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# Comparison of morphological characteristics of some plum and prune cultivars of Iran

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*Prunus* genus is economically very important and many species are cultivated worldwide for their fruits. There are about 75 native varieties of plum and prune in Iran. Guilan province is one of the important areas where fruits of some cultivars mature early in spring. The purpose of this study was to compare the morphological and pomological characteristics of eight plum and prune cultivars in Guilan, Northern Province of Iran. The cultivars were Baraghan, Red plum, Shablon, Ghatreh Tala (Golden drop), Peyvandi, Ghandi, Plastic, sour prune (Bur Alooche). Some traits such as fruit volume, weight, taste (including sour or sweet), diameter, shape and color, stone weight, flesh/stone ratio were determined as pomological characteristics at harvesting date of fruits. The data were analyzed by ANOVA procedure. The highest fruit diameter was related to Peyvandi cultivar (19.16) and the lowest belonged to Bur Alooche (5.54). The flesh/stone ratio, one of the most important characteristics of plum and prunes fresh fruits, was examined. The results revealed that there were significant differences among the cultivars. The Post-hoc Tukey test provided three groups in the evaluated cultivars for the flesh/stone ratio. The least ratio was observed in Bur Alooche (14.26), and the highest ratio belonged to Peyvandi (29.01) and Ghandi (29.32). The cultivars of Torsh (Bur Alooche) and Ghermez (Red plum) have little marketable values because of the small fruit size and sour taste of their fruits.

**Key words:** Plum and prune, cultivars, Iran, guilan.

## INTRODUCTION

*Prunus* genus includes peach, nectarine, plum, cherry, apricot, almond and many species are used as rootstock or ornamentals. The basic chromosome number of *Prunus* is 8, with 2n varying from 16 - 176 for *Prunus laurocerasus*. *Prunus domestica* is by far the most important plum species worldwide. Relatively minor use is made of the fruit of *Prunus cerasifera*, *Prunus spinosa* and *Prunus insititia* (Westwood, 1993). Chilling requirement of European plum is about 600 - 1600 h. The seeds of *P. cerasifera* require 80 - 100 days to break endodormancy (Jalili, 2004).

The yield of plum and prune was about 4 mt/ha and 10 mt/ha in the world and Iran respectively in 2007 (Table 1) (FAOSTAT, 2009). There are about 75 varieties of plum and prune native to Iran. Native *Prunus* species exist in

diverse climates ranging from sub arctic regions to the dry deserts where they are subjected to high and low temperatures, high and low moisture conditions, variable soil conditions and a host of insects and diseases. The most important varieties are Bokhara plum, Karaj black plum, Arak yellow plum, Baraghan prune (Goje Baraghan) and Sadie Uremia prune (Goje Sadie Uremia) (Khoshkhui et al., 2004). The worldwide annual production of *Prunoideae* exceeded 28.3 million metric tons in 2001, including almost 13.5 million tons of nectarines and peaches (*Prunus persica* (L.) Batsch), 9 million tons of plums (*P. domestica* L.), 2.7 million tons of apricots (*Prunus armeniaca* L.), 1.8 million tons of sour and sweet cherries (*Prunus cerasus* L. and *Prunus avium* L. respectively) and 1.3 million tons of almonds (*Prunus amygdalus* Batsch) (Martinez-Gomez et al., 2003). Worldwide and Iran annual production, yield and harvested area of plum and prune are presented in Table 1 (FAOSTAT, 2009).

The next most numerous plum species in Europe regarding genetic resources is *Prunus cerasifera*, which has

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**Table 1.** Plum and Prune Area Harvested, yield and Production quantity in the World and Iran on 1997 and 2007 (FAOSTAT, 2008).

Countries	1997			2007		
	Area harvested (ha)	Production quantity (Mt)	Yield (kg/ha)	Area harvested (ha)	Production quantity (Mt)	Yield (kg/ha)
IRAN	12516	110292	8812	14500	147000	10137.9
World	1695181	8110894	4784	2416805	9719451	4021.6

been substituted by 347 accessions (about 280 varieties) in the European *Prunus* database and about 700 varieties outside the database (mostly collected in Ukraine and Russia) (Blazek, 2007). *P. cerasifera* is relatively close to *P. domestica*, while it is far from *Prunus salicina* (Bianchi et al., 2003).

