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HIGH VACUUM TECHNOLOGY APPLIED TO MECHANICAL EXTRACTION PROCESS OF VIRGIN OLIVE OIL

Gianluca Veneziani; Agnese Taticchi; Sonia Esposto; Roberto Selvaggini; Stefania Urbani; Beatrice Sordini; Luigi Daidone; Davide Nucciarelli; Sofia Luchetti and Maurizio Servili

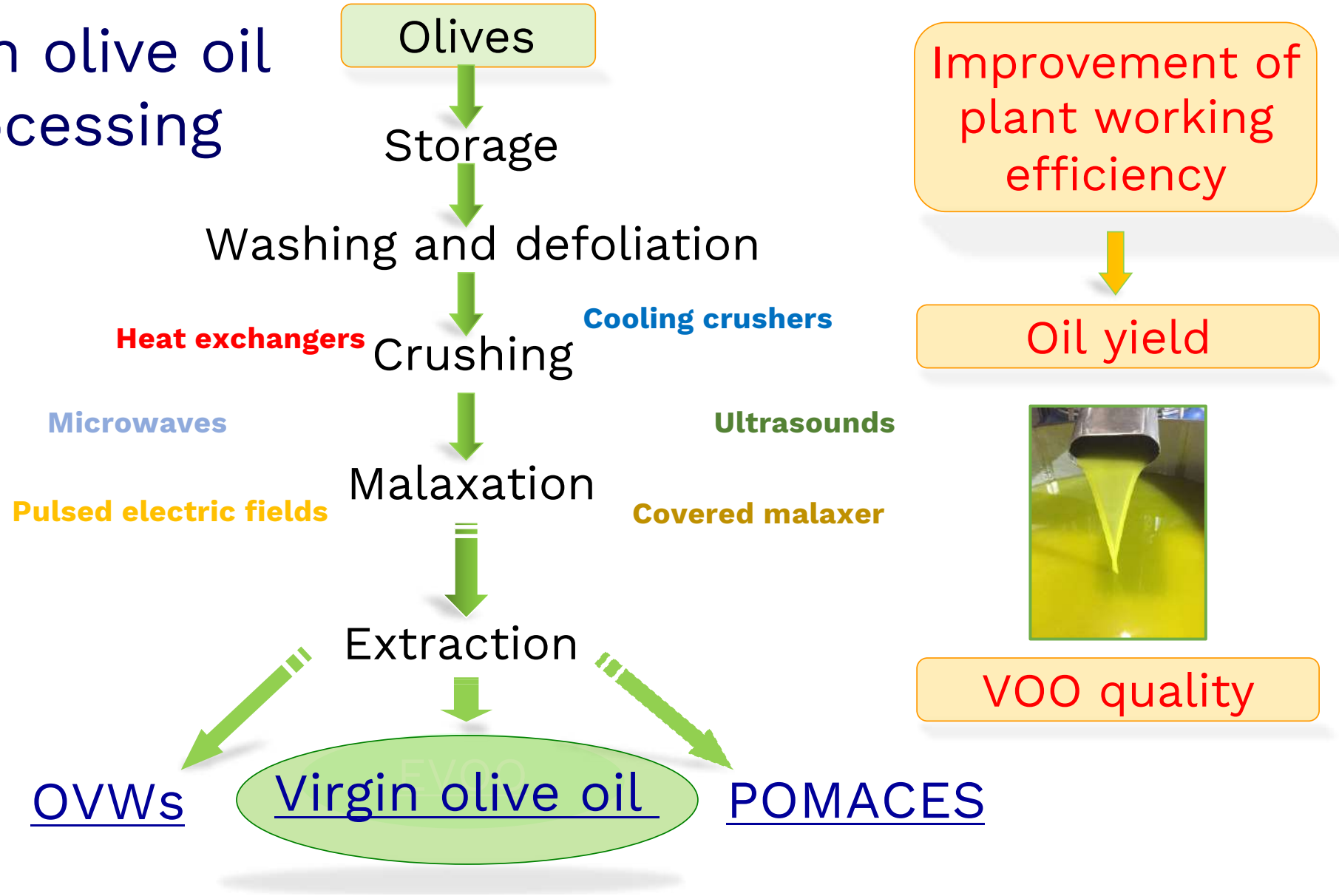
Department of Agricultural, Food and Environmental Sciences, University of Perugia, Italy

www.unipg.it

E-mail gianluca.veneziani@unipg.it

Giugno 15 - 17 **2022**
PERUGIA Complesso monumentale di San Pietro Borgo XX Giugno n°74
Dipartimento di Scienze Agrarie Alimentari ed Ambientali (DSA3), Università di Perugia

Virgin olive oil processing



LOW ALTERATION STATE
FREE ACIDITY
PEROXIDE VALUE

PESTICIDES
CONTAMINATION
CONTROL

OLIEC ACID
PHYTOSTEROLS
SQUALEN
TOCOPHEROLS
HYDROPHYLIC PHNENOLS

OLEIC ACID
CAROTENOIDS
CHLOROPHYLLS
VOLATILE COMPOUNDS
PHENOLS

Phenolic compounds

Volatile compounds

APPLICATION OF HIGH VACUUM

Lab-Scale

STEP 1 - **Physicochemical impact on olive paste and olive oil**

Industrial-Scale

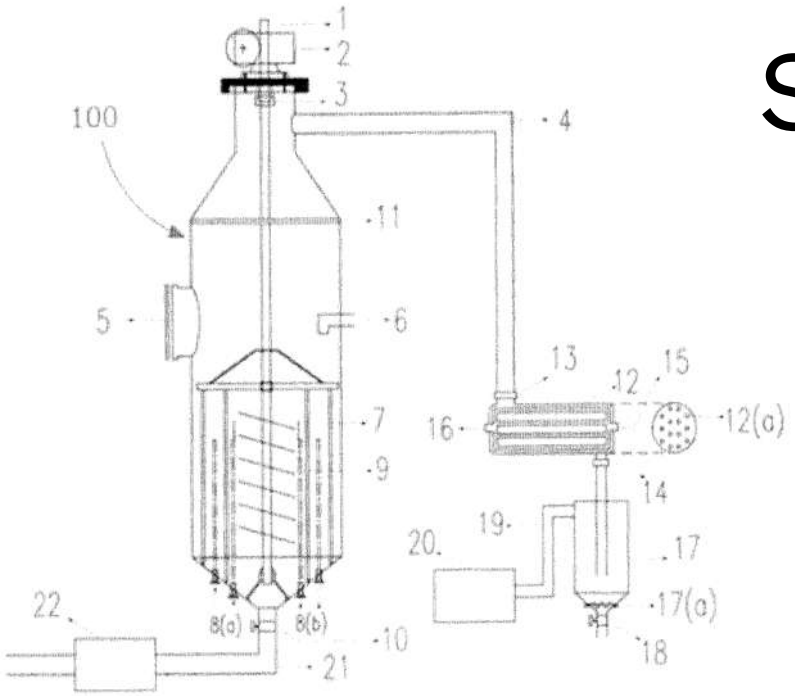
STEP 2

STEP 3

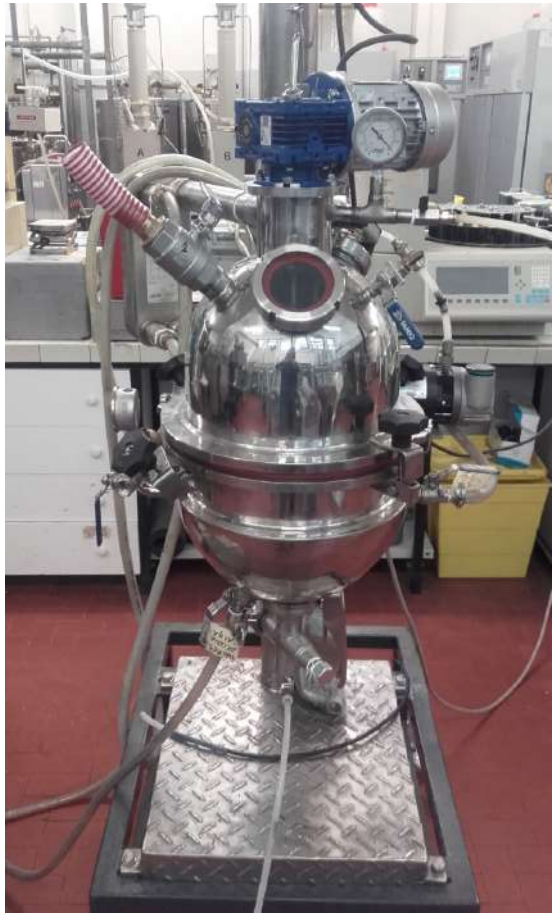
- **Extaction yield**
- **VOO quality**
- **Technological parameters**

Title: METHODS AND DEVICES TO EXTRACT OIL FROM OILY FRUITS

Zuccardi-Bonino method (WIPO, 2019)

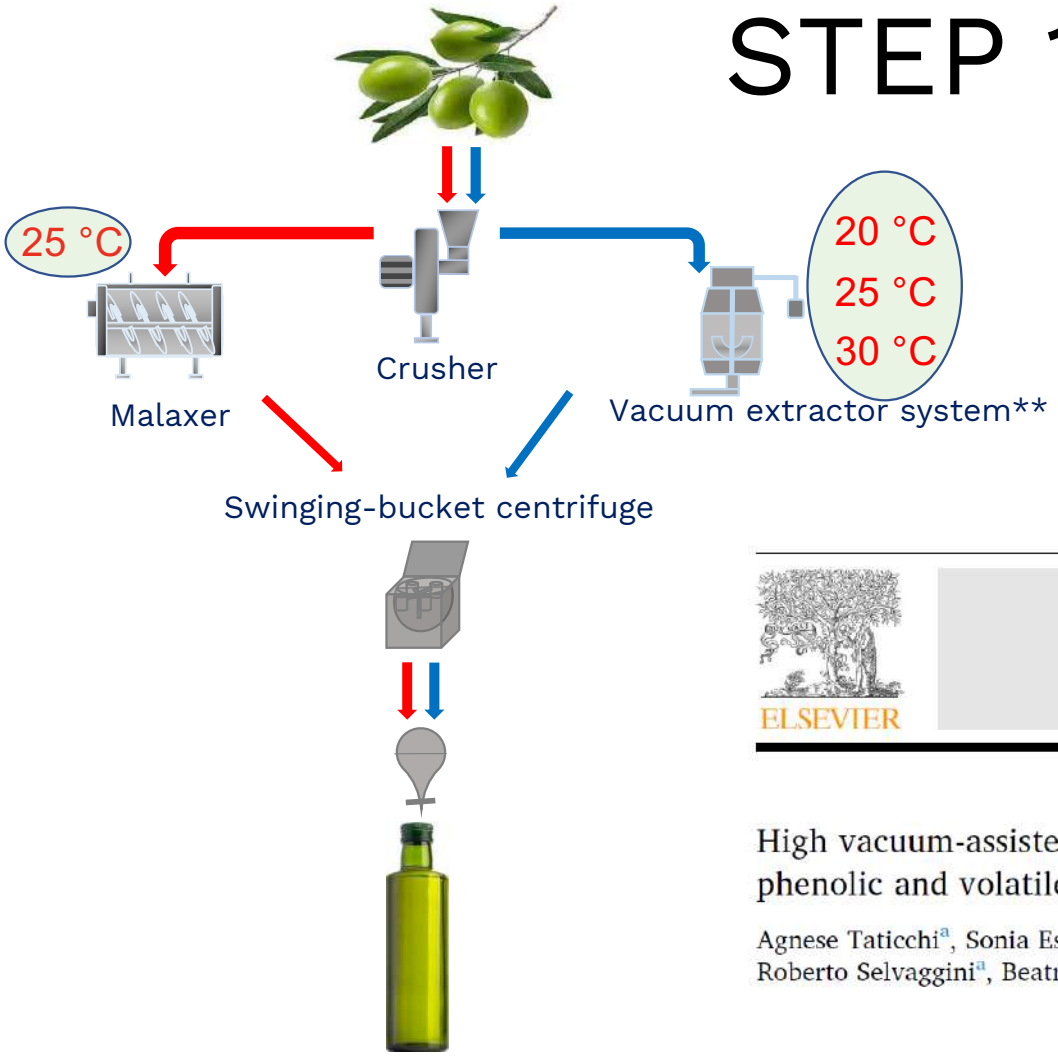


STEP 1



Lab-Scale

STEP 1



Application of high vacuum in the malaxation phase: lab scale

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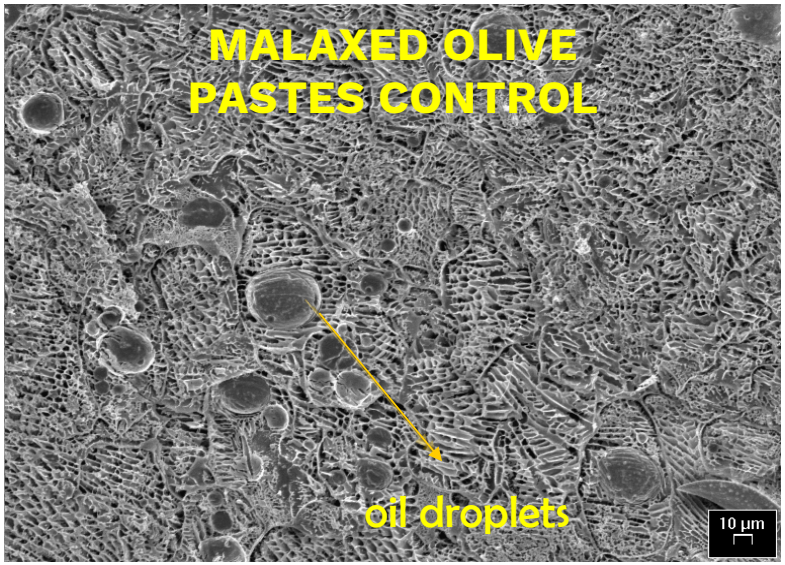
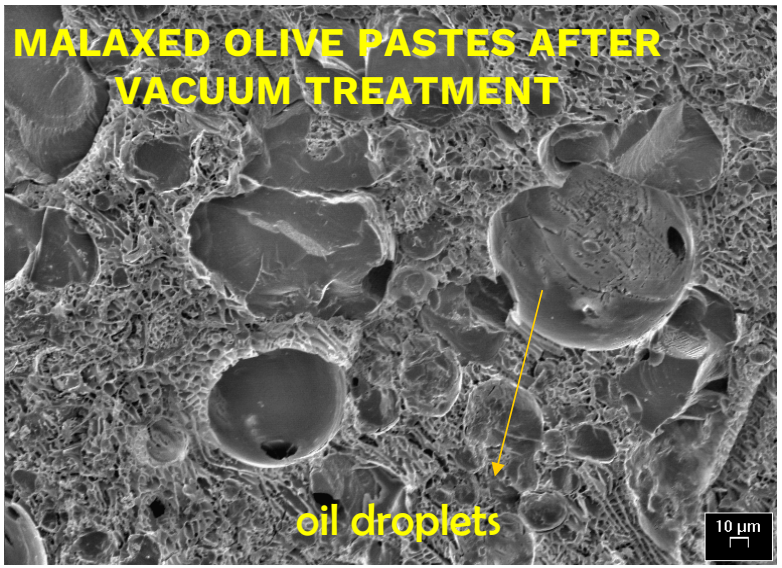
High vacuum-assisted extraction affects virgin olive oil quality: Impact on phenolic and volatile compounds

