African Journal of Biotechnology Vol. 8 (19), pp. 4969-4976, 5 October, 2009
Available online at http://www.academicjournals.org/AJB
ISSN 1684–5315 © 2009 Academic Journals

Full Length Research Paper

Evaluation of selected fig genotypes from South east Turkey

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Accepted 4 September, 2009

Turkey has great variations and distributions in wild fig forms as well as fig cultivars. This study was carried out in Mardin and Şanlıurfa provinces during 2004 - 2005. Nine fig genotypes were evaluated in this selection study for two years. In this study, some morphological characteristics investigated were tree growth habit, tree vigour, relative degree of branching, leaf shape and leaf margin dentation. Also, the characteristics of all the fig genotypes were identificated. 63-07-006 and 63-07-007 fig genotypes which had the highest scores in all the fig genotypes according to analysis in the weighted ranked method were evaluated to be best table fig genotypes. In pomological characteristics, fruit weight ranged between 71.77 g (47-02-003) and 43.29 g (63-07-005). Some other values were: 65.26 mm (47-02-003) and 46.99 mm (47-02-019) of width; 56.87 mm (47-02-003) and 38.23 mm (47-02-008) of length; 4.44 mm (63-07-007) and 3.58 mm (47-02-020) of ostiole width; 28.57% (47-02-012) and 16.87% (63-07-007) of total soluble solids (TSS) ratio were determined.

Key words: *Ficus carica*, pomological and morphological characteristics, selection, IPGR, Southeast Anatolia Region.

INTRODUCTION

Fig *(Ficus carica* L.*)* is one of the most important fruit species grown in the Mediterranean countries (Condit, 1947). Anatolia is an important gene source for horticultural crops with varieties which have multiplied numerously during the centuries. Some temperate fruit species as well as figs are also originated in Turkey (Özbek, 1978; Küden, 1995). North, south and west regions of Turkey contain rich fruit germplasm and the fig is one of the most important one among them (Aksoy et al., 1992; Küden et al., 1995; Bostan et al., 1997; Küden and Tanrıver, 1997). Fig is widely grown and extends to the South East Anatolia, the Aegean and the Mediterranean regions. On the way of the extension of fig to the neighbouring countries such as Iraq, Syria, Caspian Sea and Caucasia, a rich genotype population occurs in Anatolia. Therefore, Southeast Anatolia Region has a special place of containing rich fig germplasm (Ilgın, 1995). The total fig production of Turkey is 290,151 tons (Anonim, 2006). Recently there has been a big demand for fresh figs in the European markets. So, fresh figs from Turkey should have a big market in the very near future (Polat and Özkaya, 2005).

Bursa Siyahı is one of the best quality fresh fig cultivar grown in the country and there is an increase in its export (Çalışkan, 2003). In addition to Bursa Siyahı, there are many other good quality fresh cultivars (Polat and Özkaya, 2005). The importance of fresh fig production and exportation have encouraged researchers to find good quality fig cultivars. So, conservation of germplasm selection studies were carried out by several researchers. Küden and Tanrıver (1997) reported that fig selection began with Ulkümen et al. (1948), Ozbek (1949) and continued with Dokuzoguz (1964), Çetiner (1981), Eroğlu (1982), Kaşka et al. (1990), Aksoy et al. (1992), Can (1993), Ilgın and Küden (1997), and Şimşek (2008).

MATERIALS AND METHODS

This study was carried out from 2004-2005 in the provinces of Mardin and Şanlıurfa, which are located in the Southeast Anatolia Region of Turkey. Female fig trees growing in conditions with appropriate nutrition were surveyed during both years and the selected genotypes were evaluated according to Aksoy (1991).

The characteristics of the fruit used to evaluate the genotypes were carefully selected for the requirements of table fig industry. For the pomological analysis, fruits of all the genotypes were analysed using the random blocks design with 3 replication and 10

Table 1. Evaluation of the selected fig types according to the weighted ranking method.