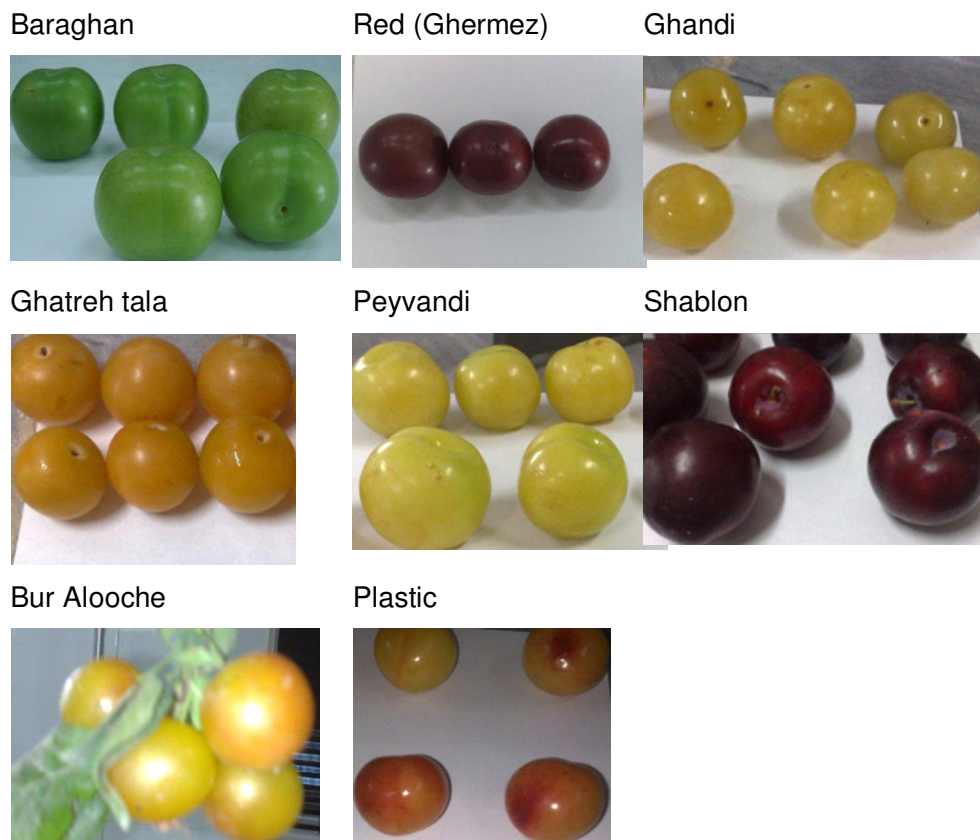
Today, there is a wide range of cultivars in *Prunus domestica* from early to late ripening, or from the end of June to the beginning of October in Germany. Their fruits are of middle size (30 - 40 g) in most European countries. During the last years, there was an increasing demand for fruits with larger size and good fruit quality for fresh fruit consumption (Hartmann, 2007). Until the 50 plums were the most important fruits for Czechoslovakia, where they were grown abundantly on the greater part of its territory with the total number of trees fluctuating for a long period about 15 million. More than 75% of this quantity takes Domestic prune (Synonym: sweet common prune or German prune). The group includes the true prunes with elongated fruit that is pointed both to the stem and the tip, usually of dark blue skin with heavy bloom. The flesh is firm, juicy, and very tasty with the special flavor and free stone. The stone is elongated, flattened and sharply pointed to the both ends. They differ from Italian prune mostly by somewhat smaller fruit, tree growth habit and less susceptibility to pests and diseases (Blazek, 1991).

