ISPEC Tarım Bilimleri Dergisi
2020 : 4(1)
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Araştırma Makalesi

E-ISSN:2717-7238
www.ispecjournal.com

ISPEC Journal of Agr. Sciences
2020 : 4(1)
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Research Article

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DOI
https://doi.org/10.46291/ISPECJASvol4iss1pp25-30

Geliş Tarihi: 02/01/2020
Kabul Tarihi: 10/02/2020

Keywords
Rosehip species, carotenoid, carotene, anthocyanin

Carotenoid, Carotene and Anthocyanin Levels of Naturally Grown old Garden Roses (*Rosa* ssp.) in Van

Abstract

Secondary metabolites especially phenolic compounds, flavonoids, tannins, and terpenoids have potential antioxidants and antimicrobial activity. Carotenoids are important antioxidants and bioactive compounds supplying to the health benefits of different foods and rosehips known for high bioactive content. Anthocyanins have physiological importance because of their abilities to protect leaves from photooxidative injuries without significantly compromising photosynthesis. Numerous studies shown that roses are rich sources of bioactive compounds. The genus *Rosa* contains various species that are widely grown in Europe, Asia, The Middle East and North America. In this study it was aimed that determination of carotenoid, carotene and anthocyanin amounts of naturally growing old garden roses species in Van ecological conditions. In this study eleven species of rosehips (*Rosa damascena, Rosa damascena* var. *semperflorens, Rosa laxa* ssp. *harputensis, Rosa alba, Rosa multiflora, Rosa pisiformis, Rosa foetida, Rosa foetida* var. *bicolor, Rosa hemisphaerica, Rosa hemisphaerica* var. *plena hort, Rosa heckellana* subsp. *vanheurckiona*) naturally grown in Van conditions were used as plant material. The fresh leaves (100-200 mg), immediately after harvesting, were homogenized by 80% aqueous acetone and filtered by white tape filter paper. In the extracts, carotenoid, carotene and anthocyanin levels were determined by using UV spectrophotometer in 470 nm, 537 nm, 647 nm, 663 nm wavelengths respectively. As a result, the highest and lowest carotenoid levels were found as 3.18 µg/ml and 0.59 µg/ml in *R. heckellana* subsp. *vanheurckiona* and *R. damascena* var. *semperflorens.* The highest anthocyanin level was determined in *R. damascena* as 0.06 µg/ml.

E-ISSN:2717-7238
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INTRODUCTION

Secondary metabolites especially phenolic compounds, flavonoids, tannins, and terpenoids have potential antioxidants and antimicrobial activity (Wenzing et. al., 2008). Numerous studies shown that roses are rich sources of bioactive compounds (Halvorsen et al., 2002; Olsson et al., 2004). The genus *Rosa* contains various species that are widely grown in Europe, Asia, The Middle East and North America (Ercişli, 2005).

Carotenoids are important antioxidants and bioactive compounds supplying to the health benefits of different foods and rosehips known for high bioactive content (Böhm et al., 2003). Andersson et al. (2011) reported that rose hips generally contain in in high levels of health-promoting compounds such as carotenoids showing differences in content due to genetic variation, degree of ripening, variations within and between years, climate, growing and storage conditions, and analytical method. Anthocyanins are a group of secondary products are defined as anthocyanins which serve important biological functions, including their role in stress protection (Winkel-Shirley, 2002; Kong et al., 2003). Anthocyanins have physiological importance because of their abilities to protect leaves from photo oxidative injuries without significantly compromising photosynthesis. Native rose species are generally important for maintaining biodiversity, for ornamental purposes and for producing healthy functional foods as a source of secondary metabolites.

In this study it was aimed that determination of carotenoid, carotene and anthocyanin amounts of naturally growing old garden rose's species in Van ecological conditions.

MATERIALS and METHODS

In this study eleven species of rosehips (*Rosa damascena, Rosa damascena var. semperflorens, Rosa laxa ssp. harputensis, Rosa alba, Rosa multiflora, Rosa pisiformis, Rosa foetida, Rosa foetida var. bicolor, Rosa hemisphaerica, Rosa hemisphaerica var. plena hort, Rosa heckellana subsp. vanheurckiona*) naturally grown in Van conditions were used as plant material. The fresh leaves (100-200 mg), immediately after harvesting, were homogenized by 80% aqueous acetone and filtered by white tape filter paper.