Characteristics	Weighting factor (coeficient)	Classification and points	
Fruit weight	40	<20.0 g	0
		20.1 - 30.0 g	2
		30.1 - 40.0 g	4
		40.1 - 50.0 g	6
		50.1 - 60.0 g	8
		> 60.0 g	10
Fruit shape [index (width/ length) = I]	9	I < 0.9	8
		I = 0.9 - 1.1	10
		I >1.1	6
Neck length	6	<5.0 mm	0
		5.1 - 10.0 mm	10
		10.1 - 15.0 mm	6
		>15.0 mm	2
Fruit skin cracks	10	None-little	10
		medium	6
		High	0
Peeling of skin	10	Easy	10
		medium	6
		difficult	0
Ostiolum width	5	0.0 - 2.0 mm	10
		2.1 - 4.0 mm	8
		4.1 - 6.0 mm	6
		>6.1 mm	2
Total soluble solid content	10	< 13.0%	2
		13.1 - 16.0%	4
		16.1 - 20.0%	10
		20.1 - 25.1%	8
		> 25.1%	6
Titrable acidity	10	< 0. 050%	0
		0.051 - 0.125%	6
		0.126 - 0.225%	8
		0.226 - 0.300%	10
		> 0.301%	4
Total	100		

fruits in each replication for each year. The quality evaluation of types was performed according to a weighted ranked method (Table 1). In addition, the characteristics of the selected genotypes were identified according to IPGRI descriptors (Anonymous, 2003).

RESULTS AND DISCUSSION

Pomological characteristics of fig genotypes

During the study, 9 fig genotypes were selected with special emphasis on the fruit quality characteristics of figs. Considering 2 years mean results (2004 and 2005), fruit weight, fruit width, fruit length, ostiole width, neck length, fruit shape index, TSS, acidity, TSS/acidity and fruit juice pH of the fig genotypes were found statistically different from each other at 5% level (Table 2).

Fruit weight is one of the most important components for determining the size of the fruits. According to the averages of the two years, the fruit weight was found to be highest at 71.77 g in 47-02-003 and lowest at 43.29 g in (63-07-005). The best size was obtained from 47-02-003 fig type. These results were better than those obtained by Ilgın and Küden (1997). They determined the fruit weight ranged between 71.50 and 17.05 g in the

Table 2. Some pomological characteristics of the selected fig genotypes (average of years 2004 - 2005).

Accession number	Average fruit weight (g)	Average fruit width (mm)	Average fruit length (mm)	Average ostiole width (mm)	Average neck length (mm)
47-02-003	71.77 a	65.26 a	56.87 a	3.69 c	4.69 ab
47-02-008	51.36 bc	52.29 b	38.23 d	3.66 c	0.00 d
47-02-012	49.14 bc	47.14 b	51.05 bc	3.75 bc	5.37 a
47-02-019	47.65 c	46.99 b	48.15 c	3.81 bc	4.95 a
47-02-020	44.75 c	48.47 b	42.75 d	3.58 c	3.85 bc
63-07-002	58.24 b	50.97 b	53.63 ab	3.64 c	5.33 a
63-07-005	43.29 c	49.85 b	41.15 d	4.14 ab	3.47 c
63-07-006	52.41 bc	51.85 b	42.76 d	3.74 bc	3.97 bc
63-07-007	45.73 c	53.61 b	49.87 bc	4.44 a	5.24 a

Mean separation within columns by Tukey's test at 0.05 level.

Table 2 (Contd).

Accession number	Average fruit shape index	Average TSS (%)	Average titrable acidity (%)	Average TSS titratable/acidity	Average pH
47-02-003	1.15 bc	23.23 a-d	0.15 c	151.57 a	5.55 a
47-02-008	1.37 a	23.07 a-d	0.19 bc	124.94 ab	5.83 a
47-02-012	0.92 e	28.57 a	0.21 ab	135.53 ab	5.16 abc
47-02-019	0.99 de	25.91 ab	0.22 ab	121.35 ab	5.38 ab
47-02-020	1.13 bc	22.12 b-e	0.25 a	89.94 b	5.76 a
63-07-002	0.95 e	25.05 abc	0.20 abc	125.49 ab	5.59 a
63-07-005	1.21 b	19.82 cde	0.18 bc	110.32 ab	5.21 abc
63-07-006	1.21 b	17.57 de	0.18 bc	96.68 b	4.62 bc
63-07-007	1.07 cd	16.87 e	0.17 bc	99.78 b	4.56 c

Mean separation within columns by Tukey's test at 0.05 level.

province and neighbourhood of K.Maraş which is located in the northeast of the Mediterranean Region of Turkey.

