

# Phenolic composition and sensory profile of vine leaves infusions produced from different Portuguese and Spanish *Vitis Vinifera* L. varieties

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**Viseu, ESAV, 4 de julho de 2019**



# INTRODUCTION

- ✧ The products obtained from the vine, in particular grapes (skins, pulp and seeds), have been deeply studied as important sources of phenolic compounds.
- ✧ Vine leaves may be potentially interesting as a source of phenolic compounds.
- ✧ Vine leaves are often left on the vine itself or used as organic material for fertilization, animal feed or energy production.





# INTRODUCTION

- ✧ The production of vine leaves infusions may be a potential alternative not fully exploited for economical valorization of vine leaves after grape harvest.



- ✧ Potential use of vine leaf infusions may be an interesting option for the habitual herbal infusion consumers.

- ✧ Vine leaves infusion as a potential alternative source of bioactive compounds for human diet, besides being caffeine-free infusions.



# INTRODUCTION

## Previous works about this topic (background)

Natural Product Research, 2014  
<http://dx.doi.org/10.1080/14786419.2014.945086>



### SHORT COMMUNICATION

#### Antioxidant capacity, radical scavenger activity, lipid oxidation protection analysis and antimicrobial activity of red grape extracts from different varieties cultivated in Portugal

Ana C. Correia and António M. Jordão\*

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(Received 28 June 2013; final version received 7 July 2014)

Natural Product Research, 2015  
Vol. 29, No. 1, 37–45, <http://dx.doi.org/10.1080/14786419.2014.957697>



#### Volatile components of vine leaves from two Portuguese grape varieties (*Vitis vinifera* L.), Touriga Nacional and Tinta Roriz, analysed by solid-phase microextraction

Bruno Fernandes<sup>a</sup>, Ana C. Correia<sup>a</sup>, Fernanda Cosme<sup>b</sup>, Fernando M. Nunes<sup>c</sup> and António M. Jordão<sup>a,\*</sup>

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(Received 17 May 2014; final version received 19 August 2014)

#### Influence of harvest date on volatile and sensory profile of vine leaves infusions from two Portuguese red grape varieties

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#### Phenolic composition of vine leaves infusions produced from different Portuguese and Spanish *Vitis vinifera* L. varieties

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## OBJECTIVES

- ✧ It is particularly scarce the knowledge about the potential influence of vine variety on their phenolic composition and consequently on the quality characteristics of the respective infusions obtained.



- ✧ The main purpose of the present study was to investigate the phenolic composition of vine leaves infusions prepared from 8 different Portuguese and Spanish *Vitis vinifera* L. varieties.





## EXPERIMENTAL WORK

- 40 leaves were picked randomly from 16 different vine plants from each vine variety between 30 and 40 days after grape harvest.



- Spanish varieties (from Ribera del Guadiana Region):**

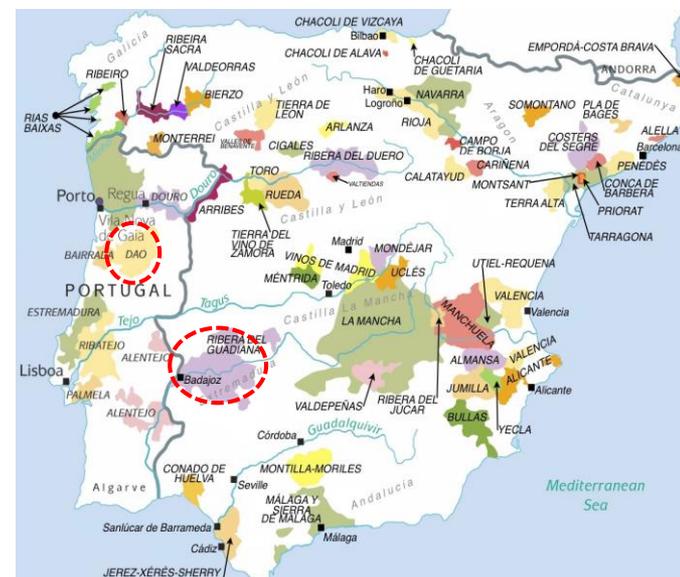
**White varieties:** *Cayetana, Pardina, Eva, Cigüente, Macabeo* and *Verdelho*.

**Red varieties:** *Garnacha* and *Tempranillo*.

- Portuguese varieties (from Dão Region):**

**White varieties:** *Fernão Pires, Encruzado* and *Siria*.

**Red varieties:** *Touriga Franca, Tinta Roriz, Touriga Nacional, Rufete*, and *Baga*.



## EXPERIMENTAL WORK

- ✧ Vine leaves were dried at room temperature ( $\pm 22$  °C) under totally dark conditions until a final humidity of 6-8 %.



- ✧ Dried vine leaves were crushed (final particle size of 2-8 mm) and stored in sachets until used for infusions production.

## EXPERIMENTAL WORK



- ✧ For the production of vine leaves infusions, leaves samples from the different varieties were placed in boiling water at a concentration of 1.5 g/L during 10 minutes.



- ✧ Vine leaves infusions were filtered before analysis.



