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Full Length Research Paper

Pomological and phenological characteristics of promising rose hip (*Rosa*) genotypes

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This study was carried out to determine pomological and phenological characteristics of eleven promising rose hip (*Rosa*) genotypes chosen from wild populations in Tokat region of northern Anatolia, Turkey. Plants were propagated by cuttings and planted in 2000 at the research station of the Horticultural Department of Gaziosmanpasa University, Tokat, Turkey. Fruit characteristics and phenological observations were recorded from 2006 - 2007. Mean fruit weight ranged from 2.3 g to 5.1 g, the proportion of flesh in fruits varied between 66.0 and 80.2%, mean seeds number per fruit numbered was between 12.8 and 35.6, the vitamin C content varied between 190 and 1223 mg/100 g, and the total soluble solids varied from 15.3 to 26.0%. The results confirmed that some of the genotypes selected, such as MR-12, MR-15, MR-26, MR-84 and YL-04, were suitable for cultivation and qualified for registry by the National Variety Registration and Seed Certification Centre of Turkey for commercial production of rose hips.

Key words: *Rosa,* pomology, rose hip.

INTRODUCTION

The Anatolia region of Turkey is one of the major genetic diversity centers of *Rosa* species (Ercisli, 2005). About 30 species of *Rosa* along with their subspecies and several interspecific hybrids grow naturally in the flora of Anatolia (Kutbay and Kilinc, 1996) and the hips of native roses have been gathered from scattered locations there, since ancient times. The Tokat region of northern Anatolia has a diverse range of suitable roses (Gunes, 1997). In this region, rosehips are processed and consumed as marmalade, fruit juice and other products. The demand for rose hips is currently met by people living in forest villages who collects the fruit from wild plants.

One of the important contributions of modern fruit production is the standardization of improved fruit cultivars. However, this standardization has not yet been accomplished in many fruit species, and some, such as rose hips, are still collected from the wild in many countries. Studies on the selection and improvement of rose hip are at the initial stage in Turkey as in some other countries (Milewski, 1975; Werlemark, 2009).

Since rose hips are used to make valuable products such as marmalade, juice and tea, they are an important fruit species and should be considered for commercial cultivation. Rose hip cultivars are also needed to generate an adequate reliable supply of products to meet increasing demand. Identifying wild selections in conjunction with and other breeding techniques can be used to obtain new standard rose hip cultivars for commercial production.

The first selection studies on rose hip germplasm in Turkey were initiated at the end of 1990s in the northern and eastern parts of Anatolia. Researchers described several fruit characteristics of promising selections (Ercisli, 1996; Gunes, 1997). Although our studies on the registration of promising genotypes are still going on, there is yet no registered rose hip cultivars found in Turkey.

The purposes of this study are to evaluate some phenological and pomological characteristics of promising rose hip genotypes grown under uniform environmental conditions and select appropriate genotypes as candidates for registration and commercial cultivation.

MATERIALS AND METHODS

This study was carried out on 11 promising rose hip selections grown at the research station of the Horticultural Department of Agricultural Faculty of Gaziosmanpasa University, Tokat, Turkey,

