

## CALITATEA FRUCTELOR LA UNELE SOIURI ROMANESTI DE PRUN FRUIT QUALITY OF SOME ROMANIAN PLUM CULTIVARS

Butac Madalina<sup>1</sup>, Militaru Madalina<sup>1</sup>, Cojocaru Marilena<sup>2</sup>

<sup>1</sup>Research Institute for Fruit Growing Pitesti, Romania

<sup>2</sup>Horticulture Faculty, University of Craiova, Romania

### Abstract

Plum fruits have been used as fresh, dried and processed food by people since ancient times. The increase consumer demand regarding the fruit quality is the reason to present information about the fruits chemical composition and sensory characteristics of some plum varieties. The study was carried out in the period 2014-2016 at the Research Institute for Fruit Growing Pitesti-Maracineni, Romania on 18 plum cultivars created at RIFG Pitesti Maracineni ('Agent', 'Albatros', 'Alina', 'Carpatin', 'Centenar', 'Dambovita', 'Flora', 'Gras ameliorat', 'Ialomita', 'Pescarus', 'Pitestean', 'Renclod de Caransebes', 'Roman', 'Romanta', 'Tita', 'Tuleu timpuriu', 'Sarmatic', 'Superb'). These cultivars were harvested at different times in the orchard, starting with the second decade of July and finishing in the last decade of August. The results of chemical composition analysis showed that the fruits of 'Agent', 'Albatros', 'Carpatin', 'Centenar', 'Gras ameliorat', 'Tita' and 'Superb' had a soluble solids content over 18%Brix. Fruits of 'Albatros', 'Alina', 'Dambovita' and 'Romanta' had the highest acids content. Based on the results of sensory evaluation the best characteristics for fresh consumption were manifested to 'Carpatin', 'Centenar', 'Tita', 'Alina', 'Gras ameliorat' and 'Tuleu timpuriu' cultivars, which presented very good taste. 'Roman', 'Romanta', 'Dambovita', 'Flora' and 'Pitestean' cultivars presented large fruits and good appearance but the fruits content in soluble solids were low. All these results show that some Romanian cultivars can be use in further breeding purposes and also can be recommend to be spread in commercial orchards.

**Cuvinte cheie:** fructe, compozitie chimica, caracteristici senzoriale

**Key words:** plum fruits, chemical composition, sensory characteristics

### 1. Introduction

In Romania, European plum (*Prunus domestica* L.) is the predominant species being a food source, but at the same time providing profits to the population (Coman et al., 2012). The high degree of appreciation of plums among consumers has promoted it as one of the most important fruits (Diaz-Mula et al., 2008). Plum fruits have been used as fresh, dried and processed food by people since ancient times (Bozhkova, 2014).

Regarding the varietal assortment, the predominant cultivars are the local ones intended to the plum brandy industry, although there are valuable old cvs. with a mixed destination: 'Tuleu gras', 'Grase romanesti' and 'Vinete romanesti'. Also, the 'Stanley' cultivar occupied a high percent in the plum orchards since 1980s. In time, the varietal assortment has been improved both numerically and quantitatively and growers are looking for new cultivars (Braniste, 2002). Following a Romanian breeding program initiated 60 years ago were obtained a lot of plum varieties which were distinguished by large fruit and commercial aspects. However not all of these varieties have a good chemical composition and sensory characteristics of fruit. Some of varieties are appreciated by farmers, but not for consumers (Bozhkova, 2014). The increase of the consumer demand regarding the fruit quality is the main reason in order to present information about the fruits chemical composition and sensory characteristics of 18 plum varieties created at RIFG Pitesti Maracineni ('Agent', 'Albatros', 'Alina', 'Carpatin', 'Centenar', 'Dambovita', 'Flora', 'Gras ameliorat', 'Ialomita', 'Pescarus', 'Pitestean', 'Renclod de Caransebes', 'Roman', 'Romanta', 'Tita', 'Tuleu timpuriu', 'Sarmatic', 'Superb').