# EXPERIMENTAL WORK

## ✧ Vine leaves infusions analysis

Several global phenolic parameters



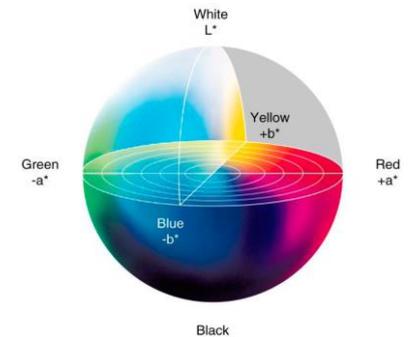
Total phenols, flavonoid and non flavonoid phenolic compounds and total anthocyanins.



Chromatic characteristics



CIELab method:  $L^*$  (lightness),  $a^*$  (redness) and  $b^*$  (yellowness).



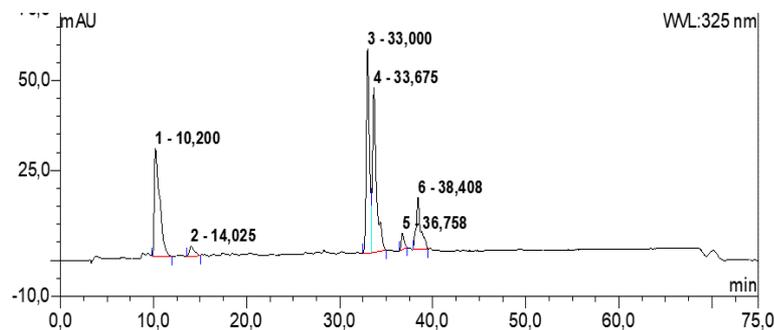
# EXPERIMENTAL WORK

## ✧ Vine leaves infusions analysis

Individual phenolic compounds



Analysis by HPLC-DAD





# EXPERIMENTAL WORK

## ✧ Sensory profile

- ✧ Habitual herbal infusion consumers: 21 men and 27 women, between 34 and 60 years of age
- ✧ Vines leaves infusions tasted:  $T=45\text{ }^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .
- ✧ Several sensorial attributes groups: *visual; aroma; taste and global appreciation.*



### Ficha de prova - Infusões

Nome: \_\_\_\_\_ Idade: \_\_\_\_\_  
 Sexo: F  M  Data: \_\_\_\_\_

À sua frente tem uma amostra de infusão de folhas de videira. Avalie-a sensorialmente, e sequencialmente, nos parâmetros abaixo indicado, assinalando com uma cruz (X) o quadrado correspondente à sua escolha, considerando (1) o valor mais baixo e (5) o valor mais alto.

CÓDIGO:

#### Avaliação Visual

Tonalidade da Cor

Intensidade da Cor  1  2  3  4  5

#### Avaliação do Aroma

Intensidade do Aroma  1  2  3  4  5

Qualidade do Aroma  1  2  3  4  5

#### Avaliação do Sabor

Doce  1  2  3  4  5

Amargo  1  2  3  4  5

Adstringência  1  2  3  4  5

Fim de Prova  1  2  3  4  5

#### AVALIAÇÃO GLOBAL

1  2  3  4  5  
 (1-muito fraca; 2-fraca; 3-média; 4-boa; 5-muito boa)

Observações:

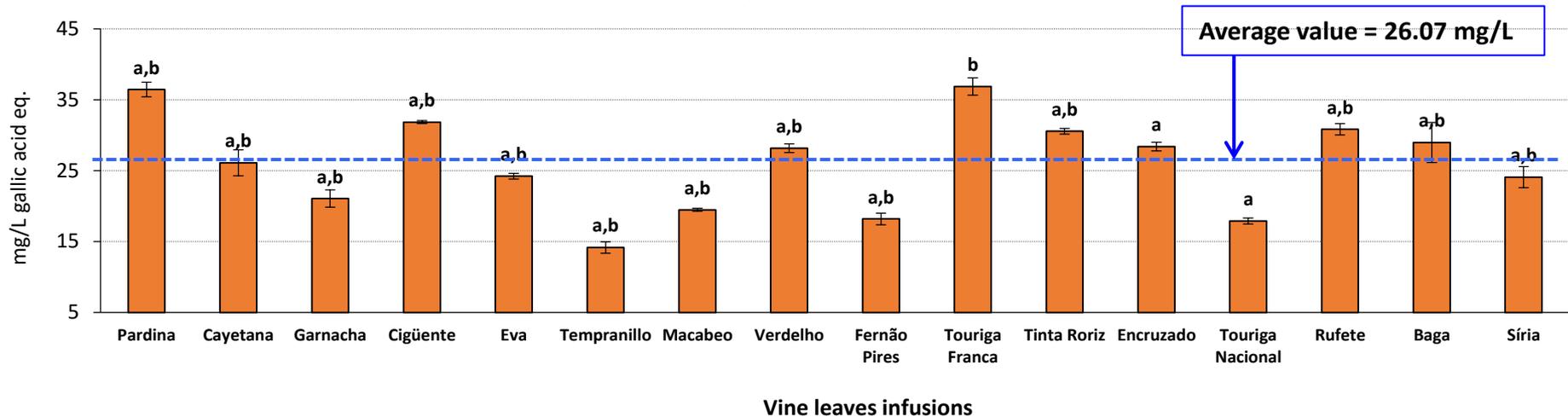
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Obrigado pela sua colaboração. © © ©



