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Biochemical content in fruits of peach and nectarine cultivars

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Abstract: In Turkey, there is an increasing interest for peach and nectarine fruits due to their sensory properties and nutritional values. The large diffusion of new peach and nectarine cultivars requires the knowledge of all fruit characteristics in connection with the cultivation area to satisfy market demand. This study seeks to determine fruit quality attributes and nutraceutical values of 7 commercially important peach (Glohaven, Dixired, Cresthaven, Redhaven, Merrill Gem Free, June Gold, and Jefferson) and 4 nectarine cultivars (Nectared4, Gransun, Cherokee, and Royal Glo) grown in Malatya region of Turkey. The fruits were evaluated for their phenolic compounds (protocatechuic, rutin, quercetin, gallic acid, catechin, chlorogenic acid, caffeic acid, syringic acid, *p* - coumaric acid, *o* - coumaric acid, phloridzin, and ferulic acid), organic acids (citric acid, tartaric acid, malic acid, succinic acid, and fumaric acid), vitamin C, and specific sugars (glucose, fructose, and sucrose). The results showed that peach and nectarine cultivars grown in the Malatya region exhibit an appreciable quality, but there are significant differences in quality properties of the fruits in different cultivars. Rutin (73.549 mg kg^{-1}), caffeic acid (70.142 mg kg^{-1}), catechin (146.609 mg kg^{-1}), and chlorogenic acid (211.879 mg kg^{-1}) were major phenolic compounds in peach and nectarine fruits. Citric acid and malic acid were dominant organic acids in fruits of peach and nectarine cultivars.

Key words: Peach and nectarine, biochemical contents, diversity

1. Introduction

Peach [Prunus persica (L.) Batsch] and nectarine (Prunus persica var. nectarine Maxim) belong to the Rosaceae family. Peaches are widely cultivated due to the fruit's easy adaptability to different ecological conditions, early fruit set and long period of harvest. Peach cultivation extends along 30–45′ north and south parallels of latitude. At higher elevations, low winter temperatures and late spring frosts are limiting factors for peaches and nectarines (Kuden et al., 2018).

Globally, leading peach and nectarine producing countries are China (14,300,000 tons), Spain (1,800,000 tons), Italy (1,250,000 tons), Greece (938,000 tons), United States (775,000 tons), and Turkey (771,000 tons) (FAO, 2018). Peaches and nectarines are grown throughout Turkey except in areas with cold climates. In Turkey, peaches and nectarines are grown mainly together in moderate climate conditions in Bursa and Samsun provinces, the subtropical climate in İzmir, Antalya, Adana, Mersin, and Hatay provinces, the plateau climate in Erzincan, and the harsh climate in Amasya province (Yarilgaç et al., 2004; Polat et al., 2012). In recent years there has been an increased demand for peaches and nectarines in Turkey and therefore production has increased. Turkey's peach and nectarine production has increased from 430,000 tons in 2000 to 547,219 tons in 2009 and reached 771,000 tons in 2017 (FAO, 2018). This production consists of nectarine (8%) and peaches (92%). In eastern Turkey, the Malatya province also has favorable soil and climate conditions for peach and nectarine growth.

The nectarine is classified as a subspecies of peach. Nectarine fruit is similar to peach fruit, except that nectarine fruit tends to be smaller, smooth, more aromatic, and has more red color on the fruit's surface. Nectarine fruits may be either yellow or white fleshed (Barut, 1999).

Peach and nectarine fruit quality is mainly determined by genotype, although other factors such as rootstock, position of the fruit in the canopy, pruning and thinning practices, and yearly climate are known to influence fruit quality (Fonti i Forcada et al., 2013).

Fruits include different levels of phenolic compounds, flavonoids, organic acids, minerals, and vitamins, and all those compounds have antioxidant properties (Orazem et al., 2011).

Phenolic compounds are a large group of plant secondary metabolites. So far, more than 8000 dietary

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phenolics have been identified, and their distribution and accumulation profiles can be affected by both genetic and environmental factors (Crozier et al., 2009; Del Rio et al., 2013).

Phenolic compounds in nectarine and peach fruits significantly contribute to the antioxidant capacity of those fruits (Gil et al., 2002). The consumption quality of peaches and nectarines depends largely on the sweetness of these fruits and it has been stated that there is a positive relation between the amount of saccharose, sorbitol, and malic acid and taste and aroma in those fruits (Orazem et al., 2011). Consumer preferences vary according to consumption habits and in general, consumers prefer fruits with low acidity but high sugar content (Rossato et al., 2009).

