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Original scientific paper

SOME AMPELOGRAPHIC AND BIOCHEMICAL CHARACTERISTICS OF LOCAL GRAPE ACCESSIONS FROM TURKEY

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Some ampelographic and biochemical characteristics of eight local grape accessions grown in Coruh valley in Northeastern Turkey were determined. The standard Turkish grape cultivar Cavus was also included the experiment to make better comparison with local ones. Ampelographic characteristics include bunch size, berry color, berry shape and usage. The biochemical parameters were the phenolic compounds, organic acids, vitamin C and specific sugars. The results showed that there was big diversity among local grape accessions in terms of most of the ampelographic and biochemical characteristics. Bunch size ranged from low to medium. Most of the accessions had round berry shape but elliptical, ellipsoidal and oval shape were also determined. The majority of accessions had purple black berry color. Among phenolic compounds compounds chlorogenic acid, syringic acid and rutin were dominant and varied between 1.394 to 4.858 mg/L; 0.731 to 1.934 mg/ L and 0.986 to 1.068 mg/L, respectively. For all accessions, tartaric acid was the dominant (ranged from 2.636 to 5.376 g/L) and followed by malic acid (ranged from 1.079 to 2.646 g/L). Among the sugars, glucose was found to be the major sugar. Overall the accessions evaluated both ampelographic and biochemical characteristics, it is suggested that the majority of accessions had promising characteristics to include them future breeding activities.

Keywords: Ampelography, bioactive content, diversity, grape, morphology

INTRODUCTION

Turkey is one of the most important areas in Eurasia for its high number of horticulture plant species. Such diversity of horticulture plants is a result of extreme altitudinal differences providing a wealth of habitats such as rocky slopes in deep, disjunction valleys in different parts of the country (DOGAN *et al*. 2014; ALP *et al.*, 2016; GUNEY *et al*., 2019; GECER *et al*., 2020).

Grapes are one of the popular horticultural crops and widely cultivated in diverse climatic conditions in different parts of the world. Grapevines are requiring a cool winter to meet chilling

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requirements and a warm growing season (150 to 180 frost-free days) to develop and mature a crop. Grapevine berries can be used in many ways including fresh, dried, juiced or for wine-making. The plant is also add value for landscape use (PEZZUTO, 2008; BENJAK *et al.*, 2005; LACOMBE *et al*., 2011; SOYLEMEZOGLU *et al*., 2014).

It is suggested that the main diversity center of grape to stretch from Afghanistan to the south of the Caspian Sea (MCGOVERN *et al*., 2003). Northeastern part of Asia Minors is believed that one of the most important zones of natural genetic resources of grapevine (EYDURAN *et al.*, 2015). Grape culture began in Asia Minor, in the region between and to the south of the Black and Caspian Seas. Wild grapes of the old world (*Vitis sylvestris*, Vitaceae) are indigenous to the south Caspian belt, Turkey and the Balkans and were widely distributed in the northern Mediterranean area including the Black and Caspian Seas (REISCH and PRATT, 1996).

Turkey has a large surface area for vineyards due to its valuable soil and climate conditions for grape production. Additionally, it has many native grape cultivars for wine and table production besides the non-native, widely cultivated cultivars such as Cabernet Sauvignon, Cardinal, Alphonso Lavelle, Merlot, and Chardonnay. Turkey has also more than 1200-1500 named national grape cultivars of which 600-800 is supposed to be genetically different and there are around around 30-50 outstanding grape cultivars among all these (EYDURAN *et al.*, 2015). The majority of these cultivars still have not been registered under the geographical indication label, which is considered as one of the problems of the grape sector in Turkey.

Collecting, preserving and characterizing local grape cultivars is an important task because the population of some local cultivars faced with genetic erosion (EMANUELLI *et al*., 2013). So, for getting new cultivars with higher yield and better quality, it is essential to characterize and conserve grape genetic resources in each country.

