss and generate new ideas that could potentially be applied to Xingchen's future study. Besides, it was also an excellent platform for Xingchen to get to know expert researchers from different countries and to promote some of the Wine Australia funded research that is occurring in Australia.

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2. In Vino Analytica Scientia 2022 and research labs visit



- The IVAS 2022 conference was held from the 3rd to 7th of July in Neustadt an der Weinstraβe, Germany by DLR Rheinpfalz. The conference comprised 9 keynote lectures, 37 full talks, a number of short communications, and 150 posters.
- The scientific sessions covered research areas of chemical analysis of grape, wine, spirits and by-products, aroma and polyphenolic chemistry, wine ageing, oxidation, biotechnology & microbiology, non-targeted metabolomics, chemical and biochemical reactions, chemometrics, sensory analysis and wine styles.
- Xingchen's poster presentation, within the scope of "Section 1 Chemical Analysis of Grape, Wine, Spirits and By-Product Constituents", showcased the impact of accentuated cut edges on the pre-fermentative release of varietal thiol precursors for Shiraz and Sauvignon blanc and the subsequent production of varietal thiols in the resultant wines. Part of the research outcome has been published and the other part has been submitted for publication.
- Xingchen has proactively interacted with various researchers and nurtured relationships with many of them, such as Professor Vicente Ferreira, Dr. Maria Nikolantonaki, Dr. Elizabeth Tomasino, and Professor Phillipe Darriet. Besides, Xingchen met his external supervisor, Dr. Aurelie Roland, in person for the first time.

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2. In Vino Analytica Scientia 2022 and research labs visit

Evaluation of "accentuated cut edges" technique on the release of varietal thiols and their precursors in Shiraz and Sauvignon blanc wine production

Xingchen Wang[1], Dimitra L. Capone[1,2], Aurélie Roland[3], Wenyu Kang[1], David Jeffery[1,2*]

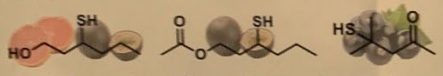
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INTRODUCTION & AIMS

- Varietal thiols, namely 3-SH, 3-SHA, and 4-MSP, contribute greatly to the typical 'passionfruit' and 'guava' aromas of Sauvignon blanc wine.[1]
- Varietal thiols are released during fermentation from non-volatile L-glutathionylated (GSH) or L-cysteinylated (Cys) precursors, i.e., GSH-3-SH and Cys-3-SH, which are more localised in grape skin.
- Enhancing extraction of thiol precursors could increase varietal thiols in wine, and thus intensify characteristic sensory attributes.
- This could potentially be achieved using accentuated cut edges (ACE), a processing technique designed to enhance extraction of grape skin.[2]
- Other winemaking practices could also affect the release of varietal thiols.



3-Sulfanylhexan-1-ol (3-SH) | 3-Sulfanylhexyl acetate (3-SHA) | 4-Methyl-4-sulfanylpentan-2-one (4-MSP)

The focus of this study was to reveal:

- The impact of ACE treatment on the release of varietal thiol precursors in grape must/juice and varietal thiols in resultant wines.
- The influence of skin contact time and water dilution in Shiraz and yeast strain and malolactic fermentation in Sauvignon blanc on the concentrations of varietal thiols.
- The impact of these parameters on the concentrations of *cis*-2-methyl-4-propyl-1,3-oxathiane (*cis*-2-MPO) enantiomers, as relevant to 3-SH.