According to Donmez and Yildirimli (2000), *Prunus divaricata* has variations in its fruit color and shape compared to other species, but these characters have no taxonomic value because there are many intermediate forms. The species has been divided in to eleven ecotypes according to their morphological characters and ecological preference. In practice, however, these ecotypes are not distinguishable from one another. They explained that all the *Prunus* species seeds have similar germination capacity. There are no differences in seedling emergence between plants of the same species collected from different altitudes and habitats. According to their report, although *P. domestica* grows well throughout Turkey; other *Prunus* species have certain ecological preferences. *P. spinosa* does not occur in the Mediterranean region or in the drier parts of E and SE Anatolia. As well as in NE Anatolia, which is characterized by a wet climate, this species grows well in humid

places in Central Anatolia, the Aegean region, the western Black Sea and Thrace. *Prunus cocomilia*, on the other hand, grows throughout Turkey, but thrives best in the Irano-Turanian regions. The species grows also in the Mediterranean region in Turkey, Greece and Italy (Donmez and Yildirimli, 2000).

Recently, in their morphological analysis, Bortiri et al. (2006) demonstrated that the subgenus *Prunus* consists of sections *Prunus* (including *P. cerasifera*), *Prunocerasus*, *Armeniaca*, *Penarmeniaca*, *Piloprunus* and *Microcerasus*. According to Woldring (2000), Cherry plum (*P. cerasifera* Ehrh.), Damson (*P. insititia* L.), domestic plums (*P. domestica* L.), and Sloe (*P. spinosa* L.) are very closely related taxa. Following Bortiri et al. (2006), all these above-mentioned species belong to the Eurasian plums. Beside the unclear phylogenetic relationships between taxa of *Prunus* section *Prunus*, the morphological discrimination of these Eurasian plum taxa is also problematic. According to Woldring (2000), the identification of *Prunus* groups at subspecies or variety level is complicated by the very wide range of variation and transitional states between and within the different taxa. Woldring (2000) exemplified this by noting that *P. insititia* and *P. domestica* include such a wide range of forms with so many overlapping features that it is hardly possible to point out diagnostic features that clearly distinguish the two groups. This phenomenon can also be observed for individuals that are morphologically intermediate between *P. insititia* and *P. spinosa*. Of all the characters used for identification, the features of the stones of *Prunus* taxa are the most stable ones.

The study of stone dimension ratios will be the most precise method to discriminate the clones of a prune variety given that the clones are cultivated in the same location and the comparisons are made among the measures of the stone harvested in the same season (Bernhard, 1991). Species of the genus *Prunus* L. are distributed in the northern hemisphere. Most of the species occur in semiarid climates. Cultivated species of the genus are found under varying ecological conditions. The taxonomy of the genus is complicated because of the polymorphism and wide ecological tolerance of the species, as well as the presence of numerous cultivars (Donmez and Yildirimli, 2000). This study was carried out to identify the morphological and pomological characteris-



**Figure1.** Important 8 cultivars of plum and prune in Guilan (North province of Iran) at harvesting date.

tics of plum and prune cultivars in a plum orchard of Rasht (north part of Iran).

## MATERIALS AND METHODS

Eight plum and prune cultivars that are commonly grown by fruits growers of Guilan province (north of Iran, Rasht) were studied in this experiment. The cultivars (Figure 1) were Baraghan, Red (Ghermez), Shablon, Ghatreh Tala (Golden drop), Peyvandi, Ghandi, Plastic, sour prune (Bur Alooche). Traits such as fruit volume, weight, taste (sour or sweet), diameter, shape and color, stone weight and fruit/stone weight ratio (F/S) were evaluated as pomological characteristics at harvesting date of fruits. Ten fruits from each tree were evaluated to determine each characteristic. We asked from consumers to rank from 1 (sour) to 5 (sweet and tasty) on the base of tasty and palatability of fruits. The data were analyzed using SPSS and EXCEL software. Statistical procedures such as ANOVA and Post-Hoc analysis (Tukey) used for data means analysis.

## RESULTS

Seven characteristics including fruit weight, stone weight, fruit/stone ratio (F/S), fruit diameter, leaf blade size, fruit volume and taste of fruit were investigated in eight plum and prune cultivars.

One of the most important characteristics of fresh fruits such as plum and prunes is flesh/stone ratio. While based on Post-hoc Tukey test, the cultivars fruit weight and their stone weight located in 5 and 4 groups respectively, but these characteristics ratio (F/S) was grouped at 3 categories. The least F/S ratio was observed in Bur alooche ( $M = 14.26$ ), Ghermez ( $M = 14.61$ ) and Baraghan ( $M = 20.46$ ). However the highest ratio belonged to Plastic cultivar ( $M = 22.66$ ), Shablon ( $M = 25.17$ ), Peyvandi ( $M = 29.01$ ) and Ghandi ( $M = 29.32$ ).