Agnese Taticchi[a], Sonia Esposto[a], Gianluca Veneziani[a,*], Antonio Minnocci[b], Stefania Urbani[a], Roberto Selvaggini[a], Beatrice Sordini[a], Luigi Daidone[a], Luca Sebastiani[b], Maurizio Servili[a]



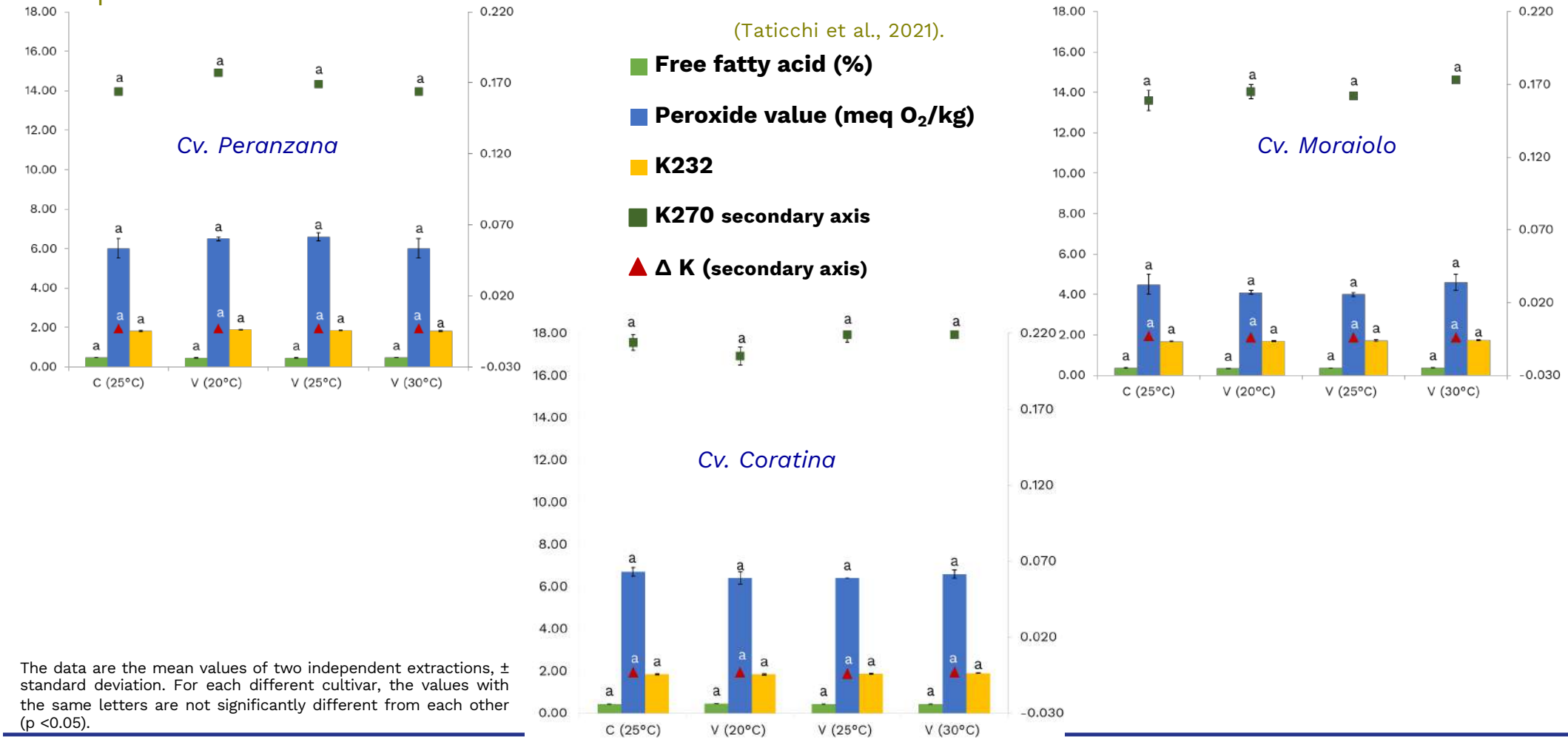
Evaluation of oil dispersed in crushed and malaxed olive pastes before and after vacuum treatment using cryo-scanning electron microscopy (CRYO-SEM)

Increase and improvement of cellular and intracellular mass transfer



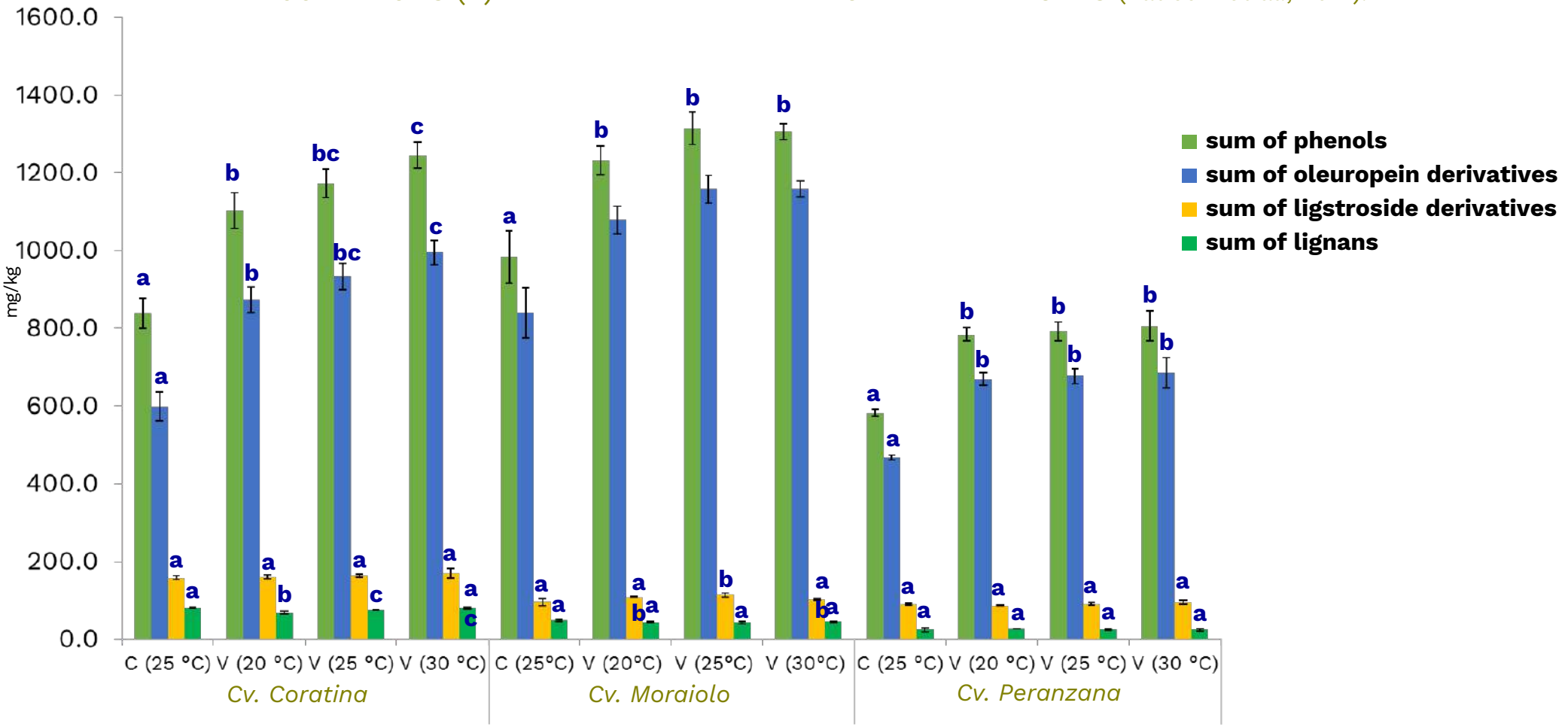
Quality indices of VOOs control (C) and VOOs extracted under high vacuum conditions (V) at different malaxatio temperatures*.

(Taticchi et al., 2021).

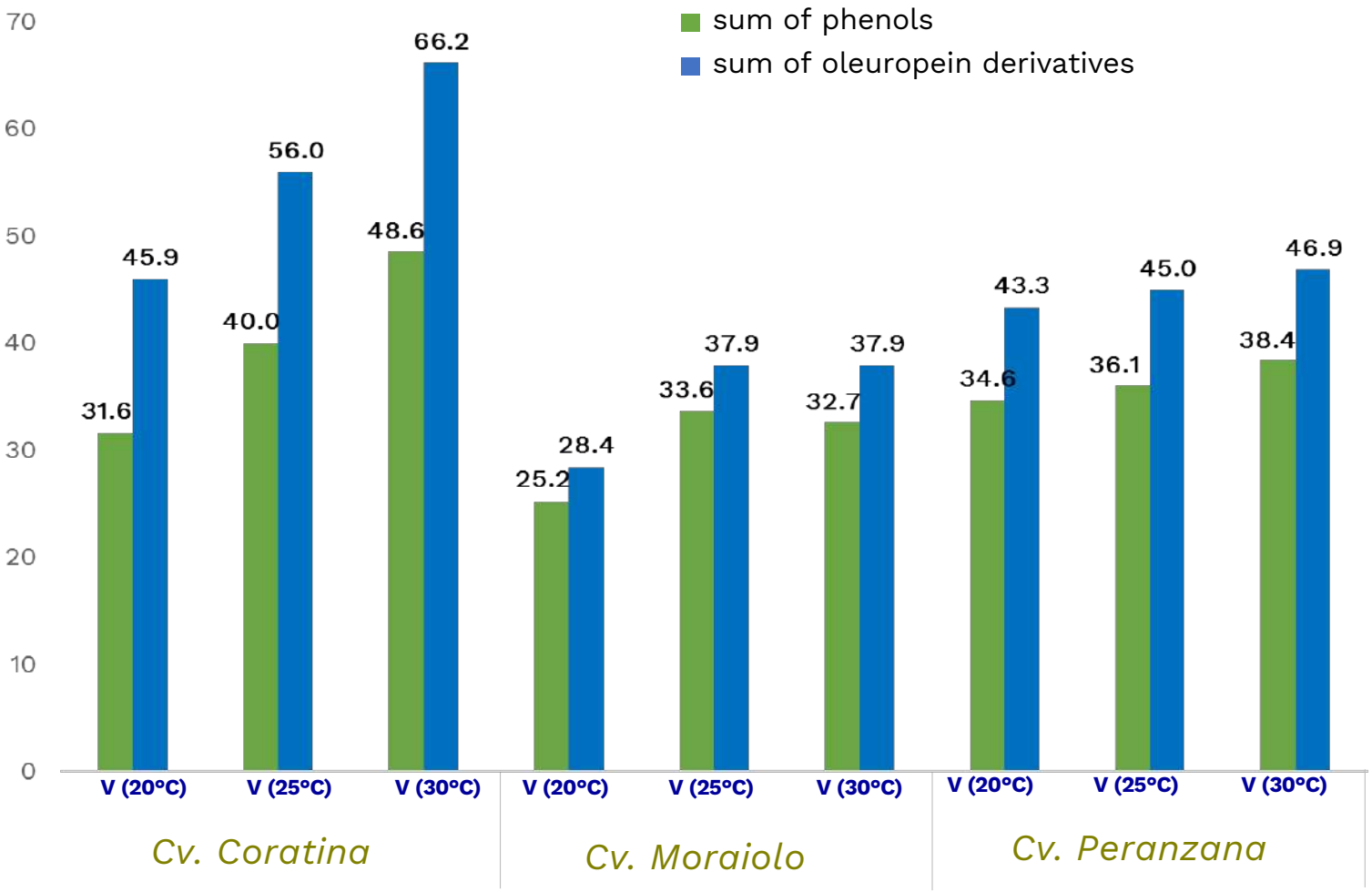


The data are the mean values of two independent extractions, ± standard deviation. For each different cultivar, the values with the same letters are not significantly different from each other ($p < 0.05$).

PHENOLIC COMPOSITION (mg/kg) OF VOOS CONTROL (C) AND VOOS EXTRACTED UNDER HIGH VACUUM CONDITIONS (V) AT DIFFERENT MALAXATION TEMPERATURES (Taticchi et al., 2021).