MATERIALS & METHODS

Grape variety	Shiraz								
Crushing method	ACE				NoACE				
Water dilution	Water dilution		No-dilution		Water dilution		No-dilution		
Skin contact time	3-day	6-day	3-day	6-day	3-day	6-day	3-day	6-day	
Grape variety	Sauvignon blanc								
Crushing method	ACE				NoACE				
Yeast strain	VIN13		Sauvy		VIN13		Sauvy		
Malolactic fermentation	MLF	NoMLF	MLF	NoMLF	MLF	NoMLF	MLF	NoMLF	

NoACE: conventional grape crushing
NoMLF: without malolactic fermentation

HPLC-MS/MS: quantitation of varietal thiols and precursors

RESULTS

Shiraz

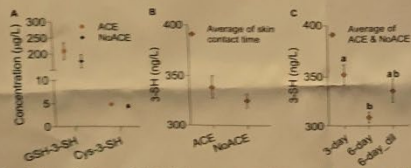
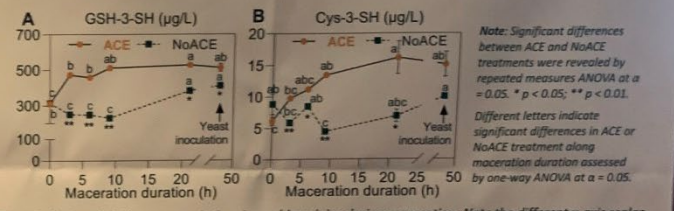


Fig. 1 Concentrations of (A) thiol precursors in Shiraz grape must; and 3-SH in Shiraz wine showing impact of (B) crushing method and (C) skin contact time. "dil" is short for water dilution applied to dilute Shiraz grape must (14 Bé → 13.5 Bé).

- Thiol precursors in Shiraz grape must were not significantly different between grape crushing methods (**Fig. 1A**).
- Supra-threshold 3-SH were quantified (**Fig. 1B & 1C**) ; 3-day skin contact time treatment had significantly greater amount of 3-SH than its 6-day counterpart (two-way ANOVA, $p < 0.05$, **Fig. 1B**).
- 3-SHA (16–21 ng/L) was not different across treatments (data not shown).

Sauvignon blanc



*Note: Significant differences between ACE and NoACE treatments were revealed by repeated measures ANOVA at α = 0.05. * p < 0.05; ** p < 0.01.*

Different letters indicate significant differences in ACE or NoACE treatment along maceration duration assessed by one-way ANOVA at α = 0.05.

Fig. 2 Evolution of thiol precursors in Sauvignon blanc juice during maceration. Note the different y-axis scales.

- ACE significantly increased extraction rates of GSH-3-SH and Cys-3-SH during cold maceration (**Fig. 2A & 2B**).
- Concentrations of both precursors were significantly higher in the ACE treatment at the end of maceration (**Fig. 2A & 2B**) and at yeast inoculation for GSH-3-SH (**Fig. 2A**), indicated by *.

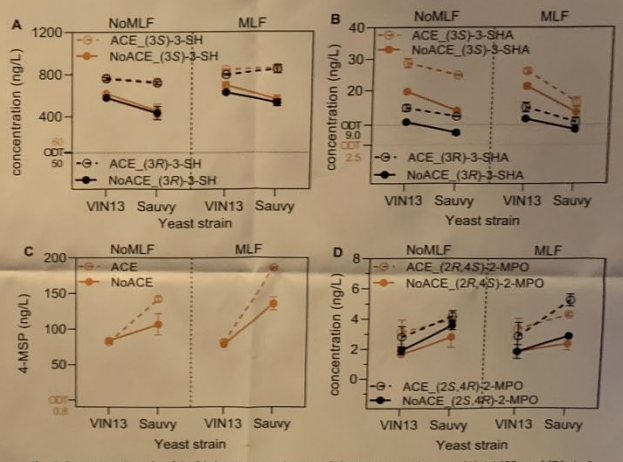


Fig. 3 Concentrations (ng/L) of (A) 3-SH enantiomers, (B) 3-SHA enantiomers, (C) 4-MSP, and (D) cis-2-MPO enantiomers in Sauvignon blanc wines at bottling.