Recent studies indicated the significance of consuming berry fruits and grape due to their high phenolic phytochemicals, organic acids and sugars and their contribution to human nutrition and health (PEZZUTO, 2008; DERRADJI-BENMEZIANE *et al.*, 2014; OZKAN *et al*., 2019; SENICA *et al*., 2019). Grape berries are rich in terms of phenolic compounds and these compounds have a protective effect in coronary heart diseases and some cancer types, demolish the free radicals and prevent aging thanks to its antioxidant properties (PEZZUTO, 2008; RODRIGUEZ-MATEOS *et al*., 2014). The formation of these substances in grape berries are affected in general by environmental conditions and genotypes. Organic acid and sugar are largely affecting the taste characteristic and organoleptic quality of grape berries. The main organic acids of grape berries are tartaric, citric and malic acids (DERRADJI-BENMEZIANE *et al*., 2014; EYDURAN *et al*., 2015). Sugars are the major components of grape berries soluble solids and sweetness of grape juice is intrinsic to its sugar composition. Sucrose is present in the largest amounts in grape juice (PEZZUTO, 2008; DERRADJI-BENMEZIANE *et al*., 2014; EYDURAN *et al.*, 2015).

Generally, the grape berries are consumed fresh in Turkey and further, it is also used for wine-making, consumed as dried fruit and added in the cakes and other bakery products, fruit juice, vinegar, marmalade, jam, and pickle and as raw material in various industries such as cosmetic and drug industry. As a result, grape production and consumption per capita has been increasing day by day in Turkey. In accordance with 2017 data of the Turkish Statistical Institute, annual grape production in Turkey was approximately 4.5 million tons in 2015 (TUIK,

2017). Turkey is one of the important grape producers after China, Italy, the USA, France and Spain in terms of production amount (FAO, 2016).

Especially in the recent reports, the determination of phenolic compounds and organic acids has revealed the higher content in local cultivars/genotypes as they have a great importance in terms of human health and nutrition and due to their high antioxidant properties. Thus, the objective of this study was to characterize major grape accessions grown in the Coruh valley based on their biochemical composition and ampelographic characteristics.

MATERIAL AND METHODS

Plant Material

In this study, eight local grape accessions (Keci memesi, Kibris, Gelin parmagi, Goh, Yag, Kokulu, Hatkul and Alvan) were investigated. The standard grape cultivar Cavus was also included in the study. They were harvested when the berries belonging to accessions reached full maturity. The berry samples picked homogenously and were stored at -24 °C until their laboratory analyses were conducted after the ampelographic measurements and examinations were handled. Average bunch size, berrycolor, berry shape and usage areas were determined. A total of 40 randomly taken samples (bunch and berry) from each accession were used.

Analysis of phenolic compounds

In the research, chlorogenic acid, syringic acid, rutine, quercetin, catechin, o-coumaric acid, gallic acid, vanillic acid and ferulic acid were determined. In the separation of phenolic acids with HPLC, the method developed by RODRIGUEZ-DELGADO *et al*. (2001) was modified and used. The samples collected were distilled with distilled water at the ratio of 1:1 and after they were centrifuged at 15000 rpm for 15 min., the supernatant was filtered with 0.45µm millipore filters and then injected to HPLC. The chromatographic separation was conducted by using a DAD detector (Agilent. USA) and 250*4.6 mm, 4µm ODS colon (HiChrom, USA) in Agilent 1100 (Agilent) HPLC system. Solvent A Methanol-acedic acid-water (10:2:88), Solvent B Methanol-acidicacid-water (90:2:8) were used as the mobile phase. The separation was conducted at 254 and 280 nm and the flow rate was determined as 1 mL/min. and the injection volume was determined as 20 µL.

Analysis of organic acids

The samples collected were kept at deepfreeze (-20 C°) until the time of analysis. In the research, the tartaric acid,malic acid, citric acid, succinic acid and fumaric acid contents were determined. In the extraction of organic acids, the method developed by BEVILACQUA and CALIFANO (1989) was modified and used. Five g was taken from the fruit samples obtained and transferred to centrifuge tubes. These samples were homogenized by adding 20 mL 0.009 N H_2SO_4 (Heidolph Silent Crusher M, Germany). Then, it was mixed on the agitator (Heidolph Unimax 1010, Germany) for 1 hour and centrifuged at 15000 rpm for 15 minutes. The aqueous part which was separated at centrifuge was filtered from the first coarse filter paper, then 0.45 µm membrane filter (Millipore Millex-HV Hydrophilic PVDF, Millipore, USA) for two times and finally SEP-PAK C_{18} cartridge. The organic acids were analyzed in the HPLC device (Agilent HPLC 1100 series G 1322 A, Germany) by using the method developed by