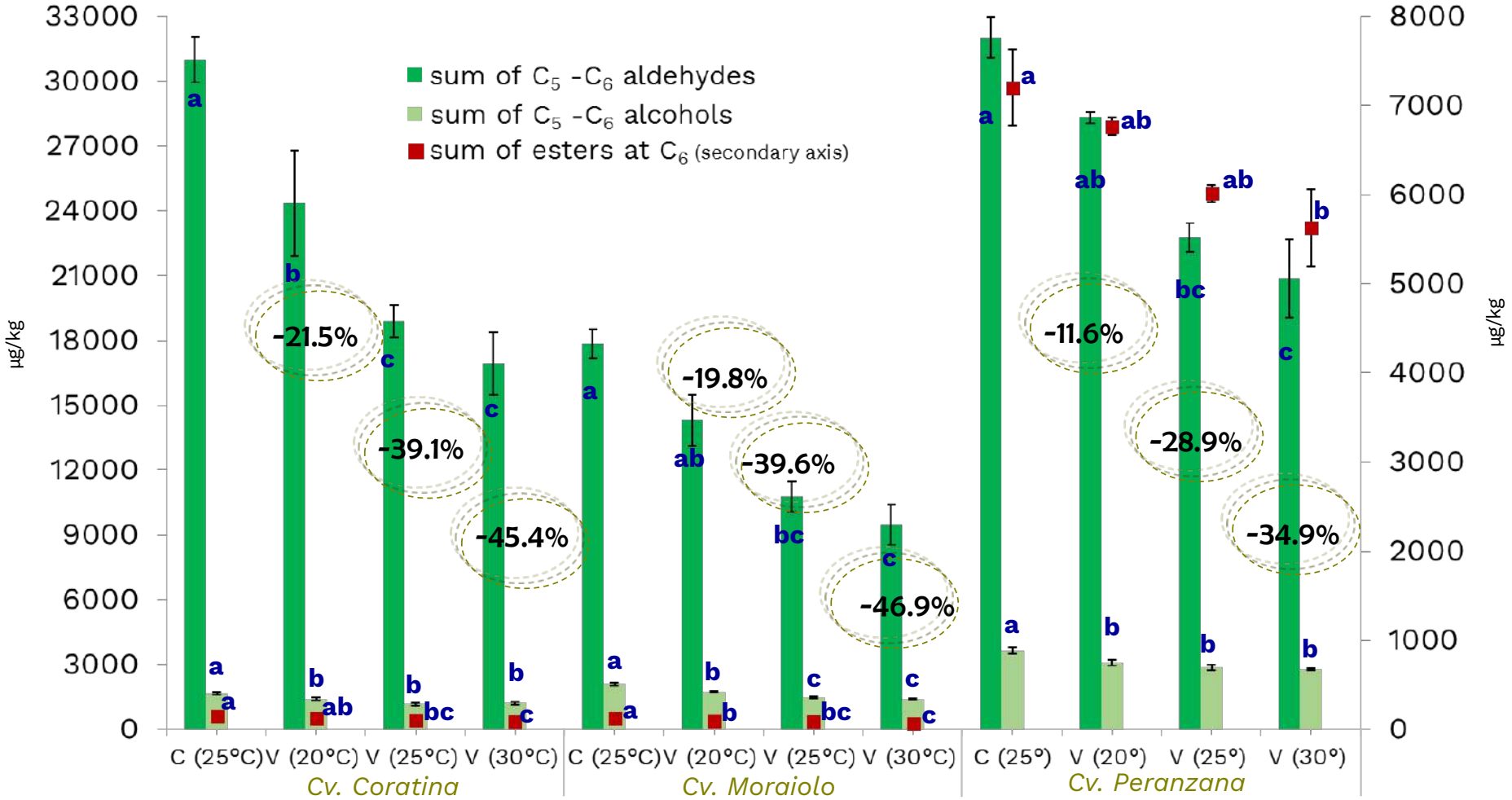


*The data are the mean values of two independent extractions, ± standard deviation. For each different cultivar, the values in having different letters (a-c) are significantly different from one another ($p < 0.05$).



INCREASE OF PHENOLIC COMPOUNDS IN VACUUM TREATED VOOS (V vs C).

VOLATILE COMPOUNDS (µg/kg) OF "FLAVOURS" OF VOOS CONTROL (C) AND VOOS EXTRACTED UNDER HIGH VACUUM CONDITIONS (V) AT DIFFERENT MALAXATION TEMPERATURES (Taticchi et al., 2021).



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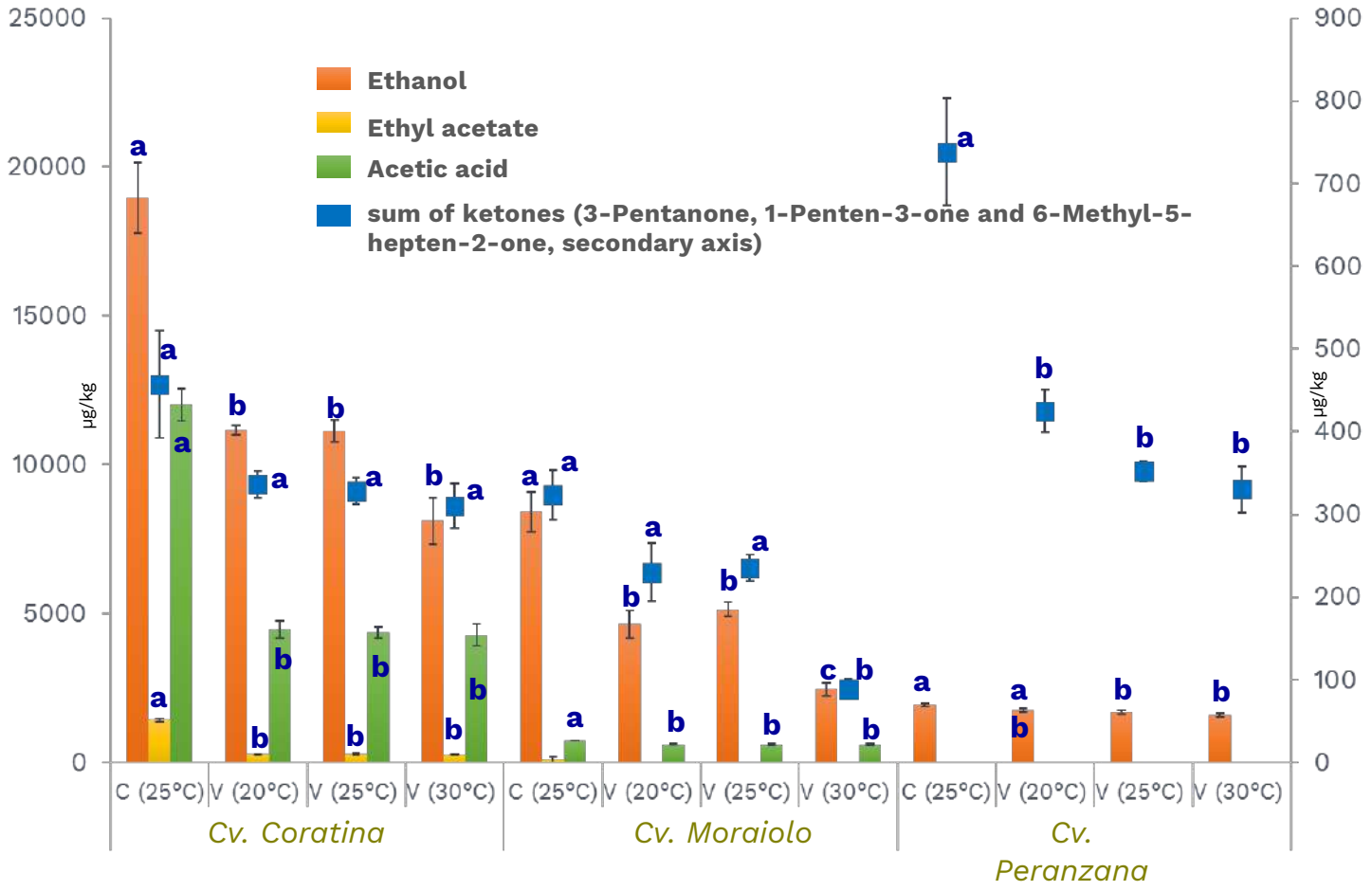
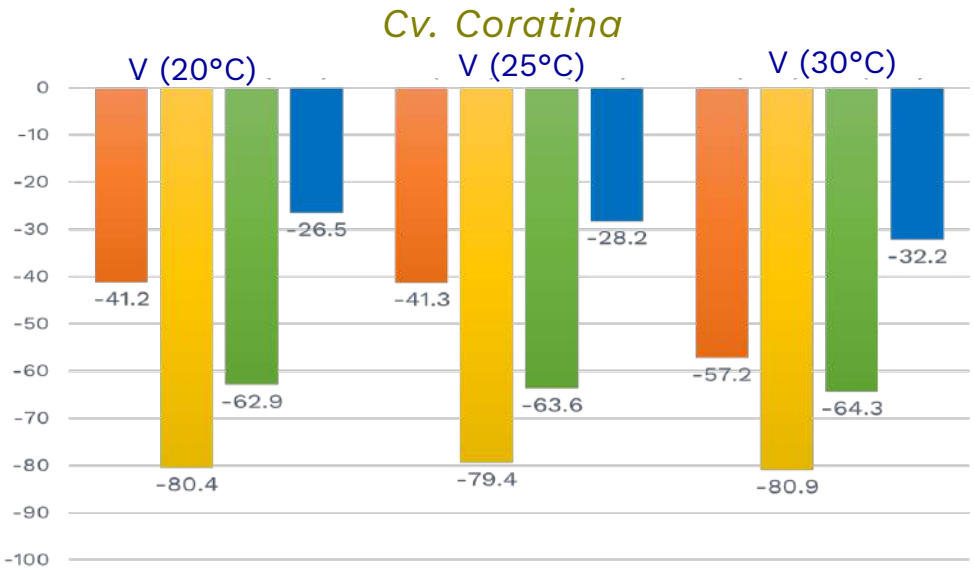
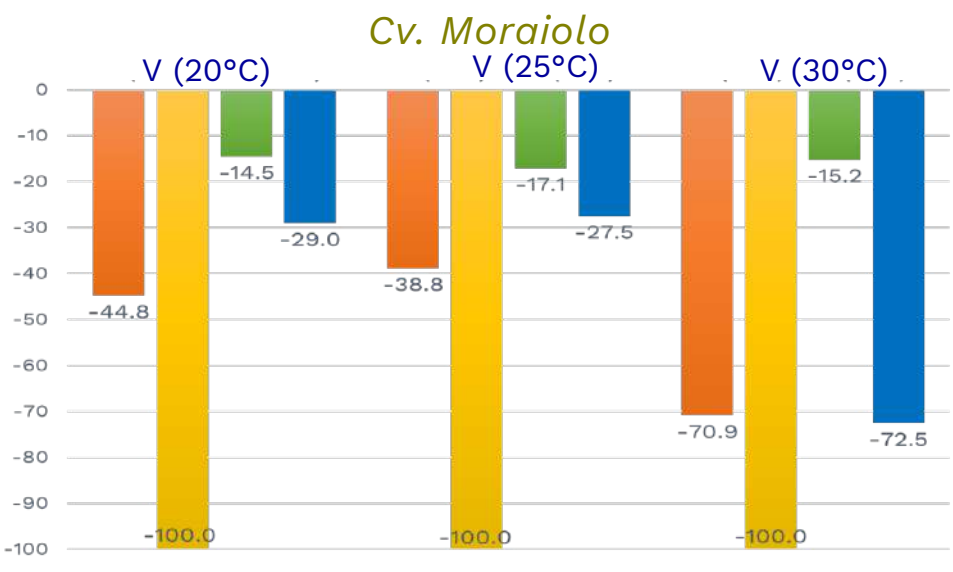
The data are the mean values of two independent extractions, ± standard deviation. For each different cultivar, the values having different letters (a-c) are significantly different from one another ($p < 0.05$).



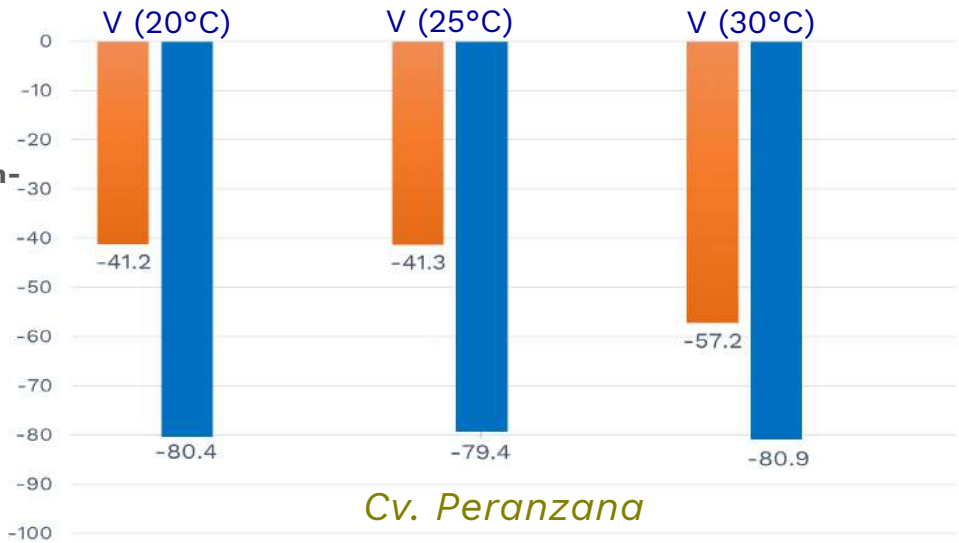
VOLATILE COMPOSITION (µg/kg) RELATED TO "OFF FLAVOURS" OF VOOS CONTROL (C) AND VOOS EXTRACTED UNDER HIGH VACUUM CONDITIONS (V) AT DIFFERENT MALAXATION TEMPERATURES (Taticchi et al., 2021).

