

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

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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

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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

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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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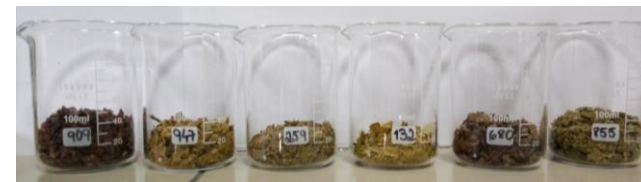
⁴Centro de Química de Vila Real (CQ-VR), Laboratório de Química Alimentar e do Vinho, Universidade de Trás-os-Montes e Alto Douro, Departamento de Química, 5001-801 Vila Real, Portugal

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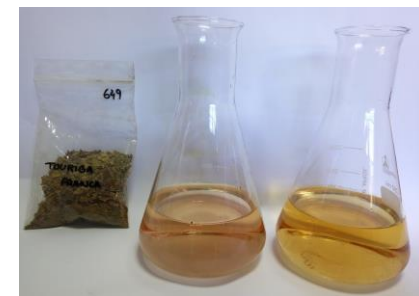


OBJECTIVES

- ✧ 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):**

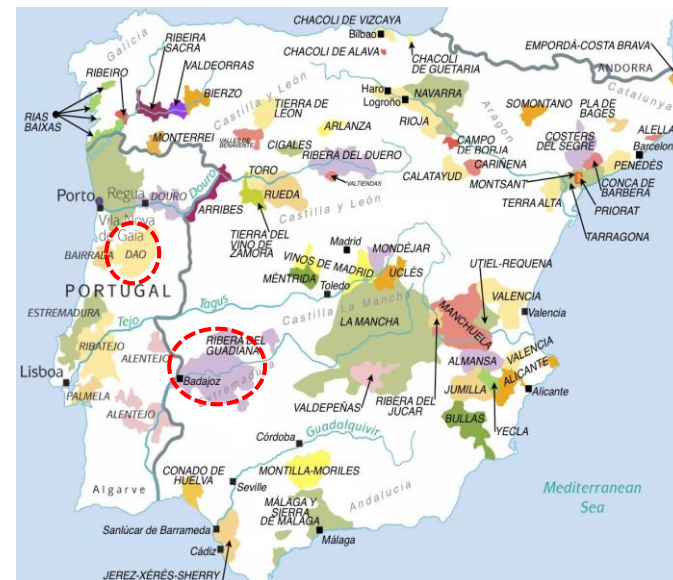
White varieties: *Cayetana, Pardina, Eva, Cigüente, Macabeo* and *Verdelho*.

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 (± 22 °C) under totally dark conditions until a final humidity of 6-8 %.

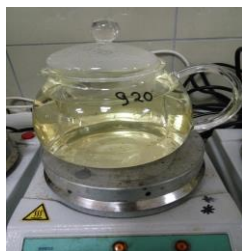
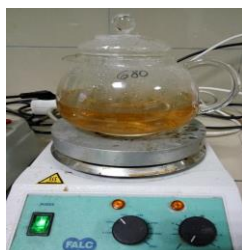


- ✧ Dried vine leaves were crushed (final particle size of 2-8 mm) and stored in sachets until used for infusions production.

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



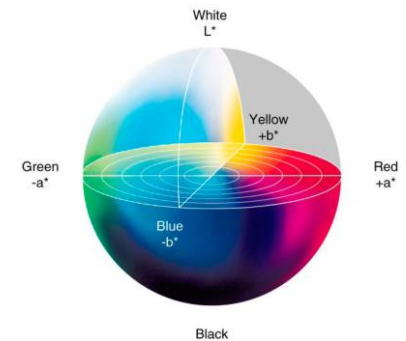
Total phenols, flavonoid and non flavonoid phenolic compounds and total anthocyanins.