BEVILACQUA and CALIFANO (1989). In the HPLC system, Aminex HPX - 87 H, 300 mm x 7.8 mm colon (Bio-Rad Laboratories, Richmond, CA, USA) was used and the device was controlled with the computers including Agilent package program. DAD detector in the system (Agilent, USA) was set to 214 and 280 nm wavelengths. In the study, 0.009 N H_2SO_4 filtered at 0.45 μm membrane filter was used as the mobile phase.

Analysis of sugars

The analysis of sugars was performed using the modified method of MELGAREJO *et al*. (2000). The sugar analyses were done with the standards of fructose and glucose of fruit juice. The sample of 5 g was homogenized and centrifuged at 12000 rpm for 2 min, after which run in SEP-PAK C18 column. The extraction was preserved at −20°C until analysis. The sugars from the samples to be filtered were determined using μbondapak-NH_2 column with an 85% acetonitrile liquid phase in HPLC that has a refractive index detector. The calculation of the concentrations was done based on fruit juice standards.

Analysis of vitamin C (Ascorbic Acid)

The sample of 5 g from the whole fruits was transferred to test tubes and then 5 mL 2.5% M-phosphoric acid solution was poured on it. The mixture was centrifuged with 6500 g for 10 min at 4°C. From the clear part in the centrifuge tube 0.5 mL was taken and 2.5% M-phosphoric solution was poured until reaching 10 mL. The new mixture was filtered by 0.45 μm teflon filter and injected to HPLC. Ascorbic Acid was detected by the C18 column (Phenomenex Luna C18, 250 × 4.60 mm, 5 μ) in the HPLC. Ultra distilled water was used as a mobile phase with a 1 mL/min flow rate and pH of 2.2 adjusted with H_2SO_4. The DAD detector with 254 nm wavelength was used for the readings. For determination of ascorbic acid different concentration levels of L-ascorbic acid (SigmaA5960) (50, 100, 500, 1000, and 2000 ppm) were used (CEMEROGLU, 2007).

Statistical analysis

The study was designed as four replication including 10 bunch and berry per replicate. In the statistical evaluations, Windows SPSS 20 was used and the differences between the means were evaluated by subjecting to ANOVA variance analysis and determined with Duncan multiple comparison test ($p<0.005$).

RESULTS AND DISCUSSION

Ampelographic properties

The results of ampelographic parameters are shown in Table 1. Among eight accessions, five (Goh, Yag, Kokulu, Hatkul and Alvan) had low bunch size while Keci memesi, Kibris and Gelin parmagi had medium bunch size. The well known standard cultivar Cavus had also medium bunch size (Table 1).

The majority of accessions had purple-black berry color (Keci memesi, Goh, Yag, Kokulu, Hatkul). Two accessions had dark red-purple berry color (Kibris and Alvan) and one accession had green-yellow berry color (Gelin parmagi). The standard cultivar Cavus had green-

yellow berry color (Table 1). Results suggesting that growers in the region mostly prefer dark colored grape accessions.

Table 1. Some important ampelographic characteristics of grape accessions

Accessions	Bunch size	Berry color	Berry shape	Usage
Keci memesi	Medium	Purple-black	Elliptical	Juice
Kibris	Medium	Dark Red-Purple	Ellipsoidal	Table
Gelin parmagi	Medium	Green-Yellow	Elliptical	Juice
Goh	Low	Purple-Black	Round	Juice
Yag	Low	Purple-Black	Round	Juice
Kokulu	Low	Purple-Black	Round	Table
Hatkul	Low	Purple-Black	Round	Juice
Cavus	Medium	Green-Yellow	Light ovoid	Table
Alvan	Low	Dark Red-Purple	Round	Juice

Most of the accessions had round berry shapes (Goh, Yag, Kokulu, Hatkul and Alvan). Two accessions had elliptical shapes (Keci memesi and Gelin parmagi). One accession had ellipsoidal berry shape (Kibris). The standard cultivar Cavus had light oval berry shape (Table 1). In addition, only two accessions used as table consumption (Kibris, Kokulu) and the rest of the local accessions used for juice production. The standard cv. Cavus used for direct consumption.