In the extracts, carotenoid and anthocyanin levels were determined by using UV spectrophotometer in 470 nm, 537nm, 647nm, 663nm wavelengths respectively.

The total carotenoids and carotenes (Lichtenthaler and Wellburn, 1983) and anthocyanin levels (Sims and Gamon, 2002) were calculated by using the following formulas:

Total carotenoids (µg g^{-1}) = (A_{470}- (17.1 x (Chl **a**+ Chl **b**) - 9.479 x anthocyanin))/119.26

Anthocyanin (µmol ml^{-1}) = 0.08173 A_{537}- 0.00697 A_{647}- 0.002228 A_{663}

RESULTS AND DISCUSSION

The carotenoids, carotenes and anthocyanin levels belong different rose species were given in Table 1 and Figure1, 2, 3.

Table 1. The carotenoids, carotenes and anthocyanin levels of different rose species

Varieties		Mean	St. Dev.	Min.	Max.
Rosa damascena	Carotene	1.456	0.0036	1.453	1.460
	Carotenoid	0.0038	$6.80x10^{-5}$	0.00378	0.00379
	Anthocyanin	$113.10x10^{-5}$	$6.44x10^{-5}$	$108.7x10^{-5}$	$1205.00x10^{-5}$
Rosa damascena var. Semperflorens	Carotene	1.919	0.0330	1.882	1.946
	Carotenoid	$2745x10^{-5}$	$37.48x10^{-5}$	$2705x8010^{-5}$	$2780x10^{-5}$
	Anthocyanin	$2745x10^{-5}$	$37.48x10^{-5}$	$2705x10^{-5}$	$2780x10^{-5}$
Rosa laxa ssp. Harputensis	Carotene	1.453	0.0479	1.425	1.509
	Carotenoid	0.0038	9.41x10-5	0.00375	0.00392
	Anthocyanin	$6.44x10^{-5}$	$1.76x10^{-5}$	$5.03x10^{-5}$	$8.42x10^{-5}$
Rosa alba	Carotene	1.247	0.0916	1.158	1.341
	Carotenoid	0.0034	$1.70x10^{-4}$	0.00323	0.00357
	Anthocyanin	$-8.00x10^{-5}$	$30.11x10^{-5}$	$-34.00x10^{-5}$	$25.00x10^{-5}$
Rosa multiflora	Carotene	1.102	0.0089	1.092	1.108
	Carotenoid	0.0031	$1.68x10^{-5}$	0.00312	0.00315
	Anthocyanin	$-305.66x10^{-5}$	$7.64x10^{-5}$	$-314.00x10^{-5}$	$299.00x10^{-5}$
Rosa pisiformis	Carotene	1.964	0.0323	1.940	2.001
	Carotenoid	0.0048	$5.82x10^{-5}$	0.00479	0.00491
	Anthocyanin	$33.06x10^{-5}$	$10.79x10^{-5}$	$24.90x10^{-5}$	$45.30x10^{-5}$
Rosa foetida	Carotene	1.547	0.0366	1.513	1.586
	Carotenoid	0.0040	$6.41x10^{-5}$	0.00394	0.00407
	Anthocyanin	$-11.06x10^{-5}$	$37.39x10^{-5}$	$-48.00x10^{-5}$	$27.80x10^{-5}$
Rosa foetida bicolor	Carotene	0.904	0.0040	0.900	0.908
	Carotenoid	0.0027	$1.11x10^{-5}$	0.00268	0.00271
	Anthocyanin	$-78.00x10^{-5}$	$2.64x10^{-5}$	$-80.00x10^{-5}$	$-75.00x10^{-5}$
Rosa hemisphaerica	Carotene	1.960	0.0110	1.949	1.971
	Carotenoid	0.045	$2.00x10^{-5}$	0.00449	0.00453
	Anthocyanin	$2842x10^{-5}$	$23.02x10^{-5}$	$2816x10^{-5}$	$2859x10^{-5}$
Rosa hemisphaerica plena hort	Carotene	1.563	0.0268	1.537	1.584
	Carotenoid	0.0041	$4.91x10^{-5}$	0.00402	0.00411
	Anthocyanin	$-154.67x10^{-5}$	$8.14x10^{-5}$	$-164.00x10^{-5}$	$-149.00x10^{-5}$
Rosa heckellana subsp. vanheurckiona	Carotene	1.647	0.0020	1.645	1.649
	Carotenoid	0.0042	$6.11x10^{-6}$	0.00417	0.00419
	Anthocyanin	$83.63x10^{-5}$	$1.08x10^{-5}$	$82.40x10^{-5}$	$84.40x10^{-5}$