Chromatic characteristics



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





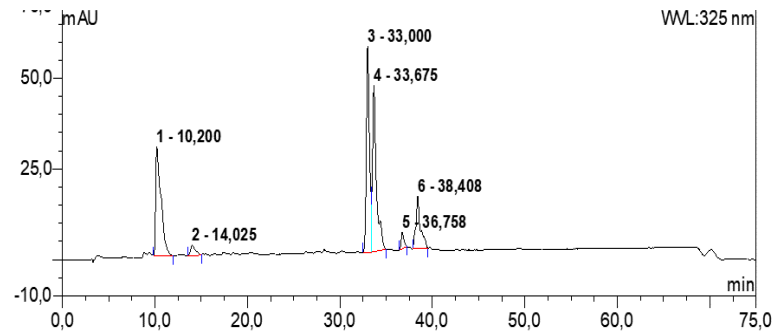
EXPERIMENTAL WORK

✧ 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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	-2				+2
Intensidade da Cor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Avaliação do Aroma

Intensidade do Aroma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualidade do Aroma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Avaliação do Sabor

Doce	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Amargo	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adstringência	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fim de Prova	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

AVALIAÇÃO GLOBAL

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

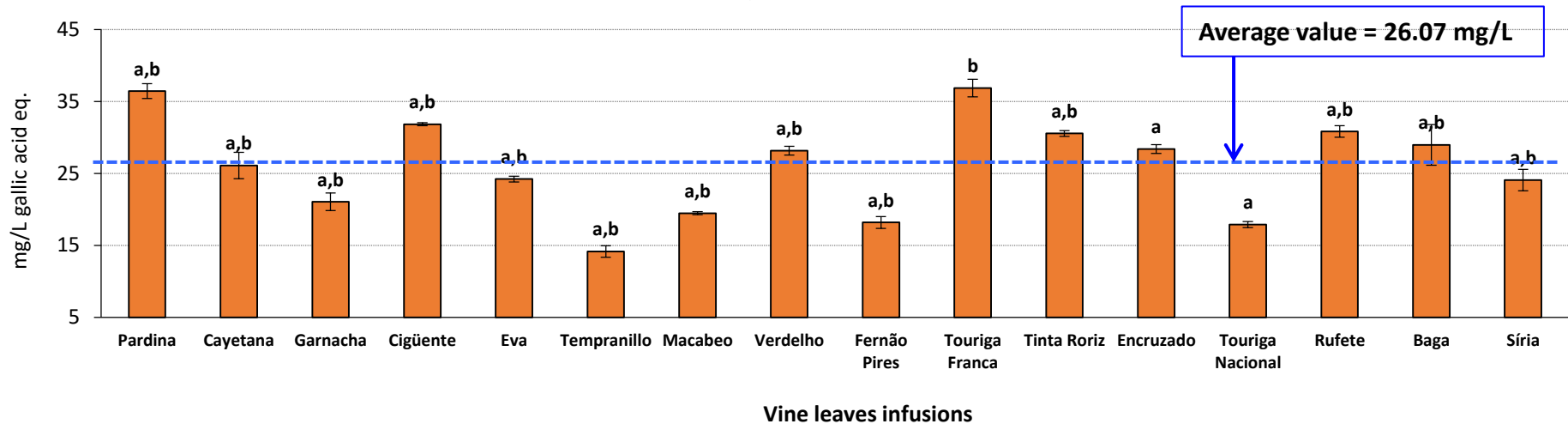
Observações:

Obrigado pela sua colaboração. © © ©



RESULTS

Total phenols



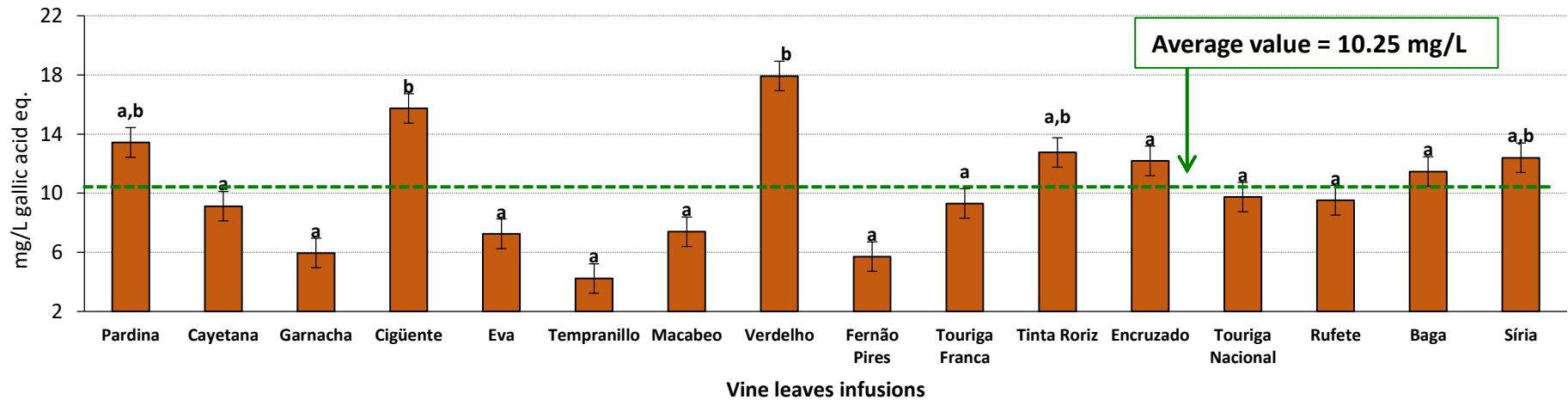
✧ **Black tea: 253 - 867 mg/L** (gallic acid eq.)
conc. 1.5 g/L (Fu et al. 2011)

- ✧ 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



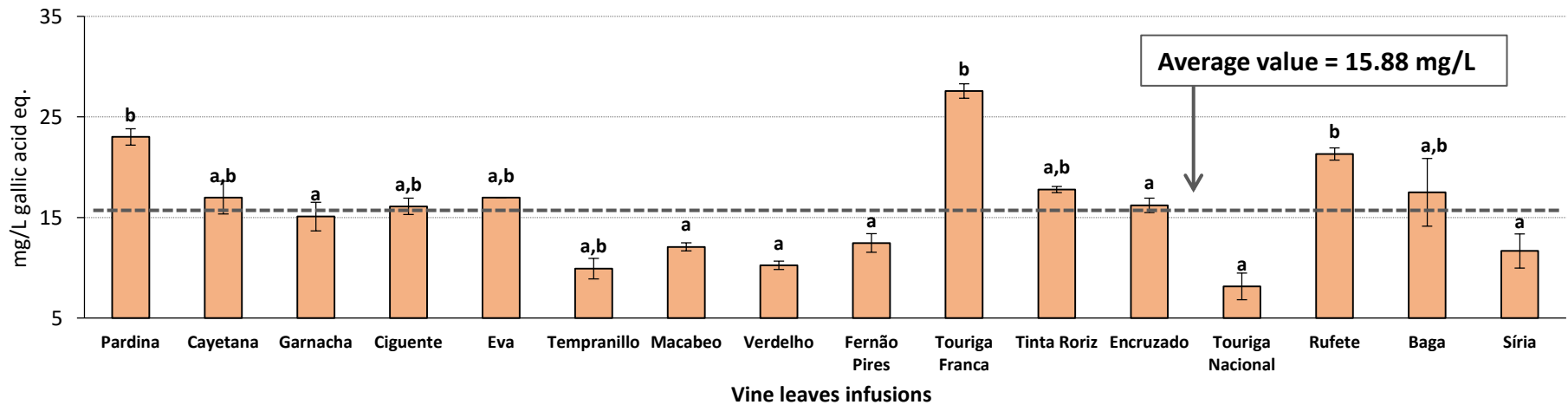
✧ **Black tea:** 60 mg/L (gallic acid eq.)
 ✧ **Chamomile infusions:** 15 mg/L (gallic acid eq.)
 conc. 1.5 g/L (Horžić et al. 2009)