As stated before, commercial expansion of peach and nectarine production in Turkey was evident; the promotion and maintenance of the highest possible fruit quality standards and to understand the role of cultivars on the human health content including phenolic compounds, organic acids, vitamin C, and sugar content in peaches and nectarines are needed. Until recently, this effect has not been studied in cultivars and little is known about the effect of cultivars on phenolic compounds, organic acids, vitamin C, and sugar content of peaches and nectarines in Turkey. Such results may help to select cultivars rich in phenolic content and enhanced nutritional properties.

The aim of this study is to determine phenolic compounds, organic acids, vitamin C, and sugar content of the fruits of some peach and nectarine cultivars.

2. Materials and methods

2.1. Plant material

Seven standard peach cultivars (Glohaven, Dixired, Cresthaven, Redhaven, Merrill Gem Free, June Gold, and Jefferson) and 4 nectarine cultivars (Nectared4, Gransun, Cherokee, and Royal Glo cultivars) were used. The experiment orchard was in the Malatya province located Eastern Anatolia of Turkey. The rootstock was peach seedlings. For each cultivar 10 trees were used and 30 fruits per tree were sampled in analysis. All fruits were harvested at commercial ripe stage.

2.2. Phenolic compounds

In separation of phenolic compounds with HPLC, the method determined by Rodriguez-Delgado et al. (2001) was used by modifying. The samples were diluted with distilled water in the ratio of 1:1 and centrifuged at 15,000 rpm for 15 min. Afterwards, the upper part was injected into HLPC by filtration through 0.45 µm millipore filters. Chromatographic separation was carried out on an Agilent 1100 (Agilent) HPLC system by using a DAD detector (Agilent, USA) and a 250 * 4.6 mm, 4 µm ODS column (HiChrom, USA). Solvent A methanol–acetic acid–water (10:2:88), Solvent B methanol–acetic acid–water (90:2:8) was used as mobile phase. The separation was carried out at 254 and 280 nm, flow rate 1 mL min^{-1}, and injection volume 20 µL was determined.

2.3. Organic acids

In extraction of organic acids, the method by Bevilacqua and Califano (1989) was used by modifying. The obtained fruits (5 g) were transferred into centrifuge tubes and homogenized by adding 20 mL of 0.009 N H_2SO_4 (Heidolph Silent Crusher M, Germany). Thereafter, 1 h of mixing was provided in the shaker (Heidolph Unimax 1010, Germany) and centrifuged at 15,000 rpm for 15 min. The aqueous part, which is separated by centrifugation, was filtered from first roughing filter paper, then 0.45 µm membrane filters (Millipore Millex - HV Hydrophilic PVDF, Millipore, USA) twice, and finally a SEP–PAK C_{18} cartridge. Organic acids were subjected to analysis on an HPLC device (Agilent HPLC 1100 series G 1322A, Germany) by using the method of Bevilacqua and Califano (1989). The device was controlled with computers containing an Agilant package by using Aminex HPX–87 H, 300 mm × 7.8 mm column (Bio-Rad Laboratories, Richmond, CA, USA) on an HPLC system. Also, the DAD detector (Agilent, USA) in the system was adjusted according to 214 and 280 nm wavelengths. Here, 0.009 N H_2SO_4, which had been filtered from 0.45 µm membrane filter, was used as mobile phase.

2.4. Vitamin C

The fruit sample of 5 g were transferred into test tubes and 5 mL of 2.5% metaphosphoric acid solution was added to it. The mixture was centrifuged at 6500 × g for 10 min at 4 °C. Metaphosphoric solution (2.5%) was completed to 10 mL by taking 0.5 mL from the clear part in the centrifuge tube. This mixture was injected into an HPLC device by filtered by a 0.45 µm teflon filter. Vitamin C analysis was carried out on a C_{18} column (Phenomenex Luna C18, 250 × 4.60 mm, 5 µ) at 25 °C. In the system, ultra pure water at a 1 mL min^{-1} flow rate whose pH level had been adjusted to 2.2 with H_2SO_4 was used. The readings were carried out at 254 nm wavelengths on a DAD detector. L–ascorbis acid, which had been prepared at different concentrations (50, 100, 500, 1000, and 2000 ppm), was used to identify the peak and amount of vitamin C (Cemeroglu, 2007).

