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Preliminary Observations on Some Sicilian Pomegranate (*Punica granatum* L.) Varieties

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Abstract

The pomological and analytical characteristics of 6 Sicilian pomegranate selections: 'Dente di Cavallo,' 'Neirana,' 'Profeta,' 'Racalmuto,' 'Ragana,' and 'Selinunte' were studied in the same experimental orchard located in Sicily in comparison to those of the 'Roja' Spanish cultivar grown in the same environment. The average characteristics of the indigenous accessions were somewhat less attractive than the Spanish cultivar. All the tested accessions had qualitative characteristics that fit general commercial requirements. However, significant statistical differences emerged among the cultivars for all the observed pomological and analytical characteristics. Compositional analyses revealed that, with the exception of 'Racalmuto,' all the local accessions can be included in the group of sweet cultivars.

'Racalmuto' had the highest fruit weight, the lowest percentage of pulp and, because of the lowest titratable acidity, showed a value of total soluble solids content/titratable acidity 4-5 times less than the average of the remaining accessions.

Overall, a considerable amount of variation has been found among the different local accessions, especially as far as number of arils per fruit and titratable acidity are concerned.

Introduction

Pomegranate cultivation has a long tradition in the Mediterranean countries. Native to the Middle East (Iran, Caucasus) it spread to the Balkans throughout the north-east of India. The Mediterranean area is its most important secondary centre of origin and diversification (6). It was probably introduced to Italy during the Roman Empire from Northern Africa following the Punic Wars and the destruction of Carthago (8). Its original name used by the Romans was "malum punicum," i.e. Cartagho's Apple. Plinio stated: "but it is the territory near Cartagho that claims malum punicum, as evidenced by the name, otherwise called 'granatum'" (literally 'seed' in Latin).

Although spread as a minor fruit tree species throughout the Italian regions, in areas from sea level to an height of 800 m above sea level (7), pomegranate cultivation suffered a great reduction in acreage over time. Historically, pomegranate cultivation in Sicily was certainly pushed during the Arab domination (827-1040 A.D.). In the period of the 14th and 15th century it is mentioned in notarial deeds among the most common fall ripening fruits and the names of different varieties, together with generic 'sweet' or 'sour' types are also reported (3). Among the latter type a variety named 'Cartasi' (i.e. papery) is often mentioned probably in reference to the paper consistency of its seed. The most complete survey on Sicilian pomegranate germplasm was performed in the early 1960s (4). In this study, four main varieties were described: 'Dente di cavallo'; 'Dente di cavallo tipica'; 'Dente di cavallo a coccio duro' and 'Dente di cavallo tardiva,' all from the eastern part of Sicily. Until recently no information was available on the consistence and characteristics of the pomegranate germplasm in other parts of Sicily. This study was carried out on six accessions, all with hard tegumen of the seeds, which have been selected after a preliminary survey in the field among about forty accessions. Most of these were discarded due to the high degree of fruit cracking.

Materials and Methods

Starting from 1988, six pomegranate accessions, (2 accessions from Agrigentum

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Table 1. Average fruit weight, percent of pulp, pulp/seed ratio and pericarp thickness in different pomegranate accessions.

Accession	Fruit weight (g)	Pulp (%)	Pulp/Seed (g/g)	Pericarp thickness (cm)
Dente di cavallo	392 bc	61 c	17 b	0.42 a
Neirana	268 a	55 bc	14 a	0.35 a
Profeta	265 a	90 c	21 bc	0.44 ab
Racalmuto	462 c	48 a	15 a	0.49 abc
Ragana	314 ab	50 ab	24 cd	0.57 bc
Roja	382 bc	61 c	29 e	0.42 a
Selinunte	339 ab	49 a	22 bc	0.59 c

Different letters within columns indicate significant differences among accessions ($P \leq 0.05$).

district: 'Ragana' and 'Racalmuto,' 2 from Trapani district: 'Profeta' and 'Selinunte,' and one from Messina and Ragusa districts, respectively: 'Neirana' and 'Dente di cavallo,' together with a Spanish selection ('Roja') from the region of Murcia, were grown in an experimental orchard located at Castelvetrano (Trapani district, 37.30° N, at sea level). The experimental design was completely randomized block with 15 self-rooted trees, 5 x 3 m spaced and free shaped, per accession. Nine trees per accession, in 3 replicates per block were used in this study.