# RESULTS

## Total phenols



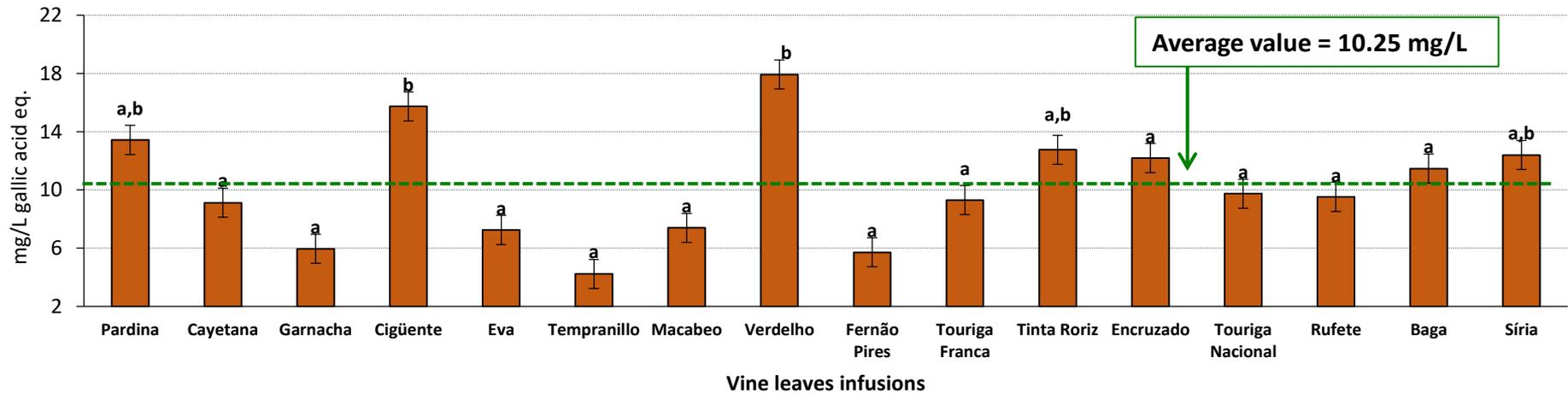
✧ **Black tea: 253 - 867 mg/L** (gallic acid eq.)  
conc. 1.5 g/L (Fu et al. 2011)

- ✧ A high variation of the values for total phenolic content between the different vine leaves infusions (values ranged from 14 to 37 mg/L gallic acid equivalents).
- ✧ Red or white vine varieties didn't induced a clear differentiation of total phenolic content quantified in the vine leaves infusions.



# RESULTS

## Non flavonoid phenols



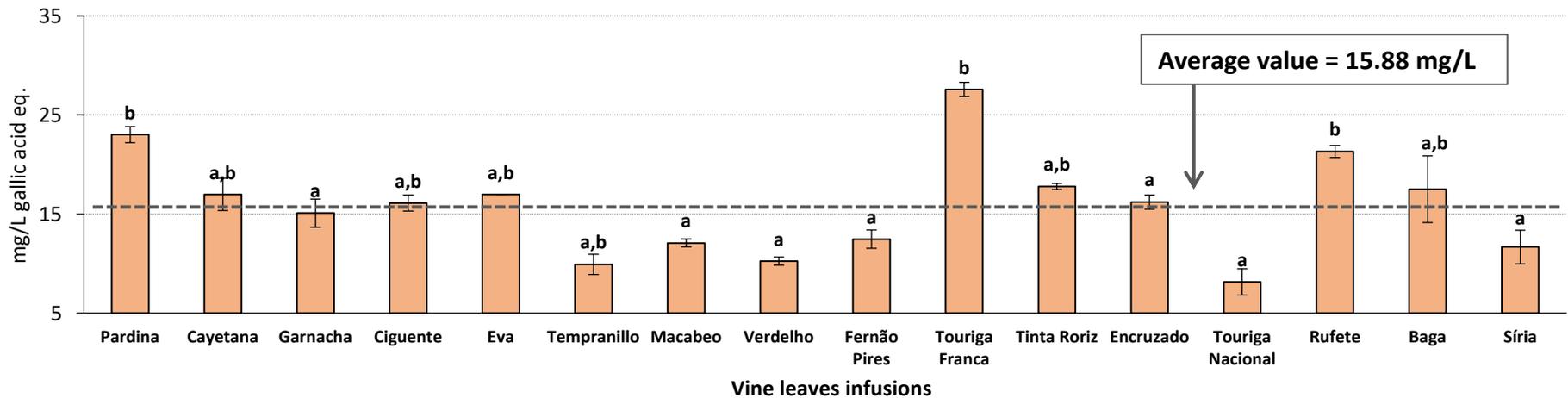
✧ **Black tea:** 60 mg/L (gallic acid eq.)  
 ✧ **Chamomile infusions:** 15 mg/L (gallic acid eq.)  
 conc. 1.5 g/L (Horžić et al. 2009)

✧ *Verdelho* and *Cigüente* varieties, showed the significantly highest values, while the infusion obtained from *Tempranillo* cultivar showed the lowest value.