### 2. Material and methods

Over the period 2014 – 2016 some chemical composition and sensorial characteristics were studied in 18 plum cultivars ('Agent', 'Andreea', 'Dambovita', 'Gras ameliorat', 'Ialomita', 'Pescarus', 'Record') in order to select the table cultivars in correlation with consumer preferences. The standard cultivar 'Stanley' was used as control.

On 30 fruits, per sample, collected at full maturity time, the soluble solid contents and fruit acidity were measured.

Fruit soluble solid contents were measured with Digital Sucrose Refractometer – (Hanna Instrument 96801). This instrument automatically applies temperature compensation to the measurement and converts the refractive index of the sample to sucrose concentration in units of percent (by weight) Brix.

The content of fruits in malic, citric and tartaric acids were measured using the device Minitrator and pH meter for fruit juice – Hanna Instrument 84532. This device measures the concentration of titratable hydrogen ions contained in fruit juice sample, by neutralization with a strong base solution to a fixed pH. This value includes all the substances of an acidic nature in the fruit juice including: free hydrogen ions, organic acids and acid salts. Titratable acidity is expressed as g/100 g fresh matter.

Plum cultivars were also evaluated by open taste panels consisting of about 10 persons. Whole fruits were presented to members on platters (10 typical fruits of cultivars), to rate attractively and flavour, in points 1 to 9 according to a questionnaire used by the Romanian stone breeders (Annex 1).

The differences among the varieties were analyzed using analysis of variance. The cultivars were compared with 'Stanley' cultivar, used as control.

### 3. Results and discussions

#### **Fruit soluble solid content (SSC)**

The cultivars studied were harvested at different times in the orchard, starting with the second decade of July ('Ialomita' cv.) and finishing in the last decade of August ('Gras ameliorat' and 'Dambovita' cvs.).

Soluble solid content is a characteristic that gives the most rapid information about the biological value of a fruit (Bozhkova, 2014).

The soluble solid content in the present research varied from 13.6% at 'Pitesteana' cv. to 25.4% at 'Agent' cv. Regarding the control cultivar 'Stanley' SSC was 14.1% (Table 1).

The average values of SSC were over 18% in 7 of the 18 cultivars. These cultivars were 'Agent', 'Albatros', 'Carpatin', 'Centenar', 'Gras ameliorat', 'Tita' and 'Superb'. In the group of cultivars which have the lowest SSC (under 14%) are: 'Ialomita', 'Pitesteana' and 'Stanley' cvs. Of all the plum varieties studied was evidenced 'Agent' cv. with a very high soluble solid content (25.4%); this variety is designed both for fresh consumption and for dehydration (Table 1).

Usually the SSC increases with maturity and ripening and could be a good quality index. A correlation between the ripening time and the SSC was not found. Considering the fact that all these cultivars were grown in the same conditions, this means that the SSC is a cultivars specific characteristic (Usenik et al., 2008; Bozhkova, 2014).

The SSC data corresponded to the results of other studies in Romania. According to Roman et al. (1984), SSC of 29 plum genotypes varied from 12% to 17%. According to Ionica et al. (2013), SSC of 12 plum cultivars varied between 15.6-22.19%. Other authors from Europe reported the similar data about SSC (Bozhkova, 2014; Drogoudi et al., 2010; Gravite and Kaufmane, 2011; Milosevic and Milosevic, 2012; Neumuller et al., 2010; Sahamishirazi et al., 2016; Vangdal et al., 2007, etc.)

#### **Titratable acidity**

Organic acids of fruits (especially malic, citric and tartaric acids) determine the fruit taste and also have a good effect on intestine tract (Ionica et al., 2013; Bozhkova, 2014).

The malic acid of plum cultivars studied varied between 0.30 g/100 g fresh matter at 'Centenar', 'Flora', 'Pescarus', 'Superb' cvs. and 0.71 g/100 g fresh matter at 'Stanley' cv. (Table 2).

