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**AROMA PROFILE OF STANUŠINA
WINES DETERMINED BY GC-MS**



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STANUŠINA



- **The only indigenous Macedonian grape variety.**
- Red and rosé wines are produced from this grape variety.
- In the literature (Web of Science database) there are limited data on this variety.
- It is necessary to pay more attention to this variety, both in terms of viticulture and wine production.
- **World trends are aimed at creating local and natural varieties, with typical and authentic varietal characteristics.**
- People choose wine differently from other wines, for different reasons: **geographical, economical and cultural.**

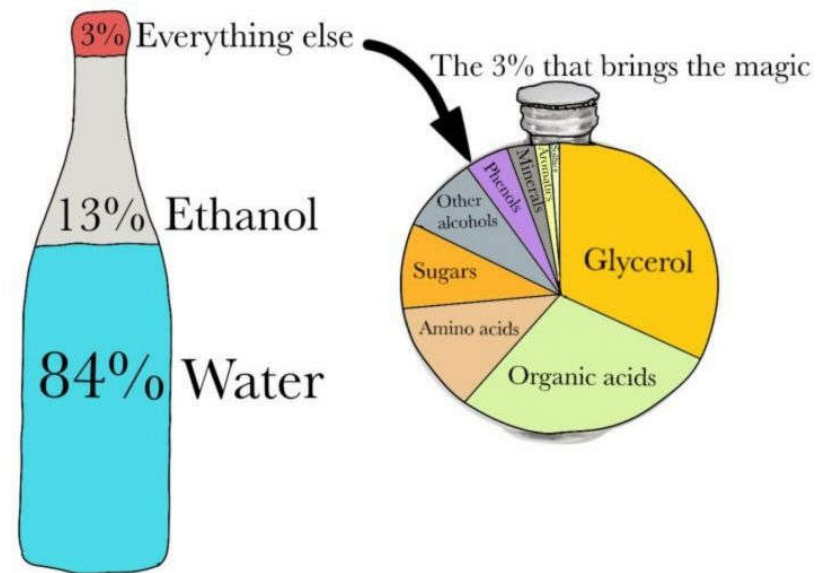
Chemical composition of wine

❖ A bottle of red wine contains over 1000 chemical compounds

❖ Wine is:
84% water + 13% alcohol + 3% everything else

Wine is a **complex** matrix of many components:

- ✓ Organic acids, Carbohydrates, Minerals, Nitrogen compounds
- ✓ Phenolic compounds
- ✓ **Aromas** (alcohols, esters, aldehydes)
- ✓ Biogenic amines
- ✓ Vitamins



- ✓ The chemistry of flavour, colour and astringency in wine is **enormously complicated**.
- ✓ Many chemical and biochemical pathways are not well **understood**.

Wine for analysis

The aim of the work:

To study, for the first time, the aromatic profile of Stanušina wines, applying GC-MS after solid-phase extraction.

Analyzed **9 Macedonian** Stanušina wines from the Tikveš wine region (vintage **2021**)

