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Research Article

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Pomological, Phenological and Morphological Characteristics a New Mutant Plum

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Abstract For researching purposes hardwood of Apricot scion (*Prunus armeniaca cv.* Malatya) was grafted on the five years old *Prunus cerasifera pissardii nigra*, which was accepted as a rootstock. After 3 years of the experiment, while the normal development was going on, a new and different shoot arose out from the apricot section. Fruits, leaves and fruit colours of this new shoot did not look like those of *Prunus cerasifera* or apricot. The conclusion was that this branch (shoot) arisen from the apricot might be the result of a bud- mutation or bud sport. Horticulturally, mutation (within clones) has been observed through the sudden appearance of branches or whole plants with marked specific characteristics. There are referred to as bud mutation and have sometimes given risen to important new cultivars. In this study short pomological, phenological, morphological and fruit characteristics of this new mutant plum emerged as a result of bud mutation were determined. For this purpose, time of bud burst, full blooming, leaves size and fall, fruit weight, width and length, firmness, length of fruit stalk, harvesting time, fruit colour, stone weight, percentage of total soluble solids, pH, total acidity, evaluated of flavour(by 1-5 scale) were taken into consideration.

Keywords Rootstock, Scion, Mutant, Plum, New fruit

1. Introduction

For researching purposes hardwood of apricot scion (*Prunus armeniaca var***.** Malatya) grafted on the five years old *Prunus cerasifera pissardii nigra*, which was accepted as a rootstock. After 3 years of the experiment, while the normal development was going on, a new and different shoot arose out from the apricot section. Fruits, leaves and fruit colours of this new shoot did not look like those of *Prunus cerasifera* or apricot. The conclusion was that this branch (shoot) arisen from the apricot might be the result of a bud-mutation. Horticulturally, mutation (within clones) has been observed through the sudden appearance of branches or whole plants with marked a specific characteristics. There are referred to as bud mutation and have sometimes given risen to important new cultivars. Mutations are preserved during cell division (mitosis), and the production of new cells derived from the original mutant cell effectively results in new clone within the original plant [8].

Mutations are genetical modifications that produce permanent changes in the genotype affected nuclear genetic material (chromosomes) or cytoplasmic genes (plastids and mitochondria**).** Chromosomal changes may results from rearrangements of the four bases in DNA (point mutations) or from deletions, duplications, translocations, and inversions of part of some chromosomes. Changes may be the results of the addition or subtractions of individual choromosomes (aneuplody) or from the multiplication of entire sets of chorosomes (polyploidy) [6,8].

Plastid mutations usually results in loss of chlorophyll, which result either in albino plants or in variegated plants that have both albino and green sectors present [1,19]. Changes in ploidy may result in giant, vigorous, low producing spots in some plants which are due to changes from the diploid to the tetraploid state [5,7]. Numerous cultivars of Japanese flowering cherry (*Prunus* subgenus *cerasus*) are recognized, but in many cases they are difficult to distinguish morphologically. Therefore, evaluated the clonal status of 215 designed cultivar

sussing SSR markers [9]. Mutation induction has been one of the important breeding methods especially in fruit trees which are vegetatively propagated, and have high degree of heterozygosity [17].

It has been reported that [10], plums are vegetatively propagated because of their high degree of heterozygosity. Spontaneous bud sport mutant is one of the good resource for developing countries fruits because these branches show not only some unique characteristics such as fruit development, colour, and ripening behaviour, but also continue to exhibit all of the other commercialized characteristics of parents. Mutation can be induced artificially with the help of various physical and chemical agents which are called mutagens [11].

Detailed physilogical studies revealed for the firts time three distinct ripening types in plum fruit. It was explained, cultivars, such as derived from bud sports produced no ethylene and softened extremely slowly [12]. The peach (*Prunus persica L. Batsch) cv.* Pillar, shows variegation in anthocyanin differ with genetic background in progeny of out crosses [4].