In the present study, the highest fruit diameter was related to Peyvandi cultivars ( $M = 19.16$ ) and the least amount belonged to Bur alooche ( $M = 5.54$ ). Leaves size comparison by Post hoc tests showed three categories, that some of cultivars (including; Ghermez, Bur Alooche, Peyvandi and Ghatreh Tala) were placed in all three categories and did not statistically have significant difference. The highest leaf size was observed in Ghandi cultivars ( $M = 25.84$ ) and the least leaf size was related to Plastic cultivars (9.57). Measurable volume fruit was measured by Archimedes way. The results of this study showed that the highest volume fruit was obtained in Peyvandi cultivar and the least amount belonged to Ghermez. These cultivars were located at five groups.

The last evaluated attribute was the quality of taste and

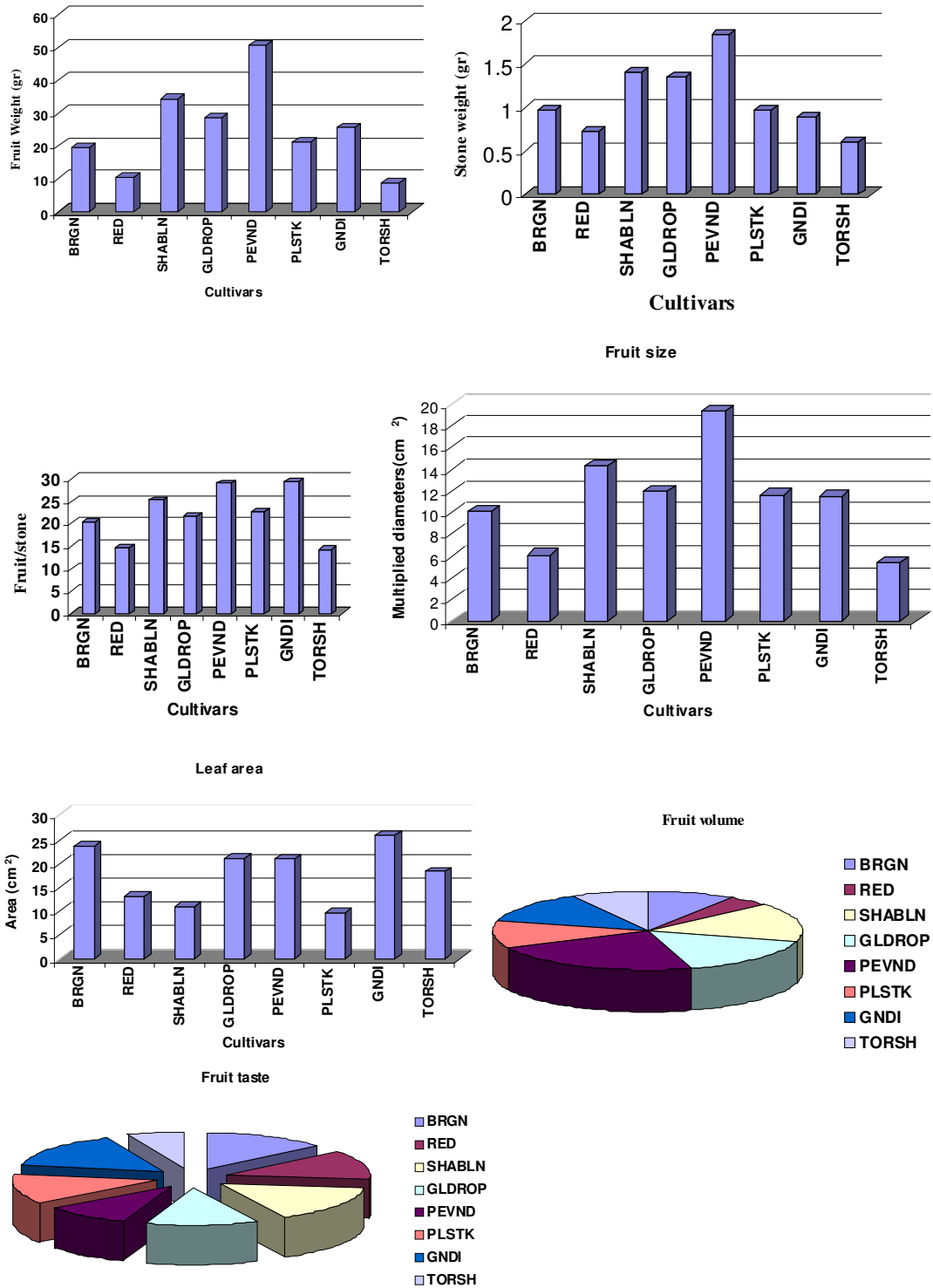


Figure 2. Fruit, Stone and leaf traits comparison in plum and prune cultivars.

the palatability of the fruits. For this purpose we asked from consumers to rank taste and palatability of fruits on a 5-point scale. Post-hoc Tukey test showed that cultivars can be separated in four different groups. In this study, the highest rank (5) belonged to Shablon and Ghandi,

and the least rank (2) was related to Bur Aloche because of its sour taste. The rank 3 was allotted to Peyvandi, Ghermez, Ghatreh Tala, Plastic and Baraghan which were placed in the 3<sup>rd</sup> group (Figure 2) with rank mean 4 and 4.4. The most important characteristics that were de-

sirable by the consumers were taste, juice and color of fruits.

## DISCUSSION

The results revealed that there were significant differences between all cultivars (Table 2). On the base of post-hoc Tukey test, cultivars of Ghermez and Bur alooche were in a similar group and the least weight fruit was allotted to this group with 8.4 and 10.53 g respectively. But, the highest fruit weight belonged to the cultivars of Shablon (M = 28.48) and Ghatreh Tala (34.46) and so these cultivars were in separated group. Based on Tukey post-hoc test, there was significant difference between stone weights of cultivars. The studied cultivars were located in 4 different groups. The most of cultivars including Plastic, Baraghan, Ghandi, Ghermez and Bur Aloocha had the least