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## Studies on Some Phenological and Pomological Traits of Mulberries Grown in Edremit and Gevaş Region

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**Abstract:** Some phenological and pomological characteristics of mulberries which are grown in Edremit and Gevaş region of Turkey were investigated in this study to get some information to select the best mulberry genotypes for horticultural and ornamental uses.

Phenological and pomological observations of mulberry genotypes were completed in 1998 and 1999. Laboratory analyses of mulberry fruits were performed in 1999. The full bud break period, the first bud bursting period, the full bloom period, the first fruit set period, the initial shoot growing period, the end of shoot growing period, and fruit maturation period were recorded from May 5 to May 17 (for E1 and G4), from May 6 to May 18 (for E1 and G4), from May 20 to June 3 (for E5 and G11), from May 6 to May 19 (for E1 and G4), from April 10 to April 24 (for E1 and E5), from September 28 to November 12 (for E4 and E5) and from June 18 to July 10 (for E1 and G17), respectively. Leaves of G14 and G17 shed in 27 to 30 days and 51 days, respectively. The vegetation period was from April 4 (for E3) to November 12 (for E5).

Average fruit weight, pH value, sugar content, soluble solid content, water content and acidity of selected 25 Mulberry genotypes were found as 1.38 to 3.08 (for G1 and G2), 5.6 to 7.4 (for E5 and G1), 8.73 to 12.30 (for G7 and G18), 15.79 to 19.71 (for G9 and G14), 76 to 83 (for G7 and G5) and 0.163 to 0.264 (for G11 and G13), respectively.

At the end of the study, some promising mulberry genotypes were determined for horticultural and ornamental uses

**Key words:** Mulberry, phenology, pomology and selection

### Edremit ve Gevaş Yöresi Dutlarının Bazı Fenolojik ve Pomolojik Özellikleri

**Özet:** Bu çalışmada Edremit ve Gevaş yöresi dutlarının Fenolojik ve Pomolojik özellikleri ile seleksiyonu üzerinde çalışılmış, meyvecilik ve süs bitkileri açısından en iyi tiplerin seçilmesi amaçlanmıştır. 1998 ve 1999 yılında 2 yıl boyunca vejetasyon devresinde seçilen tiplerin fenolojik ve pomolojik gözlemleri ile 1999 yılında meyveler üzerinde laboratuvar analizleri yapılmıştır.

Fenolojik ve pomolojik gözlemler sonucunda, tam tomurcuklanma zamanı 5-17 Mayıs (E1, G4), ilk tomurcuk patlama zamanı 6-18 Mayıs (E1-G4), tam çiçeklenme zamanı 20 Mayıs – 3 Haziran (E5-G11), ilk meyve çıkış zamanı 6-19 Mayıs (E1-G4), sürgün gelişimine başlama zamanı 10-24 Nisan (E1-E5), sürgün gelişiminin bitiş zamanı 28 Ekim – 12 Kasım (E4-E5), meyvelerin olgunlaşmaya başlama zamanı 18 Haziran – 10 Temmuz (E1-G17) yaprak döküm aralığı 27-30 gün ile 51 gün (G14-G17) vejetasyon periyodu 14 Nisan – 12 Kasım (E3-E5), çiçek ve yaprak rengi koyu yeşil olarak tespit edilmiştir. Laboratuvar analizleri sonucunda selekte edilen 25 dut tipinde ortalama meyve ağırlığı 1.38 – 3.08 g (G1-G2), pH 5.6-7.4 (E5-G1), % şeker 8.73 – 12.30 (G7-G18), ŞÇKM 15.79-19.71, (G9-G14), % nem (Su) oranı 76-83 (G7-G5), titrasyon asitliği (sitrik asit cinsinden) 0.163 – 0.264 (G11-G13) arasında değiştiği tespit edilmiştir.

Çalışmadan elde edilen sonuçlara göre meyvecilik ve süs bitkileri açısından ümitvar dut tipleri ortaya çıkarılmıştır.