Observations were carried out during three consecutive years on trees at the stages of third to fifth leaf in the field. Fruit characteristics were studied yearly on a ten fruits sample per accession collected randomly. In the lab, fruit longitudinal and transversal (max and min) diameters, fruit weight, and thickness of pericarp were measured. One hundred-aril samples for each accession were used to determine the weight of a single aril and single seed, after the removal of the pulp.

It was therefore possible to calculate a number of parameters such as the ratio between pulp and seed, the percentage of seed on the whole fruit and the shape index. The juice from arils was extracted and filtered for compositional analysis (10ml/accession). Total soluble solids content (TSS), titratable acidity (percent citric acid - TA), pH and the TSS/TA ratio were determined.

Data were processed by ANOVA and the means separation was performed by Tukey's HSD Test for $P \leq 0.05$. In order to assess and describe the overall degree of variability existing among the tested accessions a coefficient of variation (c.v.) was calculated for each parameter.

Results and Discussion

'Racalmuto' had the largest fruit, with a mean weight of 120 g more than the cumulative mean weight, and a maximum transversal diameter of about 2 cm wider than that of the 'Neirana' the smallest cultivar.

The mean dimensional characteristics of the indigenous accessions were general-

Table 2. Longitudinal diameter, maximum and minimum width and shape coefficient in fruit of different pomegranate accessions.

Accession	Longitudinal diameter (cm)	Max. Width (cm)	Min. Width (cm)	Shape index (L.D./ Max T.D.)
Dente di cavallo	8.00 b	9.53 cd	8.86 bc	0.84 bc
Neirana	6.95 a	8.28 a	7.84 a	0.84 bc
Profeta	6.78 a	8.34 ab	7.86 a	0.81 ab
Racalmuto	8.19 b	10.19 d	9.64 c	0.81 ab
Ragana	7.18 a	8.88 abc	8.54 ab	0.81 ab
Roja	8.05 b	9.24 c	8.82 bc	0.87 c
Selinunte	7.32 a	9.14 bc	8.67 b	0.80 a

Different letters within columns indicate significant differences among accessions ($P \leq 0.05$).

Table 3. Average n° of arils per fruit, 100-Aril weight, 100-Seed weight and percent of seed weight/fruit weight in different pomegranate accessions.

Accession	Number of arils per fruit	Aril weight (g/100 arils)	Seed weight (g/100 seeds)	% seed wt./fruit wt.
Dente di cavallo	428 ab	60.5 c	3.27 d	3.75 cd
Neirana	600 c	27.2 a	1.90 ab	4.34 d
Profeta	359 a	46.2 b	2.22 bc	3.08 bc
Racalmuto	524 bc	39.0 b	2.23 c	3.18 bc
Ragana	361 a	44.9 b	1.94 abc	2.31 ab
Roja	529 bc	46.2 b	1.56 a	2.14 a
Selinunte	424 ab	42.6 b	1.95 abc	2.38 ab

Different letters within columns indicate significant differences among accessions ($P \leq 0.05$).

ly below the average of 'Roja' the Spanish selection.

The shape index, obtained from the ratio between longitudinal diameter and max. transversal diameter, indicated a significant more pronounced flattened shape prevailing among the indigenous accessions in comparison to 'Roja' (tables 1-2).

The internal, qualitative characteristics (tables 1, 3 and 4) presented by the indigenous accessions are somewhat less attractive than those of 'Roja,' even if with some exception.

The percentage of pulp on the whole fruit fluctuates considerably among the different Sicilian accessions with a maximum of 90% in 'Profeta' and a minimum of 48% in 'Racalmuto.'

The ratio between the edible pulp and seeds, pericarp thickness, 100-seed weight together with the weight incidence of the seed on the whole fruit were generally better in 'Roja.'

However, the 100-seed weight was always low when compared with values of 3 to 6 grams that have been reported for the Israeli cultivars Shami and Muleís Head, and the American 'Wonderful' (9).

Tendency to fruit cracking was low, except in 'Neirana' (data not reported). Compositional analyses revealed that all the tested accessions can be included, according to Evreinoff classification (5), in the group of sweet cultivars (TA < 0.9%), with the exception of 'Racalmuto' that can be included in the 'sour' group (TA > 1.8%), whereas no 'sweet-sour' accessions (TA 0.9-1.8%) were found.

All the tested accessions had a TSS higher than the minimum threshold generally required for commercial use (12%). Furthermore TSS values always fell in the range of 11-16% suggested by other authors for the Israel conditions (2).