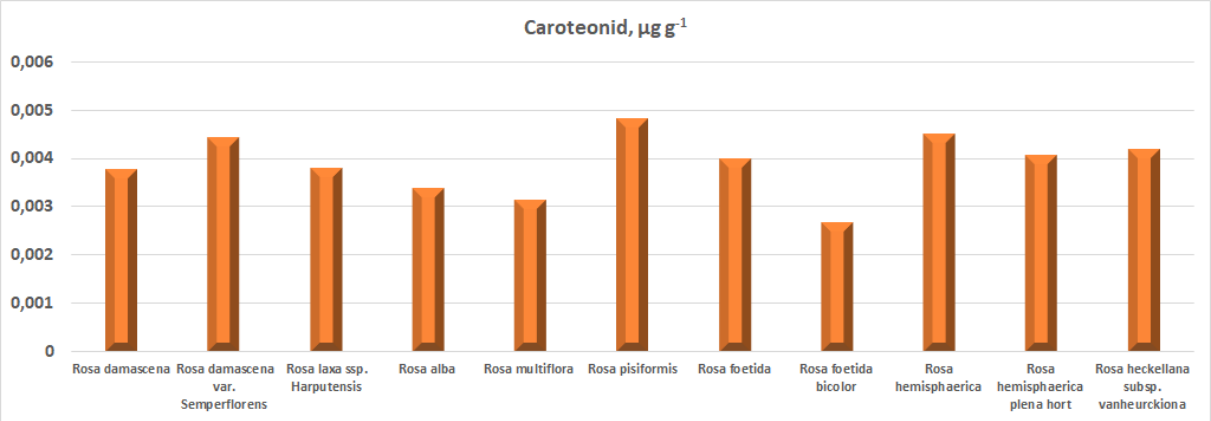

Figure 1. The carotenoids levels belong different rose species

The highest carotenoid levels were found as 0.00484 µg g^{-1} and 0.00444 µg g^{-1} in *R. pisiformis* and *R. damascena var. Semperflorens* while the lowest carotenoid level were in *R. foetida bicolor* as 0.00270 µg g^{-1} (Figure 1).