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



RESULTS

Flavonoid phenols

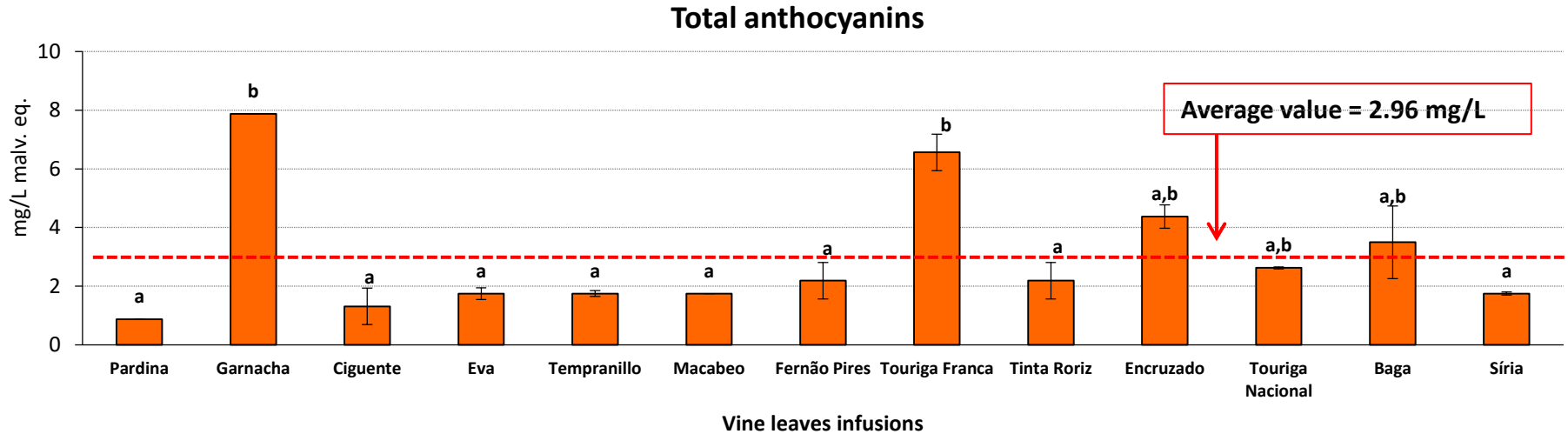


✧ **Black tea: 115 mg/L** (gallic acid eq.)
 ✧ **Chamomile infusions: 20 mg/L** (gallic acid eq.)
 Conc. 1.5 g/L (Horžić et al. 2009)

✧ *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*).

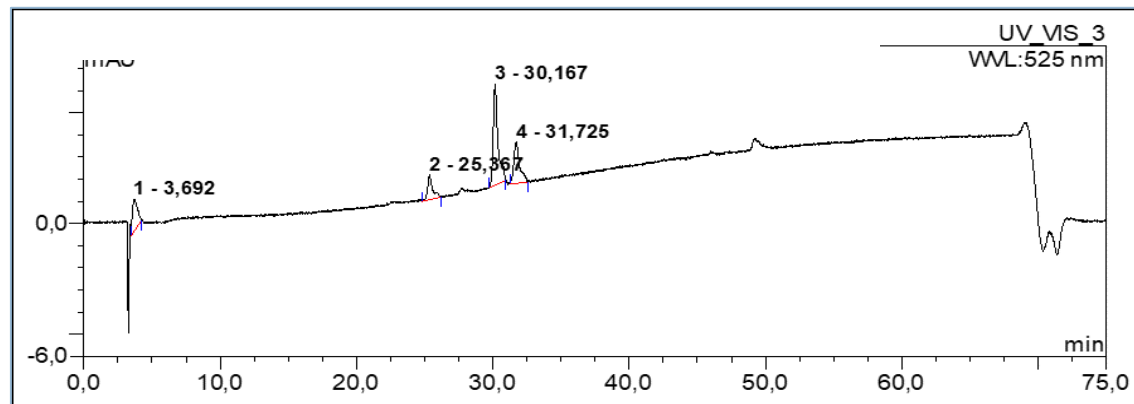
✧ Natural low levels of anthocyanins present in the leaves, degradation of these compounds during the vine leaves drying and high temperatures used in the infusions preparation.