Mutations occur naturally in garden plants as well as artificially. The rate of mutation can be increased by treatment with specific mutagenic agents such as x-rays, gamma rays, neutrons, and specific chemicals. Mutations or mutation breeding has resulted in new cultivars. For example, Ruby Red grapefruit, itself originating as a bud-sport, when subjected to radiation treatment, resulted in various mutants of which Star Ruby and Rio Red were introduced as cultivars [2,3,13,20,21].

Apical shoot tips excised from in vitro plantlets of blackberry (*Rubus fruticosus* L. Bestrna) and cherry plum (*Prunus cerasifera Ehrh*.). Experiments performed in France and in Serbia produced similar results, thereby showing the robustness and reproducibility [22].

In this study short pomological, phenological, morphological and fruit characteristics of this new mutant plum was determined which emerged as a result of bud mutation. For this purpose, time of bud burst, full blooming, leaves size and fall, fruit weight, width and length, firmness, length of fruit stalk, harvesting time, fruit colour, seed weight, percentage of total soluble solids, pH, total acidity, evaluated of flavour (by 1-5 scale) were taken into consideration.

2. Material and Methods

The following measurements and counts were made on the plum fruits obtained as a result of bud mutation.

Phenological observations

- First bud burst time
- First, full and end of blooming
- First and last harvesting time
- Leaves fall time
- Flower gender

Pomological and morphological measurement

All measurements and counts were considered in four replicates. 10 to 25 counts and measurements were taken into account each time. The obtained values were taken in the average of four repetitions.

Leaves

- Width and length (4x25 samples)
- Stalk length and thickness (4x25 samples)
- Color (light or dark green)
- Leaf edge dentition (4x10 samples)
- Leaf index (length/width: ratio of the average to each other)
- Vegetative growth (Vigorous, weak)

Fruits

- Weight, width, length(4x25 samples for each measurement)
- Fruit index (length/width:ratio of the average to each other)
- Fruit stalk length and thickness (4x10)
- Skin and pulp Colour

- Fruit firmness (with Penetrometer, using 5.0 mm diameter plunger):
  Two measures taken on each fruit opposite sides, at the middle (equatorial) point of each side, after removing 10 mm diameter disc of skin peel.

Stones

- Length and width 4x25 samples)
- Weight (4x25 samples)

Chemical measurements

- pH (using pH meter)
- Acidity (%, with titration)
- Total soluble solids (%, with refractometer)
- Fruit tasting (by 1-5 scale: 1 poor; 2 less good; 3 good: 4 best; 5 perfect, for 10x4 samples, by 5 persons).

3. Results and Discussion

The values for the plum resulting from the mutation are collectively shown in Table 1. As explained in the introduction, the mutation has been seen on the branch of apricot (*Prunus armeniaca cv.* Malatya) which has been graft grafted on *Prunus cerasifera pissardii nigra* (Figure 1). So that new bud-sports branch was growth on the apricot tree. The phenological, morphological and pomological characteristics of the organs and fruits on the branch resulting from this mutation have been taken into account.

According to our phenological observations, mutant plums in the same tree had previously bloomed before apricot flowers (Figure 2.).Size and form of leaves, shoots were very similar to each other. But their colours were different. Mutant plum leaves and shoots colour was green, but leaves and shoots of *Prunus cerasifera* used as rootstock for apricot was dark red colour (Figure 3. CD, EF**).** Also the edges of the leaves were slightly dentate.

As shown in the table, the width of the leaf was found to be 39.56 mm and the length 63.35mm. Leaves of *Prunus cerasifera* used as rootstocks showed similar measurements. Mutant plum and *Prunus cerasifera* flowers were similar to each other and both were hermaphrodite (Figure 2 AB).

Flowers were seen on the plum branch which rising with bud-sports from the apricot tree. So that mutant plum flower and apricot flower were seen on the same tree.

