Influence of the Growing Conditions in the Content of Vitamin C in *Diplotaxis eruroides*

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Abstract

Diplotaxis eruroides is an edible plant with potential for marketing. Here, we analysed the influence of the growing conditions in this species, *D. tenuifolia* and *Eruca sativa*, and studied the relation among the ascorbic (AA) and dehydroascorbic (DHA) acid forms. Plants were grown in the late winter-spring season under two conditions, greenhouse and field. The contents in AA, DHA and vitamin C (VC) were analysed by HPLC. The content of VC and AA were, in general, remarkable higher in the plants grown in the field. On the other hand, the mean percentage of DHA was less than 11%, being in this case higher for plants grown in the greenhouse. Thus, growing this potential crop in the field seems a better option in order to increase the content in VC, being AA the main form present at the moment of gathering.

Keywords: ascorbic acid, dehydroascorbic acid, field, greenhouse, wall rocket

Introduction

Traditionally, Mediterranean cultures have included wild edible plants as part of their traditional cuisine, being wall rocket an example of this tradition. Wall rocket (*Diplotaxis eruroides*) is an annual plant with lobated, edible leaves, widespread in the Mediterranean region (Martínez-Laborde, 1997). It can be considered as a good source of vitamin C. However, few studies have been done with this species (D'Antuono *et al.*, 2008) and there is a lack of information about the agronomical conditions for its growth. Thus, considering that VC is an important trait for its quality and due to the influence that culture conditions have in the content of this compound, it is necessary to establish the optimum conditions for increasing its accumulation.

Aims and Objectives

Here we analysed the influence of the growing conditions in the content of VC, ascorbic acid (AA) and dehydroascorbic acid (DHA) in wall rocket and related rocket crops.

Materials and Methods

Five populations of wall rocket were evaluated and compared with the commercial *Eruca sativa* cv. SSC 2965 and *D. tenuifolia* cv. SSC 2402, both from Shamrock Seed CO (Table 1). Plants were grown under two growing conditions, greenhouse and field. Five replicates per sample and condition were grown, with two measurements per sample. The content in AA and VC were analysed by HPLC, after the reduction of the DHA to AA with tris(2-carboxy ethyl)phosphine hydrochloride (Chebrolu *et al.*, 2012). DHA was calculated as the difference between VC and AA.

Results and Discussion

The three species presented remarkable values of VC (Table 1). This content was, in general, higher for plants grown in the field, with the exception of salad rocket cv. 2965 that remained stable. The mainly form detected was AA in the both systems, with mean values of 44.9 ± 1.9 and 74.5 ± 1.9 mg/100

Tab. 1. Mean values and standard errors in vitamin C (VC), ascorbic (AA) and dehydroascorbic acid (DHA) (mg/ 100g FW), and percentage of DHA in the total VC for greenhouse (G) and field (F). Different letters indicate differences and * means significant between conditions (LSD, $P < 0.05$).

Accession	VC		AA		DHA		% DHA	
	G	F	G	F	G	F	G	F
DER001-1	55.56 ±4.69b	93.22 ±6.90cd	50.54 ±4.27bc	86.17 ±6.29de	5.02 ±0.55a	7.04 ±0.65bc	9.09 ±0.62ab	7.50 ±0.27a
DER045-1	44.06 ±6.22ab	89.95 ±7.65cd	38.72 ±5.70ab	82.70 ±6.77cde	5.34 ±0.74a	7.25 ±1.02bc	12.80 ±11.23c	7.85 ±0.59a
DER055-1	60.27 ±8.48b	80.64 ±3.92bcd	54.79 ±7.71c	75.25 ±4.06cd	5.48 ±0.98a	5.40 ±0.72ab	9.30 ±1.13ab	6.92 ±1.04a
DER064-1	50.62 ±4.19b	94.58 ±3.50d	45.61 ±3.97bc	88.81 ±3.22e	5.01 ±0.45a	5.77 ±0.46b	10.15 ±0.86bc	6.06 ±0.43a
DER081-1	50.43 ±3.90b	78.83 ±4.36bc	45.53 ±3.34bc	72.56 ±4.10bc	4.90 ±0.69a	6.26 ±0.65b	9.43 ±0.91abc	8.03 ±0.76a
cv. SSC 2402	33.65 ±5.46a	70.93 ±3.22ab	27.44 ±4.76a	61.96 ±3.07ab	6.21 ±0.91a	8.97 ±1.14c	20.11 ±1.98d	12.67 ±1.59b
cv. SSC 2965	54.74 ±7.99b	57.85 ±3.18a	51.65 ±7.65bc	54.44 ±2.84a	3.09 ±0.40a	3.41 ±0.44a	5.86 ±0.50a	5.74 ±0.60a
Average	49.91 ±2.09	80.85 ±2.07*	44.90 ±1.91	74.55 ±1.90*	5.01 ±0.28	6.30 ±0.28*	10.97 ±0.40*	7.82 ±0.40