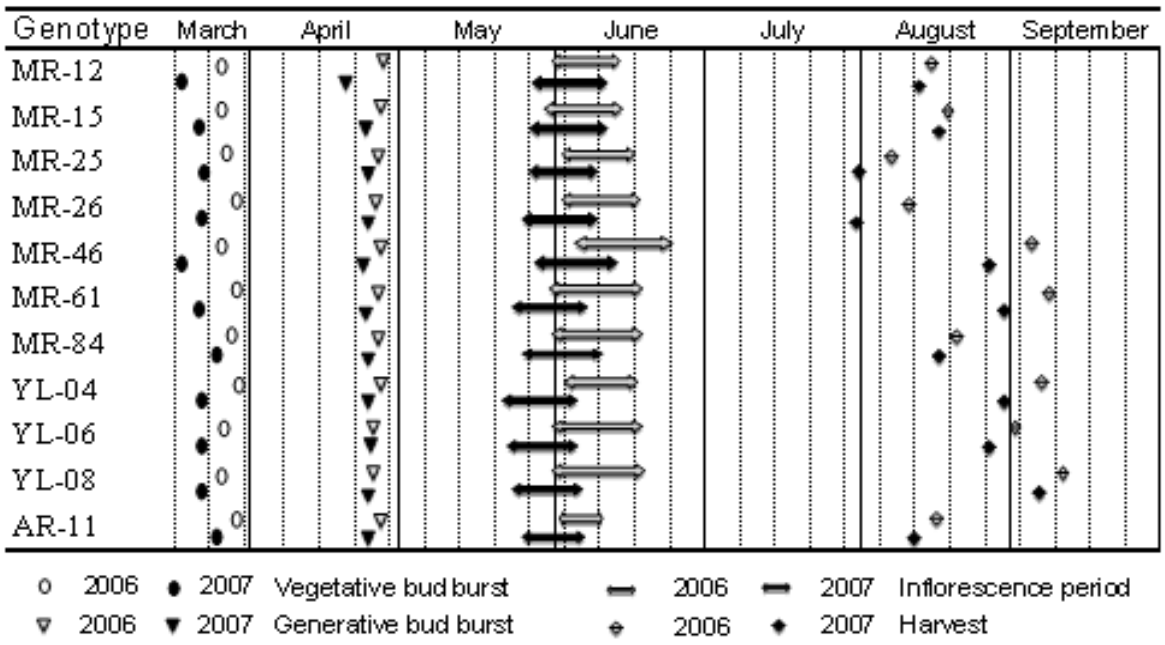

Figure 1. Phenological records of selected rose hip genotypes in Tokat, Turkey (2006 - 2007).

during 2006 and 2007. They were selected from wild rose hip populations in the Tokat region of northern Anatolia (Gunes, 1997). These selections included *Rosa dumalis* (MR-12, MR-15, MR-46, AR-11), *Rosa canina* (MR-25, MR-26), *Rosa jundzillii* (MR-61, YL-04, YL-06) *Rosa villosa* (MR-84) and *Rosa hirtissima* (YL-08) species. Genotypes were identified by the members of Biology/Botany Department of the Science Faculty, Ataturk University Erzurum/Turkey.

Selections were propagated by hardwood cuttings and three per genotype were planted on their own roots at a spacing of 3 x 3 m at the research station in 2000. The soil texture is silty clay and pH is slightly alkaline (7 - 8). The rose hip plot was drip-irrigated. The plants were not fertilized, but manure was applied at a rate of 20 MT/ha from 2006 - 2007. The plants were pruned in January or February (dormant period) of each year with removal of dry, old or low shoots.

Phenological data were obtained by recording the dates of vegetative bud burst and appearance of the hypanthium, flowering period and harvest. In addition, the following pomological traits were determined: Mean fruit weight, fruit width and length, fruit flesh ratio (%), seed number per fruit, seed weight, vitamin C content, pH, total soluble solids, titrable acidity, fruit color, shape, taste and pubescence.

For determination of each physical property (e.g. fruit weight), 90 fruit per genotype (3 replicates of 30 fruits) were measured**.** Fruits were randomly sampled from each bush when full mature fruit color was observed but it was before the fruits had softened.

Fruit weight was calculated as the mean of 90 fruits. Fruit size was measured with calipers as the mean of 90 fruits. The fruit flesh ratio was determined as the proportion of fruit flesh wet weight of the total fruit wet weight. Seed number per fruit was determined by counting all the seeds in the hypanthium. Total soluble solids (TSS) were measured in a drop of homogenized juice with a hand refractometer and expressed as percent. To determine acidity, 10 g of fruit flesh were homogenized in 20 ml distilled water and titrated with 0.1 M NaOH to an end-point of pH 8.1. The result was expressed as g malic acid (%) (Uggla, 2004). For vitamin C, 5 g of fruit flesh was homogenized with 50 ml meta-phosphoric acid (HPO_3) solution and filtered. Then, 10 ml of filtrate was titrated with 2,6 dichlorophenolindophenol solution to a pale pink color. Vitamin C content was calculated after the 2,6 dichlorophenolindophenol solution concentration had been calibrated with L-ascorbic acid (Ozkaya, 1988; Uggla, 2004). Fruit taste was determined by a taste panel. Fruit color and pubescence were determined relatively.