Previously a wide variability on bunch size, berry color, berry shape and usage areas among grape cultivars grown in different geographical regions in Turkey (KARA and BEYOGLU, 1995; USLU and SAMANCI, 1998; ECEVIT and KELEN, 1999; ODABAS *et al*., 2002; TANGOLAR *et al.*, 2002; SABIR, 2008; ATES *et al.*, 2011), in Syria (KHALIL *et al.*, 2017), in Tunisia (LAMINE *et al*., 2014), in Iran (KHADIVI-KHUB *et al*., 2014) and Brazil (LEAO *et al.*, 2011) were reported. ISCI and ALTINDISLI (2017) used a wide number of grape accessions grown together in the Aegean region in Turkey and reported that the majority of the grape varieties have round berry shapes. The authors were also reported ovate and elliptical berry shapes. ECEVIT and KELEN (1999) also reported round berry shape in most of the grape cultivars grown in Isparta province located at the Mediterranean region in Turkey.

Phenolic Compounds

Results related to phenolic compounds of grape accessions are shown in Table 2. It was found that the grape accessions investigated in this study differed each other in terms of chlorogenic acid, syringic acid, rutin, quercetin, catechin, gallic acid and vanilic acid content ($p<0.05$). There were no significant differences among cultivars for *o*-coumaric acid and ferulic acid contentThe major phenolic compounds of grape accessions were chlorogenic acid, syringic acid and rutin. These phenolic acids were followed by quercetin, catechin and *o*-coumaric acid. Chlorogenic acid, syringic acid and rutin were found between 1.394 (Keci memesi) and 4.858 mg/L (Goh); 0.731 (Kokulu) and 1.934 mg/L (Cavus); 0.986 (Goh) and 1.068 mg/L (Kibris), respectively (Table 2).

Table 2. Phenolic compounds in grape accessions (mg/L)

	Chlorogenic acid	Syringic acid	Rutin	Quercetin	Catechin	*o*-Coumaric acid	Gallic acid	Vanilic acid	Ferulic acid
Keci memesi	1.394^{d}	0.873^{h}	1.017^{ab}	0.356^{cd}	0.334^{bc}	0.563^{ns}	0.210^{ns}	0.272^{c}	0.070^{ns}
Kibris	1.979^{cd}	1.231^{f}	1.068^{a}	0.510^{c}	0.427^{bc}	0.553	0.213	0.261^{c}	0.065
Gelin parmagi	4.528^{a}	1.361^{e}	1.021^{ab}	0.435^{cd}	0.331^{b}	0.548	0.225	0.271^{c}	0.093
Goh	4.858^{a}	1.545^{d}	0.986^{b}	1.460^{a}	0.406^{bc}	0.548	0.220	0.411^{b}	0.049
Yag	4.348^{a}	1.029^{g}	1.003^{ab}	0.470^{cd}	1.041^{a}	0.576	0.316	0.622^{a}	0.019
Kokulu	2.250^{c}	0.731^{i}	1.039^{ab}	1.253^{b}	0.425^{bc}	0.604	0.173	0.333^{bc}	0.062
Hatkul	3.406^{b}	1.789^{c}	0.997^{ab}	0.553^{c}	0.301^{c}	0.551	0.281	0.469^{ba}	0.082
Cavus	4.557^{a}	1.934^{a}	1.017^{ab}	0.334^{d}	ND^{d}	0.553	0.276	0.293^{c}	0.064
Alvan	2.409^{c}	1.809^{b}	1.019^{ab}	0.432^{cd}	0.674^{b}	0.609	0.197	0.395^{bc}	0.035

Different letters in the same column indicate statistically significant differences ($p<0.05$), ns: not significant

