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SELECTION AND EVALUATION OF AUTOHTONOUS POMEGRANATE (*PUNICA GRANATUM* L.) CLONES

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ABSTRACT

Punica granatum or pomegranate is a fruit crop that requires mild climate areas. Scattered shrubs and trees can be found in Romania, mainly in gardens. Most of these plants are grown for ornamental purpose. In the present paper a number of 7 pomegranate clones selected in Vâlcea area are presented. The clones were studied from 2002 from the point of view of their behavior in the growing and fruiting processes. 4 of the clones (VL 5.1.4, VL 4.2.3, VL H.D.1 and VL H.D.2) proved good adaptability to the temperate continental climate that has Mediterranean influences and exhibited superior ornamental potential. These clones are recommended for propagation and culture in the Oltenia gardens and parks. Selection of new genotypes of pomegranate from this region has to be continued.

INTRODUCTION

Punica granatum or pomegranate, known under the names *rodie* or *rodiu* (in România), *rinom* (in Iran), *ruman* (in Arab countries), is a fruit and ornamental small tree or shrub known in Persia from 3000 B.C. (Sonea, 1984).

Pomegranate tree is native from Iran to the Himalayas, in the northern India and has been cultivated since ancient times throughout the Mediterranean region of Asia, Africa and Europe. Later, it was spread to SE Asia, India, Indonesia and tropical Africa. In the 17th Century was introduced to Bermuda and then to Central and South America. In 1769 it was brought to California by the Spanish settlers (Morton, 1987).

In Europe, the northern limit of pomegranate growing is South of Bulgaria, Dalmatian Coast, Po Valley or Padan Plains in Italy and Southern France. As ornamentals, pomegranate shrubs can be grown (with covering during winter) up to Southern Carpathian Mountains in Romania, Croatia, Serbia, FYROM (Former Yugoslav Republic of Macedonia), Albania, Slovenia, etc (Mitchell, 1984).

The evolution and importance of this crop has lead to selection and breeding of a large number of valuable cultivars for quality fruit production. Some of the best known cultivars for fruits are: 'Wonderful', 'Spanish Ruby', 'Sweet Fruited', 'Malisi', 'Poona', 'Granada Agria', 'Kandahari', 'Muscat Red', etc.

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Commercial pomegranate orchards are located in Northern Africa, Egypt, Israel, Syria, Lebanon, Turkey, Greece, Cyprus, Italy, France, Spain, Portugal, Iran, Iraq, India, China, Afghanistan, Bangladesh, Myanmar, Vietnam, Thailand, Kazakhstan, Turkmenistan, Tajikistan, Kirgizstan, Armenia, Georgia, U.S.A., Mexico, Argentina and Chile. World production of pomegranate fruits is estimated to be around 1.5 million tons annually. The most important producers are: Iran (600,000 t), India (500,000 t), China (260,000 t), U.S.A. (110,000 t) and Turkey (90,000 t). The largest planted areas are located in Iran (65,000 ha), India (54,750 ha), etc (Holland and Bar-Ya'akov, 2008).

Punica granatum species has important genetic variability (sweet or acid fruits, branches with or without thorns, different shapes and colors of flowers, etc).

Pomegranates are not specific to Romanian climatic conditions because temperatures below -12°C affect them drastically, fruits are ripening only very late in the autumn. Beside this, in the last 15-20 years ornamental pomegranate shrubs spread in the courtyards mainly in Oltenia region (in Vâlcea, Mehedinți, Gorj Counties), where protection during winter is rarely required.

Because pomegranates are used mainly for ornamental purposes in Oltenia in the courtyards and parks this paper has the aim to clarify some aspects regarding selection and culture of some genotypes in the Valcea area and to recommend a more sustained use not only for ornamental scope but also for fruit production.

MATERIALS AND METHODS

The research activity started in 2000 at SCDP Vâlcea. Initially, selections originated from Turkey were investigated, in the end they proved productive but vulnerable to low temperatures during winter. In the second stage, old pomegranate plants from Vâlcea area were selected. Once identified and tagged, selections were clonally propagated through suckers and then planted in the trial. The clones were planted in the trial in 2002 at 4 m by 3 m distances (833 shrubs/ha). Each clone is represented by 4-5 plants trained as trees. Growing and bearing fruits habits were observed and data was collected.