The data are the mean values of two independent extractions, ± standard deviation. For each different cultivar, the values having different letters (a-c) are significantly different from one another ($p < 0.05$).





- **Ethanol**
- **Ethyl acetate**
- **Acetic acid**
- **sum of ketones (3-Pentanone, 1-Penten-3-one and 6-Methyl-5-hepten-2-one)**



DECREASE OF VOLATILE COMPOUNDS RELATED TO “OFF FLAVOURS” IN VACUUM TREATED VOOS (VACUUM VS CONTROL).

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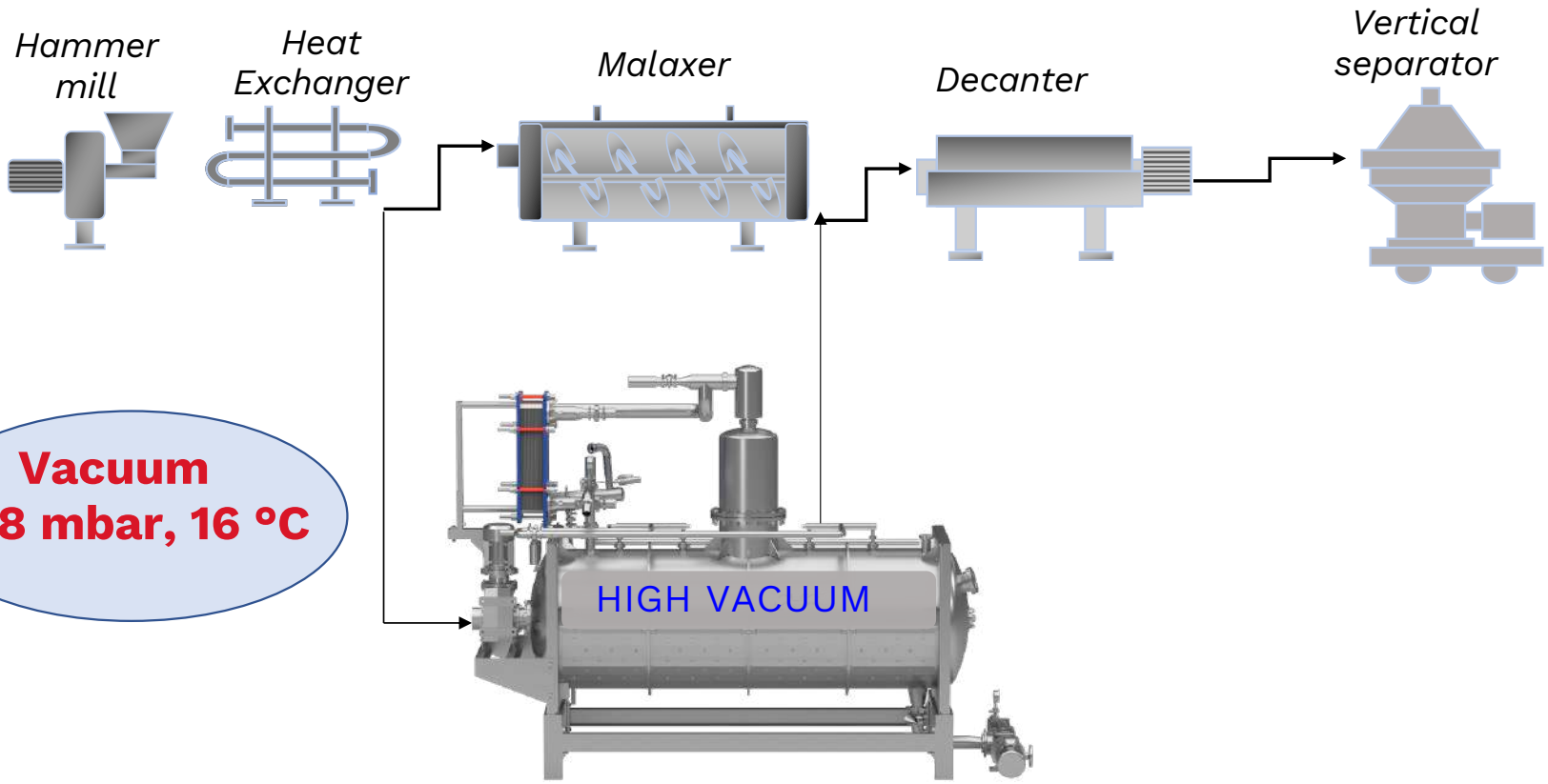

APPLICATION OF HIGH VACUUM IN THE MALAXATION PHASE: INDUSTRIAL SCALE

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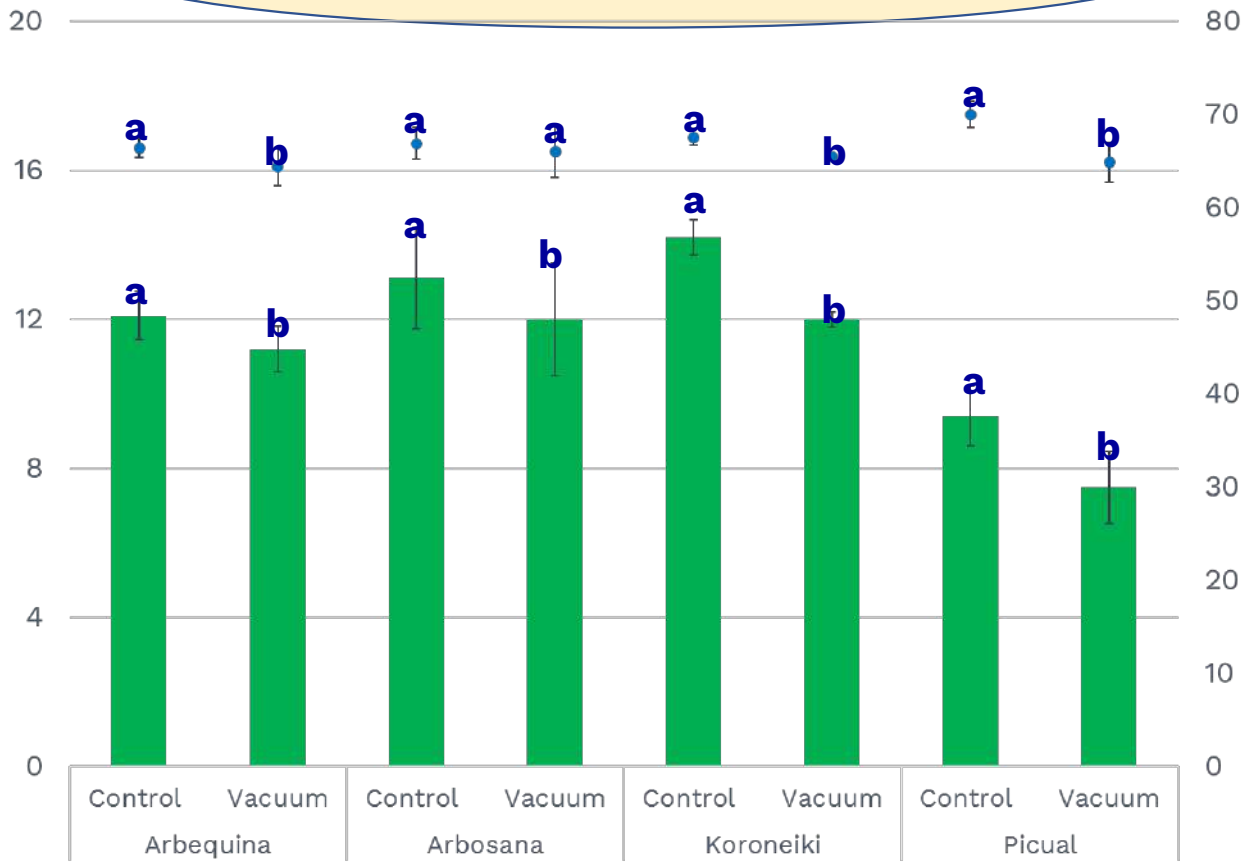
Oil decrease ranged from 9 kg/ton to 22 kg/ton (d.w.)



Moisture and oil content of olive pomace extracted under high vacuum (18 mbar 16 °C) condition from four different cultivar (Veneziani et al., 2022).

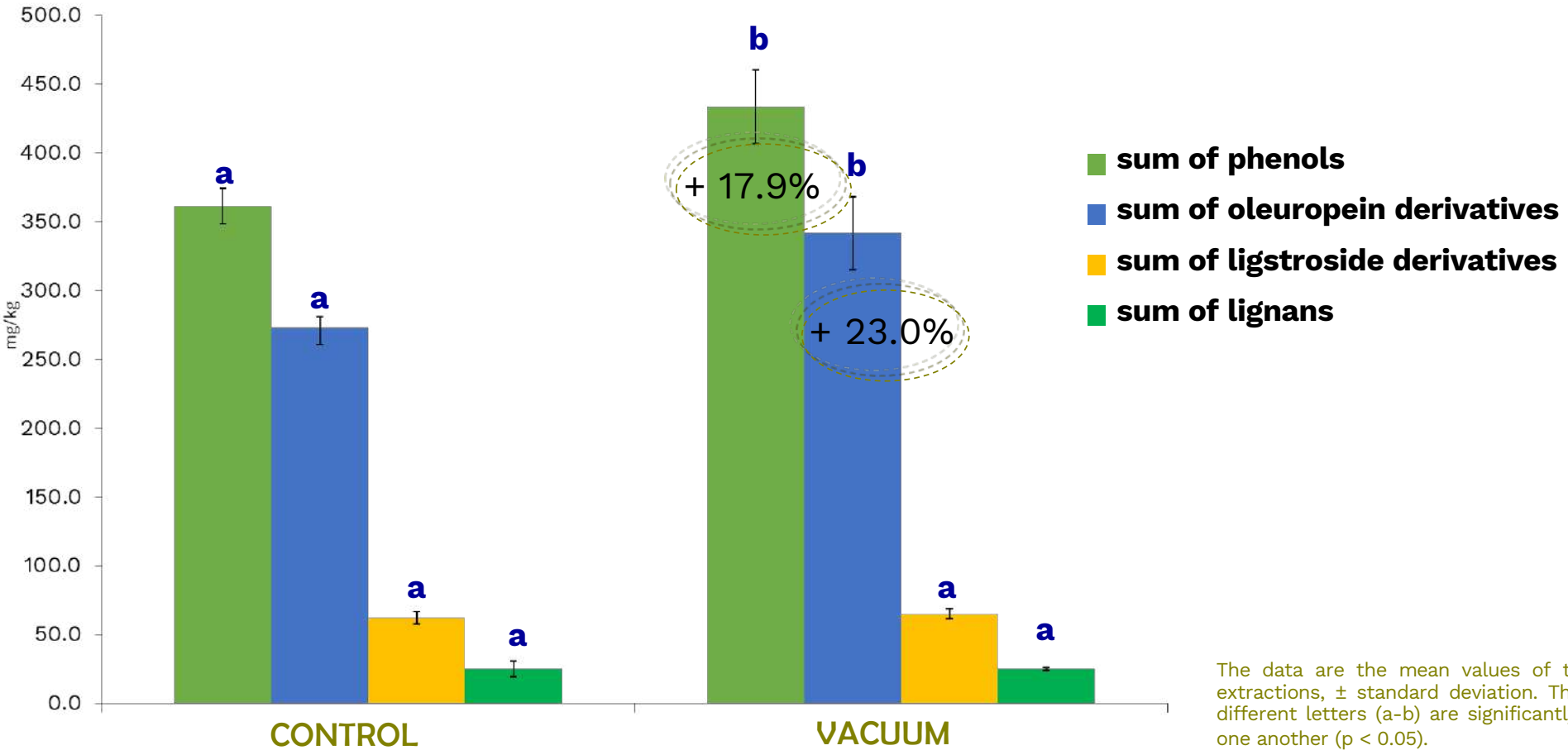
Over 30 oil independent industrial extractions

Oil content (% d.w.)