2.5. Sugars

The method used by Melgarejo et al. (2000) was used. After being passed through the homogenizer, 5 g of the sample was passed through a SEP–PAK C_{18} cartridge by centrifuging at 12,000 rpm for 2 min. The filtrate was stored at –20 °C until analysis. The sugars in the obtained fruit samples were determined on an HPLC device with a refractive index detector (IR) with the help of 85% acetonitrile liquid phase by using a µBondapak - NH_2 column. Again, the calculation of concentrations was made according to externally supplied standards.

2.6. Statistical analysis

Three replicates were carried out. Descriptive statistics of phenolic compounds, organic acids, sugars, and vitamin C extracted from cultivars were represented as mean ± SE. Experimental data were evaluated by using analysis of variance ANOVA and significant differences between the means of 3 replicates ($P < 0.05$) were determined by using Duncan's multiple range test in the SPSS 20 for Windows (IBM Corp., Armonk, NY, USA).

3. Results and discussion

Results related to the biochemical content of peach and nectarine cultivars are shown in Tables 1, 2, 3, and 4.

3.1. Phenolic compounds

As indicated in Tables 1 and 2, phenolic compounds vary largely in fruits among peach and nectarine cultivars. Peach and nectarine cultivars contained phenolic compounds in descending order chlorogenic acid (76.525 and 211.879 mg kg^{-1}) > catechin (11.055 and 146.609 mg kg^{-1}) > rutin

Table 1. Protocatechuic acid, chlorogenic acid, rutin, quercetin, gallic acid, and catechin contents (mg kg^{-1}) of peach and nectarine cultivars.

Cultivar	Protocatechuic acid	Chlorogenic acid	Rutin	Quercetin	Gallic acid	Catechin
Glohaven^{P}	2.633 ± 0.022j	90.459 ± 0.387g	10.723 ± 0.015j	5.538 ± 0.034j	2.753 ± 0.002f	80.771 ± 0.194d
Redhaven^{P}	2.772 ± 0.001i	89.749 ± 0.166h	13.148 ± 0.008h	5.751 ± 0.036g	2.838 ± 0.034e	16.334 ± 0.014i
Merrill Gem Free^{P}	6.428 ± 0.011b	84.869 ± 0.050i	16.141 ± 0.005e	6.171 ± 0.013f	2.242 ± 0.028j	14.563 ± 0.030j
June Gold^{P}	5.239 ± 0.001e	76.525 ± 0.014j	15.358 ± 0.009f	6.458 ± 0.032e	1.742 ± 0.014k	11.055 ± 0.033k
Jefferson^{P}	2.381 ± 0.005k	119.659 ± 0.049d	29.778 ± 0.004b	6.660 ± 0.018d	2.641 ± 0.033g	60.650 ± 0.338e
Dixired^{P}	5.338 ± 0.009d	199.661 ± 0.133b	21.144 ± 0.025c	5.661 ± 0.027i	3.355 ± 0.021b	113.742 ± 0.082b
Cresthaven^{P}	5.774 ± 0.023c	118.399 ± 0.034e	12.657 ± 0.006i	7.165 ± 0.019c	3.259 ± 0.028c	26.394 ± 0.330g
Cherokee^{N}	2.876 ± 0.023h	123.171 ± 0.064c	17.291 ± 0.003d	6.040 ± 0.018g	2.961 ± 0.000d	99.636 ± 0.903c
Royal Glo^{N}	3.352 ± 0.013g	90.788 ± 0.187g	15.144 ± 0.004g	7.542 ± 0.027a	2.350 ± 0.018i	25.348 ± 0.208h
Nectared4^{N}	4.680 ± 0.018f	211.879 ± 0.194a	73.549 ± 0.026a	7.267 ± 0.031b	2.444 ± 0.005h	146.609 ± 0.292a
Gransun^{N}	7.465 ± 0.022a	97.951 ± 0.245f	12.649 ± 0.013i	5.543 ± 0.008j	3.461 ± 0.014a	35.185 ± 0.062f

*: Difference between means represented with the different letter in the same column is significant at 0.05 level. ^{P}: peach, ^{N}: nectarine

Table 2. Phloridzin, caffeic acid, syringic acid, *p* coumaric, *o* coumaric, and ferulic acid contents (mg kg^{-1}) of peach and nectarine cultivars.

