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Full Length Research Paper

Fruit characteristics of some selected promising rose hip (*Rosa* spp.) genotypes from Van region of Turkey

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A few temperate zone fruit species such as apples, pears, apricots and cherries dominate the fruit production in Eastern Anatolia region in Turkey, while the other species (e.g rose hip, hawthorn, sea buckthorn etc.) are less known. Native species grown in their natural ecosystems could be exploited as new foods, valuable natural compounds and derivatives. In the last few years, interest in the rose hip as a fruit crop has increased considerably due to its nutritive and health promoting values. The study was conducted between 2005 and 2006. Among 5000 natural growing rose hip plants around the Van region were examined and among them 26 genotypes were selected. Thirteen genotypes belong to *Rosa canina*. The fruit weight, length and width of genotypes were ranged between 1.79 - 4.95 g; 15.28 - 33.83 mm and 13.11 - 19.26 mm, respectively. Soluble solid content ranged from 17.73% (VRS132) to 28.45% (VRS 234). Ascorbic acid levels ranged between 517 to 1032 mg/100 ml. The phenotypically divergent genotypes identified in this study could be of much use in the future breeding program.

Key words: Agrobiodiversity, rose hip, pomological traits, phenotypic variability.

INTRODUCTION

The invention and development of agriculture has relied on natural biodiversity from which and crops were developed by identifying, manipulating and managing the domestication of wild species. Thus, modern crops are the result of a complex evolutionary process which involves the creation of diversity and selection (Harris and Hillman, 1989). The benefits of increased production, incomes, and human well-being derived from agricultural development are associated with negative consequences of the decreasing genetic diversity of food crops (Chessa and Nieddu, 2005).

There are various neglected and underutilized fruit tree species grown in Turkey solely. These could be exploited directly as foods, or used to obtain valuable natural compounds and derivatives. One of these is rose hip (*Rosa* spp.).

The genus *Rosa* contains approximately 100 species that are widely distributed in Europe, Asia, the Middle East and North America. The Anatolia region of Turkey is one of the major genetic diversity centers of *Rosa* species (Nilsson, 1997) and most of the rose species growing in this area have arisen from seed. Twenty-five rose species have been reported in Turkey (Ercisli, 2005). These 25 species are distributed over more than half the country and the Eastern and Middle Anatolia region has the largest native rose population (Ercisli, 2004). In most parts of Anatolia, wild roses have been gathered for their fruits from scattered sites since ancient times.

The domestication of native rose hip species to become a horticultural crop in Turkey began in the 1990s. Rose hips could also be consume fresh (seldom) or processed in various ways.

The fruit of the wild rose, the rose hip, is an excellent source of total phenolics (Hvattum, 2002), vitamin C (Sen and Gunes, 1996), carotenoids (Hornero-Mendez and Minquez-Mosquera, 2000), sugars (Uggla et al., 2005) and mineral elements (Szentmihalyi et al., 2002). The fruits are commonly used to make jam, marmalade, fruit juice, etc. (Uggla and Nybom, 1999); while the dried fruits and roots are excellent for making tea (Sen and Gunes, 1996).

Hips include average 40 seeds per fruit. Approximately 30 - 35% of fruit is made up of seed while the remaining 65 - 70% is pericarp (Ercisli and Guleryuz, 2006).

Turkey has a long history of rose hip cultivation. The

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country has a rich gene pool of rose hip genotypes adapted to different local conditions in Turkey. Most shrubs are open pollinated seedlings of wild genotypes which vary widely in terms of productivity and fruit characteristics, such as size, shape, color, flavor and nutritional value (Ercisli, 2004). Despite their wide usage in the Turkey, no standard rose hip cultivars has been developed in Turkey (Ercisli, 2005).

Several studies on the pomological diversity of rose hip genotypes of Turkey have been conducted (Kara and Gercekcioglu, 1992; Sen and Gunes, 1996; Ercisli and Guleryuz, 2006). Rose hip populations are large and diverse in Van region and selection studies are needed to assess variation. This study was designed to explore wild populations and to select the most promising rose hip genotypes for use in breeding and to identify their desirable fruit and shrub characteristics.

MATERIALS AND METHODS

Sample collection

The rose hip selection studies were conducted between 2005 and 2006 throughout Van region of Turkey, a region with an average annual rainfall and average temperature are 420 mm and 10.2°C, respectively.

