

POMOLOGICAL PARAMETERS OF RED FLESHED APPLE (*M. niedzwetzkyana* Dieck.) IN CENTRAL ANATOLIA

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Abstract

Apple is the most produced temperate climate fruit in the world. There are around 30 species in the apple and it has a very wide diversity. Four different gene centers for apple have been identified in the world. These are East Asia, Central Asia, West Asia-Europe and North America gene centers. Among these centers, Central Asia has a unique richness with its unique species. *Malus niedzwetzkyana* Dieck, one of the species unique to this region. It attracts attention with its different morphological structure. There are pink-purple pigmentations on leaves, flowers and fruits. One of its most important features is that the fruit flesh is red in color. *M. niedzwetzkyana* has also been declared an endangered species and red listed. In this study, fruit characteristics of some genotypes of this species were revealed in Kayseri, Türkiye conditions. Fruit weights in the genotypes were found to be between 68.1-85.6 g. Fruit width and length values varied between 54.3-60.9 and 47.7-51.9 mm, respectively. The amount of total soluble solids (TSS) was determined as 13-14.8%. Fruit skin color L* value was revealed as 40.6-46.3, a* value as 28.9-30.3, b* value as 16.4-21.2. The results obtained were found to be important for the protection and evaluation of this species.

Keywords: Central asia, *Malus niedzwetzkyana*, *Malus* spp,

1. INTRODUCTION

Apple (*Malus domestica* Borkh.) among the temperate zone fruits, is the most produced fruit type in the world with 95 million tons/year (FAO, 2022). Morphological, biochemical and molecular studies conducted to date have shown that in the early periods, the only source of variation within apples was selection from wild apples. Later, hybridization studies became very important in obtaining new cultivars of economic importance. It is reported that the origin of cultivated apples (*Malus domestica* Borkh) is probably based on *Malus sieversii*, known as the Central Asian wild apple (Harris et al., 2002; Coart et al., 2006). In addition, it is stated that the wild apple (*Malus sylvestris*), originating from Western Europe, does not have much effect on cultivated apples, at least as a parent (Coart et al., 2006).

The Central Asian region is one of the homeland regions for apples and contains a significant level of diversity. There are apple species unique to this region. These species have survived to this day, preserved in mixed forests, especially in mountainous areas such as Kyrgyzstan. One of these apple species is *M. niedzwetzkyana*, which stands out with its unique characteristics. The distinguishing features of this species are the presence of red color in flower petals, leaves and fruit flesh (Figure 1). However, this species is one of the endangered species and is listed in the red book (Omasheva et al. 2015, Uzun et al., 2022). On the other hand, it has been reported that forests containing wild

fruit species have been lost to a great extent in the last fifty years. It has also been stated that there are a small number of *M. niedzwetzkyana* trees in the Kyrgyzstan region. (Wilson et al. 2019). Therefore, studies need to be carried out to protect and evaluate this unique species.

In this study, some pomological characteristics of different *M. niedzwetzkyana* genotypes were revealed in Kayseri conditions. This study is one of the rare studies reported on this species outside its native habitat.



Figure 1. Views of flowers, leaves, small fruits, mature fruits and fruit flesh in *M. niedzwetzkyana*

2. MATERIALS AND METHODS

In this study, *M. niedzwetzkyana* two genotypes originating from Kyrgyzstan were grafted onto rootstock and each genotype was planted in three replicates in a plot in Kayseri-Türkiye. Different tree and fruit characteristics are examined here. What the characters will be like outside the origin region is being evaluated. In mid-September, 25 fruits were taken from each tree and the following characteristics were examined.

Fruit weight (g): Measurements were made with a precision scale sensitive to 0.01 grams.

Fruit length and diameter (mm): Measured for each fruit using a digital caliper.

Total soluble solids (%): Measured with hand refractometer

Fruit skin color (L, a, b): Measured with a colorimeter according to the L*a*b* scale.

The results obtained are given together with the standard deviation values obtained in the Excel program.

3. RESULTS AND DISCUSSIONS

Differences were found between genotypes in terms of the fruit characteristics examined. Fruit weight ranged between 85.6 g (genotype no. 1) and 68.0 g (genotype no. 2) (Table 1). Although the fruit size of *M. niedzwetzkyana* is larger than some apple species, it is generally smaller than cultivated apples. Fruit diameter and fruit length found as 60.9-54.3 mm and 47.7-52.0 mm for genotype 1 and 2 respectively. Genotype 1 had the higher TSS ratio (14.8%) compared to genotype 2 (13.0%). L, a, b color values were determined as 46.4, 30.3 and 21.2, for genotype 1 and 40.6, 28.9 and 16.5 for genotype 2. In general there was variation in pomological parameters among the genotypes.

Table 1. Some fruit characteristics obtained from *M. niedzwetzkyana* genotypes

Genotype	Fruit weight (g)	Fruit diameter (mm)	Fruit length (mm)	TSS (%)	L* value	a* value	b* value
1	85.6±11	60.9±5	47.7±4	14.8±0.6	46.4±5	30.3±4	21.2±4
2	68.0±9	54.3±4	52.0±2	13±0.2	40.6±4	28.9±4	16.5±3

There are limited number of studies on fruit characteristics of this species. Volk et al. (2009) found fruit length and width of this species as 59 and 62.5 mm respectively in USA. Researchers determined TSS ratio of fruits as 10.2% that lower than our results. Uzun et al (2018) determined some fruit characteristics of *M. niedzwetzkyana* in their study in its natural habitat in Kyrgyzstan. In the study, fruit weight was found to be 41.1 g, fruit length was 40.3 mm, fruit width was 43.7 mm and TSS was 8%. These results are lower than the results in our current study. The reason for this may be that the genotype used is different and in Kyrgyzstan the genotypes were in native conditions, whereas in our study they were in the garden where cultural treatments were carried out.

4. CONCLUSIONS

M. niedzwetzkyana is one of the endangered species. It is iconic with its red fruit flesh and flowers, and it is known that 90% of its existence in nature has been destroyed in the last fifty years.

For this reason, this species urgently needs to be preserved and protected in collections. The collection we created with this study, which is the first in Türkiye is of great importance for the protection and evaluation of this iconic species.

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