Asian Journal of Chemistry Vol. 18, No. 1 (2006), 650–654

Genetic Diversity in Fruit Quality Traits in Cornelian Cherry (*Cornus mas* L.)

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In this study, some important fruit traits were screened in cornelian cherry (*Cornus mas* L.) types from the Uzundere district of Erzurum, Turkey. Twenty six types collected from Uzundere district were assessed for harvest date, fruit weight, fruit dimensions, fruit flesh ratio, fruit skin colour, total soluble solids, vitamin C, acidity and pH. The results showed tremendous variation. The types exhibited a range of 1.46–3.81 g for fruit weight, 79–88% for fruit flesh ratio, 36–74 mg/100 mL for ascorbic acid, 13–21% for total soluble solid and 1.14–2.77% for acidity. Three types had yellow fruit, while the others had fruit of various shades of red.

Key Words: Cornelian cherry, Biodiversity, Fruit properties.

INTRODUCTION

Cornelian cherry (*Cornus mas* L.) is a valuable source of vitamin C and the fruits have long been used in Turkey for different products, *e.g.*, jam, jelly, marmalade, syrup and several types of soft drinks. Its leaves and fruits are also used for medicinal purposes[1].

Anatolia is one of the major areas of genetic diversity for cornelian cherry and most of the cornelian cherries growing in this area have arisen from seeds. The Eastern and Middle Anatolia Region has the largest native cornelian cherry population[2]. Continuous seed propagation for thousands of years has given rise to the occurrence of a great diversity of cornelian cherry seedling trees. This genetic diversity is a tremendous resource that could be used to contribute to cornelian cherry breeding programme desiring high yields, good fruit characteristics and tolerance to disease and pests.

In order to utilize this variability, efforts must be made to survey different cornelian cherry production areas to study the variability and to select desirable types for establishing gene banks. Moreover, these selected shrubs can be cloned by vegetative propagation for planting uniform cultivars for better returns. The aim of this research was to determine the genetic diversity within cornelian cherry types for use in breeding and to identify their desirable fruit characteristics.

EXPERIMENTAL

This study was carried out on the natural cornelian cherry population in Golbasi village of the Uzundere district of Erzurum, Turkey in both 2003 and 2004. Twenty six seed-propagated cornelian cherry types approximately 20 years old were pre-selected according to relative yield, fruit size and resistance to disease and pests. Yields of trees were observed according to their places and compared to the other trees around the populations. Ripe fruits were harvested manually as from middle of September and measurements were made immediately after harvest. Average fruit weight and fruit dimensions were based on 30 fruits per tree. Percentage fruit flesh was estimated by weighing the seeds removed from the 30 fruits and calculating the proportion of fruit flesh. Total soluble solids (TSS) (°Brix), vitamin C, titrable acidity (as % malic acid) and pH of the fruits were determined with refractometer, titration and pH-meter. Fruit skin colour was measured with a Minolta Chromameter as L, a and b values. Variation among types was estimated with one way analyses of variance.

RESULTS AND DISCUSSION

Fruit Weight: Analyses of variance showed high variation among types in terms of fruit weight ($p < 0.001$) (Table-1). The variation among types accounted for 21.24% of the total variation and mean fruit weight of the 26 types ranged from 1.465–3.819 g.

Fruit Dimensions: There were significant differences in terms of both fruit length and fruit width ($p < 0.001$) (Table-1). Fruit length and fruit width ranged from 17.53–22.96 and 10.80–16.83 mm, respectively. The variations in these traits were 14.56% for fruit length and 17.78% for fruit width, respectively.

Fruit Flesh: No significant differences were observed in percentage of fruit flesh (Table-1). Variation between types accounted for 3.16% of the variation. Percentage fruit flesh ranged from 79.26–88.34%.

Total Soluble Solids (TSS): Significant differences in percentage TSS in the fruit flesh were found ($p < 0.001$) (Table-2). The variation in this trait was 13.56%. TSS values of types ranged between 12.60–21.06%.

Vitamin C: Significant differences were found among types ($p < 0.01$) (Table-2). Of the total variation, the types accounted for 26.90%. The type 3 had significantly higher vitamin C contents than the other types, with mean vitamin C values of 73.57 mg/100 mL fresh fruit. Type 17 had a significantly lower percentage of vitamin C content.

Acidity: Fruit acidity of *Cornus mas* L. types was between 1.14% (type 10) and 2.77% (type 8), respectively (Table-2). The variation in this trait was 12.43%. Significant differences were found among types in terms of acidity ($p < 0.01$).

pH: As shown in Table-2, average pH value was between 3.15 (type 22) and 4.01 (type 7). No significant differences were observed in fruit pH values. Values of variation between types were 7.16% of the variation (Table-2).