In terms of quercetin, catechin and *o*-coumaric acid content, the highest values were determined at Goh accession as 1.460 mg/L, Yag accession as 1.041 mg/L and Kokulu accession as 0.604 mg/L, respectively. The lowest values for quercetin and catechin was found at Cavus accession as 0.334 mg/L and 0.00 mg/L (Non determined), respectively (Table 2). (EYDURAN *et al*. 2015) reported high variability among local grape cultivars from the eastern Anatolia region of Turkey in terms of phenolic compounds. They found that chlorogenic acid was dominant (1.22-2.80 mg/L) and followed by rutin (1.09-3.34 mg/L) and caffeic acid (0.40-2.73 mg/L) in local grape cultivars. In our study the standard cultivar Cavus had higher syringic acid content than all local accessions and cv. Cavus also had higher chlorogenic acid content than all local grape accessions except Goh accession (Table 2). However, as stated before cv. Cavus had the lowest quercetin and catechin content than all grape accessions. MOTA *et al*., (2018) studied on Alphonse Lavallée, Cardinal, Dona Maria and Muscat Hamburgo grown in the Duoro region in Portugal and all used for table consumption. They found that main phenolic compounds in grape berries were chlorogenic acid, rutin, *o*-coumaric acid and catechin and those compounds significantly differed among cultivars. BREKSA *et al*. (2010) reported that rutin, catechin and gallic acid content of a wide number of grape cultivars differed significantly each other. In our experiment, the majority of local grape accessions were red grapes, which are well known to have beneficial effects for human health due to its high amounts of polyphenols that act as protective agents against inflammatory, mutagenic and degenerative processes (KUMAR and PANDEY, 2013; SOSA *et al*., 2013; HUSSAIN *et al*., 2016). Interestingly our findings reveal that white grapes (Gelin parmagi and standard cv. Cavus) could have similar benefits for humans due to their high content in chlorogenic acid, syringic acid and rutin. Chlorogenic acid has been associated with the reduction of oxidative and inflammatory stress conditions (LIANG and KITTS, 2016). Rutin, abundant in plants and known as vitamin P, has antioxidant, cyto protective, anti carcinogenic, neuro protective and cardio protective activities (GANESHPURKAR and SALUJA, 2017). The significant differences between the values presented in this study and the values from

those authors are a consequence of the influence of geographical location, cultural practices, in addition to the varietal differences (SENGUL *et al*., 2011; ZIA-UL-HAQ *et al*., 2013; 2014).

Organic acids

Organic acid content of grape accessions and cv. Cavus are shown in Table 3. There were statistically significant differences among the grape accessions in terms of organic acid contents ($p<0.05$).The dominant organic acid was tartaric acid for all accessions and followed by malic acid, citric acid and succinic acid. Tartaric, malic and citric acid comprised 95% of total acids in our samples. Fumaric acid was determined neglectable amount. Previously more than 95% of total acids are represented by tartaric acid, malic acid and citric acid in grapes at the technological maturation stage (WEN *et al*., 2014).

The highest tartaric acid content was found at Goh accession (5.376 g/L), and followed by Gelin parmagi (4.755 g/L), Keci memesi (4.654 g/L), Yag (3.985 g/L) and Kibris (3.292 g/L), respectively. The lowest tartaric acid content was determined at Alvan accession as 2.636 g/L (Table 3).

The highest malic acid content was determined at Keci memesi accession as 2.386 g/L, and followed by Yag (2.033 g/L), Alvan (1.956 g/L) and Hatkul (1.893 g/L), respectively. The lowest content of malic acid was determined at Kokulu accession as 1.079 g/L (Table 3).

Table 3. Organic acid content of grape accessions (g/L)

	Tartaric	Malic	Citric	Succinic	Fumaric
Keci memesi	4.654^{b}	2.386^{b}	0.422^{c}	0.533^{b}	0.009^{ns}
Kibris	3.292^{d}	1.623^{d}	0.252^{f}	0.436^{bc}	0.035
Gelin parmagi	4.755^{b}	1.330e	0.586^{b}	0.395^{bc}	0.067
Goh	5.376^{a}	2.646^{a}	0.290^{e}	0.286^{c}	0.091
Yag	3.985^{c}	2.033^{c}	0.784^{a}	0.427^{bc}	0.003
Kokulu	2.939^{e}	1.079f	0.124^{h}	0.852^{a}	0.003
Hatkul	2.854^{ef}	1.893^{cd}	0.171^{g}	0.504^{bc}	0.007
Cavus	2.940^{e}	1.863^{cd}	0.347^{d}	0.732^{ab}	0.014
Alvan	2.636^{f}	1.956^{cd}	0.082^{i}	0.379^{bc}	0.028