RESULTS AND DISCUSSIONS

Punica granatum shrubs that were used for clonal selection in Vâlcea were old (80-100 years), being in the 3rd or 4th growing generations. 7 clones were selected so far (Table 1). These clones have good adaptability to the specific environmental conditions from North Oltenia where were not affected by winter cold. With the exception of common traits like presence of numerous suckers, opposite leaves which are oblong, glossy and of dark green color, there is a large genetic variability that allows their discrimination. After 6 years of growth, the trees exhibit different vigor (low, medium or high) due to different elements (Table 1).

The Trunk Cross Sectional Area (T.C.S.A.) varies from 7.9 cm^2 (VL H.D.1) to 19.1 cm^2 (VL 4.2.3). Comparatively with control clone (VL 1.1.0) which has a T.C.S.A. of 9.2 cm^2, 4 clones have positive very significant values (VL 4.2.3; VL 5.1.4, VL 2.3.0 and VL H.D.2) and only VL H.D.1 clone has a negative very significant value of T.C.S.A.

The crown diameter and average height of trees have each one very close limit (102-200 cm and 147-195 cm respectively).

The crown volume is very important for pomegranate trees, larger it is more flowers and fruits are produced.

The largest crown volumes were recorded for VL H.D.2 (4.07 m^3) and VL 4.2.3. (2.84 m^3) clones, in the case of the others the differences are not significant. Out of the 7 clones which were studied, 4 do not have thorns on branches (VL 1.1.0; VL 5.1.4; VL 3.2.3. and VL 2.3.0), the rest of 3 clones have thorns.

Flowering period of pomegranate clones varies from 86 to 107 days, that means end of May and beginning of June till first 2 weeks of September. The clones which were studied showed differences of 2 to 10 days between them regarding beginning and end of flowering (Table 2).

The flower load during blooming is very important and specific. Number of flowers on trees varies from 80 (VL3.2.3) to 132.7 flowers in average (VL 5.1.4), each clone having its specificity. Another important trait is the flower structure, 6 clones have double flowers with numerous petals (59-95), and only VL 4.2.3 clone shows simple flowers with 6 petals (Table 3). Petal color is white-yellowish for 4 clones, orange for VL 4.2.3, orange and white for VL H.D.1 and dark red in the case of VL H.D.2. The sepals have same color like the petals for 6 of the clones, the exception being VL H.D.1. Sepal number is 5 for VL1.1.0, the rest of clones having 4 to 9 sepals.

Flowers size is relatively large (3.1 to 4.9 cm in diameter) and flower height oscillates from 3.7 to 4.5 cm, with the exception of VL 4.2.3. (3.1 and 3.8 cm).

The fruits are false berries, globose, large (up to 12 cm in diameter), of various colors and with persistent calyx (Table 4).

Fruit set varies from flower to flower; their formation is gradual, for this reason only 22 to 33% reach maturation. VL H.D.1 and VL H.D.2 did not set any fruits.

The fruit weight is between 165 to 202 g depending on the clone. Fruit color is green- yellowish, slightly red on the sunny side with the exception of VL 4.2.3 which has dark red fruits.

Fruit yield per hectare is relatively low (344-1542 kg/ha), fruits are acid and crack during rainy period at the end of September. The fruit yield is not economically efficient and the fruits have mainly ornamental use.

Out of the clones which were studied VL 5.1.4, VL 4.2.3, VL H.D.2 and VL H.D.1 can be recommended for propagation and growing in Oltenia in parks and gardens. These 4 clones are well adapted to the continental temperate climate from Oltenia which has sub-Mediterranean influences and have superior ornamental characteristics.

The selection and evaluation of *P. granatum* genotypes from the geographical area of Oltenia have to be carried on in the future too.

