

Uzgoj duda i borovnice u Turskoj

Mulberry and blueberry cultivation in Turkey

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SAŽETAK

Turska je jedna od najznačajnijih zemalja na svijetu sa stajališta genetskih izvora voća i proizvodnje voća. U Turskoj se uzgaja oko 100 vrsta voća uključujući gotovo sve bjelogorične vrste, te većinu subtropskog i nešto tropskog voća.

Među voćem, bobičasto voće, uključujući grožđe, iznosi 25% ukupne proizvodnje voća u zemlji. Najvažnije bobičasto voće u smislu količine proizvodnje iza grožđa su jagode (prosječna godišnja proizvodnja 200,000 tona).

Dud se uzgaja po čitavoj Turskoj ali je češći na sjeveroistoku, jugoistoku i središnjoj Anadoliji između 0 i 1500 m iznad razine mora. Zemlju predstavljaju četiri vrste duda: *Morus alba*, *Morus nigra*, *Morus rubra* i *Morus laevigata*. U Turskoj se dudovo drveće uzgaja samo radi proizvodnje voća u usporedbi sa zemljama-glavnim proizvođačima duda kao što su Indija, Kina itd. koje upotrebljavaju drveće duda za lišće radi proizvodnje svile. Interes za uzgoj duda u Turskoj raste iz godine u godinu.

Područje Crnog mora, sjeveroistočni dio Anadolije, jedno je od glavnih centara germplazme nekoliko vrsta *Vacciniums* i *Vericaceous* biljaka. Kavkaska borovnica (*Vaccinium arctostaphylos*), borovnice (*Vaccinium myrtillus* i *Vaccinium vitis-idea*) prirodno rastu u šumama i na visoravni već stoljećima. Međutim, komercijalni uzgoj borovnice primjenom visoke grmolike sjeverne borovnice započeo je 2000. godine ovog stoljeća.

ABSTRACT

Turkey is one of the most significant countries in the world from the point of view of both fruit genetic resources and amount of fruit production. Around 100 fruit species, including almost all the deciduous fruit species, most of the subtropical and some tropical fruit are grown in Turkey. Among fruits, berry fruits including grapes share 25% of total fruit production of the country. The most important berry fruits in terms of amount of production in Turkey after grape are strawberry (average 200.000 tons production annually) and followed by mulberry (70.000 tons), raspberry and blackberry (30.000 tons) and blueberry (5000 tons).

Mulberries are cultivated throughout Turkey but they are more common in Northeast, Southeast and Central Anatolia between 0 to 1500 m above sea level. The

country is represented by four mulberry species, namely *Morus alba*, *Morus nigra*, *Morus rubra* and *Morus laevigata*. Mulberry trees are grown only for fruit production in Turkey compared to the other main mulberry production countries such as India, China etc. which use mulberry trees for leaf yield in sericulture. The interest in growing mulberries is increasing year by year in Turkey.

The Black Sea Region of Turkey, northeastern part of Anatolia, is one of the main germplasm centers of several *Vacciniums* and *Ericaceous* plant species. Caucasian whortleberry (*Vaccinium arctostaphylos*), bilberry (*Vaccinium myrtillus*) and lingonberry (*Vaccinium vitis-idea*) have been naturally grown in the forests and plateaus over the centuries. However commercial blueberry production by using northern high bush blueberries started in the 2000s in the country.

Key words: Mulberry, Blueberry, Turkey

1. INTRODUCTION

Turkey has very old mulberry cultivation, and mulberries are one of the main fruits grown by Turkish farmers. The four mulberry species (*Morus alba*, *Morus nigra*, *Morus rubra*, *Morus laevigata*) can be seen in different agro-climatic regions in Turkey. There is no registered mulberry cultivar in Turkey but each region has its own local genotypes which propagated by budding or grafting over many years (Ercisli and Orhan, 2008).

Although Turkey has important *Vaccinium* genetic resources, the blueberry cultivation in Turkey is very new business. Even though several tons of frozen or dried blueberry fruits are exported every year from Turkey, blueberries have not become commercialized, because of the low total yield and the difficulties in harvesting from the wild. Over the years, blueberry fruits have been collecting from natural habitats and consumed as jelly, dried or fresh fruits only by local peoples (Celik, 2005).

The aim of this review is to give information on mulberry and blueberry cultivation in Turkey.