The citric acid of cultivars varied between 0.29 g/100 g fresh matter at 'Flora' and 'Pescarus' cvs and 0.68 g/100 g fresh matter at 'Stanley' cv. (Table 2).

The tartaric acid of plum cultivars varied between 0.31 g/100 g fresh matter at 'Superb' and 'Pescarus' cvs. and 0.79 g/100 g fresh matter at 'Stanley' cv. (Table 2).

In Norway, Vangdal (2007) reported higher values of acids, ranging from 0.9% to 2.3%. Also, in Latvia, Gravite and Kaufmane (2011) reported higher values than those obtained in this study. In Romania, Ionica et al. (2014) obtained similar results. Probably in the cooler climate are obtained fruits with higher acids content and lower sugar content.

Regarding the pH values of the cultivars studied they are between 3.2% at 'Carpatin', 'Flora' and 'Tita' cvs. and 3.7 at 'Gras ameliorat' and 'Stanley' cvs. (Table 2). Usually, plums are known as food with low acid content (Bozhkova, 2014).

#### **Line scale rating**

According to the Regulation no. 1580/2007, fruit diameter for European plum should be over 35 mm. Plum fruit quality depends on a complex of characteristics, such as: shape, size, skin color, taste and flavor, sugar content and acidity, stone adherence, but also, the optimum time to harvesting for the fresh fruit market (Cociu et al., 1997; Butac et Bulgaru, 2001; Butac et al., 2009). Therefore sensory evaluation is an important tool to evaluate the market potential of plum varieties.

Fruit size together with fruit skin colour and fruit shape contributes to fruit attractiveness. Judging by the score given for fruit size and colour it can be observed that large and dark blue fruit are preferred

by consumers. Pulp traits combine the scores given by the taste, aroma, juiciness and stone adherence. Usually consumers prefer the cultivars with very good taste, associated with the external appearance of fruits.

Based on the marks scored in questionnaire, the best appearance (size, shape and skin colour) was obtained for 'Romanta', 'Tita', 'Pitesteana' and 'Dambovita' cvs. A less appreciated appearance was noted for 'Agent', and 'Ialomita' cultivars (Table 3). The highest score for the intern characteristics of fruits were obtained the following cultivars: 'Carpatin', 'Centenar', 'Gras ameliorat', 'Pescarus', 'Tuleu timpuriu' and 'Tita' (Table 3).

The highest value (general score) based on the tasters evaluation were noted for 'Tita' (52.2 points), 'Centenar' (52.2 points) and 'Carpatin' (51.7 points) cvs., which was also well appreciated for the commercial aspect as well as for flesh characteristics, taste and flavor.

#### 4. Conclusions

Out of 18 cultivars, the fruits of 'Agent', 'Albatros', 'Carpatin', 'Centenar', 'Gras ameliorat', 'Tita' and 'Superb' cv had a soluble solids content over 18%. In the group of cultivars which had the lowest SSC (under 14%) are: 'Ialomita', 'Pitesteana' and 'Stanley' cvs. Of all the plum varieties studied was evidenced 'Agent' cv. with a very high soluble solid content (25.4%); this variety is designed both for fresh consumption and for dehydration.

The malic, citric and tartaric acids had higher values at 'Stanley' cv. and lower values at 'Centenar', 'Pescarus' and 'Superb' cvs.

Based on the marks scored in questionnaire, the best appearance (size, shape and skin colour) was obtained for 'Romanta', 'Tita', 'Pitesteana' and 'Dambovita' cvs. A less appreciated appearance was noted for 'Agent', and 'Ialomita' cvs. The highest score for the intern characteristics of fruits were obtained the following cultivars: 'Carpatin', 'Centenar', 'Gras ameliorat', 'Pescarus', 'Tuleu timpuriu' and 'Tita'. The highest value (general score) based on the tasters evaluation were noted for 'Tita' (52.2 points), 'Centenar' (52.2 points) and 'Carpatin' (51.7 points) cvs, which was also well appreciated for the commercial aspect as well as for flesh characteristics, taste and flavor.