Moisture content (%) (secondary axis)

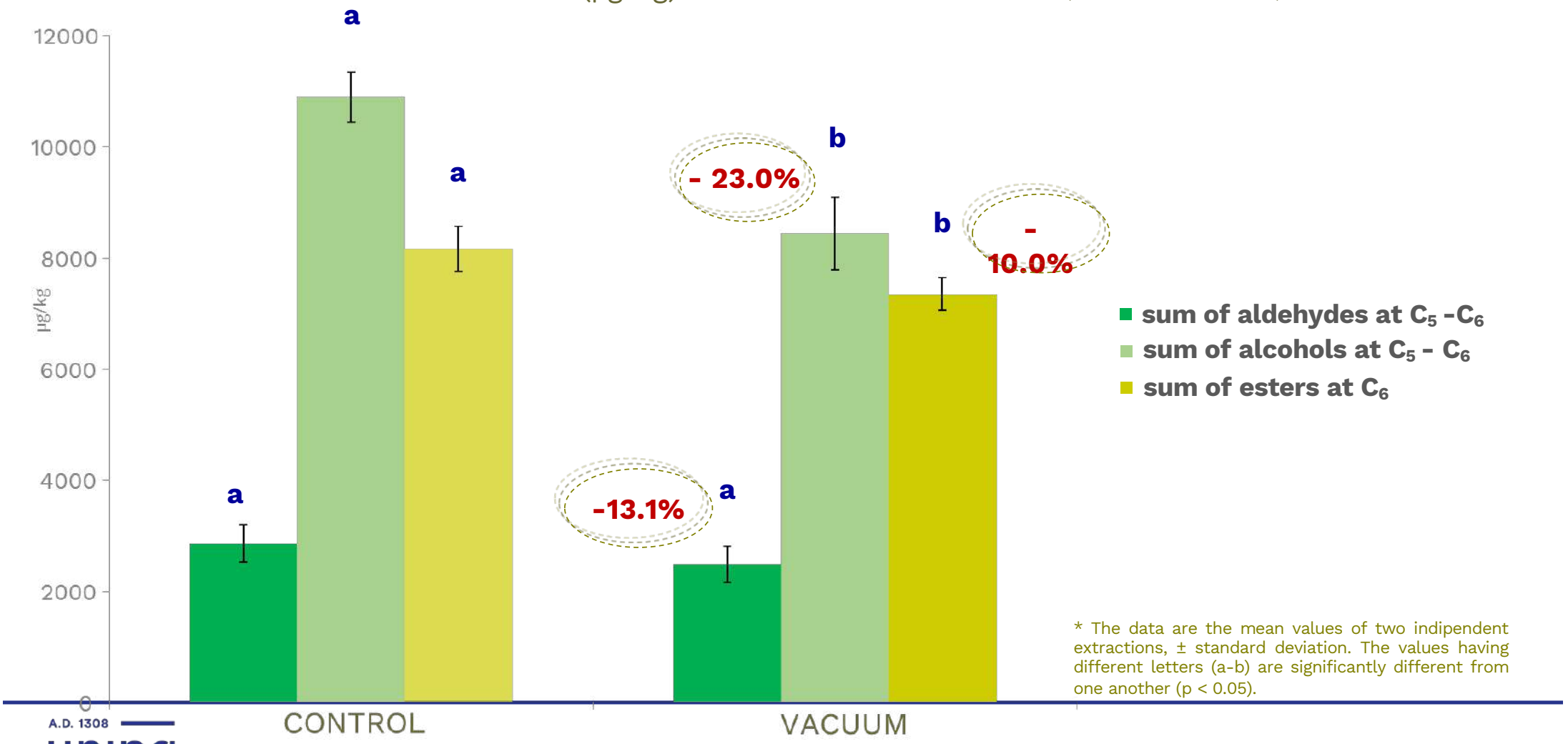
The data are the mean values of six, fifteen, four and six oil independent industrial extractions, ± standard deviation, for Arbequina, Arbosana, Koroneiki and Picual, respectively. For each different cultivar, the values in each row having different letters (a-b) are significantly different from one another ($p < 0.05$).The data are the mean values of two indipendent extractions, ± standard deviation.

EFFECT OF THE VACUUM TREATMENT (18 mbar 16 °C) OF PASTES ON THE PHENOLIC COMPOSITION (mg/kg) OF THE VOOs CV. PICUAL (Veneziani et al., 2022).*



The data are the mean values of two indipendent extractions, ± standard deviation. The values having different letters (a-b) are significantly different from one another ($p < 0.05$).

EFFECT OF THE VACUUM TREATMENT (18 mbar 16 °C) OF PASTES ON THE VOLATILE COMPOUNDS OF THE "FLAVOURS" (µg/kg) OF THE VOOs CV. PICUAL (Veneziani et al., 2022).*



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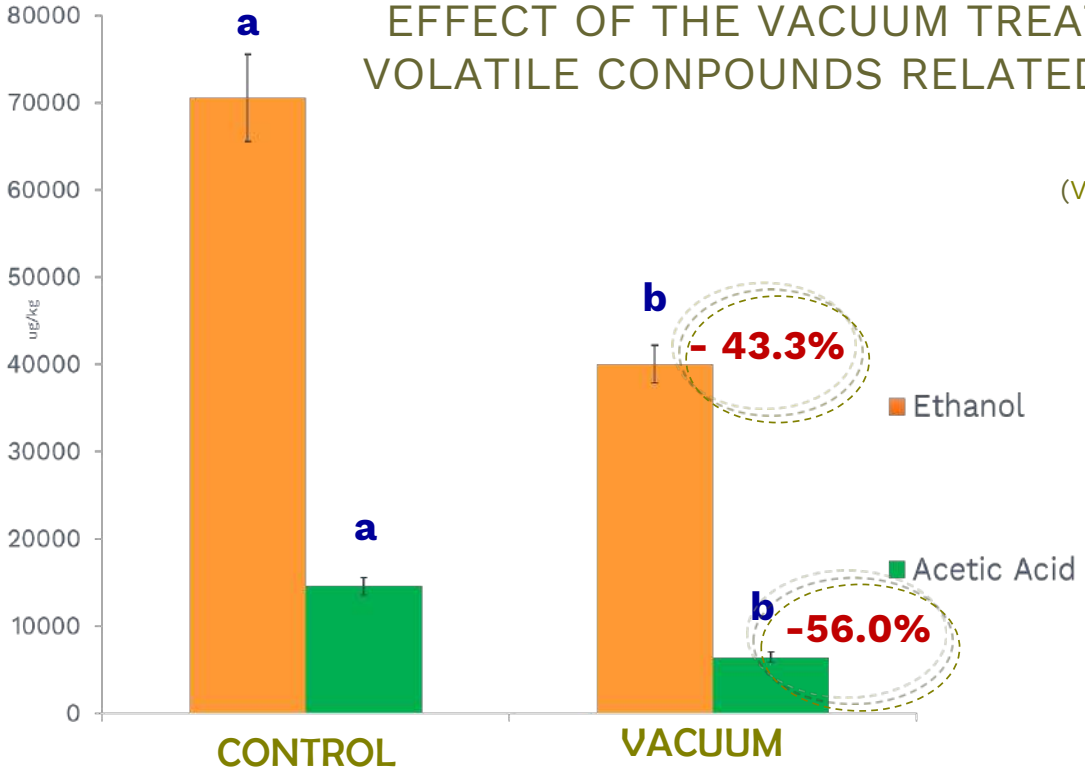
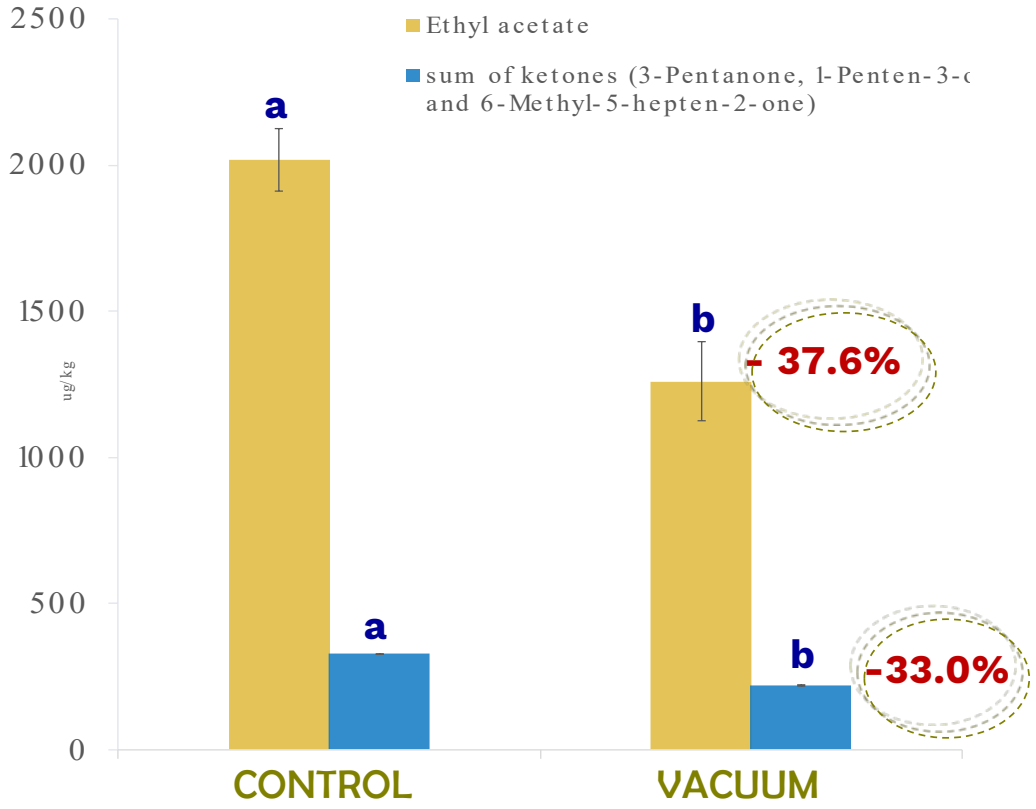
EFFECT OF THE VACUUM TREATMENT (18 mbar 16 °C) OF PASTES ON THE VOLATILE CONPOUNDS RELATED TO “OFF FLAVOURS” (µg/kg) OF THE VOOs CV. PICUAL

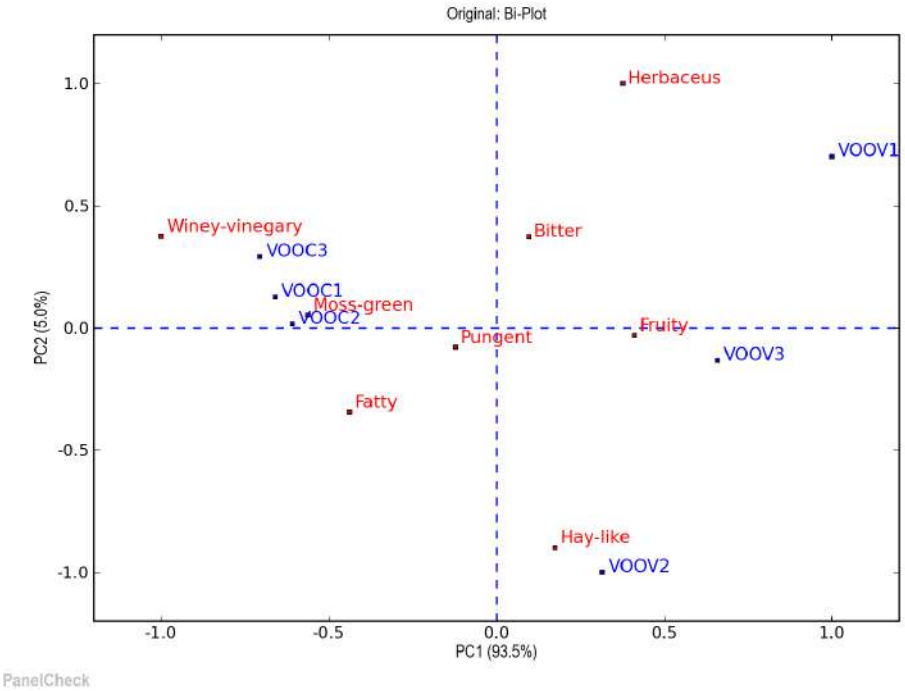
(Veneziani et al., 2022).

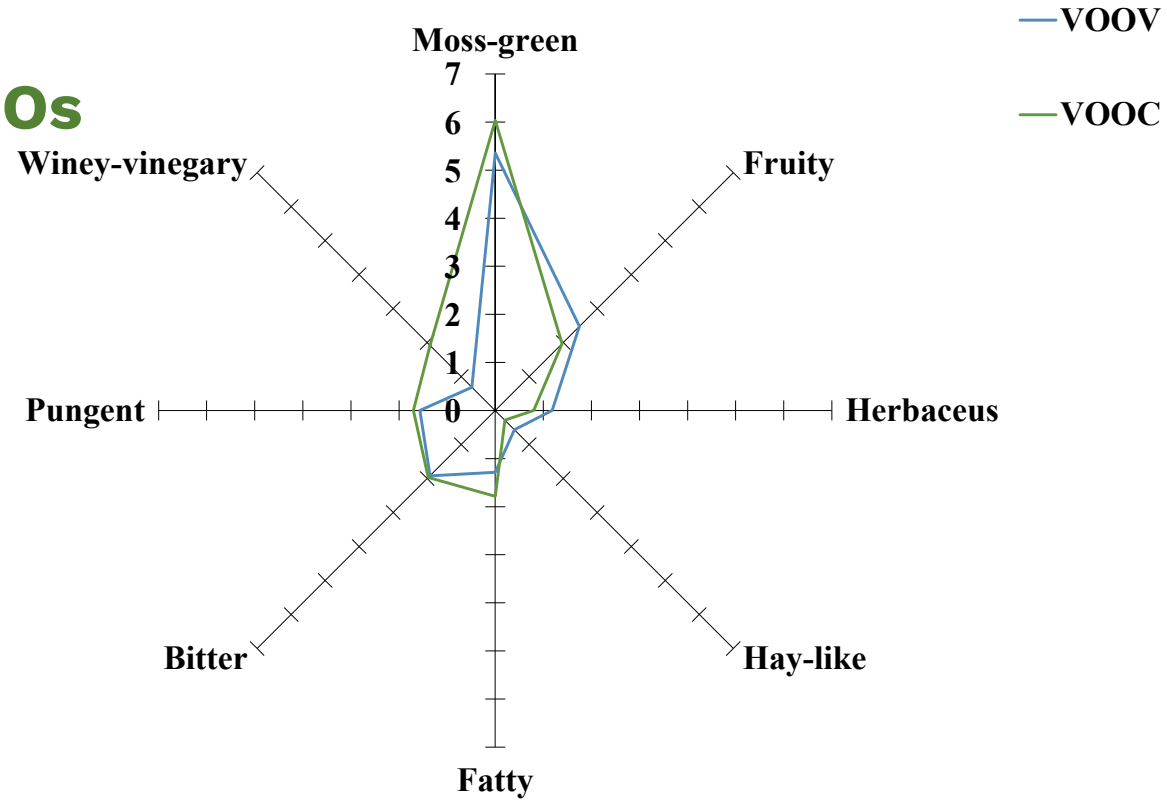




The data are the mean values of two independent extractions, ± standard deviation. For each different cultivar, the values in each row having different letters (a-b) are significantly different from one another ($p < 0.05$).