Rose – 5 wines
Red – 2 wines
White – 1 wine



RESULTS AND DISCUSSION

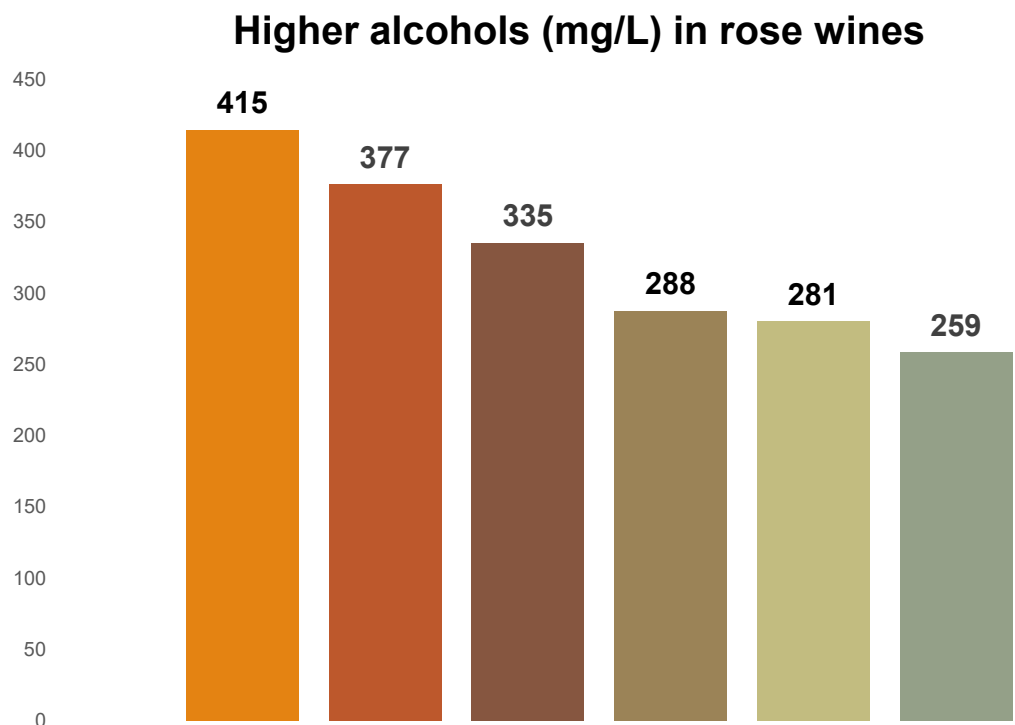
Aroma compounds in Stanušina wines

Aroma compounds	mg/L	%
Higher alcohols	341	87.85
Esters	37.5	9.67
Fatty acids	7.74	1.99
Methionol	1.75	0.45
Vinyl phenols	0.11	0.03
Terpenes	0.044	0.01

Higher alcohols in Stanušina wines

Higher alcohols (7)	%
Isoamyl alcohol	87.95
2-Phenyl ethanol	5.39
Isobutyl alcohol	4.36
1-Propanol	1.76
1-Hexanol	0.43
1-Butanol	0.08
Benzylalcohol	0.03

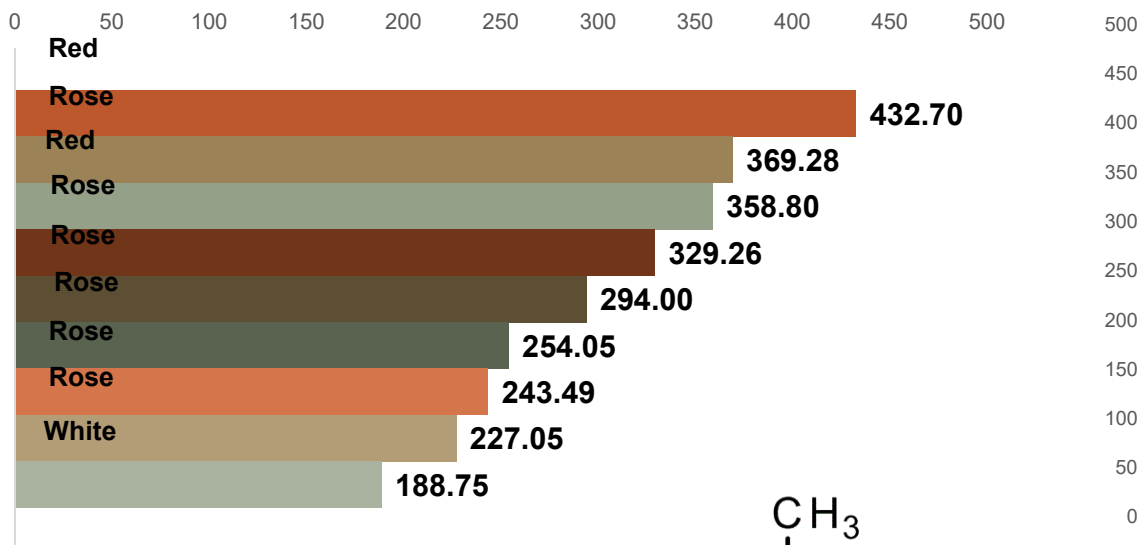
Concentrations of isoamyl alcohol and isobutyl alcohols mainly depend on the content of amino acids valine and leucine in the must and on the metabolism of the yeast.