#### 5. Acknowledgements

This paper was published under the project ADER 3.2.2/2015.

#### References

1. Braniste, N., 2002. Catalog de soiuri si material saditor pomicol. Ed. Ceres, Bucuresti, Romania.
2. Bozhkova, V., 2014. Chemical composition and sensory evaluation of plum fruits. *Trakya University Journal of Natural Sciences*, 15 (1)> 31-35.
3. Butac, M. and Bulgaru, L., 2001. Rezultate parțiale privind comportarea unor hibrizi de perspectivă la prun sub aspectul calității fructelor. *Buletin științific*, nr.65 (21), ICPP Pitești-Mărăcineni.
4. Butac, M., Militaru, M., Budan, S., Nicolae, S., Nicola, C., 2009. Fruit quality of some plum cultivars grown in Maracineni, Arges. *Lucrările Simpozionului – Mediul și Agricultura în regiunile aride (prima ediție), Stațiunea de Cercetare – Dezvoltare pentru Pomicultură Constanța și Universitatea Ovidius Constanța – Facultatea de Științe ale Naturii și Științe Agricole*. Ed. Estfalia, București: 235-241.
5. Butac, M., Militaru, M., Budan, S., 2012. Criteria for harvesting plums at the optimum maturity for Romanian varieties of the fresh fruit market. *Fruit Growing Research XXVIII*: 1-6.
6. Cociu, V., Botu, I., Minoiu, N., Pasc, I., Modoran, I., 1997. *Prunul*. Editura Conphys Valcea, Romania: 165-171.
7. Coman, M., Militaru, M., Butac, M., 2012. Fruit varieties breeding in Romania: from the beginning to present. *Annals of the Academy of Romanian Scientists* 1(1):43-52.
8. Coman M., Butac M., Sumedrea D., Dutu I., Iancu M., Mazilu Cr., Plopa C., 2012. Plum Culture in Romania – Current and Perspectives. *Acta Horticulturae* 968: 25-32.
9. Diaz-Mula, H.M., Zapata, P.J., Guillen, F., Castillo, S., Martinez-Romero, D., Valero, D., Serrano, M., 2008. Changes in physicochemical and nutritive parameters and bioactive compounds during development and on/tree ripening of eight plum cultivars: a comparative study. *Journal of the Science of Food and Agriculture*, 88: 2499-2507.
10. Drogoudi, P.D., Pantelidis, G., Papachatzis, A., 2010. Fruit physical and chemical characters in twelve European and Japanese plum genotypes during two harvesting years. *Acta Horticulturae* 968: 193-204.
11. Gravite, I. and Kaufmane, E., 2011. Stability of some quality characteristics of new plum cultivars in Latvia. *Scientific works of the Institute of Horticulture Lithuanian research centre for Agriculture and Forestry* 30 (222): 23-34.

12. Ionica, M.E., Nour, V., Trandafir, I., Cosmulescu, S., Botu, M., 2014. Physical and Chemical Properties of some European plum cultivars (*Prunus domestica* L.). Not. Bot. horti Agrobo, 41(2): 1-6.
13. Milosevic, T. and Milosevic, N., 2012. Main physical and chemical traits of fresh fruits of promising plum hybrids (*Prunus domestica* L.) from Cacak (Western Serbia). Romanian Biotechnological Letters, vol. 17, no. 3: 7358-7356.
14. Neumuller, M., Ruhmann, S., Hartmann, W., Treutter, D., 201. Strategies for improving fruit quality in European plum. Acta Horticulturae 968: 189-192.
15. Roman, R., Bulgaru, L., Badescu, A.P., Radulescu, V., 1984. Studiul soiurilor noi si a unor hibryi de perspectiva la prun sub aspectul calitatii fructelor. Lucrarile Sesiunii Tehnico – Stiintifice «Zilele prunului», Ed. I: 103-115.
16. Sahamishirazi, S, Moehring, J., Claupein, W., Graeff-Hoenninger, S., 2016. Quality assessment of 178 cultivars of plum regarding phenolic, anthocyanin and sugar content. Food chemistry 214: 694-701.
17. Usenik, V., Kastelec, D., Vebric, R., Stampar, F., 2008. Quality changes during ripening of plums (*Prunus domestica* L.). Food Chemistry, 111: 830-836.
18. Vangdal, E., Flatland, S., Nordbo, R., 2007. Fruit quality changes during marketing of new plum cultivars (*Prunus domestica* L.). Horti. Sci. (Prague), 34: 91-95.