**Anahtar kelimeler:** Dut, fenoloji ve pomolojik, seleksiyon

### Introduction

There are about 12 mulberry species in the world and three of them *Morus alba* L. (white mulberry), (de Candolle, 1967). White mulberry is produced heavily in different parts of the world due to fact that its leaves are used in silkworm production (Bailey, 1961). Mulberry can be grown in different climatic conditions from tropics to temperate regions, In, practice the conditions which are suitable for figs and grapes are also acceptable for mulberries. The long vegetation periods over 13 C° are more suitable for mulberry production. Moreover, the winter temperature must not drop under -15 C°. However, it was stated that one year old shoots and their buds on them could tolerate the cold temperatures as low as -30 C° (Ağaoğlu et al, 1987).

Among the mulberries, *M. alba* and cultivated varieties are used as ornamental plant; Pendula, a pendulous and decorative variety, is the most widely used one (Ürgenç, 1992).

There is a significant decrease in the number of mulberry trees, both fruitful and unfruitful ones in Turkey. There is a 32% decrease in the number of fruitful mulberry trees and there is about 30% decrease in the number of unfruitful mulberries in Turkey (Food and Agriculture Ministry of Turkey, 1972). Total mulberry production decreased about 20%. The average yield per tree varies 25 to 28 kg.

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Although there was various studies on other fruit species in other parts of Turkey, there has no study on mulberries in Van region. This study, the selecting of mulberries in Edremit and Gevaş districts, is the pioneer one, and aims to determine the phenological and pomological characteristics of genotypes and to select the superior genotypes.

## Materials and Methods

### Materials

Vegetation period in Van region goes through April to Mid-November. Bare rooted seedlings can even be planted in late April to the end of May (Deniz, 1996). Hot and dry summers of the region last short and cold and wet winters of the region last long. Therefore the climate can be included in the continental type of hail failings in the spring may damage the inflorescence or fruits.

The presented study was conducted in the districts Edremit and Gevaş in 1998 and 1999. Total 20 mulberry trees were studied. White and black mulberries were present in the Gevaş and Edremit districts, respectively 13 and 9. However, violet mulberries can only be examined in the Gevaş districts.

### Methods

Following are the phenological and pomological observations through bud bursting to leaf falling followed;

- 1-Budding time
- 2-Bud bursting time
- 3-Inflorescence and fruit set
- 4-The initial shoot growing period
- 5-The end of the shoot growing
- 6-The leaf area
- 7-Fruit yield and characteristics; pH, sugar(%), SSC; acidity(sort of the citric acid), dry matter(%), the average fruit weight
- 8-The ripening and harvesting time
- 9-The leaf shedding period (early to late)
- 10-Vegetation period
- 11-The color of leaves and flowers

Fruit samples were labeled and put in the refrigerator (+5 C°) until they were analyzed. Each of the 20 fruit samples per a tree was weighted on the digital scale and the average fruit weights were calculated.

Fruit juice from 20 fruits was obtained by a mixer and 10 ml of fruit juice with 20 ml distilled water were titrated by NaOH until the pH value reached to the 8.1 point in the pH Metter (Hanna). A hand refractometer was used to determine the SSC values.

Mulberries contain little sucrose but high amount of reduced sugars and the proportion of glucose to "fructose" is important (Karaçalı, 1993). First, fruit juice is purified with the Carrez solution then it is heated with Luff solution. Reduced sugars are oxidized and the Cu<sup>++</sup> of luff solution is reduced to CuO (2). CuO is indirectly evaluated with Sodium tiyosulfat titration.

The amount of Sodium tiyosulfat used in titration gives a value in a prepared table and this value is equivalent to the reduced sugar. The determination of sucrose needs inversion. The fruit samples were dried at 70 C° and 100 mn Hg pressure until they reached the constant weight. According to the results the dry weight and the water content of the samples are found.

## Results and Discussion

The phenological and pomological characteristics of the mulberry genotypes which are found in the Gevaş and Edremit districts are seen in the Table 1 and 2.