RESULTS AND DISCUSSION

Vegetative bud burst of selections occurred in the second half of March and floral buds (hypanthia) appeared in the fourth week of April (Figure 1). Bloom ranged from the end of May to the middle of June. Ripening of hips ranged from the end of July to the middle of September. Ripening times of MR-25 and MR-26 genotypes were earlier than the others and YL-08 was the last to ripen. Phenological observation dates obtained varied somewhat between the two years, probably due in part to weather conditions (Anonymous, 2006; Anonymous, 2007). However, this situation should not be seen as an abnormality, since annual changes in the phenological observation dates of genotypes may vary from 1 to 3 weeks depending on region, ecological conditions, elevations and weather conditions (Ekincialp, 2007; Kovacs et al., 2005; Turkben et al., 1999).

Among these 11 selections studied, the lowest mean fruit weight was 2.3 g (YL-08) and the highest was 5.1 g (MR-26). The wide range in mean fruit weights reflect basic differences in the *Rosa* species represented. Fruit weights in previous studies ranged between 0.4 and 7.6 g (Kiseleva, 1978; Ercisli, 1996; Gunes, 1997; Turkoglu and Muradoglu, 2003; Ercisli and Esitken, 2004), with

Table 1. Pomological characteristics of selected rose hip genotypes (2006 and 2007).

Genotype and species	Year	Fruit weight (g)	Fruit width (mm)	Fruit length (mm)	Fruit flesh ratio (%)	Seed number per fruit
MR-12	2006	3.9±0.50	18.6±0.92	24.5±2.50	71.0±1.92	31.8±4.70
R. dumalis	2007	3.1±0.42	14.6±1.25	20.0±1.88	70.7±3.14	26.3±6.20
	Average	3.5	16.6	22.2	70.8	29.0
MR-15	2006	3.5±0.54	17.3±1.22	30.4±1.62	76.0±2.98	30.4±8.86
R. dumalis	2007	2.9±0.38	16.1±0.80	25.6±1.60	84.1±2.04	31.0±5.12
	Average	3.2	16.7	28.0	80.0	30.7
MR-25	2006	3.9±0.55	18.3±1.04	26.8±2.00	76.1±2.22	27.7±3.20
R. canina	2007	3.5±0.62	17.5±1.22	24.1±1.90	71.1±3.40	22.1±3.50
	Average	3.7	17.9	25.4	73.6	24.9
MR-26	2006	5.4±0.42	20.9±1.02	28.8±1.80	80.8±1.88	30.7±4.55
R. canina	2007	4.8±0.72	16.7±1.22	21.4±1.90	75.0±2.12	22.3±6.26
	Average	5.1	18.8	25.1	77.9	26.5
MR-46	2006	3.0±0.43	17.1±0.90	21.7±1.55	68.2±1.96	41.4±3.40
R. dumalis	2007	2.2±0.34	15.0±1.42	18.1±2.08	63.7±2.80	29.8±4.90
	Average	2.6	16.1	19.9	65.9	35.6
MR-61	2006	4.4±0.52	19.5±1.20	24.3±1.50	76.4±3.50	23.1±6.50
R. jundzillii	2007	2.2±0.74	17.0±2.12	23.5±1.96	68.5±4.00	17.3±6.00
	Average	3.3	18.3	23.9	74.4	20.2
MR-84	2006	3.5±0.50	18.5±0.74	23.0±0.90	76.1±4.04	29.3±6.02
R. villosa	2007	2.3±0.40	15.9±1.40	19.2±1.08	70.7±3.22	26.5±6.60
	Average	2.9	17.2	21.1	73.4	27.9
YL-04	2006	5.3±0.69	21.6±1.54	26.0±2.52	76.2±2.98	28. 0±5.20
R. jundzillii	2007	3.4±0.52	20.2±1.62	25.1±3.00	71.4±3.22	24.0±5.30
	Average	4.4	20.9	25.5	73.8	26.0
YL-06	2006	3.8±0.58	17.8±1.10	29.1±2.42	72. 0±1.30	29.0±4.40
R. jundzillii	2007	3.1±0.56	16.6±1.02	28.2±1.80	66.8±2.64	23.8±5.00
	Average	3.4	17.2	28.7	69.4	26.4
YL-08	2006	2.8±0.43	16.0±1.20	25.2±1.56	82.6±4.80	13.8±3.22
R. hirtissima	2007	1.8±0.65	13.5±1.40	20.6±2.06	77.7±3.60	11.7±2.08
	Average	2.3	14.7	22.9	80.2	12.7
AR-11	2006	3.6±0.61	17.6±1.40	27.2±2.28	71.7±3.00	31.3±6.50
R. dumalis	2007	3.7±0.39	17.5±1.00	23.3±1.98	73.0±2.60	31.0±5.10
	Average	3.7	17.6	25.2	72.4	31.1