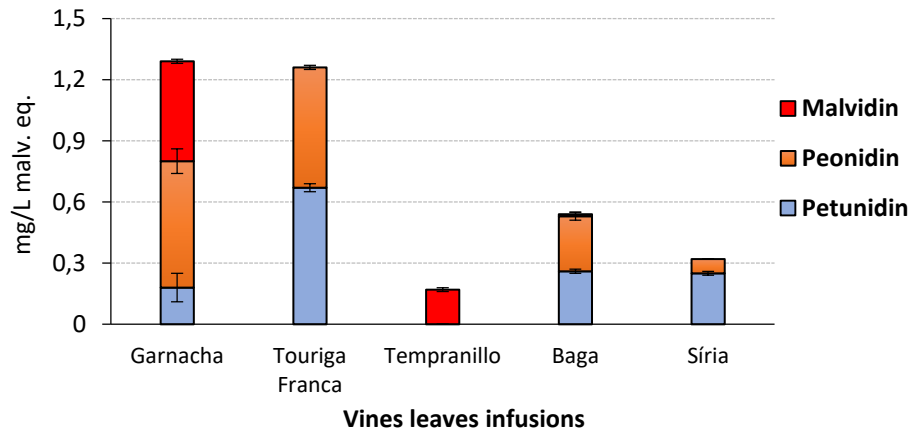
RESULTS

520 nm

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



Monomeric anthocyanins

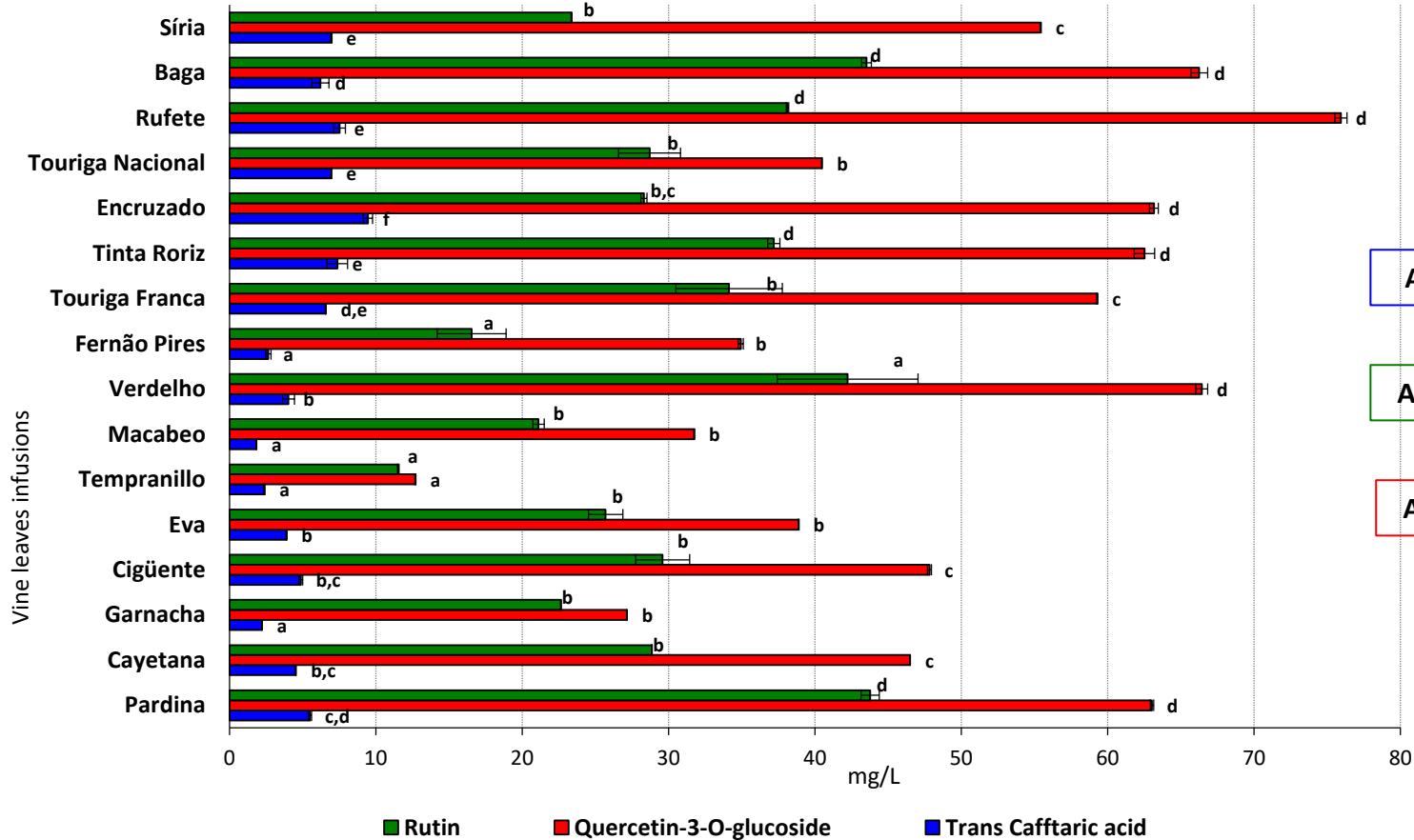


✧ Only for the infusions produced from *Garnacha*, *Touriga Franca*, *Tempranillo*, *Baga* and *Síria* varieties was possible to quantify some individual monoglucoside anthocyanins.