# RESULTS

## Flavonoid phenols

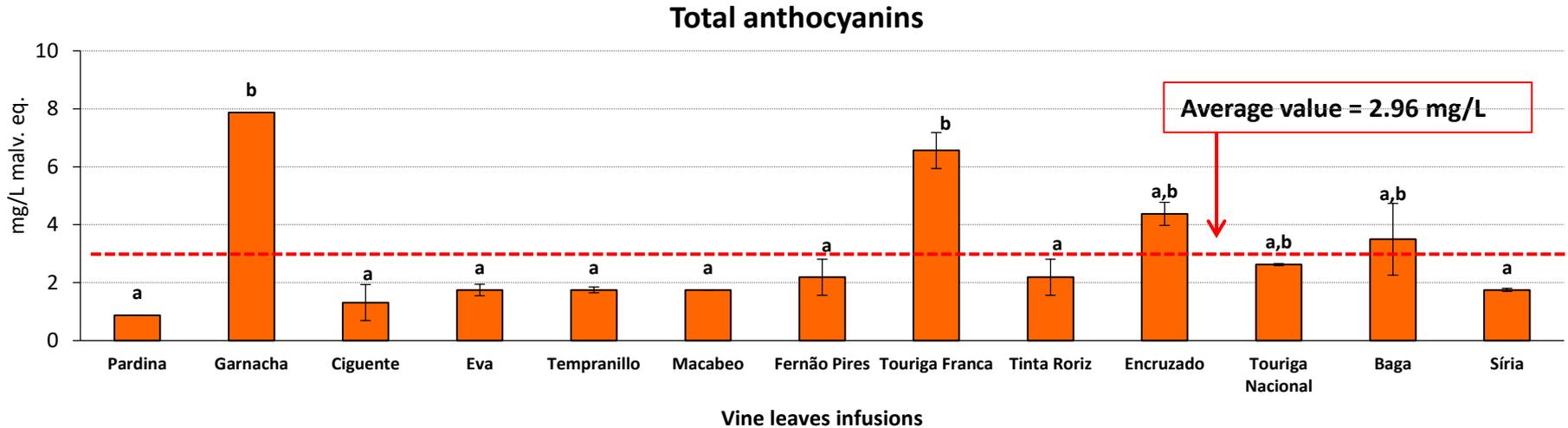


✧ **Black tea: 115 mg/L** (gallic acid eq.)  
 ✧ **Chamomile infusions: 20 mg/L** (gallic acid eq.)  
 Conc. 1.5 g/L (Horžić et al. 2009)

✧ *Touriga Franca* and *Pardina* varieties showed the highest flavonoid content while the lowest values were quantified in vine leaves infusions from *Touriga Nacional* cultivar.



# RESULTS



✧ **Blackberry infusions: 600 mg/L** (cyanidin eq.)

Conc. 1.5 g/L (Sahin et al. 2013)

✧ **Raspberry infusions: 26.2 - 51.4 mg/L** (cyanidin eq.)

Conc. 1.5 mg/L (Moldovan et al. 2016)

✧ Two infusions obtained from red varieties showed the significantly highest values (*Garnacha* and *Touriga Franca*).

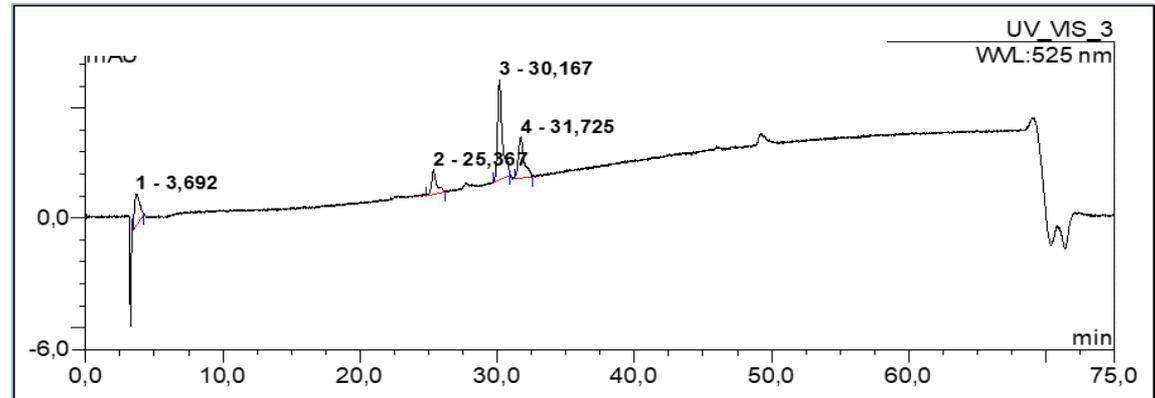
✧ Natural low levels of anthocyanins present in the leaves, degradation of these compounds during the vine leaves drying and high temperatures used in the infusions preparation.



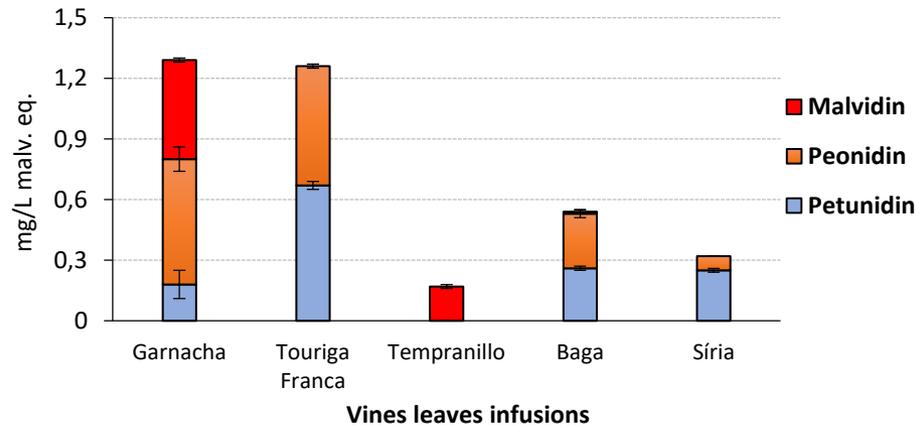
# RESULTS

## 520 nm

- (2) Petunidin-3-*O*-monoglucoside
- (3) Peonidin-3-*O*-monoglucoside
- (4) Malvidin-3-*O*-monoglucoside