Although two types of fruits were on the same tree, mutant fruits of plum were ripened before the apricot fruits. Mutant fruits sizes were bigger than similar fruits in the market. Leaves edge of the *Prunus cerasifera pissardii nigra* and mutant plum were gently dentation. In both of them, the shape and depth of their teeth were the same (Figure 4). Dentation provides an excellent visual pomologic characteristics.

Average fruit weight was found to be 37.56 g. Since the mutant plum was quite large, it was found to be more than the width (38.34 mm) of its length (33.55 mm).

Fruit stem length 16.05 mm, thickness 1.14 mm. Skin colour dark green pulp colour light green, juicy, fibrous, adherent to the stone of the flesh, slightly sourish found. Fruit penetrometric firmness (with 5.0 mm diameter plunger) obtained in 3.07 kg/cm^2 when percentage of total soluble solids was 9.71 % at first harvesting time.

The stones are adhered to fruit pulp and the weight of 100 stones is 67.05 g. When we considered the chemical analysis, the pH value was 4.45, the total acidity was 0.117 %, the total soluble solids was 9.71 %.

Fruit tasting was evaluated according to 1-5 scale with 5 persons and 3.78 value was obtained. This value is between 3 and 4 and was considered good and the best.

4. Conclusion

Allows for the production of new varieties with shoot mutations in stone fruit species. Why did a plum shoot out of an apricot branch with a bud mutation?

Moreover, the leaves, shoots and fruits of the mutation did not resemble the leaves, fruits and branches of the *Prunus cerasifera pissardii nigra* who was the rootstock of the apricot.

According to some researchers [8,14,15,16] had reported that severe pruning could increase the number of growing points that are available to show mutated sektors. Detection of a new mutant within a clone may require a series of vegetatively propagated generation and multiple propagation from many buds of the same plant.

Can bud mutation be a consequence of graft incompatibility? Because of a different thickening between the rootstock (*Prunus cerasifera pissardii nigra*) and the scion (Prunus armeniaca cv. Malatya) at the grafting point. Graft incompatibility occurs because of adverse physiological responses between the grafting partners, virus or phytoplasma transmission and anatomical abnormalities of vascular tissue in the callus bridge [8,18].

This new material with mutation will be reproduced vegetatively and will produce a variety property certificate.

Table 1: Phenologic, pomologic and morphologic characteristics of plum forming by mutation

Phenological observatins	**2017**	**2018**
1. First bud burst time	12/III	10/III
2. First blooming	15/III	13/III
3. Full blooming	20/III	17/III
4. End of blooming and berry set	24/III	20/III
5. First harvesting	29/V	25/V
6. Last harvesting	17/VI	12/VI
7. Leaves fall (Begin-end)	18/XI-15/XII	-------
8. Flower gender	Hermaphrodite	
Leaves 1. Width (mm): 39.56, Length (mm): 63.35 2. Stalk length: 12.63, Thickness (mm): 0.86 3. Color: Light green 4. Leaf edge dentation: Light dentation 5. Leaf index: 1.60		
Fruit 1. Weight(g): 37.56,Width (diameter, mm): 38.34, Length (mm): 33.55 2. Fruit stalk length (mm): 16.05, Thickness (mm): 1.14 3. Fruit index: 1.14		
4. Fruit firmness (kg/cm^2): 3.07 5. Skin color: Dark green 6. Pulp color: Light green		
Stones 1. Length(mm): 16.76, Width(mm), Narow side : 7.52 ,Wide side: 12.64 2. Weight (g/100): 67.05		
Chemical analysis 1. pH : 4.45 2. Acidity (%): 0.117 (as malic acide) 3. Total soluble solids (%) : 9.71 4. Fruit tasting score: 3.78		