RESULTS

Individual phenolic compounds



Average value = 5.18 mg/L

Average value = 29.71 mg/L

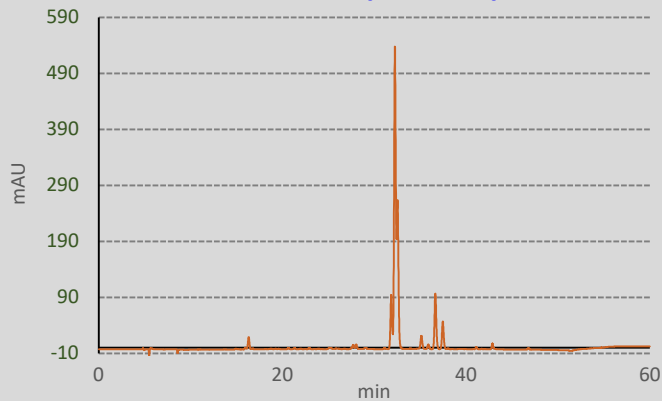
Average value = 49.51 mg/L

Vine leaves infusions

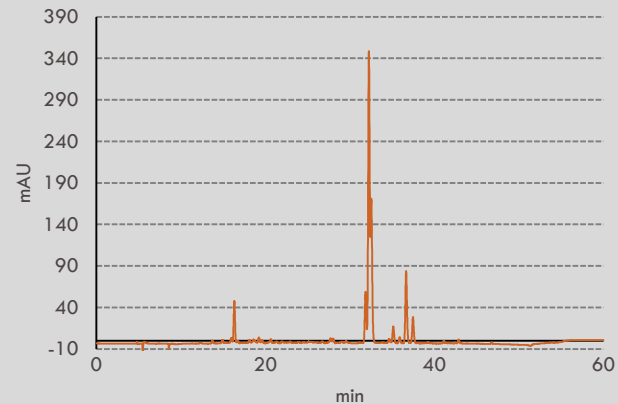


RESULTS

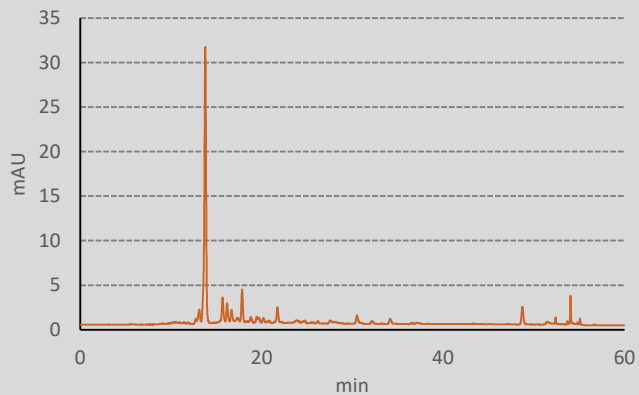
FLAVONOLS (355 nm)



