



## Leaves polymorphism and fruit shapes variation of *Sorbus torminalis* (L.) Crantz in Hyrcanian forest

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**Abstract:** *Sorbus torminalis* (L.) Crantz as a rare native species in Iran which grows between 70 to 2400 meters high sea level in Guilan province. *Sorbus torminalis* with yellow autumn color and edible fruit make it as a multipurpose tree for future. The objective of this study was to investigate the morphology type of leaves and fruits shape. Four observation sites were selected in different elevation. The leaves samples were collected at 6 meters height of tree in north and south aspect. Leaves width, leaves length and petiole were measured. Due to scarce fruit, nearly 2 Kg fruit were collected from 6 trees in each site. Fruit shape was distinguished through visual examination of 600 fruits. Length and width of fruit was measured. Obtained results were showed that the *Sorbus torminalis* revealed high polymorphism in leaves shape. Two distinct *Sorbus torminalis* fruit type were observed spheroid (apple shape) and ellipsoid (pear shape) rounded. The highest mean value of fruit length was 12.47mm from Gardelehposht site was significantly different with the other studies sites. The highest mean value of fruit width was 9.97mm from Janbehsara site which was highly significant difference with other studies site. This study was the first step in fulfilling the criteria enabling characterization and assessment of variability which facilitate *Sorbus torminalis* germplasm recognition and exchange.

**Keywords:** *Sorbus torminalis*, Polymorphism, Hyrcanian forest, Leaf shape, Fruit shape.

### 1. Introduction

Hyrcanian forest is one of the specific broadleaves forest in the western hemisphere and located on the southern coast of the Caspian Sea in the northern part of Iran. The Hyrcanian forest ecosystem is considered to be one of the last remnants of natural temperate deciduous forest in the world. In contrast to European broadleaves forest, the Hyrcanian forest apparently remained from the tertiary period and is a relic ecosystem although it has been influenced by Pleistocene glaciations and human activities. This unique forest with rich fauna and flora could be used as a gene reserve for restoration of degraded ecosystems (Sagheb-Talebi, 2000). *Sorbus torminalis* (L.) Crantz is a rare and valuable broadleaves species which grows between 70 to 2400 meters above high sea level in

Hyrcanian forest (Sabeti, 1972), and it is found over much of northern Europe, Mediterranean region and North Africa (Savill, 1992). It usually grows on clays, similar to those favored by wild cherry, but also on limestone. High productivity of *Sorbus torminalis* (L.) Crantz was found on the site located between 1500 to 2000 meters above sea level (Madjidian, 2000). Research on seedling production of *Sorbus torminalis* (L.) Crantz showed that the seed germination was correlated significantly and negatively with tree age and diameter, and tree with 30cm. DBH performed to highest percentage of seed germination (Espahbodi *et al.*, 2008). Except *Sorbus torminalis* botanical study introduced a new species which called *Sorbus titiaefolia* in Hyrcanian forest, the new species is a relative of *Sorbus torminalis* (Zare *et al.*, 2003). Interest in *Sorbus torminalis* (L.) Crantz arises from its rarity,

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the challenge it present in growing to large size and the potentially variable timber, its yellow autumn color is also most spectacular (Savill, 1992). Wood characteristic of *Sorbus torminalis* (L.) Crantz is similar to Ash and Beechwood (Shaykhali, 1990). *Sorbus torminalis* (L.) Crantz stands usually associated with Oak, Beech, Hornbeam and Sycamore (Shaykhali, 1990). *Sorbus torminalis* (L.) Crantz with leaves polymorphism and fruit shapes present a considerable of variability. Fruit shapes and leave polymorphism are a step toward setting descriptors through characterization of phenotypic trait of *Sorbus torminalis* (L.) Crantz to assess variability. However, morphological variation is usually a good due to genetic variation, but the two do not correlate perfectly (Demesure-Musch and Oddou-Muratorio, 2003), because of both environmental and genetic are effect on morphology of tree. *Sorbus torminalis* (L.) Crantz with yellow autumn color and edible fruit make it as a multipurpose tree for future. The objective of this work was to investigate the morphology type of leaves and fruit shape of *Sorbus torminalis* (L.) Crantz in western part of Hyrcanian forest in Guilan province.

## 2. Material and Methods

Observation sites were (Janbehsara, Gardelehposht, Shagardab and Olasposht) located in western part of Guilan province. Geographical status and locality of sites are shown in Table 1.

Table 1. Geographical status of studied area.