According to the averages of the two years, the fruit width was found to be the highest at 65.26 mm in 47-02-003 and lowest at 46.99 mm in 47-02-019. These results are higher than the results of Küden et al. (2008). Küden et al. (2008). They determined the fruit width ranged between 49.97 and 32.97 mm. In these years, the fruit length was found to be highest at 56.87 mm in 47-02-003 and lowest at 38.23 mm in 47-02-008. These results are higher than the results of Küden et al. (2008). Küden et al. (2008). They determined the fruit length ranged from 48.61 to 31.07 mm in the Mediterranean and Southeast Anatolia Regions of Turkey. In addition, no neck was observed in 1 genotype (47-02-008) while the others had necks and the their neck length changed from 5.37 mm in 47-02-012 to 3.47 mm in 63-07-005. These results are between the results of Polat and Özkaya (2005). Polat and Özkaya (2005) determined the neck length ranged from 0.00 to 8.01 mm. The fruits with neck that are too long were not desired by the table fig industry. The neck length, the fruit width and the fruit width can change according to the charactetistics of the genotypes, maintenance requirements and the ecological conditions.

According to the averages of the two years, the ostiolum width was found to be highest at 4.44 mm in 63-07-007 and lowest at 3.58 mm in 47-02-020. These results are between the values of Polat and Özkaya (2005). Polat and Özkaya (2005). They determined the ostiolum width changed between 9.43 and 1.04 mm in Antakya province in the Mediterranean Region of Turkey. In general, high ostiolum width is an undesirable characteristics.

According to the averages of the two years, the fruit shape index was found to be highest at 1.37 in 47-02-008 and lowest at 0.92 in 47-02-012. These results are lower than the results of all the Abbas types of Ilgın (1995). She determined the fruit shape index ranged from 1.20 to 1.40 for the studied Abbas types in Kahramanmaraş. The fruit index can change according to the genetic characteristics.

According to the averages of the two years, the TSS ratio of the genotypes was changed between 28.57% in 47-02-012 and 16.87% in 63-07-007. These results are

Table 3. Some morphological and phenological characteristics of the selected fig genotypes(average of years 2004 - 2005).

Accession number	Average leaf area (cm^2)	Average number of leaves per shoot	Petiole length (cm)	Number of lobes	Beginning of maturation	Full maturity	Harvest period
47-02-003	142.58 e	6.80 c	5.67 c	7	20-31 July	1-10 August	21-40 days
47-02-008	363.68 a	7.30 c	4.67 cd	3	20-31 July	11-31 August	41-60 days
47-02-012	222.88 c	6.60 c	4.50 cd	7	1-15 August	11-31 August	21-40 days
47-02-019	157.51 de	6.43 c	4.77 cd	3	1-15 August	11-31 August	21-40 days
47-02-020	129.57 e	4.50 d	3.83 d	5	1-15 August	11-31 August	21-40 days
63-07-002	159.07 de	7.57 c	4.93 cd	3	20-31 July	11-31 August	41-60 days
63-07-005	180.59 d	7.53 c	13.83 a	5	20-31 July	11-31 August	41-60 days
63-07-006	158.31 de	11.37 a	8.87 b	5	1-15 August	11-31 August	21-40 days
63-07-007	275.15 b	9.23 b	6.03 c	5	1-15 August	11-31 August	21-40 days

Mean separation within some colums by Tukey's test at 0.05 level.

lower than the result of Kaşka et al. (1990) but higher than the results of Koyuncu (1997). Kaşka et al. (1990) determined the TSS ratio changed between 17.4 and 29.0% in 2 years experiment, while Koyuncu (1997) determined the TSS ratio ranged from 11.90 to 24.30% in fig type under Şanlıurfa conditions. High quality table figs in term of the TSS contents are better if they are between 13.0 and 25.1% (Aksoy et al., 1992). The reason for the difference between the results of these research in term of the TSS ratio of the genotypes is the charactetistics of the genotypes, maintenance requirements and the eco-logical conditions.