As it seen in Table 1 depending on the genotypes the bud break, the first bud bursting, the full intolerance, the first fruit maturation and the end of the vegetation were realized from 5 May to 17 May (for E1 and G4), from 6 May to 18 May (for E1 and G4), from 20 May to 3 June (for E5 and G11), from 10 April to 24 April (for E1 and E5), from 18 June to 10 July (for E1 and G17), from 28 September to 12 November (for E4 and E5). The G14 genotype had the shortest leaf shedding period (27 days) while the G17 genotype had the longest period (51 days). The earliest vegetation was realized on April 17 (E13) and the vegetation continued until November 12 (E5). Moreover, our study is compatible with the finding of Alp (1999). Alp (1999) determined that the vegetation the inflorescence, the fruit color appearance, leaf paling and leaf shedding period of mulberry nigra Van pendula, were realized from to early May to the end of September, from the end of June to mid July, thorough August from the end of September to the early November, thorough the mid September, respectively.

Therefore, it can be said that mulberries can also be used in landscape arrangements in the city Van

As it seen in Table 2, the average fruit weight, pH, sugar content, SSC, water content and acidity (as citric acid) were ranked among the genotypes as 1.38-3.09 g (for G1 and G2), 5.5-7.4 (for E5 and G1), 8.73-12.30 (for G7 and G18), 15.79-19.71 (for G9 and G14), 76-83 % (for G7 and G5), 0.163-0.264 (for G11-G13), respectively.

The genotype G7 had minimum sugar and water contents among the genotypes in Gevaş. The genotype E1 had minimum pH and SSC values among the genotypes in Edremit, white mulberries had the highest total sugar content comparing to black and red ones. Therefore, white Mulberries can be important as raw materials in processing technology.

Table 1. Phenological characteristics of the mulberries of the Gevaş and Edremit districts

Genotypes	Bud break	First bud bursting	Full inflorescence	Fruit emergence time	Start of the shoot growing	End of the shoot growing
G1	9 May	9-10 May	23-25 May	11 May	20 April	10 November
G2	13 May	15 May	28-30 May	11 May	15 April	30 October
G3	13 May	14-15 May	27-28 April	15 May	25 April	30 October
G4	17 May	18 May	30May-2June	19 May	15-20 April	2 November
G5	8-10 May	10-11 May	25-27 May	12-15 May	15-20 April	4 November
G6	15 May	16 May	28-30 May	16 May	25-30 April	5 November
G7	7 May	8 May	20-24 May	9 May	15-20 April	5 November
G8	12 May	13 May	30 May	14 May	15-20 April	5 November
G9	13 May	14-15 May	25-26 May	15-16 May	15-20 April	2 November
G10	9 May	10 May	22 May	11 May	15-20 April	30 October
G11	16 May	16-17 May	30 May	17-18 May	15-20 April	3 November
G12	12 May	13-14May	25 May	15 May	15-20 April	30 October
G13	12 May	13-14 May	25 May	15 May	15-20 April	30 October
G14	13 May	14May	28-30 May	15 May	15-20 April	30 October
G15	10-11 May	12-13 May	20-22 May	13-15 May	15-20 April	1 November
G16	10-11 May	11-12 May	24 May	12-13 May	15-20 April	3 November
G17	9 May	11-12 May	27 May	14 May	15-20 April	10 November
G18	14 May	15-16 May	25-27 May	16-17 May	15-20 April	3 November
G19	11 May	13 May	25-28 May	14 May	15-20 April	5 November
G20	11 May	12-13 May	25-28 May	14 May	25-30 April	5 November
E1	5 May	6-7 May	21-22 May	7 May	15-20 April	10 November
E2	8 May	13 May	27 May	14 May	15-20 April	10 November
E3	7-8 May	10-12 May	25 May	13 May	15-20 April	10 November
E4	7 May	8 May	20-23 May	10 May	15-20 April	28 October
E5	6 May	7-8 May	20-22 May	9-10 May	12 November	25-30 May

Table 1. Phenological characteristics of the mulberries of the Gevaş and Edremit districts (continued)