2. MULBERRY AND BLUEBERRY CULTIVATION IN TURKEY

2.1. Mulberry and blueberry genetic resources in Turkey

The long growing period of mulberries in Turkey resulted in variations among trees belonging to different *Morus* species. In another word, mulberry trees differ from each other in terms of plant size, habits, productivity, leaf and

fruit properties etc. The black mulberry (*Morus nigra*) is more common in warmer regions such as the Mediterranean, the Aegean and the Black Sea regions, but white (*Morus alba*) and red (*Morus rubra*) mulberries are more common in temperate regions (Central, Northeastern Anatolia) (Ercisli, 2004).

The proportion of mulberry trees in Turkey is 95% of trees belonging to *Morus alba*, %3 to *Morus nigra* and 2% to *Morus rubra*. The limited number of trees belongs to *Morus laevigata* (Ercisli and Orhan, 2007).

The Black Sea Region of Turkey is one of the main origins of Caucasian whortleberry (*Vaccinium arctostaphylos*), bilberry (*Vaccinium myrtillus*), lingonberry (*Vaccinium vitis-idea*) and bog blueberry, bog whortleberry or bog bilberry (*Vaccinium uliginosum*) (Davis, 1978). Bilberry is known as ‘yaban mersini’ and Caucasian Whortleberry as ‘likapa’ in Turkey and they are naturally grown mainly in Northeastern Anatolia as scattered populations. The little known *Vaccinium*, bog whortleberry or bog bilberries are also naturally grown mainly in Northeastern part of Turkey (Celik, 2008). Deerberry (*Vaccinium stamineum*) is also found in that area.

2.2. Characterization of mulberry and blueberry genetic resources in Turkey

In Turkey, mulberry plants are only used for fruit production. Therefore productivity of trees and fruit characteristics both in quantitative and qualitative aspects are a long-term goal for mulberry breeders in Turkey. As well known the genetic improvement of any fruit species depends on the availability of genetic variability in germplasm. Selection of suitable genotypes from gene pool requires a thorough knowledge of fruit characteristics of different genotypes for utilizing them in hybridization studies. The breeding efforts made on mulberries so far have been restricted to selection of relevant genotypes from different regions in Turkey (Cam, 2001; Koyuncu, 2004). In fact the mulberry improvement programme on sound scientific basis started in the early 1990’s in Turkey, the scientist could identify a lot of promising clones in different parts of Turkey (Ercisli and Orhan, 2007; Kafkas et al., 2008). Different research institutes under Ministry of Agriculture and in collaboration with different universities have selected promising mulberry genotypes through conventional selection breeding studies. Several germplasm collections in different parts of Turkey with selected promising genotypes have been established. These germplasms are characterized by morphological and agronomical characteristics. In addition, more recently these germplasm characterized by molecular such as RAPD (Orhan et al., 2007) and AFLP (Kafkas et al., 2008)

markers. Significant amount of genetic diversity has been observed among these germplasms for morpho-biochemical as well as DNA markers. Molecular studies have revealed that the variability is the highest within *Morus alba* and the lowest within *Morus nigra* genotypes.

Unfortunately there is no study aimed at characterizing of wild *Vaccinium* germplasm in Turkey. Moreover, there are no cultivated genotypes selected from wild blueberry populations in Turkey.

However there have been studies on adaptation of introduced high bush blueberry cultivars to different locations and latitudes in the Black Sea region of Turkey to serve new alternative plants and develop a blueberry industry. These studies started in 2000 and included blueberry, cranberry and lingonberry (Table 1) (Celik, 2003 and 2005). In the first pioneer study, northern high bush blueberry cultivars such as 'Berkeley', 'Ivanhoe', 'Jersey', 'Northland' and 'Rekord' were planted. After the first blueberry cultivar trial, Turkish growers demanded to establish commercial blueberry orchards with new cultivars. In 2004, a new adaptation trials with 8 northern high bush blueberry cultivars ('Brigitta', 'Bluecrop', 'Bluejay', 'Earliblue', 'Duke', 'Nelson', 'Patriot' and 'Spartan') were planted at 4 different altitudes (690m, 440m, 175m and 140m) with 1.5x2.5 m in and between row spacing. After planting, tea straw and pine dust were used as mulch material. Depending on the locations, some phenological observations such as crown growth, yield and berry chemical characteristics were determined (Celik, 2007a). In 2006, nine northern high bush blueberry cultivars ('Toro', 'Brigitta', 'Darrow', 'Patriot', 'Bluecrop', 'Bluegold', 'Jersey', 'Bluejay' and 'Chandler') were introduced and established the first organic blueberry orchard in Hayrat, Trabzon province (Celik, 2007b). At the end of the preliminary work, many new commercial blueberry orchards were established.