Among 5000 plants examined the first year, 240 were selected. The primary selection criterion were high yield capacity, good and healthy vegetative growth, few thorns and freedom from *Diplolepis mayri*, the most important pest in this region, which attacked up to 90% of the plants examined (Ozbek et al., 1996). All selected genotypes were free of *D. mayri*. In the second year detailed fruit characteristics were assessed for 26 genotypes according to the method of Ercisli (1996). Shoot length and diameter were recorded on ten shoots per genotypes. In each of the 2005 and 2006 harvest seasons, 30 mature fruit from each clone were randomly chosen and measured. Data were collected on fruit weight (g), fruit width (mm), fruit length (mm), and fruit flesh ratio (%). In addition, soluble solid content (SSC, %) and L-ascorbic acid (mg/100 ml) of fruit juice were recorded according to Ercisli and Esitken (2004). The degree of thornless on the shrubs was evaluated as high, medium, low or thornless by comparing the shrubs with each other on the location where they grow. The selections were each given a VRS (Van Rose Hip Selection) number. There were no statistical differences between years therefore the data of two years were pooled.

RESULTS AND DISCUSSION

The phenological and morphological characteristics of selected 26 rose hip genotypes are described in Table 1.

The altitudes of the sites where the 26 native rose hip shrubs were selected varied from 1643 to 1899 m. Thirteen genotypes belonged to *Rosa canina,* five of *R. dumalis,* two of *R. iberica* and *R. pulverulenta* and *R. foetida*, one of *R. hemisphaerica* and *R. pisiformis*. The flowering duration as days was ranged from 13 to 21 days (Table 1). The harvest started at 1 September and extended until 28 October among genotypes. The number of days from full flowering to harvest was between 83 - 118 days among genotypes.

The longest shoots and largest diameter were observed in VRS215 (156 mm) and VRS 11 genotypes (8.97 mm), respectively. Three genotypes (VRS132, VRS140 and VRS240) were found thornless (Table 1).

The fruit properties of the 26 rose hip selections are given in Table 2. The average weight and dimensions of fruits representing selections were measured as average values ± standard deviation. The average fruit weights varied from 1.79 to 4.95 g. 'VRS 55' had the largest fruit weight (4.95 g); followed by 'VRS 208' (4.53 g) and 'VRS 66' (4.36 g) (Table 2).

Average fruit width was 13.1 – 19.3 mm. Average fruit length was 15.3 – 33.8 mm and the average fruit flesh ratio varied from 66.4 to 100.0% (Table 2).

The selections had between 517 and 1032 mg/100 ml ascorbic acid and 17.73 – 28.45% soluble solid content (SSC), respectively (Table 2).

In our study, significant differences were observed among 26 selected rose hip genotypes for most of the phenological, morphological and pomological traits (Tables 1 and 2).

One of the interesting results obtained in this study was determining 3 thornless rose hip genotypes in natural flora. Previously Ercisli (1996) also found thornless rose hip genotypes among rose hip populations. The one of the most important aims in rose hip breeding programs is to obtain thornless genotypes for ease of harvest (Ercisli, 1996).

Fruit weight, flesh ratio, and dimensions of selections were in general within the limits of previous studies (Kara and Gercekcioglu, 1992; Ercisli, 1996; Sen and Gunes, 1996; Misirli et al., 1999; Uggla et al., 2003; Ercisli and Esitken, 2004). Rose hip fruits are generally not consumed fresh. They are processed to produce jams, jellies, marmalade, syrup, and soft drinks (Ercisli, 1996). Therefore, higher vitamin C (ascorbic acid) and SSC characteristics are desirable and important properties for rose hips. With regard to SSC, TDW, and ascorbic acid, selections examined had values similar to some selections reported in the literature (Kara and Gercekcioglu, 1992; Uggla and Nybom, 1999; Kovacs et al., 2001; Ercisli and Esitken, 2004). Ercisli (1996) reported a range of 25.7 – 37.1% for SSC and 141 – 730 mg/100 ml for ascorbic acid. Also studies of native rose hip selections from the Tokat region showed selections had 12.0 – 37.0% SSC and 106 – 1788 mg/100 ml ascorbic acid (Sen and Gunes, 1996), Misirli et al. (1999), determined 24.8 – 32.0% SSC for native rose hip selections from the Aegean region.

In conclusion, this study characterizes the variation in the rose hip germplasm of the Van region of Turkey. More selection studies of the native germplasm will be required to provide the raw material for future breeding efforts and may also result in the selection of native genotypes of sufficient commercial value to justify their release to growers as local cultivars.

Results of this study indicate that the level of variation

Table 1. Some phenological and morphological properties of selected 26 rose hip genotypes from Van region (Mean of 2005 and 2006 years).