TABLE-1
MEAN VALUES OF TWENTY SIX CORNELIAN CHERRY TYPES FOR FRUIT WEIGHT, PERCENTAGE OF FRUIT FLESH, FRUIT DIMENSIONS AND FRUIT COLOR (AVERAGE OF 2003 AND 2004 YEARS)

Types	Fruit weight (g)	Fruit width (mm)	Fruit length (mm)	Fruit flesh proportion (%)	Fruit colour		
					L	a	b
1	2.283	13.50	18.20	84.23	27.85	+16.75	+1.03
2	1.465	10.80	18.24	79.26	28.29	+10.32	–1.19
3	3.073	14.80	19 37	87.36	26.70	+21.36	+2.00
4	2.721	14.25	21.38	83.61	28.45	+15.77	+0.68
5	3.319	15.97	19.41	81.61	29.50	+26.16	+4.57
6	3.127	14.08	18.13	82.65	30.02	+19.64	+1.41
7	2.456	14.26	20.93	81.01	27.21	+33.50	+6.17
8	2.435	14.42	17.98	80.55	28.26	+13.95	+0.49
9	2.340	13.24	20.50	82.83	27.22	+14.13	–0.63
10	1.945	13.41	18.98	81.95	31.46	+23.01	+2.75
11	2.673	14.74	21.23	84.73	30.05	+13.27	–0.31
12	3.379	15.45	22.32	83.92	31.28	+13.84	+0.47
13	3.381	15.49	20.96	87.60	52.05	–0.73	+27.53
14	3.150	15.36	22.05	87.20	56.17	–1.97	+31.67
15	3.248	15.53	21.35	88.34	32.54	+27.10	+5.22
16	2.600	14.77	17.59	85.25	31.58	+15.71	+0.04
17	1.977	12.82	17.53	83.56	32.33	+15.56	+0.22
18	2.521	14.29	18.44	81.70	27.37	+17.90	+0.16
19	2.850	14.86	18.71	81.19	33.03	+17.10	+0.84
20	2.183	13.89	17.90	83.15	33.83	+18.05	+1.15
21	3.819	16.83	22.96	86.76	33.68	+12.19	–0.46
22	2.965	13.61	21.67	88.15	33.77	+12.17	–0.44
23	2.073	13.66	17.58	81.38	33.15	+6.37	–2.08
24	3.483	16.23	20.89	86.72	34.44	+19.16	+1.19
25	2.690	16.24	20.02	82.90	35.53	+24.49	+2.99
26	2.077	12.86	20.68	80.79	47.97	+2.64	+17.55
p values	0.001	0.001	0.001	NS			
Variation %	21.24	17.78	14.56	3.16			

TABLE-2
MEAN VALUES OF TWENTY SIX CORNELIAN CHERRY TYPES FOR PERCENTAGE OF SOLUBLE SOLIDS, VITAMIN C, pH AND ACIDITY (AVERAGE OF 2003 AND 2004 YEARS)

Types	TSS (%)	Vitamin C (mg/100 mL)	Acidity (%)	pH	Harvest date
1	20.05	50.86	1.82	3.23	28 September
2	20.20	53.66	1.82	3.26	26 September
3	15.75	73.57	1.93	3.36	21 September
4	16.60	59.84	2.13	3.61	23 September
5	19.64	43.99	1.94	3.61	24 September
6	17.35	59.41	1.81	3.65	30 September
7	21.06	54.10	2.09	4.01	03 October
8	20.55	57.97	2.77	3.55	01 October
9	20.40	49.86	2.05	3.83	30 September
10	17.72	72.20	1.14	3.95	17 September
11	16.86	51.30	2.12	3.73	15 September
12	17.50	72.07	2.23	3.92	23 September
13	20.67	58.66	2.09	3.60	25 September
14	15.00	65.58	2.20	3.20	16 September
15	17.78	42.49	2.13	3.34	18 September
16	17.90	66.96	1.75	3.25	18 September
17	19.87	35.69	1.75	3.56	26 September
18	16.50	49.42	1.84	3.70	15 September
19	16.40	67.58	1.87	3.19	17 September
20	17.55	62.27	1.79	3.15	20 September
21	18.90	45.18	2.29	3.76	22 September
22	19.10	68.14	2.16	3.15	23 September
23	16.86	43.80	1.75	3.38	19 September
24	12.60	50.56	2.08	3.72	14 September
25	17.00	70.61	2.00	3.90	20 September
26	14.05	57.55	2.06	3.79	17 September
p values	0.001	0.01	0.01	NS	
Variation %	13.56	26.90	12.43	7.16	

Harvest date: Harvest dates varied from 14 September (type 24) to 03 October (type 7) (Table-2).

The results showed that there was a tremendous variation for fruit weight, fruit dimensions, vitamin C, percentage of total soluble solids, acidity and fruit skin colour in cornelian cherry. Previous studies of morphological characteristics in this species showed that there was a considerable diversity within populations[3–5].

In this study, fruit weight, fruit length and fruit width of cornelian cherry types ranged from 1.460–3.810 g; 17.53–22.96 mm and 10.80–16.83 mm, respectively. Similar studies on cornelian cherry types grown in Turkey recorded fruit weight, fruit length and fruit width with range 1.18–6.54 g, 14.32–24.47 mm and 11.29–18.79 mm, respectively[1, 4, 6, 7].

In the present study, vitamin C, TSS, acidity and pH were in the range 35.69–73.57 mg/100 mL; 15.07–21.16%; 1.14–2.77% and 3.15–4.01, respectively. In other studies, vitamin C, total soluble solids, acidity and pH values of cornelian cherry types were determined as 34–122 mg/100 mL, 8–23%, 1.34–4.56% and 2.44–3.60, respectively[1, 5, 6].

In conclusion, this study shows that variability existing in fruit traits that are important in plant breeding corresponds well with variability assessed in previous morphometric studies.

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(*Received*: 6 May 2005; *Accepted*: 27 October 2005) AJC-4453