Site	Attitude / m.	Slop %	Aspect
Janbehsara (Jan.)	280	24 - 34	South-west
Gardelehposht (Gar.)	820	48 - 58	"
Shagardab (Sha.)	1530	23 - 33	"
Olasposht (Ola.)	1760	39 - 49	"

### 2.1 Climate status

Rainfall happens mainly during autumn and winter time. The rainfall and temperature of observation sites are shown in Table 2.

Table 2. Status of rainfall and temperature studied.

Site	Mean annual rainfall/mm.	Mean temp./°C.	Min.	Max.	Frost day
Jan.	1958	15.6	11	38.5	10
Gar.	1958	15.6	11	38.5	10
Sha.	1286	8.5	-19.5	30	132
Ola.	1286	8.5	-19.5	30	132

### 2.2 Geology and soil type

The soil parent material in four studied are different. The basic geology of Janbehsara and Gardelehposht belong to Mesozoic which includes igneous rocks with lime layer. The basic of the other two sites are belonging to Pliocene and Miocene (Neogene's period).

The soil type of Janbehsara was forest brown earth with highly depth soil. Gardelehposht site had acid brown earth with loam sand texture and good drainage. The most part of area in Shagardab and Olasposht had shallowness soil with limestone parent material.

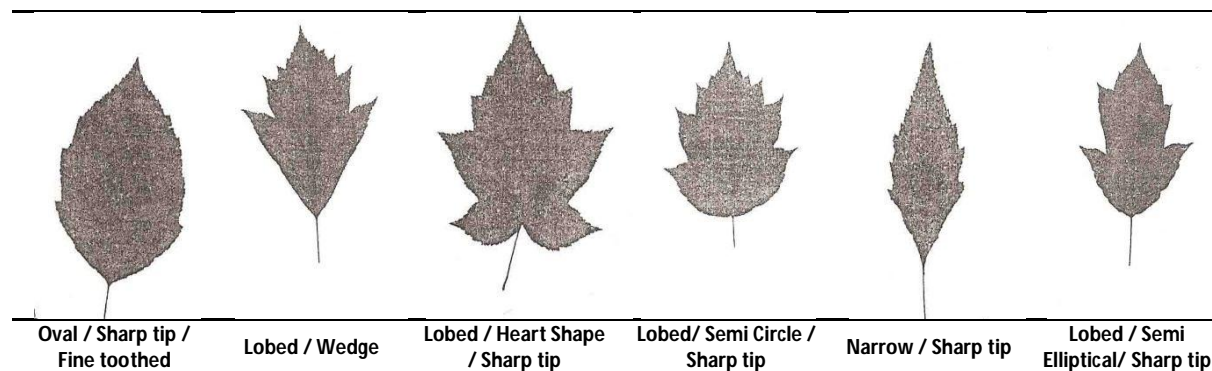
## 3. Methods

Investigation of leaves polymorphism and fruit shapes concerned on 12 trees with four diameter classes (10, 15, 20 and 25cm) per each site. Leaves sample were collected at 6 meters height in north and south aspects of 12 trees. Leaf width (LW), leaf length (LL) and petiole length (PL) were measured. Leaves type distinguished through visual examination for any each site. Due to fruit scarce, nearly 2 Kg. fruit were collected from 6 trees in each site. Fruit shape was distinguished by visual examination, fruit length (FL) and fruit width (FW) was measured. All data were computed by the SPSS.

## 4. Results

Some features of *Sorbus torminalis* leave shape in studied area are shown in Table 3, and Data analysis for leaves size is shown in Table 4.

Table 3. Some features of *Sorbus torminalis* leave shape in four studied area.



**Table 4.** Leaf width (LW), leaf length (LL) and petiole length of *Sorbus torminalis* (L.) Crantz in four study areas.

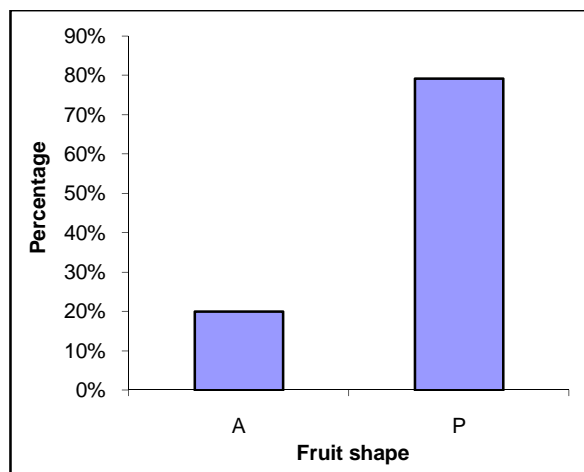
Site	LW (cm.)	LL (cm.)	PL (cm.)
Jan.	6.3	9.9	3.7
Gar.	5.8	9.2	3.5
Sha.	6.4	9.5	3.5
Ola.	6.4	8.9	3.3