Genotypes	Fruit ripening period	Leaf falling period	Vegetation period	Color of the leaves and flowers	Color of the fruit
G1	3 July	35 Days	29Apr-10November	Dark yellow	Black
G2	8-10 July	38 Days	30Apr-30October	Dark yellow	White
G3	30 June	34 Days	30Apr-30October	Dark yellow	Black
G4	7-10 July	36 Days	22Apr-2November	Dark yellow	Black
G5	30June-5July	30-35 Days	26Apr-4November	Dark yellow	Black
G6	7-10 July	33 Days	29Apr-5November	Dark yellow	Black
G7	27-28 June	35-40 Days	20Apr-5November	Dark yellow	White
G8	5-10 July	35-40 Days	25Apr-5November	Dark yellow	White
G9	30June-5July	30-35 Days	30Apr-2November	Dark yellow	White
G10	26June-5July	30-40 Days	20Apr-30October	Dark yellow	White
G11	26June-5July	30-35 Days	29Apr-3November	Dark yellow	White
G12	4-8 July	30-35 Days	30Apr-30October	Dark yellow	White
G13	4-8 July	30-35 Days	30Apr-30October	Dark yellow	Black
G14	30June	27-30 Days	25Apr-30October	Dark yellow	White
G15	27June-1July	30-35 Days	20Apr-1November	Dark yellow	White
G16	28 June	35-38 Days	25Apr-3November	Dark yellow	Black
G17	26 June	51 Days	25Apr-10November	Dark yellow	White
G18	30June-8July	35-40 Days	29Apr-3November	Dark yellow	White
G19	30June-4July	30 Days	20Apr-5November	Dark yellow	White
G20	30June-4July	30-35 Days	30Apr-5November	Dark yellow	White
E1	18-23 June	38-42 Days	20Apr-10November	Dark yellow	White
E2	20-25 June	38-42 Days	15Apr-10November	Dark yellow	White
E3	20-25 June	38 Days	15Apr-10November	Dark yellow	White
E4	6 July	28-35Days	25Apr-28October	Dark yellow	Black
E5	3-5 July	35-40 Days	29Apr-12November	Dark yellow	Black

The another study which was conducted on the different mulberry genotypes in Antalya province of Turkey had also gave comparatively similar results (Özdemir,1998). The result of pH, sugar content(%), SSC, water content and

acidity (as malice acid) of that study were ranked as 3.74-5.65, 7.85-21.04, 11.40-26.60,76-81% and 0.2-2.5, respectively.

Table 2. Fruit characteristics of the mulberries at the Gevaş and Edremit districts

Genotypes	pH	Sugar content%	S S C%	Water content %	Acidity%	Average fruit weight(g)
G1	7.4	11.80	17.26	82	0.208	1.38
G2	6.7	10.52	17.00	81	0.196	3.08
G3	6.4	11.40	19.00	78	0.203	1.66
G4	7.1	9.63	18.61	78	0.179	2.40
G5	7.1	10.40	16.62	83	0.189	2.03
G6	6.9	8.74	17.62	79	0.189	2.20
G7	6.9	8.73	18.36	76	0.170	2.21
G8	6.6	10.30	17.67	81	0.168	2.33
G9	6.4	10.10	15.79	82	0.204	1.77
G10	7.2	11.21	18.34	80	0.215	2.06
G11	6.7	9.05	18.25	77	0.163	2.42
G12	5.8	10.80	17.61	81	0.186	2.54
G13	6.2	11.50	19.16	79	0.267	2.46
G14	6.4	10.15	19.71	78	0.247	2.33
G15	5.9	10.70	17.31	82	0.107	2.42
G16	6.5	11.60	18.00	82	0.164	2.62
G17	7.3	9.60	16.53	80	0.217	2.67
G18	7.1	12.30	19.00	76	0.229	2.55
G19	6.3	11.00	17.56	78	0.181	2.51
G20	5.8	10.66	17.12	82	0.193	2.58
E1	7.2	10.80	18.47	81	0.242	2.41
E2	6.2	9.80	16.41	79	0.260	2.42
E3	6.5	11.20	17.84	78	0.235	2.15
E4	6.7	10.80	17.70	81	0.101	2.65
E5	5.6	11.90	18.46	77	0.169	2.29

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