

SELECTION OF SOME PROMISING LINES THROUGH PEDIGREE METHOD IN OKRA.

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ABSTRACT

The present investigation was carried out with the purpose of selecting new economic okra strains through pedigree method. In this respect, four original cultivars were previously crossed. The resulting F1's of them were self pollinated. Having the descendant F2's in 2004, self pollination and selection based on economic traits was done subsequently for five successive generations. The complete phenotype and genotype homozygosity was then reached having 9 selected strains descended from 5 F2's. In the summer season of 2009, a large scale field experiment was designed and applied to evaluate these promising nine selected strains side by side with their original 4 cultivars.

The most important results obtained can be summarized as follows :

- Differences between all the studied traits were shown to be highly significant for the 9 selected strains as well as 4 original cultivars.
- The 9 selected strains surpassed their 4 original cultivars with respect to the average total yield of pod/plant. It was recorded as 1213.79 gr for the 9 selected strains , 917.41 gr for original 4 cultivars .
- Line number 5 gave the highest mean of yield quantity (1839.54 gr) in comparison to the highest cultivar Balady (1073.8 gr).
- Lines number 5,1,7,6 and 8 surpassed all 4 cultivars with respect to yield quantity. Also lines 3,2 and 9 acted in the same manner as the rest of lines.
- Line number 4 showed the least values for the most studied characters. Line number 5 gave the highest values with respect to days to first flower, number of fruits , number of branches and number of leaves.
- All the nine selected lines showed earlier in comparison to 4 cultivars except Romy cultivar . -Lines number 5,6,1 and 7 gave the highest number of fruits.
- Lines number 3,5 and 2 were the shortest as plant height while line number 6 was the longest (289.3 cm) at all.
- Line number 1 showed the highest value with respect to fruit weight (7.1 gr) while line number 4 was the lowest (4 gr) with respect to this character.
- There was a negative significant correlation between plant height and both number of node and days to first flower. The same was found between fruit length and fruit diameter. Also, there was a highly positive significant correlation between number of fruit and all of number of branches, number of leaves and fruit weight. A highly positive significant correlation between total number of fruits/plant and both fruit weight and number of fruits per plant were detected. Also, a highly positive significant correlation was noticed between fruit diameter and fruit weight and between number of node and days to first flower. Thus, it could be concluded that most of these selected lines are useful for commercial cultivation.

INTRODUCTION

The dramatic expansion of the Egyptian population as well as the drop of national economy caused by the glorious January 25th revolution made it obligatory to increase food production as an ultimate goal. Vegetables consist

a major part of food consumed by the Egyptian population. One of the important vegetable crops in Egypt is okra (*Abelmoschus esculentus*).

In Okra, it is possible to raise green fruit and seed yield as well as the quality by improving agricultural practices and applying suitable breeding programs. Many attempts were done trying to improve several okra characters among them Wahba 2005; Masoud *et al.* 2007; Abo El-khair 2003; Ragheb *et al.*,1994; El-Shaikh and Mohammed, 2009; Mistry and Vashi,2011 and Guddadamath *et al.* 2011. All of the previous researchers found and noticed huge variations for okra traits especially the Egyptian local cultivars (Abd El-maksoud *et al.*,1984; Damarany and Farag,1994; Hussein,1994 and Rashwan, 2011).

In the Egyptian delta, great variations in vegetative,earliness,yield componants and pod quality in okra plants were recorded. In addition, selecting for yield characters with significant positive relationships both genotypically and phenotypically will subsequantly increase yield. Therefore, the present investigation was designed as an attempt to use an important inbreeding and selection programs to select superior strains dominates the local cultivars.

MATERIALS AND METHODS

The present study was carried out during the summer seasons through 2004 up to 2009 at Baramon experimental farm of Horticulture Institute (Mansoura Research Station, ARC). Early in 2004 season there were F2 plant populations produced from selfing F1 resulting from hybridization between sort of four local cultivars i.e. Romy(R),Balady(B),Mansoura Red(HM),and Cairo Red(HK). Twelf F2 populations (all possible hybrids of Okra) were planted and well noticed. Selection of individual plants based on earliness, high number of pods, pod shape and color and uniformition of plant phenotype with moderate vegetable growth was carried out. Inbreeding of the selected plants was carried out for several successive generations and the pollination technique method discribed by Lee (1980) was followed. After 5 generations of inbreeding and selection, nine strains were selected after their complete homoginisity . The nine selected strains and the local 4 cultivars were evaluated during the summer season of 2010 at ElBaramon Farm of Mansoura Research Station, Horticultural Institute, ARC, Egypt. Seeds of all 13 genotypes (4 cultivars + 9 selected strains) were sown in April 4th. The experimental design was a complete randomized block with three replicates. Each plot area was 12 m² including 4 rows, each of 4 m length and 75 cm width and one plant per hill 20 cm apart. Growing plants were thinned to leave one plant per hill just before first irregation. The agricultural practices were regularly done according to the general program of okra cultivation as reported by the Egyptian Ministry of Agriculture. The pedigree of obtaining the nine selected strains was represented in Table (1).