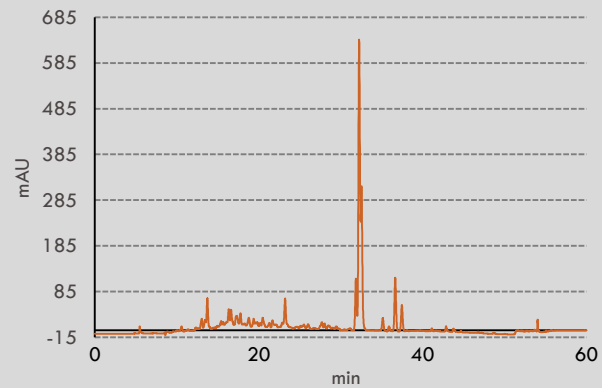
HYDROCINNAMIC ACIDS (320 nm)



FLAVA-3-OLS (320 nm)



(220 nm)

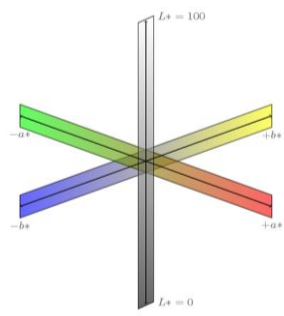


✧ Different classes of phenolic compounds are being analyzed.



RESULTS

✧ Chromatic characteristics



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

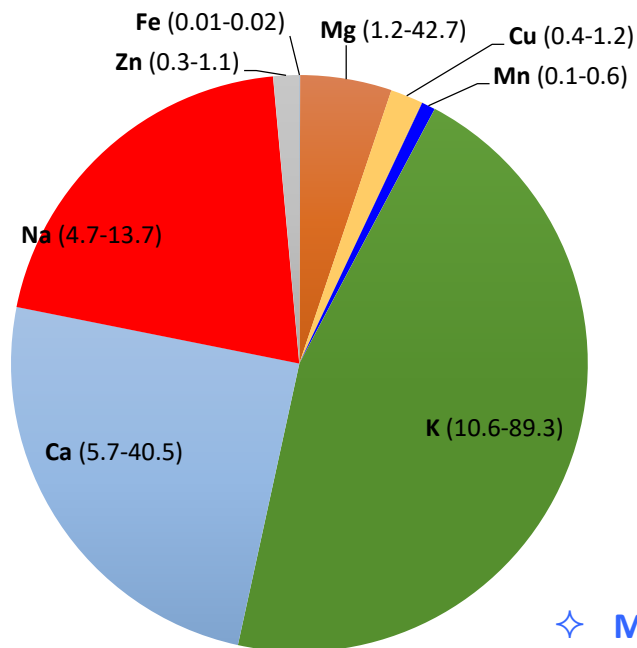


L^* (lightness); a^* (redness); b^* (yellowness)



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)

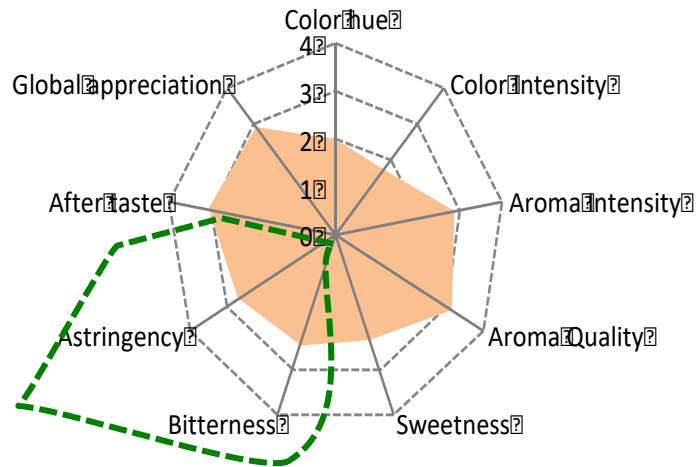
✧ Iron

Síria (0.02 ppm)
Cigüente (0.01 ppm)