According to averages of the two years, titrable acidity was found to be the highest at 0.25% in 47-02-020 and lowest at 0.15 % in 47-02-003. These results are lower than the results of Küden et al. (2008). They determined the titrable acidity ratio changed from 0.18 to 0.48% in 3 years experiment. High quality table figs with respect to the titrable acidity contents are best if they are between 0.226 and 0.300% (Aksoy et al., 1992). The reason for the difference between the results of these research in term of the titrable acidity can change according to the charac-teristics of the genotypes, harvested earlier or later, and the ecological conditions.

According to averages of the two years, the TSS/titrable was found to be highest at 151.57 in 47-02-003 and lowest at 89.94 in 47-02-020. These results are different from the results of Çalışkan (2003). He determined the TSS/titrable changed from 272.80 to 67.70 in 2001 and from 338.00 to 85.00 in 2002. The reason for the difference between the results of these two studies can be the characteristics of the genotypes and the ecological conditions. In addition, fruit juice pH was found to be highest at 5.83 in 47-02-008 and lowest at 4.56 in 63-07-007. These results are higher than the results of Küden et al. (2008). Küden et al. (2008). They determined the fruit juice pH changed between 4.53 and 5.65 in 3 years experiment. The reason for the difference between the results of these researchs in term of the TSS acidity and the fruit juice pH can change according to the charactetistics of the genotypes, harvested earlier or later, and the ecological conditions.

Morphological and phenological characteristics of fig genotypes

Considering 2 years mean results (2004 and 2005), leaf area, number of leaves per shoot and length of leaf stalk of the fig genotypes were found statistically different from each other at 5% level (Table 3).

According to the averages of the two years, the leaf area was found to be highest at 363.68 cm^2 in 47-02-008 and lowest at 129.57 cm^2 in 47-02-020. These results are different from the results of Mısırlı et al. (1997). They determined the leaf area changed between 204.00 cm^2 of Göklop type and 278.00 cm^2 of Dumanlıkara type in Erbeyli town in Aydın, Turkey. In these years, the petiole length was found to be highest at 13.83 cm in 63-07-005 and lowest at 3.83 cm in 47-02-020. These results are different from the results of Küden et al. (2008). They determined the petiole length changed from 9.10 to 5.50 cm. In addition, in the same year, the number of leaves per shoot was found to be highest at 11.37 in 63-07-006 and lowest at 4.50 in 47-02-020. These results are different from the results of Küden et al. (2008). They determined the number of leaves per shoot changed between 6.70 and 10.50. The reason for the difference among the results of these studies in term of the leaf area, the petiole length and the number of leaves per shoot can be due to the charactetistics of the geno-types and the ecological conditions.

In addition, the number of lobes, the beginning of matu-ration, the full maturity and the harvest period of the fig genotypes were investigated in this study (Table 3).

Table 4. The names, the origins, the coordinates, the altitudes and the total points of the selected fig genotypes(average of years 2004-2005).

Accession number	Names of fig genotypes	Origins	Coordinates
47-02-003	Zerık1	Mardin Derik	006-03-108 E-041-36-751 N
47-02-008	Zer	Mardin Derik	006-03-162 E-041-36-875 N
47-02-012	Sincari	Mardin Derik	006-03-044 E-041-37-258 N
47-02-019	Kılıri	Mardin Derik	006-03-165 E-041-36-878 N
47-02-020	Erbani	Mardin Derik	006-03-165 E-061-36-889 N
63-07-002	Şinık	Şanlıurfa Hilvan	004-87-124 E -041-71-254 N
63-07-005	Şin	Şanlıurfa Hilvan	004-87-118 E -041-71-503 N
63-07-006	İzmir İnciri	Şanlıurfa Hilvan	004-87-119 E -041-71-510 N
63-07-007	Zerık2	Şanlıurfa Hilvan	004-85-973 E -041-71-270 N

Table 4. (contd).