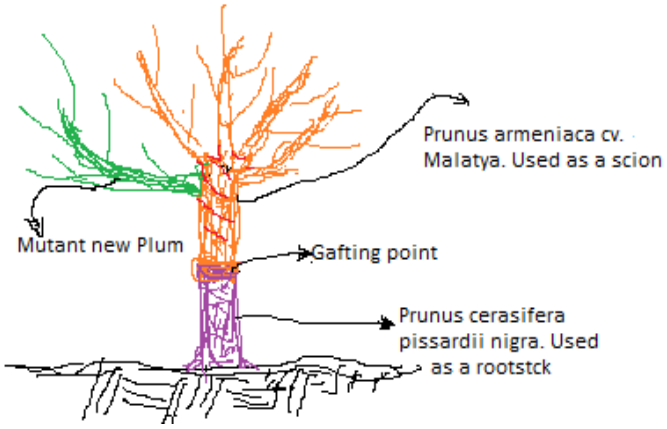

Figure 1: Formation scheme of new mutant plum

Figure 2: Prunus armeniaca tree in which one mutant branch (A) blooming, The flowers are the same in both (B)

Figure 3: Leaves and shoots form in Prunus cerasifera pissardii nigra (C, E) and mutant plum (D, F)

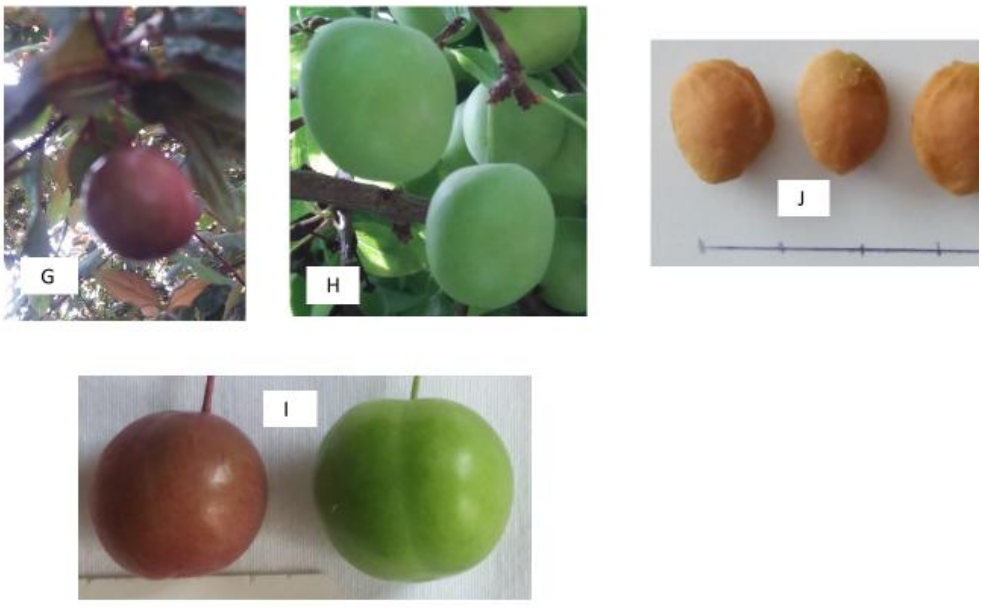

*Figure 4: Fruits on the branches (**G**: Prunu.cerasifera pissardii nigra, **H**: Mutant Plum fruit, **I:**View of two fruits together, J:Mutant plum Stones).*

References

[1]. Bassert, R. A. E.(1986). Plant Chimeras. London, Edward Anold Press.

[2]. Boretis, C., and Van Harten, A.M., (1987). Application of mutation breeding methods. Ind: A.J.Abbot and R.K.Atkin, Eds.: *Improving Vegetatively Propagated Crops.* NY: Academic Press, 335-348.

[3]. Cambell, A.I. (1986).Workshop on Clonal Selection in Tree Fruits. Acta Hort. 180. 1-131.

[4]. Chaparro, X., L., Werner, D.J. Whetten, R.W., Malley, D.M., (1995). Characterization of an Unstable Anthocyanin Phenotype and Estmation on Somatic Mutation Rates in Peach. Jour. of Heredity, Vol. 86(3): 186-193.