Table 1: The pedigree for obtaining the nine selected strains.

No	Parents		F1	F2	Selected Strains
	female	male			
1	Romy (R)	Balady (B)	(R x B)	F2 (1)	1
2	Romy (R)	Mansoura Red (HM)	(R x HM)	F2 (2)	2
3					3
4					4
5					5
6	Mansoura Red (HM)	Balady (B)	(HM x B)	F2 (3)	6
7	Mansoura Red (HM)	Cairo Red (HK)	(HM x HK)	F2 (4)	7
8	Cairo Red (HK)	Romy (R)	(HK x R)	F2 (5)	8
9					9

Where: R : Romy cultivar , B: Balady cultivar, HM: Mansoura Red Cultivar and HK : Cairo Red Cultivar.

Data of the present investigation were recorded for the following characters:

- 1- Number of first fruiting node (NNF)
- 2- Number of days to flowering (NDF)
- 3- Number of Fruits/plant (NF/p)
- 4- Fruit Weight in grams (FW gr)
- 5- Total product of pods/plant (TP/p gr)
- 6- Number of Branches/plant (NB/p)
- 7- Number of Lecules/fruit (NL/F)
- 8- Plant Height (PH cm)
- 9- Fruit Length in cm (FL cm)
- 10- Fruit Diameter in cm (FD cm)

Statistical Analysis:

Data obtained through this investigation were statistically analyzed according to the methods mentioned in (Cochran and Cox, 1957).

RESULTS AND DISCUSSION

This investigation was carried out at the aim of selecting promising lines of okra. Data in Table (2) represents the analysis of variance and mean squares for ten traits studied in (13) tested genotypes of okra.

Table 2: Analysis of variance and mean squares for Earliness, vegetative and yield traits in 13 tested genotypes of okra.

S. O. V.	D.F.	NNF	NDF	NF/p	FW gr	TP/P gr	NB/p	NL/f	PH cm	FL cm	FD cm
Genotypes (G)	12	2.58**	39.47**	6677**	2.08*	370563**	11.06**	5.83**	6164**	2.81**	1.10**
Error (E)	26	0.38	0.08	603	0.76	59318	3.64	0.56	777	0.22	0.11
Total	38										

(NNF) Number of first fruiting node - (NDF) Number of days to flowering - (NF/p) Number of Fruits/plant - (FW gr) Fruit Weight in grams - (TP/p gr) Total product of pods/plant - (NB/p) Number of Branches/plant - (NL/F) Number of Lecules/fruit - (PH cm) Plant Height - (FL cm) Fruit Length in cm - (FD cm) Fruit Diameter in cm.

*, ** Significant at 0.05 and 0.01 levels probability, respectively

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As shown from Table (2), it's obvious that variations were highly significant for all studied characters as well as between all the 13 genotypes under study i.e (Between 4 parents and 9 selected lines). Also, highly significant differences were noticed within each group of genotypes.

These significant differences allows further comparisons within and between the tested genotypes. Hence, defining the best order of them from the view point of economical importance.

Data in Table (3) represents the mean performance and standard deviation of studied traits in 4 parents and 9 selected promising lines of okra. In general, the 9 selected lines surpassed the 4 original cultivars used in this study for most characters . It was (57-68.3) and (56-59) days to first flower for original cultivars and 9 selected lines, respectively. The shortest period to first flower was recorded as 56 days for the selected lines 1,4,5.

To show how is the bedigree program used is useful in selecting promising lines, the following example of the obtained data is given as following :

The original cultivar Romy (R) was crossed as giving female gamets along with the original cultivar Mansoura Red (HM) as male which resulted in F1 and subsequently in F2-2. The successive selections applied to F2-2 for five generations resulted in lines 4 and 5.

So, (R x HM) → F1 → F2-2 → line 4 → Line 5

Then , (57 x 68.3) → F1 → (62.7) → 560 days → 56.0 days

i.e the selected lines 4 and 5 had the shortest period to first flower (the most earlier lines at all).

Also for the number of fruits / plant , it was found as follows :

(HM x B) → F1 → (F2-3) --- → (line 5)

(153.7 x 182.0) → F1 → (136.7) → (296.7)

i.e the line 5 gave the highest number of fruits per plant, while line 4 gave the least number of fruits / plant (140.0).

With respect to plant height, the shortest value was (140 cm) recorded for Balady and the tallest was (289.3 cm) for line 6 .