**Table 5.** Leaf characters in four study sites.

Site	Leaf shapes	Leaf base			Leaf tip	Leaf edged	Number of Lobe					
		Heart shaped	Semi-circle	wedge			3	4	5	6	7	9
1	Lobed to Oval	57.8%	28.3%	13.7%	Sharp tip	Fine-toothed	1.9%	7.8%	3.9%	3.9%	84.3%	-
2	Lobed to Narrow	26.4%	38.3%	35.5%	Sharp tip	Fine-toothed	1.3%	-	15.23%	66%	72.8%	7.9%
3	Lobed	23.5%	49.1%	27.07%	Sharp tip	Fine-toothed	3.3%	-	9.4%	4.4%	75%	7.7%
4	Lobed	39.2%	41.5	19.2%	Sharp tip	Fine-toothed	-	2.08%	8.3%	7.08%	79.1%	8.4%

The computed F value for the (LL) was 1.3291 which was not significant, while the F value of (LW) and (PL) were 10.1701 and 4.1521 respectively which were highly significant. The result of leaves shapes is shown in Table 5.

The fruit had 0.9 – 1 cm diameter and 1.1 – 1.3 cm length. The result of fruit shape distinguished indicated two shapes such as apple shapes and pear shapes. Percentages of each fruit shape are given in Fig. 1.

**Fig. 1.** Percentage of fruit type in four study area.

Percentages of collected fruit from three sites are given in table 6.

**Table 6.** Percentage of fruit shape in three sites.

Site	Pear Shape	Apple Shape
1	74	26
2	83	17
3	81	19

This study indicated that there are significant differences between two shapes of fruits. The computed F value for fruit width (FW) and fruit length (FL) were 50.2027 and 7.2908 respectively, which were highly significant.

Regarding geographic position of sites general leaf shape and fruit, type are shown in Table 7.

**Table 7.** General leaf shape, fruit type and tree size in study sites.

Site	Altitude/m.	Mean of DBH/cm	Mean of height/m	Leaf shape	Fruit type
1	280	23.9	16.3	Lobed to Oval	Pear > Apple
2	820	16.1	17.6	Lobed to Narrow	Pear > Apple
3	1530	30.7	13.5	Lobed	Pear > Apple
4	1760	23.3	12.2	Lobed	Pear > Apple

## 5. Discussion

Polymorphism is the existence of a number of different forms within a species, whether caused by genetic or environmental factors, also great within tree differences occur for foliage characteristic (Zobel and Talbert, 1984). Bednorz (2006) stated that the most of the leaves are significantly correlated and are characterized by moderate level of variation. Our results for *Sorbus Torminalis* revealed high polymorphism in leaves shape. Fifteen common shapes of leaves were observed in four studied area. Most collected leaves had seven lobed, differences between petiole lengths was significant. Although, extensive examination of genetic diversity of *Sorbus torminalis*, were carried out in Europe (Démessure *et al.*, 2000; Bednorz, 2004). But in Iran, some preliminary biologic studies on *Sorbus torminalis* have been carried out recently (Madjidian, 2000; Iranmanesh, 2007 and Espahbodi *et al.*, 2007). Therefore, this type of data commonly may use by researchers who involved forest genetic. And further study with isozyme markers are needed to improve our knowledge of genetic structure of *Sorbus torminalis* in Iran.

Two distinct *Sorbus torminalis* fruit type were observed spheroid (apple shape) and ellipsoid (pear shape) rounded. The highest mean value of fruit length was 12.47mm from Gardelehposht site was significantly different with the other studies sites. The

highest mean value of fruit width was 9.97mm from Janbehsara site which was highly significantly differenced with other studies site. Maximum fruit length of *Sorbus torminalis* from Europe reported between 15 to 19mm. (Rotach, 2003). Results of data analysis showed that fruit from low elevation were bigger than the fruit from higher elevation. *Sorbus torminalis* as a promising multipurpose species should be more considered. Therefore, this study was the first step in fulfilling the criteria enabling characterization and assessment of variability which facilitate *Sorbus torminalis* germplasm recognition and exchange.

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