## Annex, Tables and Figures

### Annex 1. Questionnaire for assessing fruit quality (cultivars, selections, hybrids) of plum

|   |       |                   |   |   |   |   |
|---|-------|-------------------|---|---|---|---|
| 1. Name .....                             |       |                   |   |   |   |   |
| 2. Occupation.....                        |       |                   |   |   |   |   |
| 3. Tasting location.....                  |       |                   |   |   |   |   |
| 4. Date of tasting.....                   |       |                   |   |   |   |   |
| Analyzed traits                           | Scale | Sample (cultivar) |   |   |   |   |
| 5. Exterior (commercial) aspect of fruits | Marks | 1                 | 2 | 3 | 4 | 5 |
| Size                                      | 1-9   |                   |   |   |   |   |
| Shape                                     | 1-9   |                   |   |   |   |   |
| Skin colour                               | 1-9   |                   |   |   |   |   |
| 6. Pulp traits                            | Marks |                   |   |   |   |   |
| Taste                                     | 1-9   |                   |   |   |   |   |
| Aroma                                     | 1-9   |                   |   |   |   |   |
| Juiciness                                 | 1-9   |                   |   |   |   |   |
| Stone adherence                           | 1-9   |                   |   |   |   |   |
| 7. General mark (5+6)                     | 7-63  |                   |   |   |   |   |

**Table 1. Fruits characteristics of varieties studied**

| No. | Variety               | Harvesting time | Fruits soluble solids content (%) |
|-----|-----------------------|-----------------|-----------------------------------|
| 1   | Agent                 | 15.08           | 25.4***                           |
| 2   | Albatros              | 10.08           | 18.5***                           |
| 3   | Alina                 | 10.08           | 17.4***                           |
| 4   | Carpatin              | 26.07           | 19.1***                           |
| 5   | Centenar              | 25.07           | 18.0***                           |
| 6   | Dambovita             | 28.08           | 14.7***                           |
| 7   | Flora                 | 8.08            | 16.7***                           |
| 8   | Gras ameliorat        | 30.08           | 18.3***                           |
| 9   | Ialomita              | 15.07           | 13.7                              |
| 10  | Pescarus              | 2.08            | 14.8***                           |
| 11  | Pitestean             | 28.07           | 13.6                              |
| 12  | Renclod de Caransebes | 2.08            | 15.8***                           |
| 13  | Roman                 | 5.08            | 14.8***                           |
| 14  | Romanta               | 25.08           | 15.6***                           |
| 15  | Tuleu timpuriu        | 27.07           | 15.4***                           |
| 16  | Tita                  | 26.07           | 18.3***                           |
| 17  | Sarmatic              | 1.08            | 14.3                              |
| 18  | Superb                | 10.08           | 18.1***                           |
| 19  | Stanley (control)     | 25.08           | 14.0                              |

