‘Ntoulia 1’ and ‘Ntoulia 2’ Cornelian Cherries (*Cornus mas L.*)

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Cornelian cherry is a minor fruit species that deserves some attention mainly as a result of its economic potential and environmental importance of its cultivation. ‘Ntoulia 1’ and ‘Ntoulia 2’ are two new Greek cornelian cherry cultivars, whereas ‘Electra’ and ‘Naoussa’ are new selected clones. The experiment was conducted in northern Greece for 2 consecutive years. Productivity and fruit weight of ‘Ntoulia 1’ were higher than ‘Ntoulia 2’. ‘Electra’ showed the highest fruit weight followed by ‘Ntoulia 1’, whereas ‘Naoussa’ and ‘Ntoulia 2’ showed lower fruit weight values. ‘Ntoulia 2’ showed the highest value of total soluble solids followed by ‘Ntoulia 1’ and ‘Electra’. Total titratable acidity did not differ between genotypes. In descending antioxidant capacity, the order was: ‘Ntoulia 2’ > ‘Electra’ > ‘Naoussa’ > ‘Ntoulia 1’. Total phenolics in fruits of the cultivar Ntoulia 2 were higher than ‘Ntoulia 1’ and ‘Electra’. Nitrogen, potassium, manganese, and zinc concentrations of ‘Electra’ were higher than the other genotypes, whereas boron concentration was lower. However, concentrations of phosphorus, calcium, and magnesium were not different between genotypes.

**Origin**

Cornelian cherry belongs to the order of Cornales, family Cornaceae, genus *Cornus*, and species *Cornus mas* L. Cornelian cherry is a deciduous shrub to small tree cultivated as a landscape ornamental and/or as the source of fruits to produce syrups and preserves (Tenenbaum, 1994). Homer (8th century B.C.) in his epic poem *Iliad* refers to the cornelian cherry and reports that the Trojan horse was built from cornelian cherry wood, which was very hard, cut from the holy forest of the God Apollo (Willcock, 1978). The cornelian cherry plant was described in terms of botany very early by the Greek philosopher Theophrastus (between the 3rd and 4th century B.C.) (Chatzopoulos, 1998). Cornelian cherries have a long history of use in a variety of medicinal tonics, including those used to treat excessive urination, incontinence, excessive sweating, excessive menstrual bleeding, and decreased erectile function (McGuinn et al., 1997). Several cultivars/genotypes were selected worldwide for the color or size of fruits or leaves (Dirr, 1998; Stylianidis et al., 2011). In Greece until now, there was not systematic cultivation of cornelian cherry. However, selection from a high number of seedlings originated from open-pollinated autochthonous cornelian cherry plants in northern Greece by the grower Konstantinos Ntoulias resulted in the cultivars Ntoulia 1 and Ntoulia 2. After selection, the plants were then propagated by semi-hardwood cuttings. ‘Electra’ was selected by the agriculturist Konstantinos Georgiadis, whereas ‘Naoussa’ is natively grown in the area of Naoussa. The evaluation and the description were done over 2 consecutive years (2009 to 2010) in a private orchard that is located in Kipseli Imathias (northern Greece, long. 22°12’0” E, lat. 40°28’59” N; elevation 98 m). Data from the nearest meteorological station showed that the mean maximum temperature of the experimental area is 40°C in July and 8°C in January, whereas the mean minimum temperature in January is –9°C. The objective of this research was to give information about the new Greek cornelian cherry cultivars Ntoulia 1 and Ntoulia 2 and to compare them in terms of fruit quality with the selected clones ‘Electra’ and ‘Naoussa’.

**Description**

Plant vigor of the cultivars Ntoulia 1 and Ntoulia 2 is weak and growth habit is erect. Attitude of shoots of the cultivar Ntoulia 1 is erect, whereas that of the cultivar Ntoulia 2 is semierect. The density of branches of the cultivar Ntoulia 1 is medium, whereas that of the cultivar Ntoulia 2 is sparse. The color of 1-year-old shoots of the cultivar Ntoulia 1 is purple–brown, whereas that of the cultivar Ntoulia 2 is brown. The length of internodes of both cultivars is medium. Lateral branches are borne from the axis of old wood (more than 2 years) before the leaf buds open. The trees do not have pest and disease infections and are presently cultivated under the organic farming model.

The leaves of ‘Ntoulia 1’ and ‘Ntoulia 2’ have the following dimensions: length of 85 and 65 mm, width of 58 and 42 mm, and leaf area of 3950 and 2184 mm², respectively. Mean pedicel length of ‘Ntoulia 1’ and ‘Ntoulia 2’ is 7 and 5 mm, respectively. Leaf measurements were made with a portable leaf area meter, AM 300 (ADC Bioscientific Ltd., Hertfordshire, U.K.). The leaf arrangement of both cultivars is opposite and the leaf shape is ovate. The shape of the blade apex is strongly pointed, the shape of the base is rounded, and the glossiness is medium for both cultivars. In the petiole of both cultivars, anthocyanin is deposited. In the leaf blade, the pubescence of the lower side is along the veins. Leaf fall occurs mid-November.