Sensory analysis of Picual VOOs





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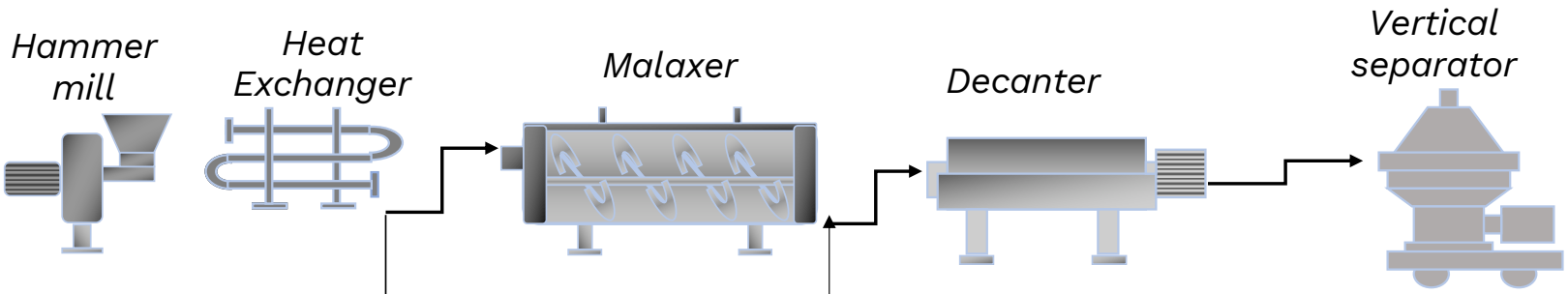
High vacuum applied during malaxation in oil industrial plant: Influence on virgin olive oil extractability and quality

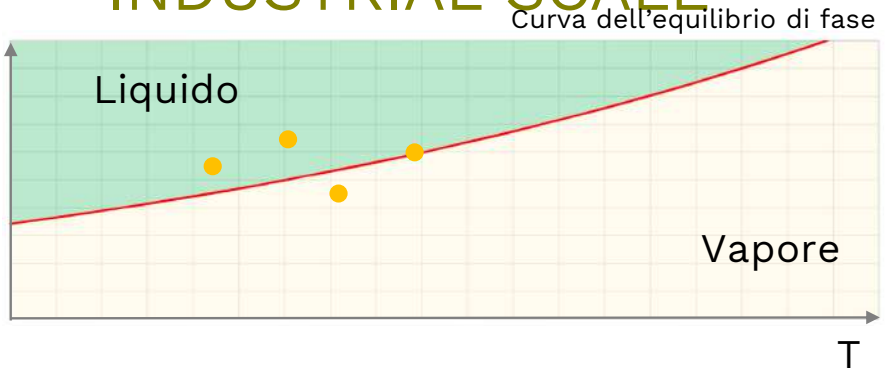
Gianluca Veneziani, Roberto Selvaggini, Agnese Taticchi, Stefania Urbani, Sonia Esposto *, Maurizio Servili



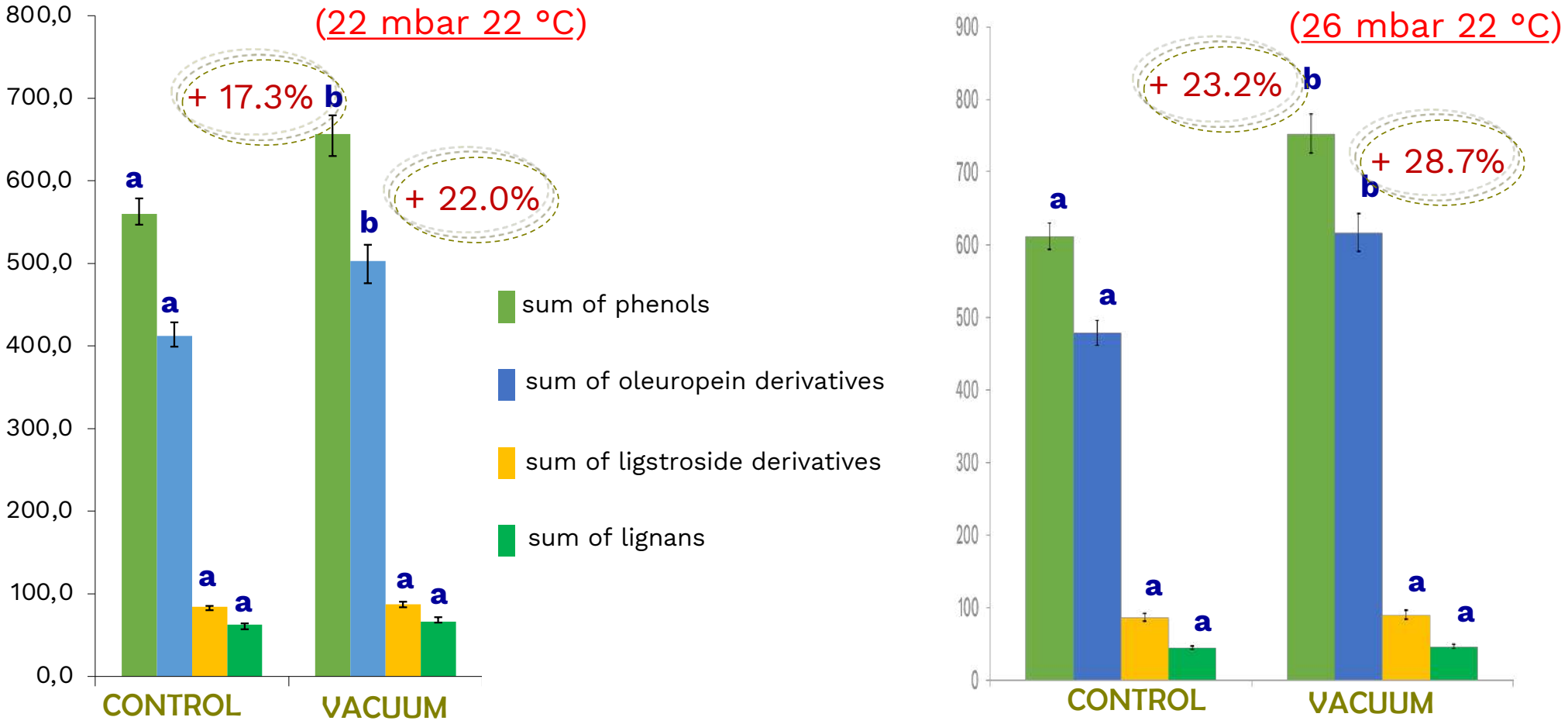
STEP 3

APPLICATION OF HIGH VACUUM IN THE MALAXATION PHASE: INDUSTRIAL SCALE

Vacuum
- 22 mbar, 22 °C
- 26 mbar, 22 °C
- 29 mbar, 22 °C



EFFECT OF THE VACUUM TREATMENT OF PASTES ON THE PHENOLIC COMPOSITION (mg/kg) OF THE VOOs CV. LECCINO (unpublished data).*



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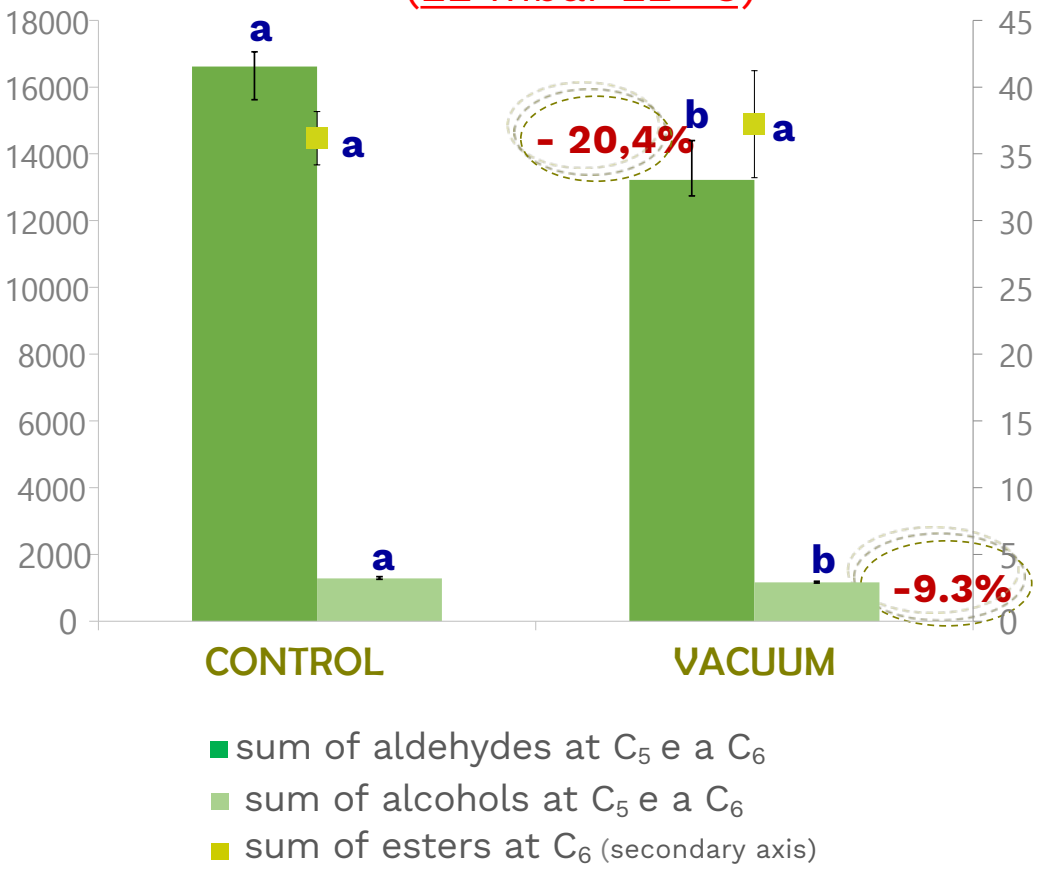
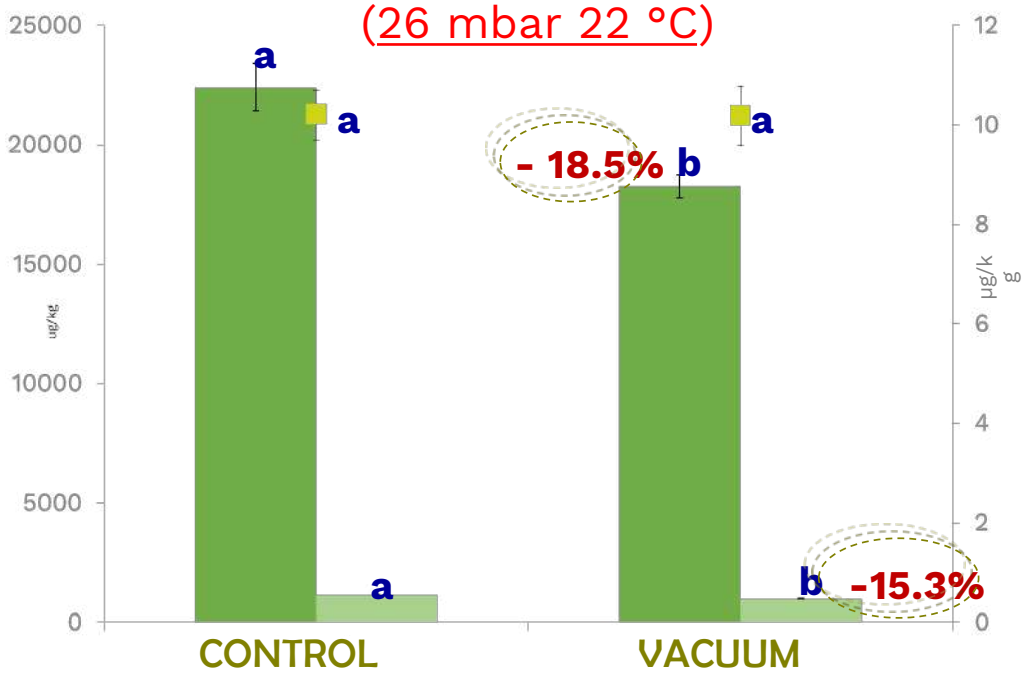
EFFECT OF THE VACUUM TREATMENT OF PASTES ON THE VOLATILE COMPOUNDS (µg/kg) OF THE "FLAVOURS" OF THE VOOs CV. LECCINO (unpublished data).*