LSD 5% = 0.373%; LSD 1% = 0.498%; LSD 0.1% = 0.655%

**Table 2 . Chemical characteristics of fruits on plum varieties studied**

| No. | Cultivar              | pH* | Malic acidity (%)** | Citric acidity (%)*** | Tartric acidity (%)**** |
|-----|-----------------------|-----|---------------------|-----------------------|-------------------------|
| 1   | Agent                 | 3.6 | 0.36 <sup>000</sup> | 0.35 <sup>000</sup>   | 0.41 <sup>000</sup>     |
| 2   | Albatros              | 3.3 | 0.62 <sup>000</sup> | 0.59 <sup>000</sup>   | 0.70 <sup>000</sup>     |
| 3   | Alina                 | 3.6 | 0.67 <sup>0</sup>   | 0.64 <sup>0</sup>     | 0.75 <sup>0</sup>       |
| 4   | Carpatin              | 3.2 | 0.37 <sup>000</sup> | 0.36 <sup>000</sup>   | 0.39 <sup>000</sup>     |
| 5   | Centenar              | 3.3 | 0.30 <sup>000</sup> | 0.30 <sup>000</sup>   | 0.32 <sup>000</sup>     |
| 6   | Dambovita             | 3.3 | 0.66 <sup>00</sup>  | 0.63 <sup>00</sup>    | 0.74 <sup>00</sup>      |
| 7   | Flora                 | 3.2 | 0.30 <sup>000</sup> | 0.29 <sup>000</sup>   | 0.33 <sup>000</sup>     |
| 8   | Gras ameliorat        | 3.7 | 0.35 <sup>000</sup> | 0.34 <sup>000</sup>   | 0.40 <sup>000</sup>     |
| 9   | Ialomita              | 3.4 | 0.33 <sup>000</sup> | 0.32 <sup>000</sup>   | 0.35 <sup>000</sup>     |
| 10  | Pescarus              | 3.4 | 0.30 <sup>000</sup> | 0.29 <sup>000</sup>   | 0.31 <sup>000</sup>     |
| 11  | Pitestean             | 3.4 | 0.33 <sup>000</sup> | 0.32 <sup>000</sup>   | 0.35 <sup>000</sup>     |
| 12  | Renclod de Caransebes | 3.5 | 0.37 <sup>000</sup> | 0.35 <sup>000</sup>   | 0.42 <sup>000</sup>     |
| 13  | Roman                 | 3.5 | 0.36 <sup>000</sup> | 0.35 <sup>000</sup>   | 0.41 <sup>000</sup>     |
| 14  | Romanta               | 3.6 | 0.57 <sup>000</sup> | 0.55 <sup>000</sup>   | 0.64 <sup>000</sup>     |
| 15  | Tuleu timpuriu        | 3.3 | 0.35 <sup>000</sup> | 0.34 <sup>000</sup>   | 0.37 <sup>000</sup>     |
| 16  | Tita                  | 3.2 | 0.36 <sup>000</sup> | 0.34 <sup>000</sup>   | 0.39 <sup>000</sup>     |
| 17  | Sarmatic              | 3.6 | 0.49 <sup>000</sup> | 0.46 <sup>000</sup>   | 0.54 <sup>000</sup>     |
| 18  | Superb                | 3.4 | 0.30 <sup>000</sup> | 0.30 <sup>000</sup>   | 0.31 <sup>000</sup>     |
| 19  | Stanley (control)     | 3.7 | 0.71                | 0.68                  | 0.79                    |