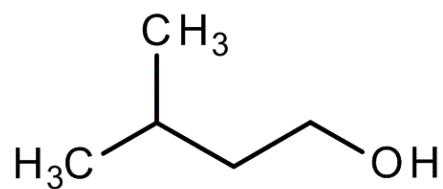
Total concentration of higher alcohols < 300 mg/L has positive effect on the wine aroma, > 400 mg/L may have negative effect on the aroma.

Isoamyl alcohol in Stanušina wines

Isoamyl alcohol (mg/L)

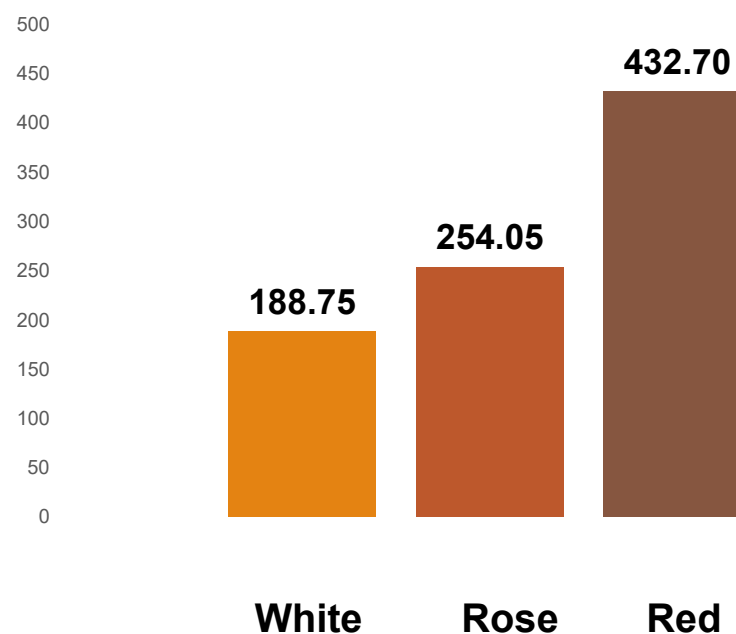


Fruity aroma,
Odor of PEAR

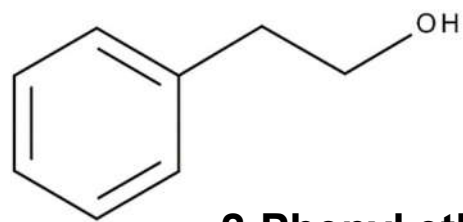
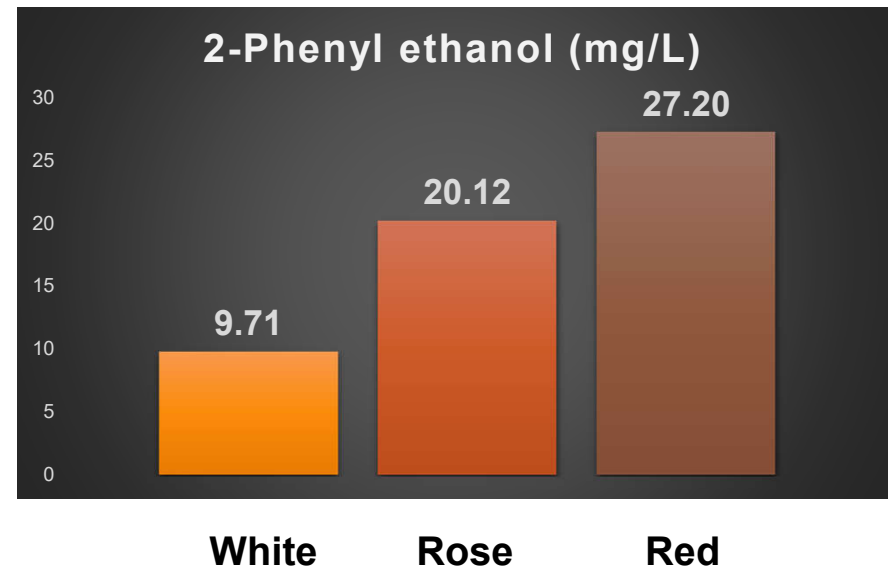
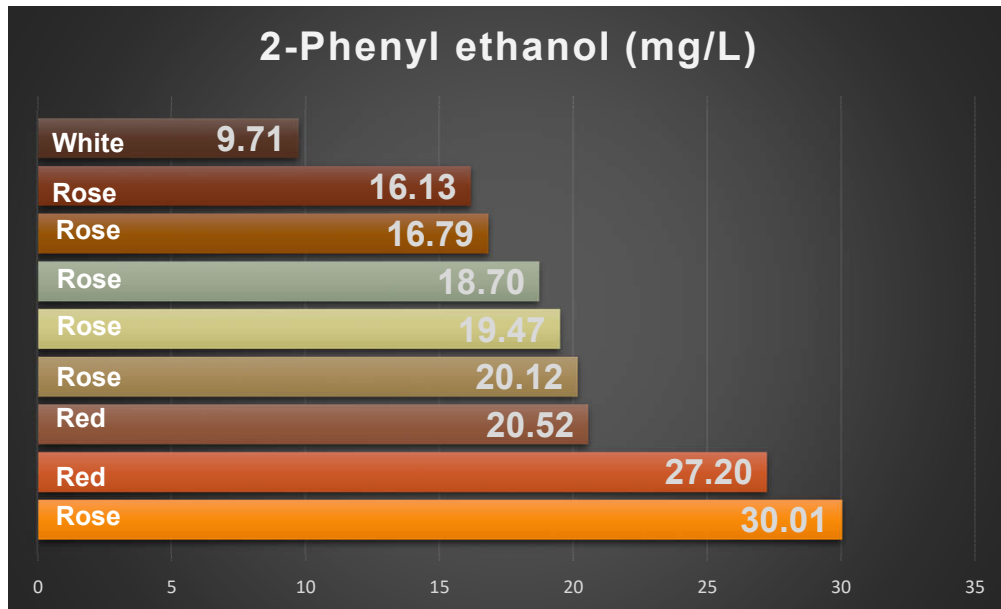