## Monomeric anthocyanins

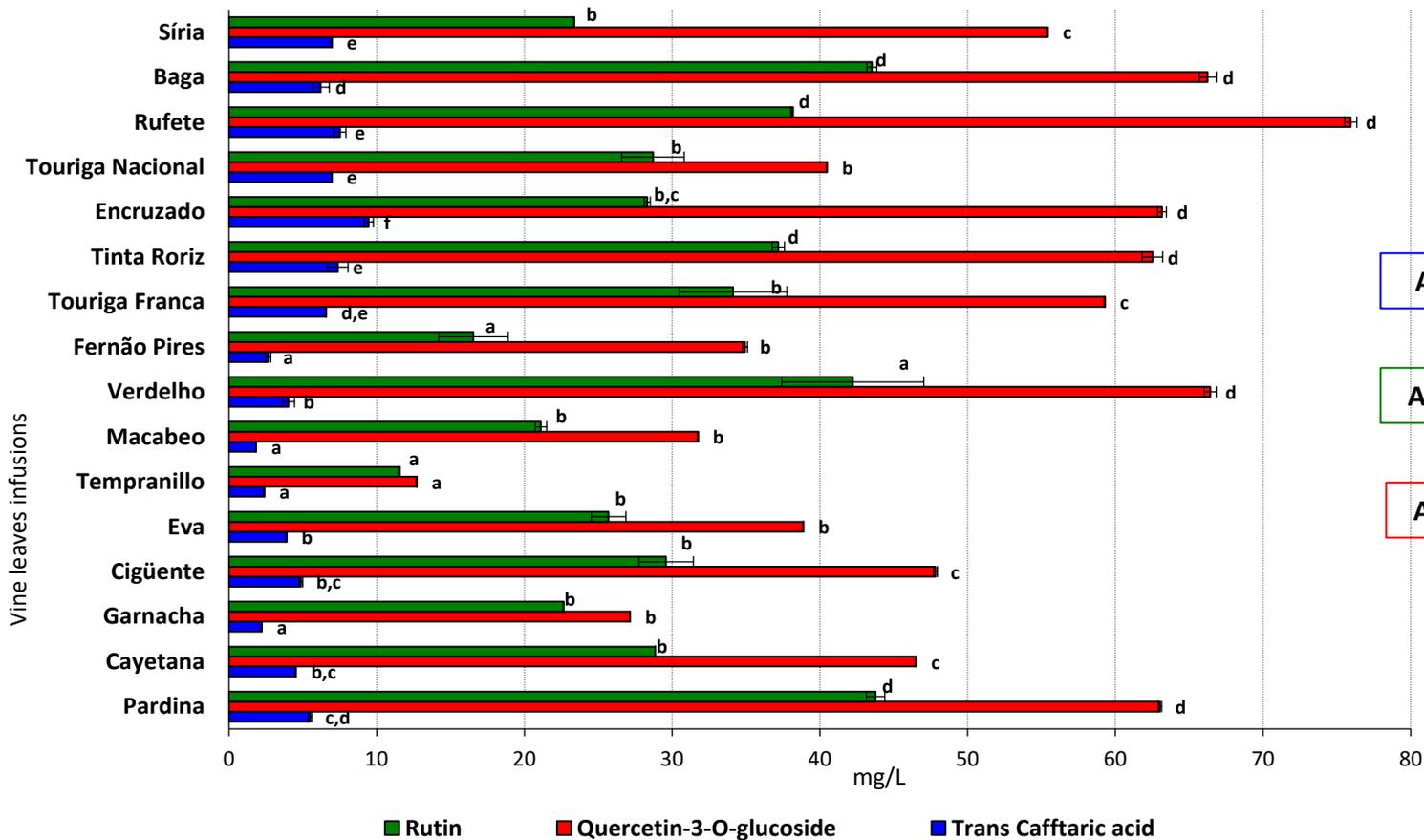


✧ Only for the infusions produced from *Garnacha*, *Touriga Franca*, *Tempranillo*, *Baga* and *Síria* varieties was possible to quantify some individual monoglucoside anthocyanins.