Cultivar	Phloridzin	Caffeic acid	Syringic acid	*p* Coumaric	*o* Coumaric	Ferulic acid
Glohaven^{P}	2.950 ± 0.016e	37.676 ± 0.001e	10.473 ± 0.018b	5.675 ± 0.005f	1.454 ± 0.014b	3.553 ± 0.020a
Redhaven^{P}	2.941 ± 0.016e	15.034 ± 0.016i	3.645 ± 0.015g	3.663 ± 0.009h	1.410 ± 0.006b	1.423 ± 0.010f
Merrill Gem Free^{P}	4.418 ± 0.008b	8.610 ± 0.006j	2.830 ± 0.005i	2.947 ± 0.006i	0.983 ± 0.003c	1.773 ± 0.145e
June Gold^{P}	1.461 ± 0.034i	7.919 ± 0.002k	2.790 ± 0.000i	7.536 ± 0.021e	1.059 ± 0.004c	1.460 ± 0.029f
Jefferson^{P}	4.335 ± 0.015c	37.355 ± 0.035f	7.138 ± 0.028d	2.877 ± 0.015j	0.981 ± 0.005c	2.781 ± 0.011b
Dixired^{P}	1.742 ± 0.022h	70.142 ± 0.015a	4.543 ± 0.013f	22.776 ± 0.016a	2.444 ± 0.022a	1.452 ± 0.003f
Cresthaven^{P}	1.471 ± 0.006i	22.245 ± 0.024h	9.738 ± 0.013c	7.924 ± 0.015d	1.299 ± 0.187b	1.346 ± 0.041f
Gransun^{N}	2.255 ± 0.041f	28.751 ± 0.023g	2.665 ± 0.005j	9.565 ± 0.025b	1.409 ± 0.005b	1.951 ± 0.012d
Cherokee^{N}	7.210 ± 0.010a	42.179 ± 0.002d	3.143 ± 0.004h	8.966 ± 0.002c	1.062 ± 0.007c	2.081 ± 0.008cd
Royal Glo^{N}	3.448 ± 0.045d	48.656 ± 0.028c	5.748 ± 0.033e	3.763 ± 0.027g	1.073 ± 0.004c	2.043 ± 0.009cd
Nectared4^{N}	2.012 ± 0.005g	66.658 ± 0.008b	13.953 ± 0.008a	8.987 ± 0.005c	1.439 ± 0.008b	2.138 ± 0.023c

*: Difference between means represented with the different letter in the same column is significant at 0.05 level. ^{P}: peach, ^{N}: nectarine

Table 3. Citric acid, tartaric acid, malic acid, succinic acid, and fumaric acid contents in peach and nectarine cultivars.

Cultivar	Citric acid (g kg^{-1})	Tartaric acid (g kg^{-1})	Malic acid (g kg^{-1})	Succinic acid (g kg^{-1})	Fumaric acid (mg kg^{-1})
Glohaven^{P}	2.835 ± 0.009h	0.131 ± 0.001i	3.920 ± 0.018k	2.223 ± 0.010d	10.940 ± 0.010a
Redhaven^{P}	6.191 ± 0.000e	0.257 ± 0.005h	7.150 ± 0.021h	2.875 ± 0.024b	6.155 ± 0.005d
Merrill Gem Free^{P}	2.731 ± 0.013i	0.986 ± 0.007a	9.958 ± 0.019b	2.441 ± 0.041c	4.576 ± 0.004g
June Gold^{P}	2.615 ± 0.010j	0.505 ± 0.004e	8.453 ± 0.037f	1.046 ± 0.031i	7.076 ± 0.005b
Jefferson^{P}	6.734 ± 0.010c	0.483 ± 0.004f	9.460 ± 0.038d	3.183 ± 0.005a	4.850 ± 0.010f
Dixired^{P}	2.415 ± 0.011k	0.475 ± 0.004f	4.358 ± 0.003j	1.859 ± 0.015g	5.240 ± 0.030e
Cresthaven^{P}	3.778 ± 0.006g	0.518 ± 0.011e	7.082 ± 0.006i	2.017 ± 0.009f	7.071 ± 0.010b
Gransun^{N}	9.455 ± 0.036a	0.696 ± 0.003d	10.348 ± 0.023a	1.838 ± 0.031g	5.220 ± 0.010e
Cherokee^{N}	6.442 ± 0.041d	0.860 ± 0.002b	8.727 ± 0.015e	2.442 ± 0.020c	3.404 ± 0.004h
Royal Glo^{N}	4.511 ± 0.005f	0.438 ± 0.004g	9.538 ± 0.004c	1.769 ± 0.021h	5.250 ± 0.010e
Nectared4^{N}	7.453 ± 0.039b	0.785 ± 0.003c	8.161 ± 0.010g	2.129 ± 0.008e	6.665 ± 0.005c