Isoamyl alcohol

Isoamyl alcohol (mg/L)



2-Phenyl ethanol in Stanušina wines



2-Phenyl ethanol

Odor of ROSE

Esters

Ethyl esters – ethyl acetate

- ✓ Derived from the yeast metabolism
- ✓ Fruity aroma and complexity
- ✓ **30 – 60 mg/L in „normal“ wines**
- ✓ **150 – 200 mg/L in fault wines**

Esters	%
Ethyl acetate	74.12
Ethyl lactate	17.39
Diethyl succinate	2.23
Diethyl malate	1.50
Isoamyl acetate	1.39
1-Hexyl acetate	0.08
2-Phenylethyl acetate	0.29
Isobutyl acetate	0.04
Ethyl butyrate	0.39
Ethyl hexanoate	1.02
Ethyl octanoate	1.28
Ethyl decanoate	0.28
Ethyl dodecanoate	0.01

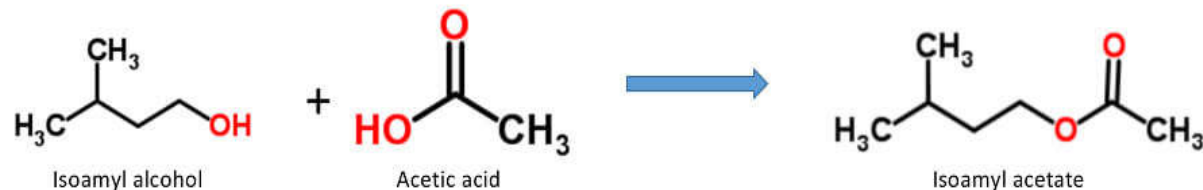
Ethyl lactate

- one of the most characteristic aromatic compound produced during the malolactic fermentation, which concentration increases progressively.
- It is beneficial for the wine's bouquet due to its floral, buttery and creamy aromas.

Diethyl succinate

- faint, pleasant odor.
- fruity (apple, apricot, peach, pear), waxy, floral and slightly musty.