Anthesis occurs at the end of February, before shoot sprouting. ‘Ntoulia 1’ and ‘Ntoulia 2’ flowers are self-fertile. Flowers are numerous (15 for ‘Ntoulia 1’, 18 for ‘Ntoulia 2’, 17 for ‘Electra’, and 20 for ‘Naoussa’) and are borne in a subsessile umbel. Pedicels are slender, 3 to 4 mm long, and lengthen to 6 mm with matured flowers. The four petals are

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Table 1. Mean fruit weight, total soluble solids, total titratable acidity, total antioxidant capacity, and total phenolics in fruits of the cornelian cherry cultivars Ntoulia 1 and Ntoulia 2 and the selected clones ‘Electra’ and ‘Naoussa’.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Fruit wt (g)</th>
<th>Total soluble solids (% Brix)</th>
<th>Total titratable acidity (%)</th>
<th>Total antioxidant capacity (μmol AAE/g FW)</th>
<th>Total phenolics (mg GAE/g FW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ntoulia 1</td>
<td>5.03 b a</td>
<td>20.7 b</td>
<td>1.25 a</td>
<td>65.5 d</td>
<td>3.0 b</td>
</tr>
<tr>
<td>Ntoulia 2</td>
<td>2.18 c</td>
<td>24.0 a</td>
<td>1.24 a</td>
<td>100.8 a</td>
<td>5.6 a</td>
</tr>
<tr>
<td>Electra</td>
<td>7.00 a</td>
<td>21.1 b</td>
<td>1.24 a</td>
<td>88.9 b</td>
<td>2.8 b</td>
</tr>
<tr>
<td>Naoussa</td>
<td>2.14 c</td>
<td>18.2 c</td>
<td>1.29 a</td>
<td>76.1 c</td>
<td>—</td>
</tr>
</tbody>
</table>

*Means of 50 fruits of 16 trees (four replications × four trees) for 2 years (2009 to 2010). Fruits were pooled from all trees.

*Means followed by the same letter in the same column are not significantly different (Duncan’s multiple range test, P < 0.05).

AAE = L-ascorbic acid equivalents; FW = fresh weight; GAE = gallic acid equivalents.
Table 2. Fruit nutrient concentrations of the cornelian cherry cultivars Ntoulia 1 and Ntoulia 2 and the selected clones ‘Electra’ and ‘Naoussa’.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Nitrogen (mg g⁻¹ DW)</th>
<th>Phosphorus (mg g⁻¹ DW)</th>
<th>Potassium (mg g⁻¹ DW)</th>
<th>Calcium (mg g⁻¹ DW)</th>
<th>Magnesium (mg g⁻¹ DW)</th>
<th>Iron (μg g⁻¹ DW)</th>
<th>Manganese (μg g⁻¹ DW)</th>
<th>Zinc (μg g⁻¹ DW)</th>
<th>Boron (μg g⁻¹ DW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ntoulia 1</td>
<td>0.25 b⁹</td>
<td>0.08 a</td>
<td>0.88 c</td>
<td>0.02 a</td>
<td>0.05 a</td>
<td>19 b</td>
<td>2 b</td>
<td>3 b</td>
<td>14 a</td>
</tr>
<tr>
<td>Ntoulia 2</td>
<td>0.24 b</td>
<td>0.09 a</td>
<td>1.08 b</td>
<td>0.02 a</td>
<td>0.05 a</td>
<td>42 a</td>
<td>1 b</td>
<td>3 b</td>
<td>12 a</td>
</tr>
<tr>
<td>Electra</td>
<td>0.50 a</td>
<td>0.08 a</td>
<td>1.32 a</td>
<td>0.02 a</td>
<td>0.04 a</td>
<td>45 a</td>
<td>4 a</td>
<td>5 a</td>
<td>9 b</td>
</tr>
<tr>
<td>Naoussa</td>
<td>0.26 b</td>
<td>0.09 a</td>
<td>0.91 bc</td>
<td>0.03 a</td>
<td>0.04 a</td>
<td>21 b</td>
<td>2 b</td>
<td>3 b</td>
<td>13 a</td>
</tr>
</tbody>
</table>

¹Means of 50 fruits of 16 trees (four replications × four trees) for 2 years (2009/2010). ²Fruits were pooled from all trees.

For determining fruit nutrient concentrations, flesh analysis was carried out from samples taken at harvest. Nitrogen was determined by the Kjeldahl procedure; phosphorus colorimetrically by the ammonium phosphovanadomolybdate method; potassium, calcium, magnesium, iron, manganese, and zinc by atomic absorption spectrometry (Model 2380; Perkin Elmer, Wellesley, MA) (Page et al., 1982); and boron by the azomethine-H method (Wolf, 1974). Nitrogen, potassium, manganese, and zinc concentrations of ‘Electra’ were higher than the rest of the genotypes, whereas boron concentration was lower (Table 2). However, concentrations of phosphorus, calcium, and magnesium were not different between genotypes. Cornelian cherry is a good source of potassium and its concentration is relatively high compared with other fruits (Sotiropoulos et al., unpublished data). Specifically, potassium concentration of cornelian cherries was higher than ‘Kristalli’ pear and ‘Golden Delicious’ apple; it was in the same level with that of banana, ‘Hayward’ kiwifruit, and ‘Everts’ peach; and it was lower than ‘Bebeco’ apricot.

In conclusion, ‘Ntoulia 1’ and ‘Ntoulia 2’ are promising cornelian cherry cultivars.

Availability

‘Ntoulia 1’ and ‘Ntoulia 2’ cornelian cherries were described and patented by the European Community Plant Variety Office in 2010 and are available from the Ntoulia nursery (http://www.krano.gr; e-mail: info@krano.gr).

Literature Cited


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