# RESULTS

## Individual phenolic compounds



Average value = 5.18 mg/L

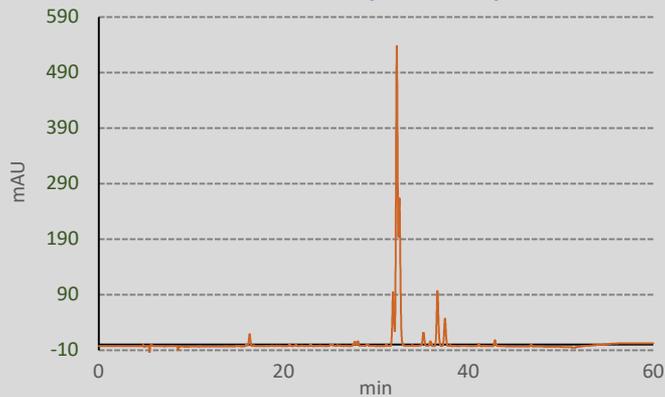
Average value = 29.71 mg/L

Average value = 49.51 mg/L

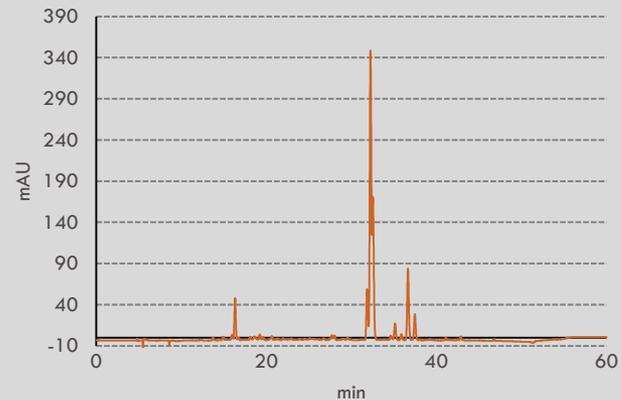


# RESULTS

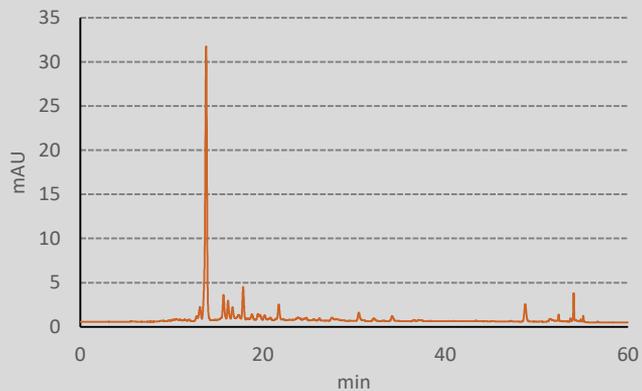
**FLAVONOLS (355 nm)**



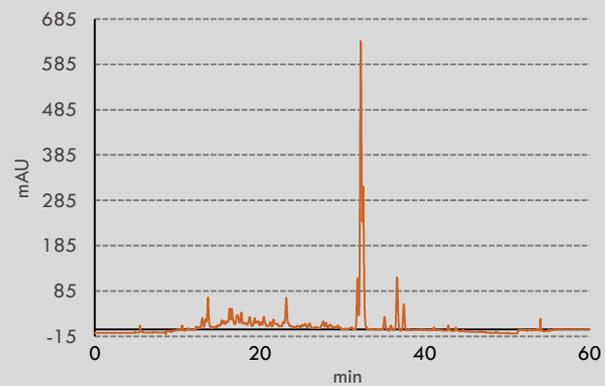
**HYDROCINNAMIC ACIDS (320 nm)**



**FLAVA-3-OLS (320 nm)**



**(220 nm)**

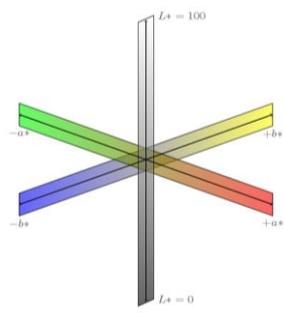


✧ Different classes of phenolic compounds are being analyzed.



# RESULTS

## ✧ Chromatic characteristics



Vine leaves infusions	Chromatic coordinates		
	$L^*$	$a^*$	$b^*$
Pardina	92.93 ± 0.02 <sup>b</sup>	0.97 ± 0.01 <sup>e</sup>	19.17 ± 0.11 <sup>i</sup>
Cayetana	96.44 ± 0.08 <sup>cd</sup>	-0.07 ± 0.02 <sup>c</sup>	10.94 ± 0.03 <sup>f</sup>
Garnacha	96.02 ± 0.04 <sup>cd</sup>	0.44 ± 0.03 <sup>d</sup>	7.83 ± 0.09 <sup>cd</sup>
Cigüente	92.13 ± 1.80 <sup>b</sup>	0.11 ± 0.36 <sup>cd</sup>	15.42 ± 0.41 <sup>g</sup>
Eva	94.12 ± 0.02 <sup>b</sup>	1.86 ± 0.03 <sup>f</sup>	16.23 ± 0.15 <sup>h</sup>
Tempranillo	98.10 ± 0.19 <sup>d</sup>	-0.56 ± 0.08 <sup>b</sup>	4.94 ± 0.07 <sup>a</sup>
Macabeo	95.55 ± 0.40 <sup>c</sup>	-0.01 ± 0.10 <sup>cd</sup>	9.33 ± 0.03 <sup>e</sup>
Verdelho	88.94 ± 0.81 <sup>a</sup>	1.18 ± 0.28 <sup>e</sup>	21.02 ± 0.28 <sup>f</sup>
Fernão Pires	96.59 ± 0.09 <sup>cd</sup>	-0.46 ± 0.04 <sup>b</sup>	6.59 ± 0.03 <sup>b</sup>
Touriga Franca	95.38 ± 0.01 <sup>c</sup>	1.25 ± 0.03 <sup>e</sup>	11.50 ± 0.12 <sup>f</sup>
Tinta Roriz	94.19 ± 0.02 <sup>b</sup>	-0.60 ± 0.01 <sup>b</sup>	11.55 ± 0.21 <sup>f</sup>
Encruzado	90.09 ± 0.41 <sup>a</sup>	1.39 ± 0.06 <sup>ef</sup>	21.32 ± 0.03 <sup>j</sup>
Touriga Nacional	97.42 ± 0.07 <sup>cd</sup>	-0.83 ± 0.04 <sup>b</sup>	6.95 ± 0.14 <sup>b</sup>
Rufete	97.00 ± 0.06 <sup>cd</sup>	-1.39 ± 0.01 <sup>a</sup>	7.62 ± 0.02 <sup>c</sup>
Baga	96.13 ± 0.14 <sup>cd</sup>	0.04 ± 0.01 <sup>cd</sup>	8.31 ± 0.08 <sup>d</sup>
Síria	96.80 ± 0.02 <sup>cd</sup>	-0.96 ± 0.03 <sup>a</sup>	8.38 ± 0.04 <sup>d</sup>