Acetate esters – isoamyl acetate, banana flavor

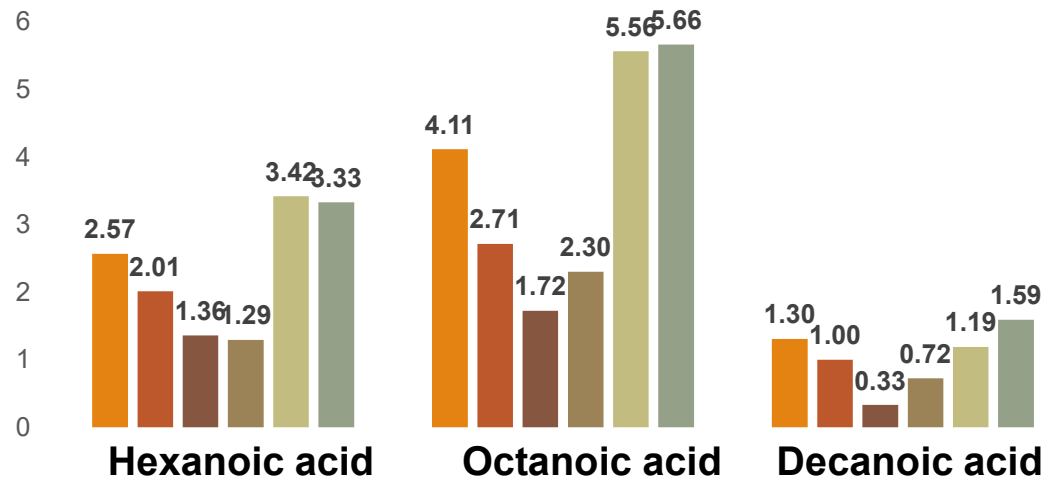


Fatty acids

Fatty acids	mg/L	%
Isobutyric acid	0.66	8.6
Butyric acid	0.56	7.3
Isovaleric acid	0.47	6.1
2-Methylbutanoic acid	0.30	3.8
Hexanoic acid	2.06	26.5
Octanoic acid	2.92	37.7
Decanoic acid	0.76	9.8
Dodecanoic acid	0.02	0.2

- Unpleasant, oil smell, smell of cheese.
- They give the wine complexity, but present in higher concentrations (> 8 mg/L) have an unpleasant smell.

Fatty acids in rose Stanušina wines



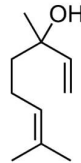
Octanoic acid – musty, pungent odor

Hexanoic acid – fatty, cheesy, waxy odor

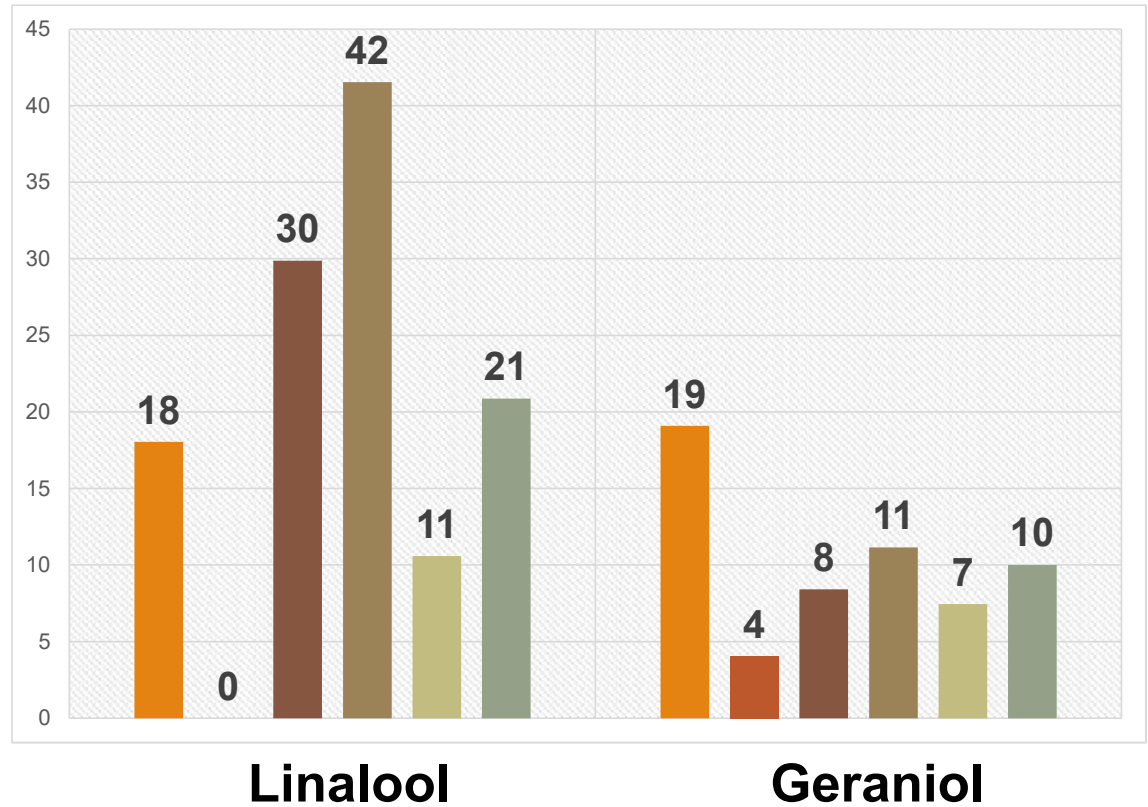
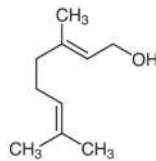
Terpenes