Different letters in the same column indicate statistically significant differences ($p<0.05$), ns: not significant

In terms of the other organic acid contents, citric and succinic acid contents varied between 0.082 g/L (Alvan) - 0.784 g/L (Yag) and 0.286 g/L (Goh) - 0.852 g/L (Kokulu), respectively (Table 3).Tartaric acid is the predominant acid in grapes and at technological ripeness, its concentration ranges between 2 and 8 g/L depending on the cultivar, on agronomic management of the vineyards and pedo-climatic factors. The malic acid content in ripe grapes can vary according to the grapevine variety, to seasonal trends and temperatures during the last stages of maturation. Its average concentration ranges between 1.5 and 4 g/L. Citric acid is present in many fruits and in particular in the citrus genus, in healthy grapes its concentration range between 0.150 and 0.500 g/L (FOWLES, 1992).

Our organic acid results revealed that accessions significantly affects tartaric, malic, citric, succinic and fumaric acid content in grapes implying that the cultivars were a very

significant source of the variation on the organic acids in grape berries. Previous studies reported that grape berries dominantly included tartaric acid and genotypes had an important effect on organic acid content in grape berries (RUSJAN and KOROSEC-KORUZA, 2007; EYDURAN *et al*., 2015). SABIR *et al.* (2010) reported tartaric acid between 3.8-5.2 g/L, malic acid between 2.8-3.6 g/L and citric acid between 0.200-0.400 g/L among 5 grape cultivars grown in inner Turkey. Organic acids affect the organoleptic characteristics of fruits including grapes and are useful for human nutrition stimulating saliva production and contributing to oral hygiene by reducing the number of bacteria responsible for dental caries and oral infections. They also promote the secretion of gastric juices and are slightly laxative and diuretic (ABRAHAM and FLECHAS, 1992; PENNISTON *et al*., 2007).

Vitamin C and Sugars

Vitamin C and sugars in grape accessions are shown in Table 4. There were significant differences among grape accessions in terms of vitamin C and sugars ($p< 0.05$). For Vitamin C, with the range of 13.03 to 27.11 mg/100 g, the highest average value was achieved for Keci memesi accession, which was ascertained to be significantly different from the others ($p< 0.05$). The Vitamin C content generally followed the order: Keci memesi > Kibris > Alvan > Yag > Kokulu > Goh > Gelin parmagi > Cavus > Hatkul (Table 4).

Table 4. Vitamin C and sugars in grape accessions

	Vitamin C (mg/100 g)	Glucose (g/100 g)	Fructose (g/100 g)
Keci memesi	27.11^{a}	6.35^{cd}	4.78^{d}
Kibris	21.48^{ab}	9.61^{c}	7.99^{c}
Gelin parmagi	14.16^{bc}	5.97^{d}	4.15^{d}
Goh	14.48^{bc}	5.31^{d}	4.91^{d}
Yag	16.61^{bc}	7.03^{cd}	6.87^{cd}
Kokulu	15.12^{bc}	15.24^{b}	12.88^{b}
Hatkul	13.03^{c}	16.86^{ab}	13.84^{ab}
Cavus	13.56^{c}	15.33^{b}	12.98^{b}
Alvan	20.08^{b}	18.24^{a}	16.80^{a}

Different letters in the same column indicate statistically significant differences ($p<0.05$)

Grapes are known to be a moderate source of vitamin C. EYDURAN *et al*. (2015) reported vitamin C between 11.21 and 33.55 mg/100 g among 9 local grape cultivars grown in eastern Anatolia region in Turkey. DERRADJ-BENMEZIANE *et al*., (2014) reported ascorbic acid content ranged from 12.33 (cv. Victoria) to 30.80 mg/100 mL of grape juice (cv. Gros noir) in Algeria. Several factors influence the ascorbic acid content, including preharvest factors, such as climatic conditions (sunlight exposure and weather) and farming practices (fertilizers), maturity at harvest, harvesting method, postharvest handling conditions (storage), species, cultivars and tissues (LEE and KADER, 2000), as well as genotype (SHARIQUE and BEIGH, 2009). All these factors are responsible for the wide variation in vitamin C content of fruits and vegetables.