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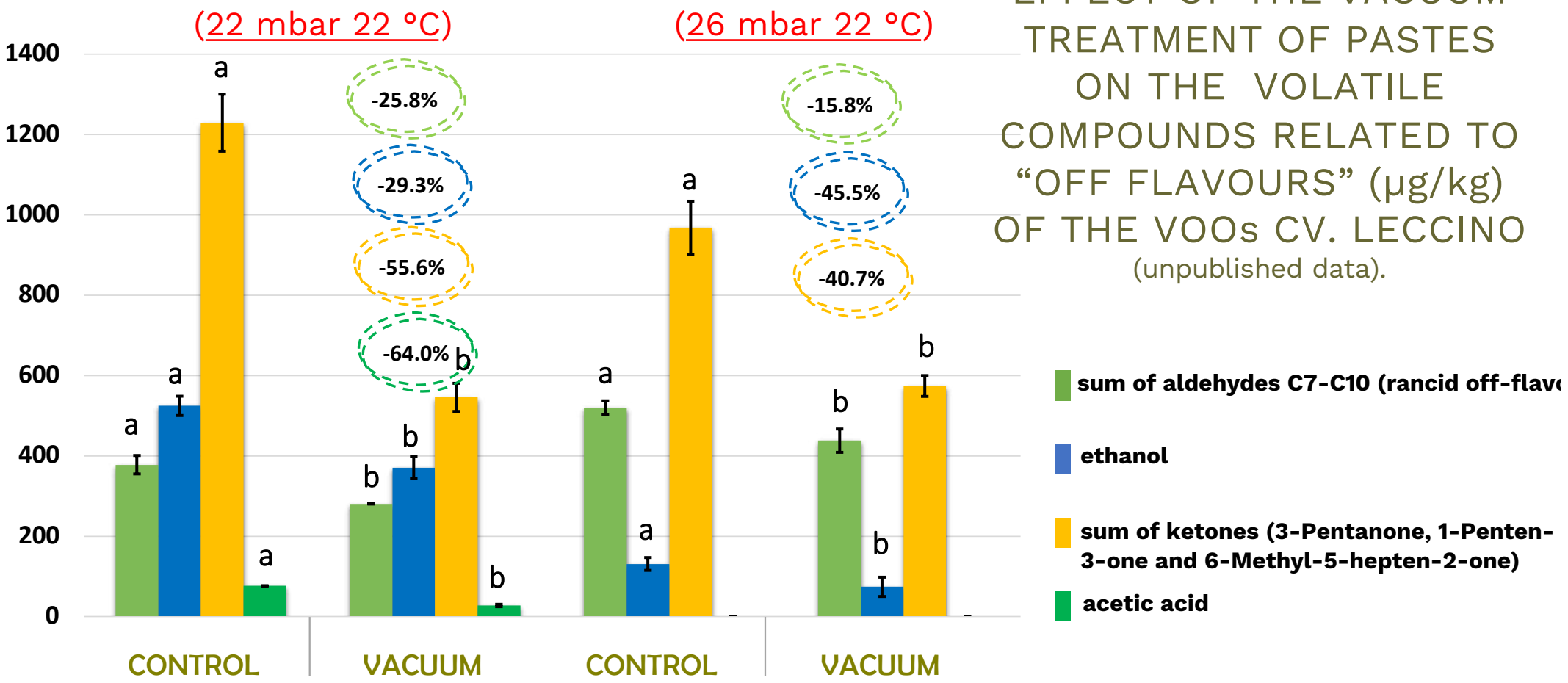
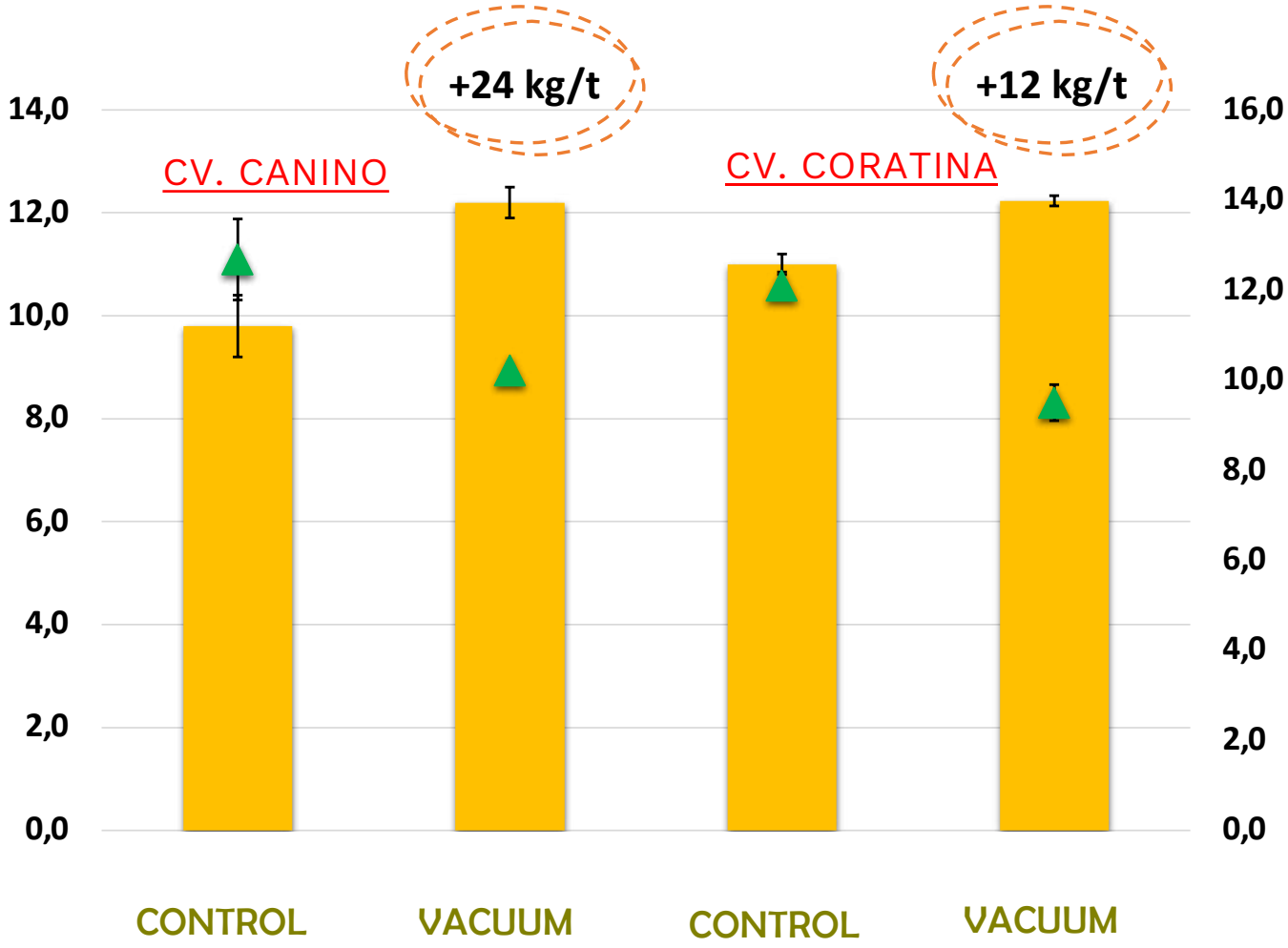
EFFECT OF THE VACUUM TREATMENT OF PASTES ON THE VOLATILE COMPOUNDS RELATED TO "OFF FLAVOURS" (µg/kg) OF THE VOOs CV. LECCINO

(unpublished data).



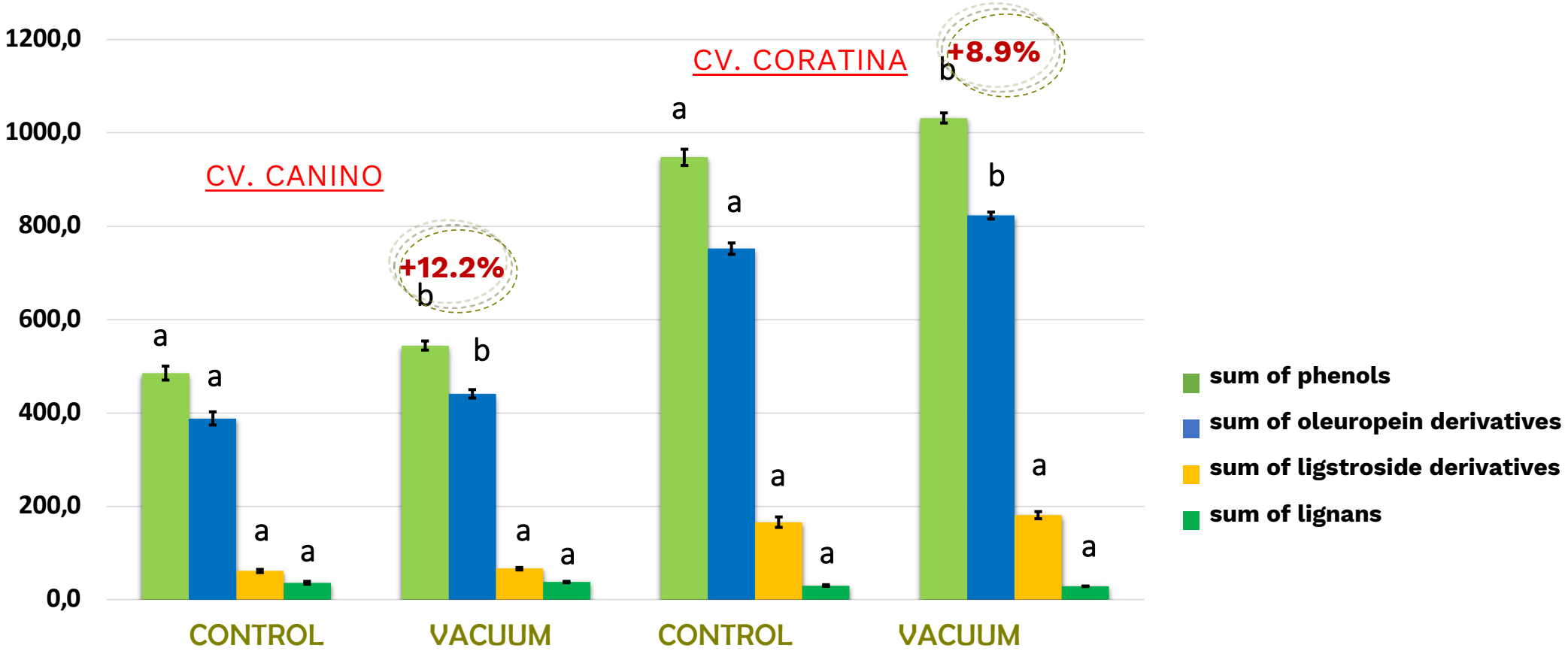


Oil yield and oil content of olive pomace extracted under high vacuum condition from CV Canino and CV Coratina (unpublished data).

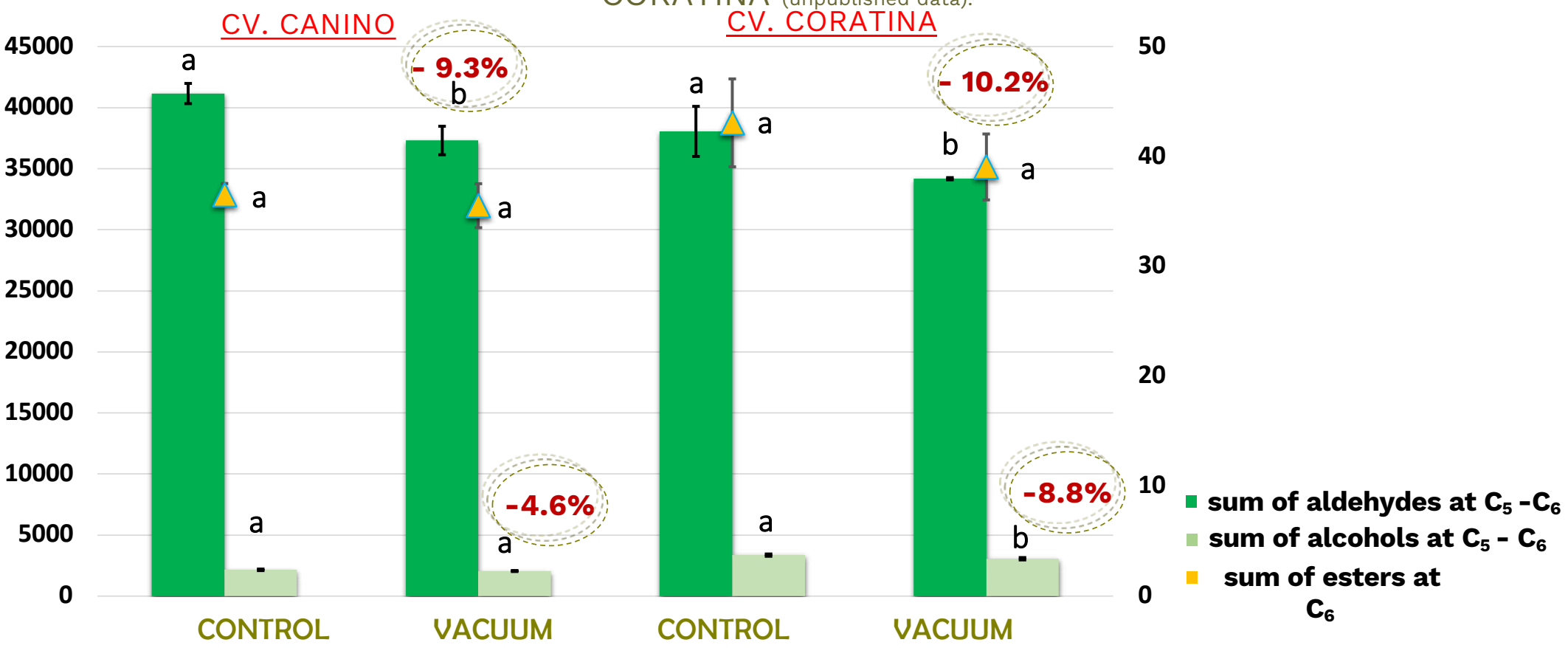
(29 mbar 22 °C)

- oil yield (%)
- oil content of pomace (% d.m.)