stone weight. In addition, there was no significant difference between these cultivars and consequently the whole of these five cultivars located in a same group. The least stone weight in this group was allotted to the Bur alooche (M = 0.61 g) and the highest stone weight belonged to Plastic cultivar (M = 0.98 g). In this study the highest stone weight like fruit weight was related to Peyvandi cultivar with 1.84 g (Figure 2).

Ganji Moghadam and Khalighi (2007) evaluated morphological characters of 17 Mahaleb (another *Prunus* species) populations. One-way analysis of variance was performed for determination of different regions genetic diversity, which indicated significant differences for most traits. Correlation coefficient showed significant correlation between tree vigor, crown width, and crown volume and size index (Ganji Moghadam and Khalighi, 2007).

Guilan province is one of the important plum and prune growing areas that some varieties are produced as early fruit at spring. The most important varieties that were grown in the north part of Iran were studied in this research. We can rank these cultivars in below categories based on taste results:

- Ghandi: very tasty, juicy and very sweet.
- Shablon: very tasty, relatively sweet and juicy
- Ghermez: astringent, attractive and special (red color and tasty)
- Ghatreh Tala: tasty, juicy and sweet
- Baraghan: juicy and sweet
- Plastic: juicy and sweeter than Peyvandi
- Peyvandi: satisfactory and astringent
- Bur Aloocha: Sour and acidic taste

It be concluded that Ghermez had special taste including sour, sweet and astringent taste all together and had good marketable trait, because of attractive and special red color. However, this cultivar had lower rank than to Shablon and Ghandi cultivars. It is to be considered that cultivars of Torsh (Bur Aloocha) and Ghermez had little marketable values because of small fruit size and sour taste of their fruits.

**Table 2.** ANOVA of Plum and Prune cultivars characteristics.

character	df	MS	F
Fruit weight	7	1833.59	8.04**
stone weight	7	1.65	24.38**
stone/fruit	7	328.56	13.86**
fruit diameter	7	1937749.4	95.19**
size leaf	7	361.96	5.46**
volume fruit	7	1477.14	78.20**
taste	7	10.16	114.35**

## ACKNOWLEDGEMENT

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