Table 1

Growth characteristics of *Punica granatum* clones at SCDP Vâlcea (5th-6th leaf)

No.	Clones	Trunk Cross Sectional Area (cm^2)			Crown diameter (cm)	Tree height (cm)	Crown volume (m^3)			Thorn presence	Tree vigor
		T.C.S.A. mean	±	Significance			Quantity	±	Significance		
1	VL 1.1.0 (Control)	9.2	-	-	128	147	1.90	-	-	no	low
2	VL 5.1.4	13.8	4.6	***	131	175	2.32	0.42	-	no	median
3	VL 4.2.3	19.1	9.9	***	176	195	4.74	2,84	***	no	high
4	VL 3.2.3	9.6	0.4	-	124	167	2.01	0.11	-	no	low
5	VL 2.3.0	10.7	1.5	***	126	159	1.98	0.08	-	no	median
6	VL H.D.1	7.9	-1.3	000	102	170	1.38	-0.52	-	no	low
7	VL H.D.2	11.6	2.4	***	200	190	5.97	4.07	***	no	high
	Mean	11.7	-	-	141	172	2.90	-	-	no	-

LSD 5% = 0.61 cm^2 LSD 1% = 0.83 LSD 0.01% = 1.14 LSD 5% = 0.92 m^3 LSD 1% = 1.26 LSD 0.01% = 1.72

Table 2

Timing and flowering capacity of *Punica granatum* clones at SCDP Vâlcea (5th-6th leaf)

No.	Clones	Flowering period (2008-2009)			Flower load on tree		
		Beginning of flowering	End of flowering	No. of days with flowers	25.06-05.07	25.08-05.09	No. flowers / Total no. of days
1	VL 1.1.0 (Control)	25-30.05	01.09-05.09	92-102	102.0	6.2	108.2
2	VL 5.1.4	20.05-25.05	01.09-05.09	97-107	112.2	20.5	132.7
3	VL 4.2.3	24.05-03.06	20.08-31.08	80-92	132.5	1.5	134.0
4	VL 3.2.3	24.05-04.06	27.08-08.09	84-106	72.5	7.3	80.0
5	VL 2.3.0	20.05-06.06	01.09-10.09	87-112	94.6	27.6	122.2
6	VL H.D.1	24.05-10.06	01.09-08.09	82-116	84.6	8.7	93.5
7	VL H.D.2	27.05-11.06	03.09-09.09	82-113	97.6	11.4	109.0
	Mean	-	-	86.0-107.0	99.6	11.8	111.4

Table 3

Flower characteristics of *Punica granatum* clones at SCDP Vâlcea (5th-6th leaf)

No.	Clones	Flower type	Petal color	Average no. of petals per flower	Sepal color	Average no. of sepals per flower	Corolla diameter (cm)	Flower height (cm)
1	VL 1.1.0	double	white-yellowish	95	white-yellowish	5	4,2	3,9
2	VL 5.1.4	double	white-yellowish	75	white-yellowish	4-9	3,8	4,1
3	VL 4.2.3	simple	orange	6	orange	4-9	3,1	3,8
4	VL 3.2.3	double	white-yellowish	71	white-yellowish	4-9	3,5	3,9
5	VL 2.3.0	double	white-yellowish	87	white-yellowish	4-9	3,7	3,7
6	VL H.D.1	double	orange and white	63	orange	4-9	4,2	4,4
7	VL H.D.2	double	dark red	59	light red	4-9	4,9	4,5

Table 4

Yield capacity and fruit characteristics of *Punica granatum* clones at SCDP Vâlcea (5th-6th leaf)

No.	Clones	Fruit yield			Fruit color	Fruit shape	Ratio of ripened fruits at 20.09-30.09 (%)
		No. of fruits /tree	Average fruit weight (g)	Quantity* (kg/ha)			
1	VL 1.1.0 (Control)	2.5	165	344	green-yellowish	globose	22
2	VL 5.1.4	6.3	180	945	green-yellowish	globose	28
3	VL 4.2.3	10.7	173	1542	dark red	globose	33
4	VL 3.2.3	4.0	202	673	green-yellowish	globose	27
5	VL 2.3.0	3.6	191	573	green-yellowish	globose	25
6	VL H.D.1	-	-	-	-	-	-
7	VL H.D.2	-	-	-	-	-	-

*Density = 833 trees/ha

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