Accession number	Ages	Yields (1-5)	Average total points	Altitudes (m)
47-02-003	25	Good efficiency (4)	590	591
47-02-008	23	Good efficiency (4)	539	591
47-02-012	23	Very efficient (5)	536	530
47-02-019	24	Very efficient (5)	532	590
47-02-020	24	Good efficiency (4)	538	595
63-07-002	30	Very efficient (5)	872	535
63-07-005	31	Good efficiency (4)	867	535
63-07-006	30	Very efficient (5)	894	535
63-07-007	29	Good efficiency (4)	874	597

Table 5. Identifications of the characteristics of the fig genotypes (average of years 2004 - 2005).

Accession number	Characteristics and identifications				
	Tree growth habit	Tree vigour	Relative degree of branching	Tendency to form suckers	Terminal bud colour
47-02-003	Spreading	High	Dense	High	Green
47-02-008	Spreading	High	Dense	Medium	Green
47-02-012	Spreading	High	Dense	High	Light green
47-02-019	Spreading	High	Dense	Medium	Pinkish brown
47-02-020	Spreading	High	Dense	Low	Green
63-07-002	Spreading	High	Dense	High	Green
63-07-005	Weeping	High	Dense	High	Green
63-07-006	Spreading	High	Dense	High	Green
63-07-007	Open	Intermediate	Intermediate	Medium	Pinkish brown

Names, origins, coordinates, altitudes, yields, ages and total points of fig genotypes

During the study, total points, names, origins, coordinates, yields, ages and altitudes of the fig genotypes were investigated in this study (Table 4).

According to the averages of the two years, the total point was found to be highest at 894 in 63-07-006 and lowest at 532 in 47-02-019. These results are different from the results of Şimşek (2008). He determined the total point changed between 950 and 559 in the two years. The reason for the difference in the results of these two

Table 5 (Cont'd).

Accession number	Characteristics and identifications			
	Leaf shape	Petiole length	Leaf area	Leaf margin dentation
47-02-003	Base calcarate. lobes linear (A)	Medium	Small	Only upper margins dented
47-02-008	Base decurrent (G)	Short	Medium	Only upper margins dented
47-02-012	Base calcarate. lobes linear (A)	Short	Small	Only upper margins dented
47-02-019	Base decurrent (G)	Short	Small	Lobes sides completely dented
47-02-020	Base calcarate. lobes lyrate (C)	Short	Small	Only upper margins dented
63-07-002	Base decurrent (G)	Short	Small	Only upper margins dented
63-07-005	Base cordate. five lobed. lobes spatulate (B)	Long	Small	Lobes sides completely dented
63-07-006	Base cordate. five lobed. lobes spatulate (B)	Long	Small	Only upper margins dented
63-07-007	Base cordate. five lobed. lobes spatulate (B)	Medium	Medium	Lobes sides completely dented

Table 5. (Cont'd).

Accession number	Characteristics and identifications					
	Density of hairs or spicules on leaf upper surface	Density of hairs or spicules on leaf lower surface	Petiole colour	Fruit shape	Fruit neck length	Fruit length
47-02-003	Sparse	Sparse	Light green	Oblate	Short	Long
47-02-008	Sparse	Sparse	Light green	Oblate	Absent	Short
47-02-012	Sparse	Sparse	Green	Globose	Medium	Medium
47-02-019	Sparse	None	Light green	Globose	Short	Medium
47-02-020	Sparse	Sparse	Light green	Oblate	Short	Short
63-07-002	Sparse	Sparse	Light green	Globose	Medium	Medium
63-07-005	Sparse	Sparse	Green	Oblate	Short	Short
63-07-006	Intermediate	Intermediate	Light green	Oblate	Short	Short
63-07-007	Intermediate	Intermediate	Light green	Globose	Medium	Medium

Table 5 (Cont'd).