The aim of above studies was to determine more appropriate blueberry cultivars and to extend blueberry industry along the Black Sea Region of Turkey. In the Black Sea Region of Turkey, many locations have natural acidic soils; especially tea growing areas which have been acidified using ammonium sulphate fertilizers for many years. The advantage of Black Sea Region for blueberry cultivation is due to natural presence of wild *Vaccinium* species, cool climates, rainy and humid growing periods and natural acidic soils (Celik, 2005). To extend blueberry cultivation in the region, effective advertising (brochures on blueberry cultivation, local meetings, TV and radio conferences etc.) has been done. With these studies, 50 hectares of commercial high bush blueberry orchards have been established in the region.

Table 1. *Vaccinium* sp. cultivars introduced into the University of Ondokuzmayis, Faculty of Agriculture.

Type of <i>Vaccinium</i> sp.	Cultivar	Year introduced	Origin of Cultivar
High bush blueberry (<i>Vaccinium corymbosum</i> L.)	'Ivanhoe', 'Jersey', 'Rekord', 'Berkeley', 'Northland'	2000	Poland
	'Brigitta', 'Bluejay', 'Bluecrop', 'Earliblue', 'Nelson', 'Duke', 'Spartan', 'Patriot'	2005	Poland
Cranberry (<i>Vaccinium macrocarpon</i> Ait.)	'Pilgrim', 'Stevens', 'Early Black', 'Ben Lear', 'McFarlin'	2005 2007 2008	Poland USA Poland
Lingonberry (<i>Vaccinium vitis-idea</i> L.)	'Koralle'	2007 2008	Germany

2.3. The importance and use of mulberry and blueberry fruits

The most important widely grown anthocyanin-rich *Morus* species are *Morus alba*, *Morus rubra*, and *Morus nigra*. *Morus alba* has white and purple fruits with a very sweet taste and low acidity. Its fruits are perishable and mostly used for fresh consumption. *M. rubra*, known as "red mulberry", is high in dry matter and has a sweet taste and low acidity. *M. nigra*, known as "black mulberry", has juicy fruits of extraordinary color and a unique, slightly acidic flavor (Ozgen et al., 2008). Also, black mulberry fruits are used for treating mouth lesions in Turkey. Recently, red and black mulberries have gained an important position in the food industry due to the presence of anthocyanins. In Turkey, it has wide use for many purposes and several very special traditional products such as 'mulberry jam', 'mulberry pastilles' and 'mulberry kome' made with mulberry fruit. The red-coloured fruit (*M. nigra*) which tastes very pleasant when eaten fresh also have other uses as marmalades, juices, liquors, natural dyes and in the cosmetics industry (Ercisli and Orhan, 2007).

Wild blueberry fruit has been locally processed into jelly and jam and has also been used for fresh consumption for a long time. However, as mentioned before commercial blueberry cultivation just started in 2000 in Turkey and

currently the cultivated fruits are processed in jam and muffin industry and also used as fresh fruit.



Figure 1. Blueberry growing areas of Turkey. Map A: Northern high bush blueberry growing area, Map B: Wild *Vaccinium* distribution along Black Sea region of Turkey.

2.4. The propagation of mulberry and blueberry plants in Turkey

Mulberries are propagated by budding, grafting and cutting. There are big differences among mulberry species in terms of propagation success. For example the propagation success is in the order *Morus alba*>*Morus rubra*>*Morus nigra*. In other words the grafting, budding and rooting capacity of *Morus nigra* is very low (Koyuncu and Senel, 2003; Karadeniz and Sisman, 2004). *Morus nigra* also grows very slowly. In Turkey, blueberry cultivars

propagated from cuttings using different plant growth regulators. In propagation studies, micro and macro cuttings from 'Ivanhoe', 'Jersey', 'Rekord', 'Northland', 'Berkeley' and 'Bluejay' were used (Celik, 2007a).

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