g FW for greenhouse and field, respectively. Thus, both total VC and AA form presented the same trend between culture conditions and also among accessions. On the other hand, although the content in DHA was higher for the field conditions, differences between the systems were not as remarkable as those found for the AA. Due to this fact, the calculated percentage of DHA was higher for plants grown in the greenhouse, representing in any case less than 11% of the total VC.

According to our results, wall rocket could be considered as a leafy vegetable with high content in VC as it happens with their related rocket crops (Colonna *et al.*, 2016). Moreover, choosing the correct culture system may also contribute to the accumulation of this compound since the growing conditions can affect the grade of stress and response in plants. As our results suggest, growing this crop in the field is more interesting for this goal. On the other hand, as it happens in many horticultural crops (Lee and Kader, 2000), the main form of the vitamin C present in this leafy vegetable at the moment of gathering was the AA, a powerful antioxidant with high interest for human health.

Conclusion

Wall rocket has interest as a new crop with high content in vitamin C, mostly in the form of AA. Growing this vegetable in the field would be a good option for its commercial exploitation, since this kind of culture seems to enhance the content in vitamin C.

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REFERENCES

- Chebrolu, K. K., Jayaprakasha, G. K., Sun Yoo, K., Jifon, J. L., Patil, B. S. (2012). An improved sample preparation method for quantification of ascorbic acid and dehydroascorbic acid by HPLC. *LWT-Food Sci Technol*, 47, 443-449.
- Colonna, E., Rouphael, Y., Barbieri, G., de Pascale, S. (2016). Nutritional quality of ten leafy vegetables harvested at two light intensities. *Food Chemistry*, 199, 702-710.
- D'Antuono, L. F., Elementi, S., Neri, R. (2008). Glucosinolates in *Diplotaxis* and *Eruca* leaves: Diversity, taxonomic relations and applied aspects. *Phytochemistry* 69, 187-199.
- Lee, S. K., Kader, A. A. (2000). Preharvest and postharvest factors influencing vitamin C content of horticultural crops. *Postharvest Biol Technol*, 20, 207-220.
- Martínez-Laborde, J.B. (1997). A brief account of the genus *Diplotaxis*. In S. Padulosi, and D. Pignone (Eds.), *Rocket: a Mediterranean crop for the world* (pp. 13-22) Rome, Italy: International Plant Genetic Resources Institute

- Vymyslický T, Toker C, Saxena RK, Roorkiwal M, Pandey MK, Hu J, Li, YH, Wang LX, Guo Y, Qiu LJ, Redden RJ, Varshney R (2015). Legume Crops Phylogeny and Genetic Diversity for Science and Breeding. *Crit. Rev. Plant Sci.* 34(1-3): 43-104.
24. Stepnowski P, Synak E, Szafranek B, Kaczyński Z (2010). The separation techniques. *Wydz. Uniw. Gdańskiego* (in Polish).
25. Thippeswamy TG, Lalitha J, Shinde M (2015). Enhancement of ascorbic acid in processed yellow cultivar mung bean seeds. *Int. J. Food Sci. Nutr. Diet.* 4(7): 253-257.
26. Unal H, Isik E, Izli N, Tekin Y, (2008). Geometric and mechanical properties of mung bean (*Vigna radiata* L.) grain: Effect of moisture. *Int. J. Food Prop.* 11(3): 585-599.
27. Yildiz UM (2005). Some physical properties of mash bean (*Phaseolus aureus* L.) seeds cultivated in Turkey. *S. U. Ziraat Fakultesi Dergisi* 19(35): 41-45.
28. Zhang H, Ninghui L, Cheng X, Weinberger K (2003). The impact of mung bean research in China. *AVDRC* 14: 1-26.