- Significant two-way or three-way interactions of crushing method, yeast strain, and malolactic fermentation affected varietal thiols according to three-way ANOVA. Simple main effects from significant interaction effects were further studied:
- ACE and MLF significantly increased 3-SH enantiomer concentrations; VIN13 had significantly higher 3-SH enantiomers than Sauvy only in NoACE and NoMLF treatments (**Fig. 3A**).
- ACE and VIN13 significantly increased 3-SHA enantiomer concentrations; MLF generally led to a decrease in 3-SHA enantiomers (**Fig. 3B**).
- Sauvy had significantly higher 4-MSP concentration than VIN13; ACE and MLF had significantly higher 4-MSP than NoACE and NoMLF, respectively (**Fig. 3C**), except for VIN13 fermented wines.
- *cis*-2-MPO enantiomers were quantified in Sauvignon blanc wines (**Fig. 3D**), but the concentrations were too low to be worthy of further discussion.

CONCLUSIONS

- In Shiraz must/wine, ACE did not increase thiol precursors and varietal thiols, but 3-day skin contact time had significantly higher concentrations of 3-SH than the 6-day treatment.
- In Sauvignon blanc juice, ACE significantly increased extraction rate and concentration of thiol precursors.
- In Sauvignon blanc wines, ACE had higher 3-SH, 3-SHA, and 4-MSP than NoACE; VIN13 had more 3-SH and 3-SHA, but less 4-MSP than Sauvy; and MLF had higher 3-SH and 4-MSP, but lower 3-SHA than NoMLF.

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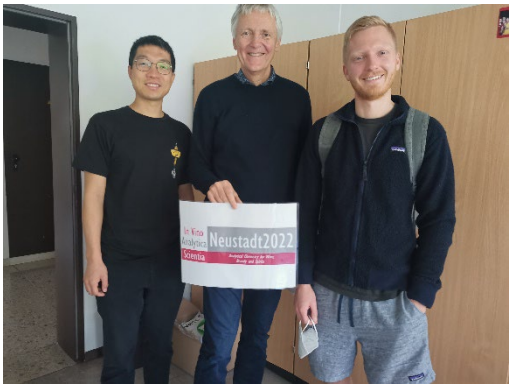
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2. In Vino Analytica Scientia 2022 and research labs visit

- Xingchen also visited research laboratories at DLR Rheinpfalz in Neustadt an der Weinstrasse, Germany, hosted by Professor Ulrich Fischer and Dr. Jochen Vestner, and at IUVV in Dijon, France, hosted by A/Prof. Maria Nikolantonaki and Dr Florian Bahut in the days after the conference.



People in the photo (left to right):
Xingchen Wang, Professor Ulrich Fischer (DLR Rheinpfalz), Ross Sanders (UofA)

- The visit to BASF Central Research and Analytical Chemistry Unit Ludwigshafen was a rare chance to view advanced analytical chemistry labs, which is beneficial to professional development.
- Wine region visits in Germany and France, including Pfalz (Germany), Champagne (France), and Burgundy (France) are closely related to Xingchen' PhD candidature.







Photos above show BASF visitor card (as photography inside the site is forbidden) to the left; Mumm Champagne house visit in Champagne to the middle; and Romanee Conti vineyard visit in Burgundy to the right.

Conclusion

- This travel grant enabled Xingchen to present his research outcomes with an oral presentation at MacroWine 2021 and a poster presentation at IVAS 2022, which contributed to improving the impact of research partially funded by and devoted to the Australian wine sector.
- The latest wine research outcomes in the field of analytical chemistry, and research gaps identified from the discussions and networking with other conference participants were beneficial to Xingchen's project professional development, and scientific network.
- This travel grant also facilitated Xingchen's visit to several research labs during and after the conference, which helped build connections between Xingchen and researchers from those labs. This provides a foundation for any potential collaborations between Department of Wine (UofA) and the research bodies in DLR and IUVV.
- This grant also provided Xingchen the opportunity to visit several famous wine regions in Germany and France, with this study tour being closely related to Xingchen's PhD degree and of benefit to Xingchen's career development.

Acknowledgements

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