large variation depending on *Rosa* species, ecological conditions and cultural practices. The fruit weights recorded in 2006 were generally higher than those obtained in 2007, partly because of very high fruit set in the second year. In other words, high crop load resulted in smaller fruit. Another reason for the difference between the two years may be due to weather conditions. The high variation among genotypes in fruit weight is also partly due to the genotypes that belonged to different species.

Rose hips are typically and poorly suited for fresh consumption. However, they can be used after processing for different products such as marmalade, juice and tea. Because rose hips are generally processed, the fruit flesh ratio is economically important. The proportion of flesh in fruits in these 11 selections varied from 66.0 (MR-46) to 80.2% (YL-08) over two years (Table 1). Values obtained in 2006 were higher than those obtained in 2007. As mentioned earlier, the yearly differences are

Table 2. Morphological characteristics of the fruit of promising rose hip genotypes.

Genotype	Fruit color	Fruit shape	Fruit taste	Pubescence of fruit exterior	Pubescence within fruit
MR-12	Orange	Conical	Good	Absent	Medium
MR-15	Orange	Long oval	Good	Absent	Medium
MR-25	Red	Oval	Excellent	Absent	Poor
MR-26	Red	Oval	Excellent	Absent	Poor
MR-46	Orange	Round	Medium	Absent	Abundant
MR-61	Orange	Conical	Medium	Absent	Abundant
MR-84	Red	Round	Good	Present	Medium
YL-04	Orange	Oval	Good	Absent	Poor
YL-06	Orange	Oval	Medium	Absent	Medium
YL-08	Orange	Long oval	Medium	Absent	Medium
AR-11	Orange	Oval	Good	Absent	Abundant

probably due to a combination of factors, including crop load and weather conditions such as temperature, the number of sunny days and solar intensity, and cultural practices, especially irrigation. Nitransky (1976) and Uggla (2004) reported that the proportion of flesh for rose hips is between 65 and 70%. In some of the previous studies conducted in Turkey, values varied from 55.0 to 92.0% (Ercisli, 1996; Misirli, 1999; Kizilci, 2005; Ekincialp, 2007; Celik et al., 2009). Fruit flesh ratio can also vary depending on species (Ercisli, 1996). The differences in ecological conditions and cultural practices are other important factors affecting fruit flesh ratio. Particularly, irrigation causes a significant increase in fruit weight and flesh rate, while reducing total soluble solid percentage.

Morphological characteristics of the fruits in different genotypes are presented in Table 2. MR-25, MR-26 and MR-84 had red fruits, while others had orange colored ones. Five of the genotypes had oval fruits (MR-25, MR-26, YL-04, YL-06 and AR-11), two long-oval (MR-15 and YL-08), two conical (MR-12 and MR-61) and two rounded (MR-46 and MR-84). For fruit aroma, MR-25 and MR-26 were excellent; MR-12, MR-15, MR-84, YL-04 and AR-11 were good; and others were moderate. Outer surface of the fruit of MR-84 was pubescent, while that of others were not.

Rose hips contain nutritionally important content of vitamin C among the highest of commercial fruits (Halasova and Jicinska, 1988). Mean vitamin C content (over two years) varied from 190 mg/100 g for MR-46 to 1223 mg/100 g for MR-15 (Table 3). Others reported similar vitamin C content for rose hips from 109 to 5300 mg/100 g (Nitransky, 1976; Halasova and Jicinska, 1988; Ercisli, 1996; Misirli, 1999; Kizilci, 2005; Ekincialp, 2007). Variation in vitamin C content was clearly related to genotype; it only varied slightly between two years. Differences in vitamin C between years could be as a result of differences in harvest time in relation to fruit maturity. The vitamin C content of fruit is affected by several factors besides fruit maturity, elevation, ambient oxygen concentration, light status, changes in endogenous plant growth regulators and temperature, and they can all alter vitamin C content of rose hips. Celik et al. (2006) reported that low temperature reduces the respiration rate of rose hips, which can slow or delay degradation of vitamin C.