*: Difference between means represented with the different letter in the same column is significant at 0.05 level. ^{P}: peach, ^{N}: nectarine

Table 4. Vitamin C content and sugars in peach and nectarine cultivars.

Cultivar	Vitamin C (mg $100g^{-1}$)	Glucose (g kg^{-1})	Fructose (g kg^{-1})	Sucrose (g kg^{-1})
Glohaven^{P}	6.937 ± 0.033i	1.357 ± 0.011j	2.353 ± 0.012i	49.404 ± 0.268h
Redhaven^{P}	9.056 ± 0.036d	1.567 ± 0.007i	2.437 ± 0.016h	52.465 ± 0.316g
Merrill Gem Free^{P}	8.571 ± 0.014e	2.043 ± 0.007f	2.824 ± 0.013g	56.298 ± 0.169e
June Gold^{P}	9.846 ± 0.035a	1.880 ± 0.009h	2.069 ± 0.010k	49.453 ± 0.277h
Jefferson^{P}	9.436 ± 0.021c	2.388 ± 0.009c	3.872 ± 0.008b	58.596 ± 0.420d
Dixired^{P}	9.722 ± 0.006b	1.090 ± 0.008k	2.112 ± 0.005j	45.311 ± 0.035i
Cresthaven^{P}	7.793 ± 0.030f	2.361 ± 0.004d	3.667 ± 0.012d	55.590 ± 0.053f
Gransun^{N}	7.721 ± 0.020f	2.585 ± 0.012b	4.546 ± 0.004a	60.198 ± 0.039b
Cherokee^{N}	7.442 ± 0.014h	2.167 ± 0.007e	3.749 ± 0.003c	59.319 ± 0.154c
Royal Glo^{N}	6.557 ± 0.022j	2.681 ± 0.008a	3.025 ± 0.009f	58.345 ± 0.167d
Nectared4^{N}	7.570 ± 0.030g	1.980 ± 0.004g	3.162 ± 0.006e	61.256 ± 0.101a

*: Difference between means represented with the different letter in the same column is significant at 0.05 level. ^{P}: peach, ^{N}: nectarine

(10.723 and 73.549 mg kg^{-1}) > caffeic acid (7.919 and 70.142mg kg^{-1}) > *p* - coumaric (2.877 and 22.776 mg kg^{-1}) > quercetin (5.538 and 7.542 mg kg^{-1}) > syringic acid (2.665 and 13.953 mg kg^{-1}) > protocatechuic acid (2.381 and 7.465 mg kg^{-1}) > gallic acid (1.742 and 3.461 mg kg^{-1}) > phlorizin (1.461 and 7.210 and mg kg^{-1}) > ferulic acid (1.346 and 3.553 mg kg^{-1}) > *o* - coumaric (0.981 and 2.444 mg kg^{-1}) (Tables 1 and 2). Tomas-Barberan et al. (2001) determined phenolic compounds in 25 plum, peach, and nectarine cultivars and reported that phenolic compounds had differed among cultivars according to maturity periods and fruit flesh and peel, as well as cultivars. Zhao et al. (2015) used 17 Chinese peach cultivars and evaluated for phenolic content and antioxidant activity. They found that chlorogenic acid and catechin were the predominant components in both the peel and pulp of peach fruits, which supports our findings. Andreotti et al. (2008) found that chlorogenic acid and catechin were dominant phenolic compounds in 6 peach and 6 nectarine cultivars in Italy. The phenolic profile of fruits can change in relation to factors such as genotype, growing conditions, management techniques, orchard location, and stage of maturity (Chang et al., 2000; Tomas-Barberan et al., 2001).