\* LSD 5% = 0.317; LSD 1% = 0.423; LSD 0.1% = 0.556

\*\* LSD 5% = 0.038%; LSD 1% = 0.050%; LSD 0.1% = 0.066%

\*\*\* LSD 5% = 0.035%; LSD 1% = 0.047%; LSD 0.1% = 0.062%

\*\*\*\* LSD 5% = 0.034%; LSD 1% = 0.046%; LSD 0.1% = 0.061%

**Table 3. Sensory evaluation of fruits**

| Cultivar               | Appearance (1-9) |             |              |                     | Pulp traits (1-9) |       |           |                 |               | General score<br>*** |
|------------------------|------------------|-------------|--------------|---------------------|-------------------|-------|-----------|-----------------|---------------|----------------------|
|                        | Fruit size       | Fruit shape | Fruit colour | Total score*        | Taste             | Aroma | Juiciness | Stone adherence | Total score** |                      |
| Agent                  | 6.0              | 7.7         | 6.0          | 19.7 <sup>000</sup> | 6.0               | 6.4   | 5.8       | 5.4             | 23.6          | 43.3 <sup>000</sup>  |
| Albatros               | 7.9              | 7.8         | 6.5          | 22.2 <sup>000</sup> | 5.0               | 6.2   | 5.6       | 5.5             | 22.3          | 44.5 <sup>000</sup>  |
| Alina                  | 8.5              | 8.6         | 6.8          | 23.9                | 5.8               | 6.4   | 6.7       | 6.9             | 25.8**        | 49.7***              |
| Carpatin               | 8.5              | 8.5         | 6.8          | 23.8                | 6.8               | 6.7   | 7.6       | 6.8             | 27.9***       | 51.7***              |
| Centenar               | 7.0              | 8.5         | 8.8          | 24.3**              | 7.0               | 6.9   | 7.0       | 7.0             | 27.9***       | 52.2***              |
| Dambovita              | 9.0              | 8.0         | 8.8          | 25.8***             | 5.2               | 6.8   | 6.2       | 6.5             | 24.7          | 50.5***              |
| Flora                  | 8.4              | 7.8         | 6.8          | 23.0 <sup>000</sup> | 5.0               | 6.7   | 5.2       | 5.1             | 22.0          | 45.0 <sup>000</sup>  |
| Gras ameliorat         | 8.3              | 8.0         | 6.8          | 23.1 <sup>000</sup> | 6.2               | 6.4   | 6.5       | 6.9             | 26.0**        | 49.1***              |
| Ialomita               | 6.0              | 7.9         | 6.2          | 20.1 <sup>000</sup> | 5.0               | 5.5   | 5.0       | 6.7             | 22.2          | 42.3 <sup>000</sup>  |
| Pescarus               | 7.0              | 8.5         | 8.8          | 24.3**              | 6.2               | 5.6   | 6.4       | 6.8             | 25.0*         | 49.3***              |
| Pitestean              | 7.5              | 8.8         | 8.8          | 25.1***             | 5.6               | 5.7   | 6.5       | 6.8             | 24.6          | 49.7***              |
| Renclocl de Caransebes | 7.5              | 7.6         | 6.8          | 21.9 <sup>000</sup> | 5.8               | 5.8   | 6.2       | 6.7             | 24.5          | 46.4 <sup>00</sup>   |
| Roman                  | 8.2              | 7.8         | 6.7          | 22.7 <sup>000</sup> | 5.8               | 5.9   | 5.1       | 5.5             | 22.3          | 45.0 <sup>000</sup>  |
| Romanta                | 9.0              | 8.5         | 9.0          | 26.5***             | 5.5               | 5.5   | 6.8       | 5.7             | 23.5          | 50.0***              |
| Tuleu timpuriu         | 6.9              | 7.8         | 7.3          | 22.0 <sup>000</sup> | 6.5               | 5.8   | 6.4       | 6.8             | 25.5**        | 47.5                 |
| Tita                   | 8.8              | 8.5         | 8.1          | 25.4***             | 6.8               | 6.3   | 7.2       | 6.5             | 26.8***       | 52.2***              |
| Sarmatic               | 6.1              | 7.0         | 8.2          | 21.3 <sup>000</sup> | 5.7               | 5.5   | 6.2       | 6.5             | 23.9          | 45.2 <sup>000</sup>  |
| Superb                 | 7.0              | 7.0         | 7.5          | 21.5 <sup>000</sup> | 5.4               | 5.4   | 5.7       | 6.2             | 22.7          | 44.2 <sup>000</sup>  |
| Stanley (control)      | 7.0              | 8.5         | 8.3          | 23.8                | 5.3               | 5.3   | 6.0       | 6.7             | 23.3          | 47.1                 |

\* LSD 5% = 0.330; LSD 1% = 0.441; LSD 0.1% = 0.580

\*\* LSD 5% = 1.639; LSD 1% = 2.190; LSD 0.1% = 2.880

\*\*\* LSD 5% = 0.439; LSD 1% = 0.587; LSD 0.1% = 0.771