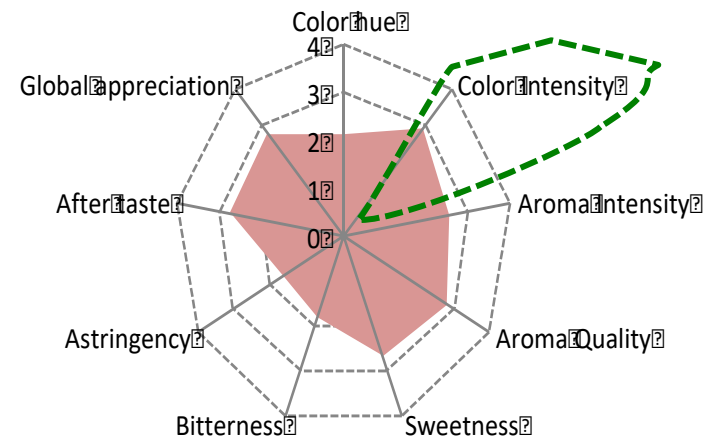


RESULTS

Cayetana



Touriga Nacional



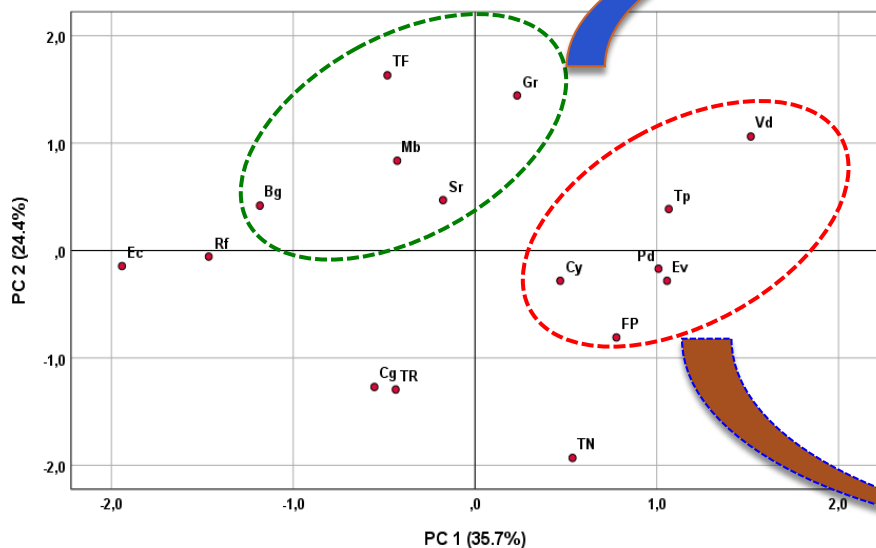
✧ According to each grape variety, the vine leaves infusions produce showed a diverse sensory profile.



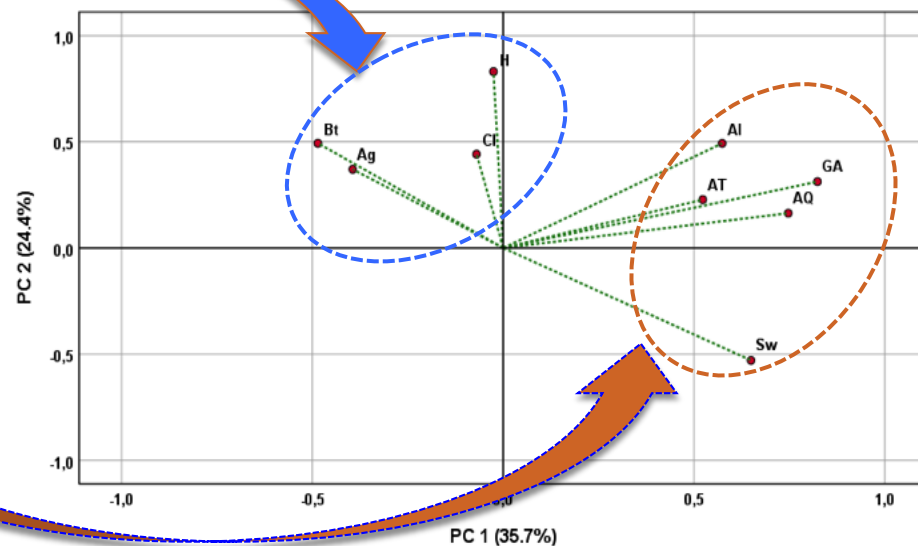


RESULTS

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**



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**Thank you for
your attention**