Terpenes	µg/L	%
Linalool	21	48.42
Geraniol	10	23.36
Ho-trienol	7	14.69
Alpha-Terpineol	6	13.29
Nerol	0	0.24

Linalool – characteristic floral aroma, lavender, with spicy tones and aroma of lemon.



Geraniol – rose-like aroma



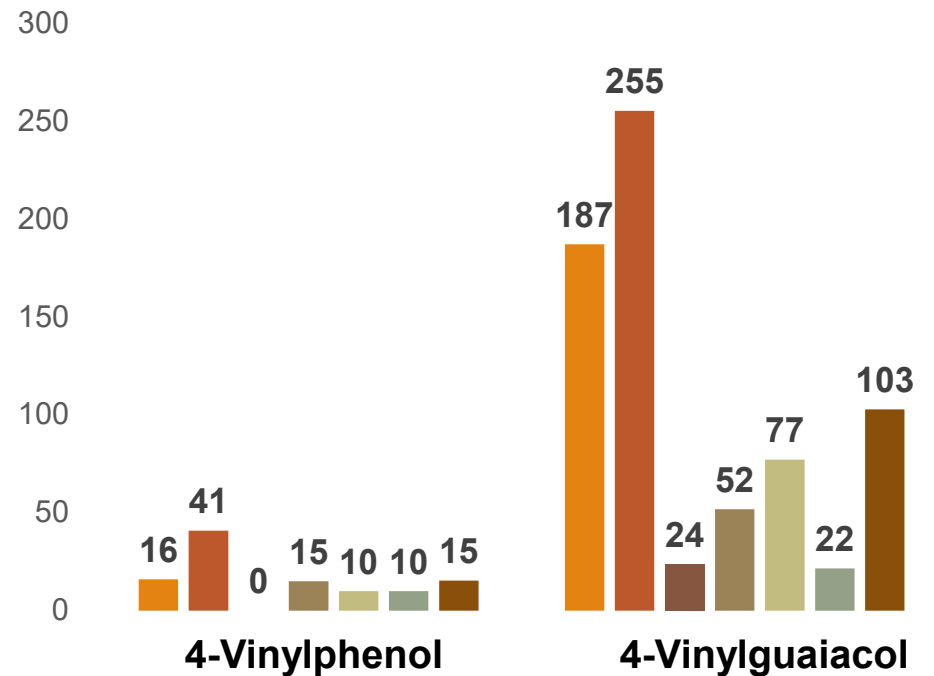
Volatile phenols

- Volatile phenols – unpleasant aromas at concentration > 700 µg/L

4-Vinylphenol – derived from precursor *p*-coumaric acid.
- Medical, pharmaceutical, mousy flavour

4-Vinylguaiaicol – derived from **ferulic acid**.
- clove-like flavour

Vinyl phenols	µg/L
4-Vinylphenol	103
4-Vinylguaiaicol	15



CONCLUSION

- **Stanušina wines presented satisfactory aromatic profile.**
- **Dominant aromas were higher alcohols, with fruity and floral aromas.**
- **Terpenes: linalool and geraniol.**



The best way to learn about wine is by drinking it!



Thank you for your kind attention!

ХВАЛА ВАМ НА ПАЖЊИ!