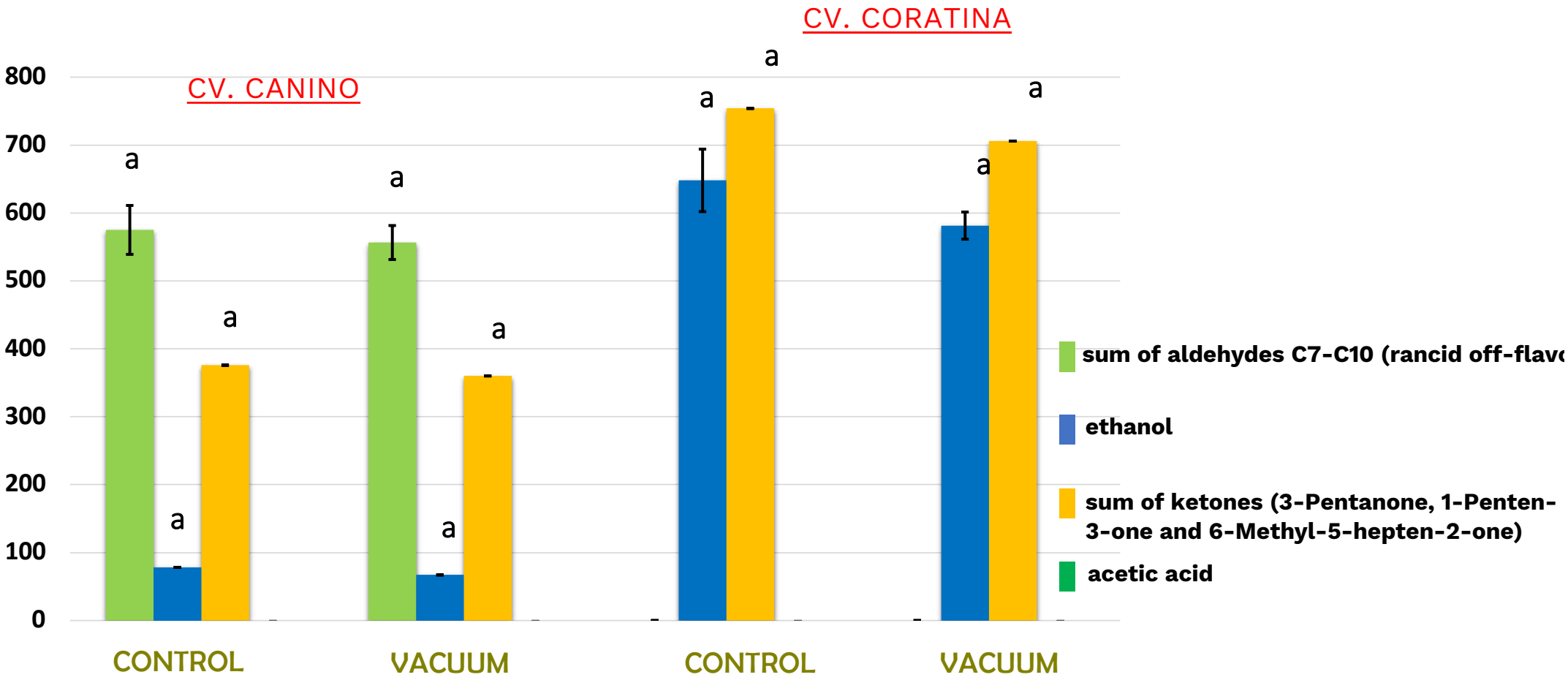
EFFECT OF THE VACUUM TREATMENT (29 mbar 22 °C) OF PASTES ON THE PHENOLIC COMPOSITION (mg/kg) OF THE VOOs CV. CANINO and CV. CORATINA (unpublished data).



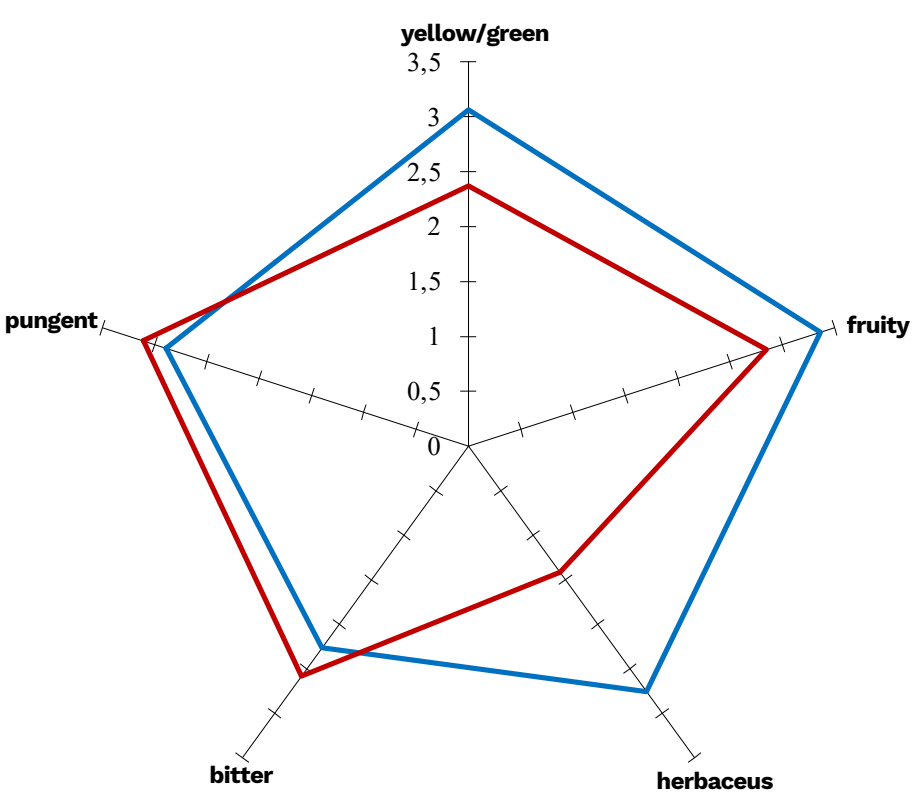
EFFECT OF THE VACUUM TREATMENT (29 mbar 22 °C) OF PASTES VOLATILE COMPOUNDS (µg/kg) OF THE "FLAVOURS" OF THE VOOs CV. CANINO and CV. CORATINA (unpublished data).

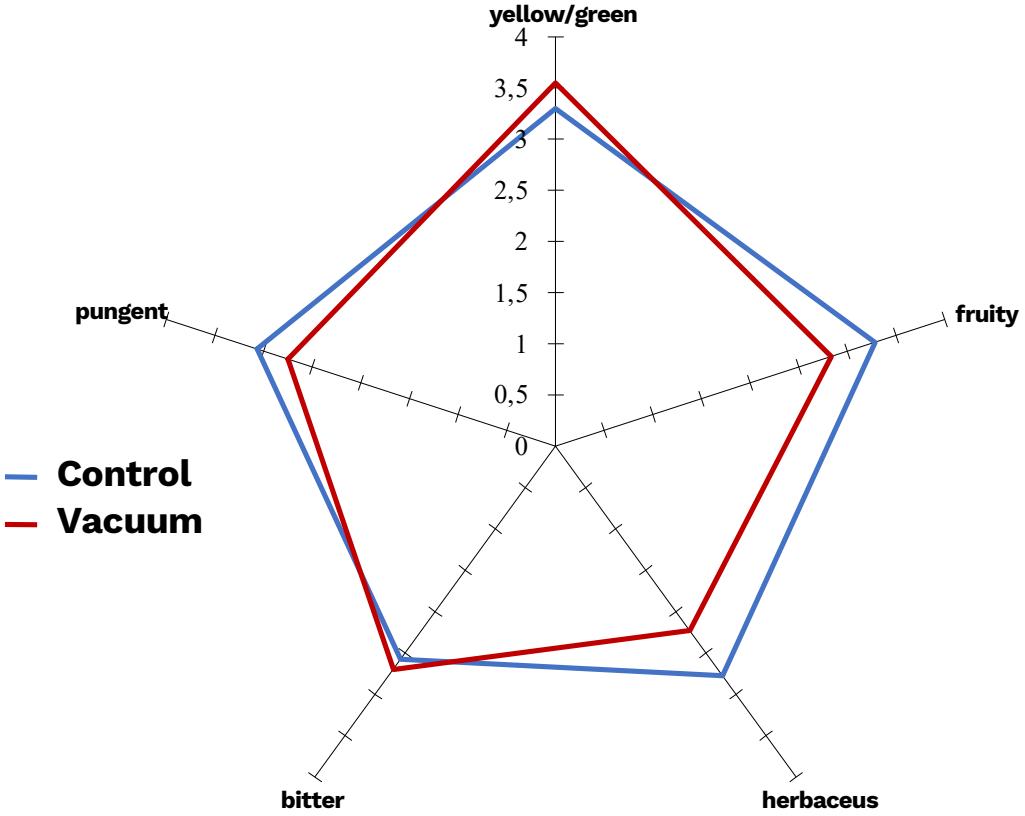


EFFECT OF THE VACUUM TREATMENT (29 mbar 22 °C) OF PASTES ON THE VOLATLIE COMPOUNDS RELATED TO "OFF FLAVORS" (µg/kg) OF THE VOOs CV. CANINO and CORATINA (unpublished data).



Sensory analysis of Leccino VOOs at different vacuum conditions.

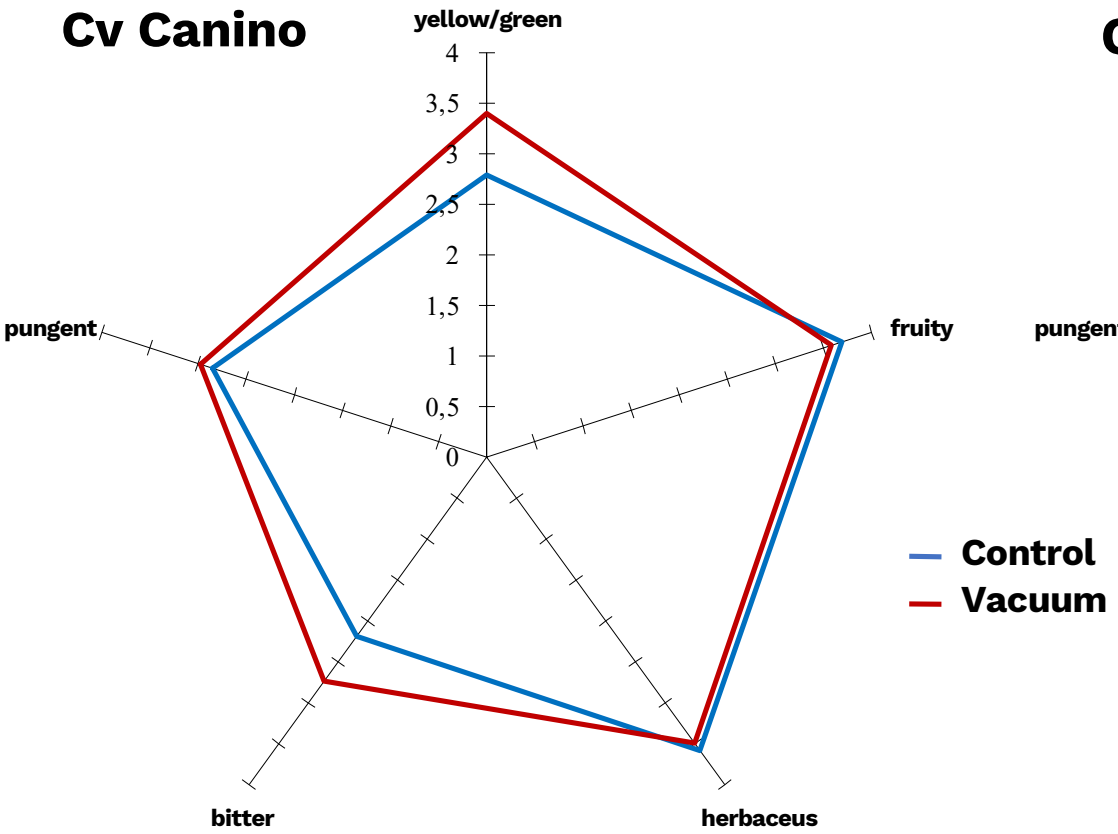


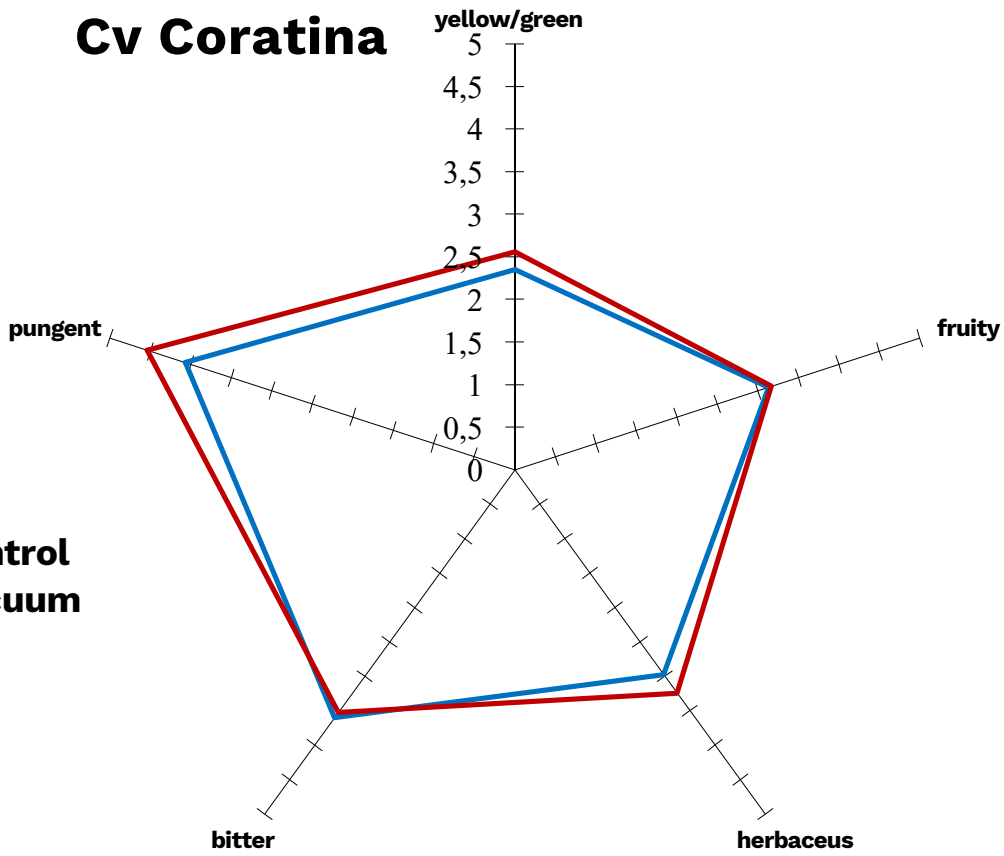


(22 mbar 22 °C)

(26 mbar 22 °C)

Sensory analysis of Canino and Coratina VOOs extracted at 29 mbar of vacuum.





Control
Vacuum

Conclusions

- Increase of VOO extractability
- Increase of phenolic compounds
- Volatile compounds influenced by different level of vacuum

High vacuum extractor

THANKS FOR THE ATTENTION