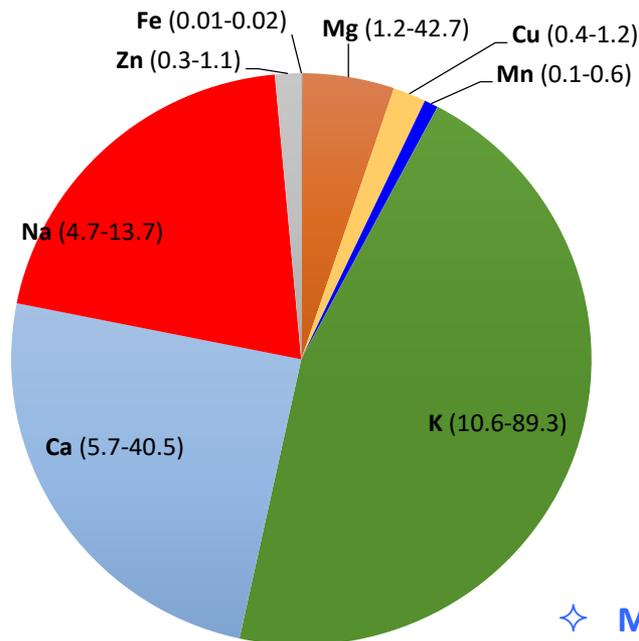


$L^*$  (lightness);  $a^*$  (redness);  $b^*$  (yellowness)



# RESULTS

## ✧ Vine leaves infusions - Mineral Composition



### ✧ Potassium

*Síria* (89.3 ppm)  
*Macabeo* (10.6 ppm)

### ✧ Calcium

*Pardina* (40.5 ppm)  
*Fernão Pires* (5.7 ppm)

### ✧ Magnesium

*Eva* (42.7 ppm)  
*Touriga Franca* (1.20 ppm)

### ✧ Sodium

*Cigüente* (13.7 ppm)  
*Eva* (4.7 ppm)

### ✧ Zinc

*Baga* (1.1 ppm)  
*Rufete* (0.3 ppm)

### ✧ Copper

*Touriga Nacional* (1.20 ppm)  
*Pardina* (0.4 ppm)

### ✧ Manganese

*Pardina* (0.6 ppm)  
*Fernão Pires* (0.1 ppm)

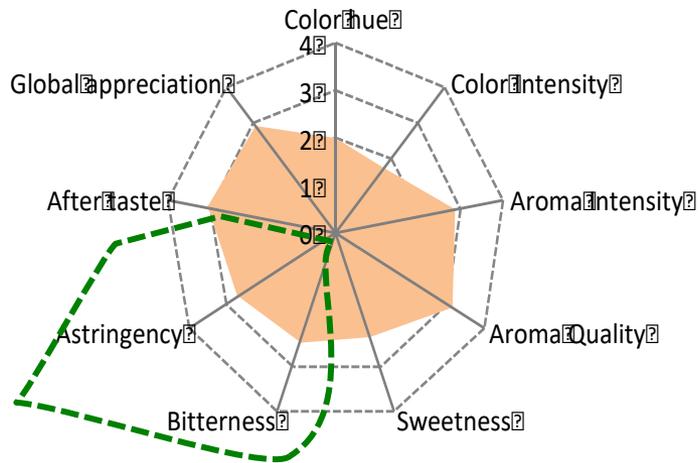
### ✧ Iron

*Síria* (0.02 ppm)  
*Cigüente* (0.01 ppm)