Genotypes	Species	Altitude (m)	Thorn	Flowering duration (Days)	Harvest dates	Shoot length (cm)	Shoot diameter (mm)	The days from full flowering to harvest
VRS9	*R. canina* L	1666	Medium	19±2	10-22 September	93.22±6.10	7.48±0.32	88-101
VRS11	*R. canina* L.	1661	Medium	18±3	29 August- 16 September	108.32±5.10	8.97±0.20	86-95
VRS21	*R. canina* L.	1688	Medium	13±2	10 September-23 September	138.36±9.79	8.71±0.29	96-108
VRS24	*R. canina* L.	1781	Medium	17±2	19 September-3 October	155.08±5.22	7.74±0.15	103-116
VRS35	*R. canina* L.	1698	Medium	18±3	14-25 September	56.42±5.88	4.66±0.27	96-108
VRS55	*R. canina* L.	1674	Medium	18±3	18 September-5 October	95.42±2.63	6.65±0.25	103-117
VRS66	*R. dumalis* subsp. *boissieri* var. *boissieri*	1772	Medium	18±2	26 September-8 October	64.16±4.66	4.76±0.23	106-116
VRS77	*R. canina* L.	1743	Low	18±3	01-14 September	95.38±3.00	5.12±0.24	87-100
VRS81	*R. dumalis* subsp. *boissieri* var. *boissieri*	1739	Medium	15±2	10 -27 September	109.22±2.24	7.04±0.32	95-104
VRS86	*R. pulverulenta* Bieb.	1703	Low	16±2	17 September-2 October	84.98±3.31	6.09±0.20	105-118
VRS110	*R .iberica* Stev.İn Bieb.	1874	Low	14±2	20 September-9 October	46.12±1.59	4.19±0.14	93-105
VRS115	*R .canina* L.	1813	Medium	13±1	21 September-6 October	83.48±3.17	5.70±0.21	101-112
VRS132	*R. iberica* Stev.İn Bieb.	1899	Thornless	14±1	05 September-23 September	24.58±2.17	2.16±0.11	85-94
VRS140	*R. dumalis* subsp. *boissieri* var. *boissieri*	1869	Thornless	16±1	04-21 September	119.08±5.97	7.89±0.21	86-98
VRS154	*R .dumalis* subsp. *boissieri* var. *boissieri*	1672	Medium	15±2	20 September-9 October	115.94±7.09	5.76±0.26	102-112
VRS175	*R .canina* L.	1656	Medium	17±2	10-28 September	82.66±4.12	6.62±0.06	90-100
VRS183	*R. canina* L.	1643	Medium	19±2	10-28 September	132.80±7.33	6.79±0.15	91-103
VRS208	*R. pulverulenta* Bieb.	1767	Medium	18±2	22 September-10 October	147.20±7.02	7.26±0.26	106-114
VRS215	*R .canina* L.	1836	Medium	16±1	25 September-13 October	155.54±6.20	8.13±0.21	110-119
VRS223	*R .canina* L.	1850	Medium	17±2	16 September-2 October	125.66±9.02	8.06±0.46	103-115
VRS224	*R .canina* L.	1853	Medium	17±2	16 September-6 October	124.38±8.22	7.08±0.15	102-113
VRS227	*R .dumalis* subsp. *boissieri* var. *boissieri*	1660	Medium	21±4	21 September-8 October	132.78±9.56	8.44±0.14	108-117
VRS229	*R. foetida* J. Herrm.	1646	Low	16±2	24 August-2 September	89.64±6.82	3.14±0.23	88-96
VRS234	*R. foetida* J. Herrm.	1824	Low	16±2	24 August-2 September	34.75±4.31	3.95±0.28	83-95
VRS238	R. hemisphaerica J. Herrm.	1818	Medium	16±2	27 August-7 September	117.43±6.11	2.61±0.21	86-95
VRS240	*R. pisiformis* (Christ) D. Sosn.	1685	Thornless	14±1	12-28 October	109.16±4.05	6.34±0.47	109-118

Table 2. Fruit characteristice of rose hip selections from Van region (mean of 2005 and 2006 years).