[5]. Darrow, G. M., Gibson, R. A.,Toenjes, W. E. and Dermen, H. (1958). The natüre of giant apple sports. Jour. Hered. 39, 45-51.

[6]. Dermen, H. (1960). Nature of Plant Sports. Amer. Hort. Mag. 123-173.

[7]. Einset, J. and Pratt, C. (1960). Giant Sports of Grapes .Proc. Soc. Hort. Sci. 63:251-256.

[8]. Hartman, H.T., and Kester, E. D. (1997). Plant Propagation. Principles and Practis .7th Edition Upper Saddle Liver, NY 074458. Prentice Hall. 176-178.

[9]. Kato, S., Matsomoto,A., Yoshimora, K., Katsuki,T., Iwamoto, K., Tsuda, Y., Ishio,S., Nakamora, K., Moriwaki, K., Shiroishi, T., Gozobari, T., Yoshimaniu, H. (2012). Clone Identification in Japanese Flowering Cherry (*Prunus Subgenus Cerasus)* Breeding Science, 62 (2013) 3., 248-255.

[10]. Kim, Ho-Yo .82015). Characterization of Bud Sport Mutation in Plum Fruit.Physiologica Biochemical and Molecular approches. Seedcenral.org. Veg. R.

[11]. Lemo, K., Bhat, D.J., Kour, K., Pratop, S. (2017). Mutation Studies in Fruit Crops. A review, L J, Cams.2017, 612-408. Doi.org/10.20546.

[12]. Minas, I.S., Forcada, F.C., Dangli, G. S., Gradziel, T.M., Dandekan, A.M., Crisasto, C.H. (2015). Discovery of non-Climacteric Suppressed Climacteric Bud Sport Mutastions Originating from a Climacteric Japanese Plum Cultivar (Prunus salicine Linde). Plant Sci.12 May, 2015.

[13]. Moore, J.M. and Janic, J. Eds.: (1983). Meyhods of Fruit Breeding. West Lafayette. Ind.: Perdue univ. Press.

[14]. Özbek, S. (1974). Bağ-Bahçe Bitkilerinin Islahı . Ankara Üniv. Ziraat Fak. Yayını. 419, Yardımcı Ders Kitabı: 146. 105-114.

[15]. Özbek, S. (1977). Genel ve Özel Meyvecilik. Çukuova Üniv. Yayını: 111, Ders Kitabı:6, p.841.

[16]. Özkarakaş, D., ve Ercan, N. (2003). Güneydoğu Anadolu ve Karadenđz Bölgelerınden Toplanan Bazı erik (*Prunus cerasifera Ehrh*.) Genetik Kaynakları Materyalinin değerlendirimesi. Anadolu ,J. of AARI 13 (1) 2003, 91 – 106, MARA.

[17]. Sanada, T., Amano, E. (1998). Induced Mutation in Fruit Trees. Mutad Breed Newsl. 42-53.

[18]. Santamour, F.S. (1988). Graft compatibility in wood plant: An expanded perspective. J. Environ. Hort. 6(1): 27-32

[19]. Stewart, R. N. (1978). Ontogeny of primary body in chemical forms of higher plants. S. Subtelny at al., eds., NY: Academical Press131-160

[20]. Van Osten, H.J. and Van der Borg. Eds.:(1997). Symposium on Clonal Variation in Apple and Pear. Acta Hort. 75: 1-185.

[21]. Van Harten, A.M.,(1998). Mutation Breding. UK, Cambridge Univ. Press.

[22]. Vujovic, T., Sylvestre, I., Ruzi, D., Engelmann, F. (2011). Droplet-vitrification of apical shoot tips of *Rubus fruticosus* L. and *Prunus cerasifera* Ehrh. Scientia Horticulturae 130 (2011) 222–228.