High TSS of rose hips are important for fruit juice and marmalade production (Ercisli, 1996). TSS level for these 11 genotypes ranged from 15 to 26% (Table 3). TSS levels in previous reports, similarly ranged from 9 to 43% (Nizharadze, 1971; Turkben et al., 1999). TSS are influenced by elevation, growing conditions and cultural practices, in addition to genotype (Ozbek, 1977; Guleryuz, 1988; Karacali, 1990). Acidity and pH characteristics of the selections studied were between 1.2 and 2.4% and 3.4 and 4.4, respectively. As a result, a great diversity of rose hip species grow wild in Turkey. However, studies to improve rose hips and their cultivation are only now being conducted.

Phenological and pomological traits were characterized in 11 *Rosa* selections from natural populations growing in the Tokat region of northern Anatolia. Some selections among the 11 genotypes, such as MR-12, MR-15, MR-26, MR-84 and YL-04, are promising candidates for the National Variety Registration and Seed Certification Centre. Further studies on the selection of the native rose germplasm can provide raw material for future breeding efforts and may also contribute to the identification of native genotypes with sufficient commercial value to justify their direct release to growers as cultivars.

Table 3. Chemical characteristics of the fruit of selected rose hip genotypes (2006 and 2007).

Genotype	Year	Vitamin C (mg/100 g)	TSS (%)	pH	Titrable acidity (%)
MR-12	2006	300	20.7±2.15	3.6±0.19	1.8±0.25
	2007	520	24.6±3.12	3.7±0.16	1.5±0.23
	Average	410	22.7	3.6	1.7
MR-15	2006	1290	20.4±2.00	3.7±0.17	2.2±0.19
	2007	1155	18.8±1.11	4.7±0.17	1.9±0.32
	Average	1223	19.6	4.2	2.0
MR-25	2006	720	24.6±2.01	3.0±0.24	3.1±0.41
	2007	750	27.4±1.73	3.7±0.20	1.7±0.30
	Average	735	26.0	3.3	2.4
MR-26	2006	546	21.0±1.14	3.3±0.22	3.2±0.66
	2007	328	27.3±1.30	4.6±0.26	1.4±0.20
	Average	437	24.2	4.0	2.3
MR-46	2006	175	18.6±2.85	3.8±0.10	2.0±0.55
	2007	204	23.0±1.73	4.0±0.05	1.0±0.09
	Average	190	20.8	3.9	1.5
MR-61	2006	665	13.2±4.40	3.9±0.09	1.4±0.60
	2007	690	22.7±2.24	3.8±0.07	1.2±0.38
	Average	678	17.9	3.8	1.3
MR-84	2006	655	26.4±1.92	3.4±0.11	1.5±0.65
	2007	786	25.3±2.34	3.5±0.03	1.5±0.50
	Average	721	25.8	3.4	1.5
YL-04	2006	654	16.2±1.22	3.5±0.20	2.5±0.75
	2007	300	23.7±0.33	4.5±0.29	1.4±0.25
	Average	477	19.9	4.0	2.0
YL-06	2006	1134	22.8±0.95	3.8±0.12	2.5±0.32
	2007	1266	20.1±0.05	4.0±0.04	1.1±0.08
	Average	1200	21.4	3.9	1.8
YL-08	2006	590	16.2±1.88	3.8±0.18	1.7±0.22
	2007	660	14.4±2.08	4.9±0.06	0.8±0.30
	Average	625	15.3	4.4	1.2
AR-11	2006	461	22.2±2.19	3.7±0.48	3.1±0.95
	2007	425	24.7±2.63	4.0±0.45	1.3±0.56
	Average	443	23.4	3.9	2.2

REFERENCE

Anonymous (2006). Climatic data of Tokat province. State Meteorological General Directorate, Ankara, Turkey. (in Turkish).

Anonymous (2007). Climatic data of Tokat province. State Meteorological General Directorate, Ankara, Turkey. (in Turkish).

Celik F, Kazankaya A, Dogan A, Oguz H I and Ekincialp A (2006). Different altitudes on vitamin C content of rose hip (*Rosa* spp.) genotypes. pp. 313-316. 2nd National Minor Fruit Symposium, Tokat, Turkey. (in Turkish).