Glucose was found to be the major sugar (5.31-18.24 g/100 g) followed by fructose (4.15-16.80 g/100 g) in our samples. The highest glucose and fructose content was seen in Alvan accession as 18.24 g/100 g and 16.80 g/100 g while the lowest values for these two sugars were found in Goh accession as 5.31 g/100 g and Gelin parmagi accession as 4.15 g/100 g, respectively (Table 4). EYDURAN *et al*., (2015), used 9 local grape cultivars and glucose and fructose gave the range of 9.51-16.47 g/100 g 8.03 to 15.55 g/100 g, respectively. SABIR *et al.*, (2010) reported glucose and fructose content between 8.64-10.70 g/100 g and 8.04-9.41 g/100 g among grape cultivars, respectively. RUSJAN and KOROSEC-KORUZA (2007) used 15 red wine cultivars and obtained the range of 5.09-8.99 g/100 g for glucose content, and 5.48-8.39 g/100 g for fructose content. Our findings related to glucose and fructose were consistent with the results reported above.

CONCLUSION

In this research, some horticultural characteristics and bioactive content of berries belonging to grape accessions grown in the Coruh valley were investigated. To the best of our knowledge, this study is the first report on phenolic compounds, organic acids and sugars on those local accessions. In terms of the ampelographic properties of grape accessions, Keci memesi, Kibris and Gelin parmagi are promising in terms of bunch weight and sizes which affect the attractiveness of accessions. In terms of phenolic compounds, Gelin parmagi, Goh and Yag accessions come to the forefront. In terms of organic acid contents of grape accessions investigated, it was determined that Alvan accession is promising. In the light of findings obtained in this research, it is thought that relevant promising accessions have the potential to be a candidate for developing new industrial cultivars for future studies. Conducting studies which will reveal the relation of phenolic compounds and organic acids with genes and developing new cultivars are significant in terms of protecting gene resources of our country and we hope that this research will create a resource for this kind of studies.

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AMPELOGRAFSKE I BIOHEMIJSKE KARAKTERISTIKE LOKALNIH UZORAKA GROŽĐA IZ TURSKE

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Izvod

U radu su određene neke ampelografske i biohemijske karakteristike osam lokalnih uzoraka grožđa gajenih u dolini Coruh na severoistoku Turske. Uključena je I standardna turska sorta grožđa Cavus kako bi se što bolje uporedile sa lokalnim. Ampelografske karakteristike uključile su veličinu grozda, boju i oblik bobica i upotrebu. Biohemijski parametri bili su fenolna jedinjenja, organske kiseline, vitamin C i specifični šećeri. Rezultati su pokazali da postoji velika raznolikost među lokalnim uzorcima grožđa u pogledu većine ampelografskih i biohemijskih karakteristika. Veličina grozda se kretala od niskog do srednjeg. Većina uzoraka imala je okrugli oblik bobica, ali su takođe određeni eliptični, elipsoidni i ovalni oblik. Većina uzoraka imala je ljubičasto crnu boju bobica. Među fenolnim jedinjenjima dominantna su jedinjenja hlorogena kiselina, siringinska kiselina i rutin i varirala su između 1.394 do 4.858 mg / L; 0,731 do 1,934 mg / L i 0,986 do 1,068 mg / L, respektivno. Za sve uzorke, dominantna je bila vinska kiselina (u rasponu od 2.636 do 5.376 g / L), a zatim jabučna kiselina (u rasponu od 1.079 do 2.646 g / L). Među šećerima najzastupljenija je bila glukoza. Sveukupno, uzorci su ocenjeni i ampelografskim i biohemijskim karakteristikama, a pretpostavlja se da je većina imala obećavajuće karakteristike koje će ih uključiti u buduće oplemenjivačke aktivnosti.

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