While line 5 gave a higher number (10.7) of branches /plant surpassing all the selected lines, the original cultivar Balady was with (12) branches /plant.

Data in Table 3 also represents that the selected lines surpassed the 4 original cultivars with respect to total product of pods weight per plant all over the season. The general mean of the nine selected lines could be calculated as 1213.79 gr, while it could be calculated as 917.41 gr for the 4 original cultivars. In the mean time, line 5 showed the greatest total product of pods weight as (1839.54 gr).

So, arranging the 9 selecting lines in this respect descendingly will be :

5 → 1 → 7 → 6 → 8 → 3 → 2 → 9 and 4 .

It was noticed that line 4 gave the least values for most of the studied characters.

These findings are in accordance with what was found by some investigators who noticed high variation for pods yield of the Egyptian local cultivars of okra (Abd El-Hafez and Salah, 1977 ; Damarany and Farag , 1994; Hussien ,1994; Ragheb *et al.* , 1994; Abo El-Khair , 2003 and Rashwan 2011). The quality of okra is determined by pod length, diameter, weight and color. It's clear from Table 3 that pod length ranged from 3.3 cm up to 6.6 cm in original cultivars and (3.5 → 5.6) in selected lines. The shortest (3.3) was represented by Balady cultivar, while the tallest (6.6), was recorded for Romy cultivar . The average of pod diameter ranged from 4.7 cm in Romy cultivar to (6.6) in Balady. The pod color was green for lines 1,2,3,5 and 9 , while it was red for lines 4,6,7 and 8 . Many previous studies noticed high variations in pod characteristics (Damarany and Farag , 1994; Hussien , 1994; Abo El-Khair, 2003, Akotkar *et al.*,2010 and Mistry and Vashi,2011). Table 4 represents a morphological discription for the selected 9 lines with respect to some different fruit characteristics.

Table 4: Fruit characteristics in 9 selected lines of okra and their original cultivars.

Selected Lines	Morphological discription of fruit
1	Green, mediam intall,very locular,thin, smooth
2	green , tall, locular,smooth
3	Green, mediam in tall,locular, spiny
4	Green red, short,locular,smooth
5	Green, mediam in tall,very locular,thin,smooth
6	Green red, tall, circular,smooth
7	Green red,mediam in tall, very locular,thin,smooth
8	Green red, mediam in tall,locular,smooth
9	Green,short,locular,smooth
Original cultivars	Morphological discription of fruit
Romy	Green,tall,smooth,locular
Balady	Green,short,very locular,thin,spiny
HM	Green red,mediam in tall,locular,spiny
HK	Green red,mediam in tall,locular,thin,smooth

It was obvious that differences noticed among the selected strains and their original cultivars of okra were highly significant. This finding proves that these strains are genetically different and constitutes a wide range of variation for further study in breeding programs.

Finally, Table 5 represents data on the correlation between the ten measured traits. There was a negative significant correlation between plant hight and both number of node and days to first flower. The same was found between fruit length and fruit diameter.

Also, there was a highly positive significant correlation between number of friut and all of number of branches, number of leaves and fruit weight.

A highly positive significant correlation between total number of fruits/plant and both fruit weight and number of fruits per plant were detected . Also, a heighly positive significant correlation was noticed between fruit diameter and fruit weight and between number of node and days to first flower.

These correlations threw the lights on the relationship between the studied genetic characters each others .

Table 5: Correlation between all measured traits in 4 cultivars and 9 selected lines of okra.

Traits	NNF	NDF	NF/p	FW gr	TP/P gr	NB/p	NL/f	PH cm	FL cm
NDF	0.71**								
NF/p	-0.23	-0.38							
FW gr	0.15	0.14	0.35						
TP/P gr	-0.12	-0.25	0.90**	0.71**					
NB/p	0.08	0.00	0.52	0.30	0.52				
NL/f	0.34	0.30	0.40	0.53	0.54	0.06			
PH cm	-0.60*	-0.57*	0.21	-0.17	0.07	-0.37	-0.37		
FL cm	-0.29	-0.20	0.16	-0.17	0.01	0.22	-0.27	0.21	
FD cm	0.26	0.23	0.05	0.70**	0.37	0.15	0.45	-0.38	-0.76**

* significant correlation ** Highly significant correlation

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إنتخاب بعض السلالات المباشرة من خلال طريقة سجلات النسب فى الباميا