3.2. Organic acids

Differences exist between peach and nectarine cultivars in terms of organic acid content in their fruits (Table 3). Malic acid had the highest value among organic acids for both species. As seen in Table 3, citric, tartaric, malic, succinic, and fumaric acids were measured between 2.415–9.455 g kg^{-1}, 0.131–0.986 g kg^{-1}, 3.920–10.348 g kg^{-1}, 1.046–3.183 g kg^{-1}, and 3.404–10.940 mg kg^{-1}, respectively. Bassi and Selli (1990) determined the content of succinic, malic, and citric acids in some peach and nectarine cultivars in the range of 32.90–214.20 mg 100 g^{-1}, 242.30–1059.80 mg 100 g^{-1} and 70.60–479.90 mg 100 g^{-1}, respectively. Colaric et al. (2005) measured the amounts of citric and malic acids in the fruits of 9 peaches and nectarine cultivars in the range of 1.71–5.55 g kg^{-1} and 3.82–8.05 g kg^{-1}, respectively. In the another study, it was determined that maturity periods (unripe, commercially ripe, and tree ripe) and artificial maturation (85% relative humidity up to full maturity and temperatures between 18–26 °C) caused differences on the citric and malic acid contents of Springbright and Vermail nectarine cultivars (Aubert et al., 2003). Thakur and Singh (2012) determined that the application of deficit irrigation (DI 33) had decreased the levels of total acid and malic acid during fruit development and maturation periods.

3.3. Vitamin C and sugars

The vitamin C contents of peach and nectarine cultivars were determined between 6.557–9.846 mg 100 g^{-1} (Table 4). Cantin et al. (2009a) determined vitamin C content between 1.2–9.1 mg 100 g^{-1} in nectarine and peach cultivars in Spain. In the analysis of some peach and nectarine cultivars grown in California, USA, vitamin C content was determined between 3.60–12.60 mg 100g^{-1} and 4.80–13.20 mg 100g^{-1}, respectively (Gil et al., 2002).

In this study, the amount of glucose, fructose, and sucrose were determined as basic sugars of peach and nectarine fruits and the differences among the cultivars were revealed (Table 4). Glucose content was measured lower than the other sugars. However, the highest glucose level was obtained from Royal Glo: 2.681 g kg^{-1}. In terms of sucrose content, the highest value was obtained from the Nectared4: 61.256 g kg^{-1} and the lowest value was obtained from the Dixired: 45.311 g kg^{-1}. In terms of fructose content, the highest value was measured in Gransun cultivar: 4.546 g kg^{-1}. Esti et al. (1997) measured sucrose (4.30–9.80 g 100g^{-1}), glucose (0.40–2.00 g 100g^{-1}), and fructose (0.40–3.40 g 100g^{-1}) in some peach and nectarine cultivars. The amounts of fructose, glucose, and sucrose in fruits of peach and nectarine cultivars were determined to be 325.70–1048.10 mg 100g^{-1}, 721.70–1902.10 mg 100g^{-1}, and 5216.30–9122.40 mg 100g^{-1}, respectively (Bassi and Selli, 1990). Aubert et al. (2003) determined that maturity periods (unripe, commercially ripe, and tree ripe) and artificial maturation (85% relative humidity up to full maturity and temperatures between 18–26 °C) revealed differences on sucrose, fructose, and glucose contents in the nectarine fruits. Colaric et al. (2005) determined the amount of sucrose between 46.14–66.92 g kg^{-1} in some nectarine and peach cultivars. Cantin et al. (2009b) determined sucrose (47.10–64.00 g kg^{-1}), glucose (5.60–8.00 g kg^{-1}), and fructose (6.90–10.30 g kg^{-1}) in the fruits of peaches and nectarines. In a study conducted in Spain, sugar content such as sucrose, glucose, and fructose in fruits of nectarines were measured as 58.40, 12.20, and 12.40 g kg^{-1} on average as a result of 4–year study (Abidi et al., 2011). Horticulture plants are diverse and composition of horticulture crops variable (Sahin et al., 2002; Ozturk et al., 2009; Halasz et al., 2010; Ercisli et al. 2008a,b; Butiuc-Keul et al. 2019; Guney et al., 2019).

The findings of this study confirm the existence of phenolic compounds, organic acids, vitamin C, and sugar content in peach and nectarine cultivars, which are important for healthy life and nutrition. In addition, on account of these chemicals properties, these cultivars are important in terms of quality evaluation in the fruit industry and as a source for reclamation work to be done.

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