Accession number	Characteristics and identifications				
	Fruit width	Fruit cavity	Fruit skin ground colour	Fruit Skin over colour (regular bands)	Shape of the fruit stalk
47-02-003	Very large	Small	Yellow	Green	Short and thick (J)
47-02-008	Large	Small	Yellow	Green	Variously enlarged (A)
47-02-012	Medium	Medium	Light green	Green	Short and thick (J)
47-02-019	Medium	Medium	Green	Absent	Short and thick (J)
47-02-020	Medium	Large	Yellow green	Green	Short and thick (J)
63-07-002	Large	Small	Green	Yellow	Long and slender (I)
63-07-005	Medium	Small	Green	Purple	Long and slender (H)
63-07-006	Large	Medium	Green	Purple	Short and thick (J)
63-07-007	Large	Medium	Yellow	Green	Short and thick (J)

studies in term of the total point is the fruit quality charactetistics and enviromental conditions of the fig genotypes.

Identifications of characteristics of fig genotypes

Characteristics of the selected fig genotypes were identificated. In this study, it was determined that all the genotypes had flat fruit apex shape, various fruit size, scarce abnormal fruit formation, no fruit skin cracks, absence of apical dormancy, conic terminal bud shape, brown shoot colour, bark tuber location trunk and older branches and apparent leaf venation.

Growth habits of trees in 8 genotypes were spreading

Table 5 (Cont'd).

Accession number	Characteristics and identifications						
	Pulp internal colour	Pulp flavour	Ostiole width	Drop at the eye	Colour of liquid drop at the ostiolum	Scale size around the ostiolum	Colour of scales around the ostiolum
47-02-003	Red	Strong	Large	Present	Transparent	Medium	Different from skin
47-02-008	Red	Aromatic	Large	Absent	Absent	Small	Different from skin
47-02-012	Red	Little lavour	Large	Absent	Absent	Small	Same as skin
47-02-019	Dark red	Aromatic	Large	Absent	Absent	Medium	Different from skin
47-02-020	Amber	Aromatic	Large	Absent	Absent	Medium	Different from skin
63-07-002	Amber	Strong	Large	Present	Transparent	Small	Different from skin
63-07-005	Amber	Strong	Very large	Present	Transparent	Medium	Same as skin
63-07-006	Dark red	Strong	Large	Absent	Absent	Medium	Different from skin
63-07-007	Dark red	Strong	Very large	Absent	Absent	Medium	Same as skin

Table 5. (Cont'd).

Accession number	Characteristics and identifications						
	Adhesion of Scales around the ostiolum	Abscission of the stalk from the twig	Total soluble solids	Peeling of skin	Beginning of maturation	Full maturity	Harvest period
47-02-003	Semi-adhered	Hard	High	Easy	Early	Early	Short
47-02-008	Detached	Hard	High	Medium	Early	Mid-season	Long
47-02-012	Detached	Easy	Very high	Easy	Mid-season	Mid-season	Medium
47-02-019	Semi-adhered	Hard	Very high	Easy	Mid-season	Mid-season	Medium
47-02-020	Semi-adhered	Hard	High	Medium	Mid-season	Mid-season	Medium
63-07-002	Detached	Easy	Very high	Easy	Early	Mid-season	Long
63-07-005	Semi-adhered	Easy	Medium	Medium	Early	Mid-season	Long
63-07-006	Semi-adhered	Easy	Medium	Difficult	Mid-season	Mid-season	Medium
63-07-007	Semi-adhered	Hard	Medium	Easy	Mid-season	Mid-season	Medium

and in one genotype was open. These results are different from the results of Küden et al. (2008). They determined the growth habits of trees to be very erect for one genotype, erect for seven genotypes, weeping for five genotypes and spreading for nine genotypes. Growth habit of the tree is heritable and the heritability can change according to the genotypes and diversities.

Vigours of trees in eight genotypes were high and in one genotype was intermediate. These results are different from the results of Küden et al. (2008). They determined the vigours of trees to be low for four genotypes, intermediate for eight genotypes and high for ten genotypes. The vigour of tree can change according to genotypes and diversities as well as the ecological conditions. In addition, the characteristics of the fig genotypes were identificated in Table 5.

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