TSS/TA was particularly high in 'Ragana' as a consequence both of a low TA and of a high TSS, whereas TSS/TA was lowest in 'Racalmuto' leading to its inclusion in the sour group.

The variation was great, among the indigenous accessions, especially for number of arils per fruit (c.v. ≅ 30%), TSS/TA

Table 4. Titratable acidity (TA), pH, total soluble solids (TSS) and TSS/TA in fruit of different pomegranate accessions.

Acession	pH	TA (%)	TSS °Brix)	TSS/TA
Dente di cavallo	4.2 c	0.4 abc	12.9 a	32 c
Neirana	3.9 b	0.7 d	15.9 c	24 b
Profeta	3.9 b	0.5 c	14.6 b	31 c
Racalmuto	3.3 a	2.0 e	15.9 bc	8 a
Ragana	4.0 bc	0.3 a	16.3 c	53 e
Roja	4.0 bc	0.4 bc	16.9 c	40 d
Selinunte	3.9 b	0.3 ab	16.3 c	49 e

Different letters within columns indicate significant differences among accessions ($P \leq 0.05$).

and TA. Particularly, this last character was extremely variable (c.v. ≅ 83%) due to the inclusion in the calculation of 'Racalmuto' a sour genotype among sweet genotypes. If we do not consider 'Racalmuto,' the remaining accessions showed a more restricted variation with a TA ranging from 0.32% for 'Ragana' to 0.67% for 'Neirana.' All the characters related to fruit dimension had the smallest variation (c.v. ≅ 7%). Similarly, pH and TSS showed a low variation. The other considered parameters presented a degree of variation of about 20%.

Conclusions

Although only a small portion of the existing indigenous pomegranate germplasm was considered in this study, the data demonstrates the existence of valuable pomological traits among the tested accessions. For most of these characters the observed values can be considered comparable, sometimes superior, to those presented by other well-known cultivars from other countries (1, 2, 9).

The between-accession variability indicates the existence of a considerable degree of variation, especially as far as characters such as number of arils per fruit, 100-seed weight, TA and TSS/TA are concerned. This interesting source of genetic diversity needs to be better studied and preserved from the risk of extinction for future breeding programmes.

An ongoing international project supported by the E.U. (GENRES 29) on conservation, evaluation, and utilization of minor fruit tree species involves pomegranate in Greece, Italy and Spain, and maintain in collections about of 100 accessions.

References

1. Al-Khatani, H. A. (1992). Intercultivar differences in quality and postharvest life of pomegranates influenced by partial drying. J. Amer. Soc. Hort. Sci., 117:100-104.
2. Ben-Arie, R., Segal, N. and Guefat-Reich, S. (1984). The maturation and ripening of the 'Wonderful' pomegranate. J. Amer. Soc. Hort. Sci., 109:898-902.
3. Bresc H. (undated). Les Jardins de Palerme (1290-1460).
4. Damigella, P. (1960). La coltura del melograno (*Punica granatum* L.) nella Sicilia orientale. Tecnica Agricola, 6:591-605.
5. Evreinoff, V. A. (1957). Contribution a l'etude du granadier. J. Agr. Trop. Bot. Appl., 3/4:124-138.
6. Levin, G. M. (1994). Pomegranate (*Punica granatum*) plant genetic resources in Turkmenistan. Plant Gen. Res. Newsletter, 97:31-36.
7. Pignatti, S. (1982). Flora d'Italia. Calderini, Bologna.
8. Scortichini, M. (1990). Il melograno. Frutticoltura, 2:41-48.
9. Shulman, Y., Fainberstein, L. and Lavee, S. (1984). Pomegranate fruit development and maturation. J. Hort. Sci., 59:265-274.

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The Wilder Medal is conferred on individuals or organizations which have rendered outstanding service to horticulture in the area of pomology. Special consideration is given to work relating to the origination and introduction of meritorious fruit cultivars. Individuals associated with either commercial concerns or professional organizations will be considered if their introductions are truly superior and have been widely planted.

Significant contributions to the science and practice of pomology other than through fruit breeding will also be considered. Such contributions may relate to any important area of fruit production such as rootstock development and evaluation, anatomical and morphological studies, or noteworthy publications in any of the above subjects.

To obtain nomination guidelines, contact committee chairperson, Desmond R. Layne, Dept. of Horticulture, Box 340375, Clemson University, Clemson, SC 29634-0375; phone: 864-656-4960; fax: 864-656-4960; e-mail: dlayne@clemson.edu. Nominations must be submitted by **1 May 2001.**