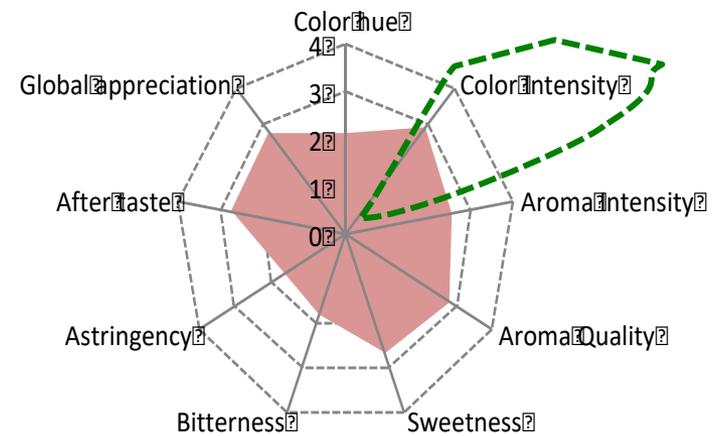


# RESULTS

**Cayetana**



**Touriga Nacional**



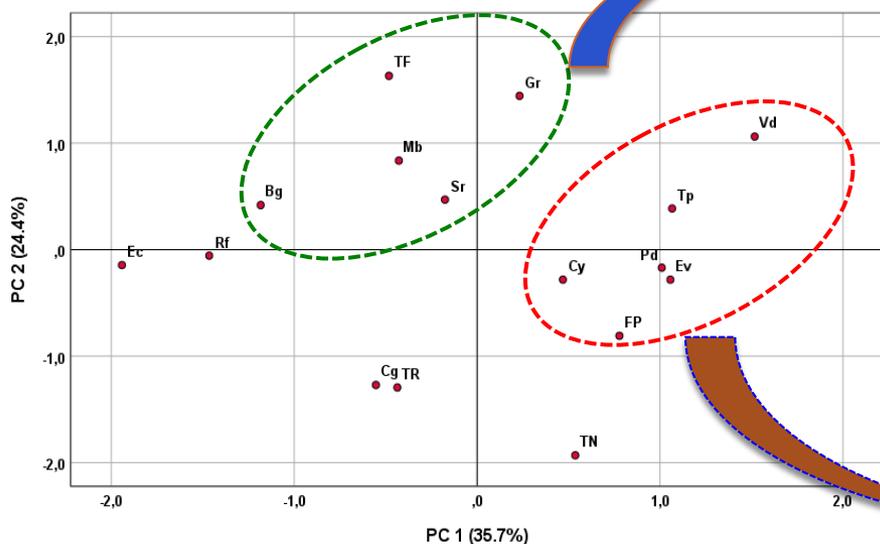
✧ According to each grape variety, the vine leaves infusions produce showed a diverse sensory profile.



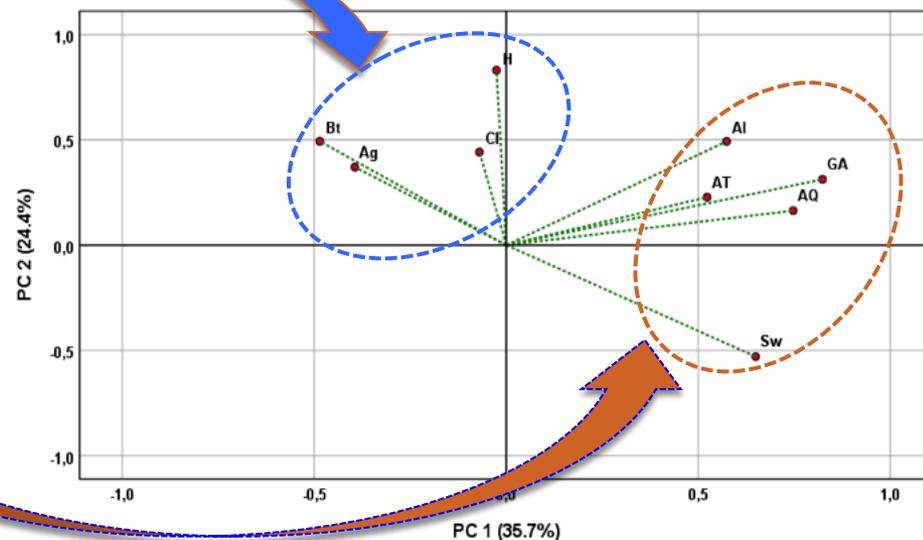


# RESULTS

Projection of the *vine leave infusions samples*



Projection of the *sensory variables*



**SAMPLES:** Tinta Roriz - **TR**; Touriga Nacional - **TN**; Rufete - **Rf**; Baga - **Bg**; Encruzado - **Ec**; Fernão Pires - **FP**; Touriga Franca - **TF**; Síria - **Sr**; Cigüente - **Cg**; Cayetana - **Cy**; Eva - **Ev**; Garnacha - **Gr**; Macabeo - **Mb**; Verdelho - **Vd**; Pardina - **Pd** and Tempranillo - **Tp**.

**SENSORY VARIABLES:** Color hue - **H**; Color intensity - **CI**; Aroma intensity - **AI**; Aroma quality - **AQ**; Sweetnes - **Sw**; Bitterness - **Bt**; Astringency - **Ag**; After taste - **AT**; Global appreciation - **GA**.



## FINAL REMARKS

- ✧ ***A high variation of the values*** for phenolic content from the different vine leaves infusions studied.
- ✧ ***Red or white vine varieties didn't induced a clear differentiation*** of phenolic content quantified in the vine leaves infusions.
- ✧ It will be possible to detected a potential ***higher number of individual phenolic compounds***, however in ***low concentrations***.
- ✧ ***For sensory profile***, different sensory profiles were detected according to the vine leaves infusions obtained from different grape varieties



## Next works ....

- ✧ Study the impact of ***maceration time*** and ***water temperature*** used during the vine leaves infusions preparation on phenolic composition.
- ✧ Analyze the potential influence of the ***vine leaves harvest time*** on the phenolic composition of vine leaves infusions and other parameters.
- ✧ Studies that contribute to the development of knowledge about the ***sensory profile*** of grapevine leaf infusions produced.



**VALORIZATION OF  
VINE LEAVES**



# ACKNOWLEDGMENTS



**Thank you for  
your attention**



Food and Wine Chemistry Laboratory  
Chemistry Research Center – Vila Real