Genotypes	Species	Fruit Weight (g)	Fruit Length (mm)	Fruit Width (mm)	Flesh Ratio (%)	Soluble Solid Content (%)	Ascorbic Acid (mg/100 ml)
VRS9	*R. canina* L	3.15±0.09	23.54±0.44	16.33±0.37	67.89±2.05	24.15±2.1	776±44
VRS11	*R. canina* L.	2.60±0.02	29.39±0.81	13.50±0.22	86.67±3.19	21.80±1.9	734±28
VRS21	*R. canina* L.	3.58±0.10	28.22±0.51	16.25±0.20	78.48±2.79	21.05±3.3	914±43
VRS24	*R. canina* L.	4.05±0.04	26.51±0.33	17.26±0.17	74.08±1.16	28.75±4.2	913±37
VRS35	*R. canina* L.	3.99±0.08	26.81±0.47	16.88±0.26	66.42±0.72	22.65±1.4	851±29
VRS55	*R. canina* L.	4.95±0.12	30.94±0.84	17.81±0.47	71.49±1.95	22.85±2.2	1032±47
VRS66	*R. dumalis* subsp. *Boissieri* var. *boissieri*	4.36±0.18	27.89±0.67	17.14±0.52	68.63±1.77	21.45±0.9	985±26
VRS77	*R. canina* L.	2.95±0.09	24.36±0.76	15.34±0.47	66.55±1.17	20.20±0.9	661±18
VRS81	*R. dumalis* subsp. *Boissieri* var. *boissieri*	3.73±0.08	28.92±1.39	16.23±0.23	70.30±2.37	25.50±2.3	920±31
VRS86	*R. pulverulenta* Bieb.	2.65±0.07	26.20±0.51	14.41±0.37	75.02±1.73	26.90±3.1	971±34
VRS110	*R .iberica* Stev.İn Bieb.	3.39±0.05	29.40±0.87	16.08±0.42	75.24±0.59	17.90±0.6	814±25
VRS115	*R .canina* L.	2.60±0.07	32.88±0.49	13.11±0.22	78.24±2.21	26.00±2.2	633±28
VRS132	*R. iberica* Stev.İn Bieb.	2.57±0.09	29.96±0.43	14.66±0.25	90.14±0.58	17.73±0.7	713±33
VRS140	*R. dumalis* subsp. *boissieri* var. *boissieri*	3.25±0.07	28.78±0.48	16.27±0.34	75.74±0.98	22.40±0.6	734±35
VRS154	*R .dumalis* subsp. *Boissieri* var. *boissieri*	3.69±0.08	27.32±0.53	16.62±0.25	71.91±0.84	21.60±0.8	788±28
VRS175	*R .canina* L.	4.21±0.31	26.48±0.51	18.40±0.41	69.85±1.23	22.95±1.1	781±29
VRS183	*R. canina* L.	2.63±0.11	23.53±0.30	16.08±0.98	70.56±.3.01	23.05±2.4	796±44
VRS208	*R. pulverulenta* Bieb.	4.53±0.11	31.70±0.11	16.84±0.22	71.19±0.78	23.10±3.3	698±34
VRS215	*R .canina* L.	3.39±0.09	32.84±0.30	15.16±0.26	80.63±1.00	22.30±0.9	785±28
VRS223	*R .canina* L.	3.89±0.33	33.04±0.55	16.78±0.33	75.51±0.73	21.05±2.3	624±23
VRS224	*R .canina* L.	3.70±0.12	33.83±0.99	15.88±0.55	71.36±0.71	20.80±0.8	814±33
VRS227	*R .dumalis* subsp. *Boissieri* var. *boissieri*	4.30±0.23	24.51±0.51	18.42±0.24	68.73±0.72	19.25±0.7	847±37
VRS229	*R. foetida* J. Herrm.	1.87±0.07	16.55±0.38	16.98±0.40	100.00±0.00	25.80±2.6	517±15
VRS234	*R. foetida* J. Herrm.	1.79±0.07	15.28±0.28	15.55±0.32	100.00±0.00	28.45±4.4	625±34
VRS238	*R. hemisphaerica* J. Herrm.	2.26±0.10	15.45±0.61	19.26±0.26	95.35±0.35	23.85±1.7	604±18
VRS240	*R. pisiformis* (Christ) D. Sosn.	3.09±0.11	26.97±0.37	13.88±0.16	80.69±0.95	25.60±2.5	833±28

among rose hip genotypes is appreciably high and these genotypes can be used for breeding programs and the information generated in this study is of much use in the improvement of rose hip through breeding. These results are of particular interest given the current and future benefits of local crop varieties in improving production diversification and food security, as well as in securing traditional and sustainable crops utilization. In addition, Van region has proved to be a large reservoir of agro-biodiversity wealth with potential to enhance the aesthetic value of the natural and rural landscape.

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