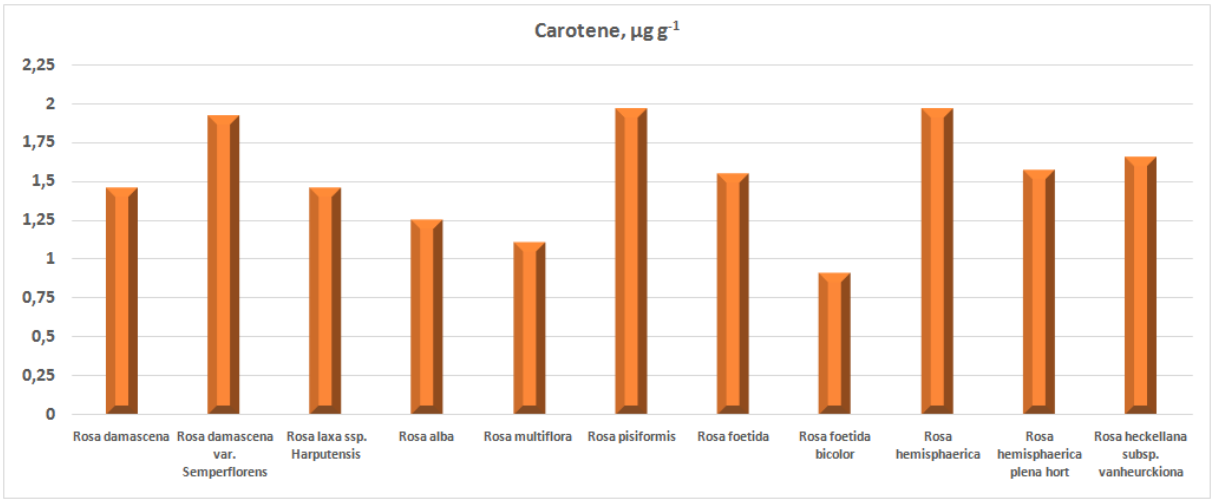

Figure 2. The carotenes levels belong different rose species

The highest carotene levels were determined as 1.960 µg g^{-1} and 1.919 µg g^{-1} in *R. hemisphaerica* and *R. damascena var. Semperflorens* while the lowest carotene level were found as 0.904 µg g^{-1} in *R. foetida bicolor* such as ones in the carotenoid levels (Figure 2).

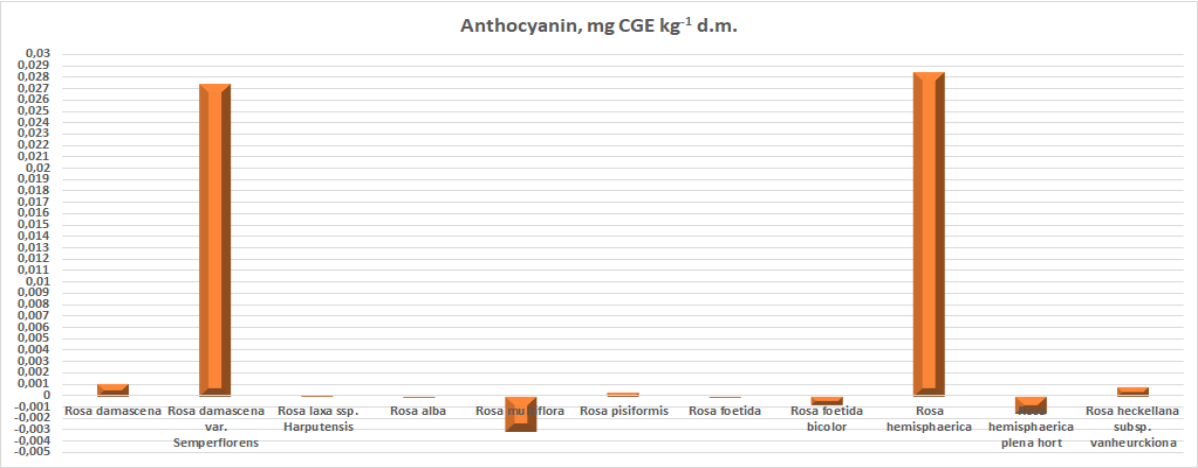

Figure 3. The anthocyanin levels belong different rose species

The highest anthocyanin level was determined as 2745 x10^{-5} mg CGE kg^{-1} d.m. and 2842 x10^{-5} mg CGE kg^{-1} d.m. in *R. x damascena var. semperflorens* and *R. hemisphaerica* respectively. In the others species anthocyanin levels were determined in very low levels (Figure 3). In this study carotenoids, carotenes and anthocyanin levels shown differences amog roses species.

D'angıolıllo et al. (2018) and Andersson et al. (2018) determined that phosenthetic pigments levels changed according to plants species. Plant pigments concentrations can vary depending on different species as well as by local environmental, biogeological and biogeochemical factors.

Environmental changes promote the activation of physiological processes in plants, allowing them to adapt to a new physiological status. D'angıolıllo et al. (2018) and Andersson et al. (2011) declared that carotenoid levels of roses species shown differences according to seasonal changes and increased from spring to autumn. The results obtained in this study were corresponding with referred literature knowledges.

CONCLUSION

As a result, carotenoids, carotenes and anthocyanin levels of roses species can vary depending on different species as well as by local environmental factors.

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