Celik F, Kazankaya A, Ercisli S (2009). Fruit characteristics of some selected promising rose hip (*Rosa* spp.) genotypes from Van region of Turkey. African Journal of Agricultural Research. 4(3): 236-240.

Ekincialp A (2007). Rose hip (*Rosa* spp.) selection in Hakkari province. M.Sc. Thesis, Yuzuncu Yil Univ. Natural. Appl. Sci. Inst., Van, Turkey. p. 45. (in Turkish).

Ercisli S (1996). Selection and propagation of rose hips naturally grown in Gumushane district. Ph.D. Thesis, Ataturk University, Erzurum, Turkey. p. 168.

Ercisli S, Esitken A (2004). Fruit characteristics of native rose hip (*Rosa* sp) selections from the Erzurum province of Turkey. NZ J. Crop Hort. Sci. 32: 51-53.

Ercisli S (2005). Rose (*Rosa* spp.) germplasm resources of Turkey. Genet. Resour. Crop Evaluation, 52: 787-795.

Guleryuz M (1988). Fruit and vegetable improvement. Ataturk University Agricultural Faculty, Dept. of Horticulture, Erzurum, Turkey. p. 189. (in Turkish)

Gunes M (1997). A research on improvement of rose hips (*Rosa* spp.) by selection and propagation with cuttings, wild grown in Tokat province. Ph.D. Thesis. Yuzuncu Yil Univ. Natural Appl. Sci. Inst. Van, Turkey. p. 120.

Halasova J, Jicinska D (1988). Amount of ascorbic acid in the hips of *Rosa* species. Folia Geobotanica et Phytotaxonomica, 23: 181-185.

Karacali İ (1990). Storage and preparation for market of horticulture. Ege University, Izmir, Turkey. p. 413.

Kiseleva AS (1978). *Rosa* varieties. Plant Breed. Abst. 48(10): p. 9966.

Kizilci G (2005). Adaptation of some promising rose hip genotypes to Erzincan ecological conditions (selection II). M.Sc. Thesis,

Gaziosmanpasa Univ. Appl. Sci. Inst., Tokat, Turkey. p. 50.
Kovacs S, Fascar G, Udvardy L, Toth M (2005). Phenological, morphological and pomological characteristics of some rose species Found in Hungary. pp. 71-76. 1st.International Rose Hip Conference, Gumushane, Turkey.
Kutbay HG, Kilinc M (1996). Taxonomic characteristics of rose hips (*Rosa* L.) and diversity in Turkey. Ist Rose Hip Conference, 5-6 September 1996, Gumushane, Turkey. pp. 75-83. (in Turkish)
Milewski J (1975). New varieties of fruit roses. (Nowe odniany roz owocowych.) Sylwan, 119: 61-68.
Misirli A, Guneri M, Gulcan R (1999). Phenological and pomological evaluation of rose hips grown wildly in Kemalpasa (Izmir). Proc. 3rd National Horticultural Congress, Ankara, Turkey. pp. 764-768.
Nizharadze AN (1971). Chemical analysis of the dog rose. Trudy Gruzinskii Nauchno-Issledovatel'shii Institut Pischchevoi Promyshlennosti, 4: 121-126.
Nitransky S (1976). Some pomological and technological properties of hips of cultivated *Rosa pomifera*. Vedecke Prace Vyskumneho Ustavu Rastlinnej Vyroby Piestany. 13: 227-233.
Ozbek S (1977). General fruit production. Cukurova University Agricultural Faculty Publication No. 11, Adana, Turkey. p. 386. (in Turkish).
Ozkaya H (1988). Analytical food qualty control. Ankara Univ. Agric. Faculty Publication No.186 Ankara, Turkey.
Turkben C, Copuri OU, Tamer CE, Senel Y (1999). A study on fruit characteristics of rose hips grown in Bursa. Proc. 3rd National Horticultural Congress, Ankara, Turkey. pp. 809-815.
Turkoglu N, Muradoglu F (2003). Determination of superior characteristics of rose hips grown in Tatvan. 5th National Horticulture Congress, Antalya, Turkey. (in Turkish)
Uggla M (2004). Domestication of wild roses for fruit production. PhD Thesis, Swedish University of Agricultural Sciences, Alnarp, Sweden.
Werlemark G (2009). Dogrose: Wild plant, bright future. Chronica Hortic. 49(2): 8-13.