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أجريت هذه الدراسة بغرض الحصول على سلالات من الباميا مستنبطة بطريقة سجلات النسب وذلك بتطبيق برنامج تربية بمحطة بحوث اليرامون بالمنصورة , حيث تم الحصول على جميع نباتات الجيل الثانى الناتجة إنعزاليا من الجيل الأول لأربعة آباء أصلية (رومى , بلدى , أحمر منصوره , أحمر قاهرة). وقد تم التلقيح الذاتى والإنتخاب لنباتات الجيل الثانى فى صيف عام 2004 لكل سلالة على حده وذلك لمدة خمسة أجيال متتالية حتى تم التوصل إلى التماثل الوراثى تماما. وقد تم الحصول على تسعة من أفضل هذه السلالات حيث قيمت جنبا إلى جنب مع الأربعة أصناف الأصلية فى تجربة حقلية خلال الموسم الصيفى 2009

وكانت أهم النتائج المتحصل عليها ما يلى:-

- كانت الإختلافات عالية المعنوية لجميع الصفات تحت الدراسة وذلك للآباء و للسلالات التسعة .
 - تفوقت السلالات التسعة بشكل عام من حيث كمية المحصول للنبات الواحد خلال الموسم على كل من الآباء الأصلية حيث كان المتوسط العام هو 1213.79 جرام و 917.41 جرام على الترتيب.
 - أعطت السلالة رقم 5 أعلى متوسط كمية محصول (1839.54) مقارنة بأعلى قيمة لأعلى صنف وهو البلدى (1073.8) . ومن حيث كمية المحصول أيضا تفوقت السلالات 5 و 7 و 6 و 8 على جميع الأصناف الأربعة. كما تفوقت أيضا السلالات 3 و 2 و 9 على جميع الأصناف ما عدا الصنف البلدى. وقد أعطت السلالة 4 أقل القيم لمعظم الصفات تحت الدراسة , كما أعطت السلالة 5 أعلى القيم من حيث التبركير وعدد الثمار وعدد الأفرع. وتعتبر السلالات التسع جميعها مبكرة إذا ما قورنت بالأصناف الأربعة ما عدا الصنف الرومى.
 - أبدت السلالات 5 و 6 و 1 و 7 أنها هى الأعلى فى عدد الثمار. ومن ناحية أخرى فإن السلالات 3 و 5 و 2 هى الأقصر من حيث صفة طول النبات بينما السلالة 6 هى الأطول على الإطلاق (289.3 سم). وقد سجلت السلالة 1 القيمة الأعلى من حيث صفة وزن الثمرة (7.1 gram) بينما كانت السلالة 4 هى الأقل (4 gram) لذات الصفة.
 - أوضحت دراسة الارتباط بين الصفات تحت الدراسة بأن هناك ارتباطا معنويا سالبيا بين طول النبات وكل من صفتى رقم العقدة وعدد الأيام للتزهير كما هو الحال بين قطر الثمرة وطول الثمرة. فى حين أن الارتباط كان معنويا جدا وموجبا بين كل من (صفتى عدد الثمار للنبات الواحد و صفة وزن الثمرة) وبين صفة محصول الثمار الكلى للنبات. وكذلك الحال بين صفة قطر الثمرة ووزن الثمرة وأيضاً رقم العقدة وعدد الأيام للتزهير.
- وأخيرا يمكن أن يستنتج من هذه الدراسة أن معظم السلالات المنتخبة تكون مفيدة جدا فى الزراعة على نطاق تجارى.

قام بتحكيم البحث

كلية الزراعة - جامعة المنصورة

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مركز البحوث الزراعية

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Table 3: The mean performances and standard deviation (Sd) of studied traits in 4 cultivars and 9 selected lines of okra.

Traits	NNF		NDF		NF/p		FW gr		TP/P gr		NB/p		NL/f		PH cm		FL cm		FD cm	
	Means	Sd	Means	Sd	Means	Sd	Means	Sd	Means	Sd	Means	Sd	Means	Sd	Means	Sd	Means	Sd	Means	Sd
AP1R	1.7	0.6	57.0	0.0	156.0	12.8	5.2	0.9	810.6	187.6	8.3	0.6	5.0	0.0	224.0	18.3	6.6	0.4	4.7	0.3
AP2B	4.0	0.0	63.7	0.6	182.0	26.3	5.9	1.0	1097.2	353.6	12.0	3.0	6.3	0.6	140.0	10.0	3.3	0.3	6.6	0.4
AP3HM	5.0	0.0	68.3	0.6	153.7	11.8	5.9	1.1	913.0	222.0	7.0	1.0	7.7	0.6	173.3	15.3	4.4	0.7	5.6	0.2
AP4HK	4.0	0.0	61.7	0.6	154.0	33.0	5.7	1.1	895.6	351.9	6.0	1.0	8.3	0.6	200.7	21.0	4.0	0.5	5.9	0.1
Line-1	2.3	0.6	56.0	0.0	223.3	36.9	7.1	1.3	1563.5	247.9	9.0	2.6	6.7	0.6	261.7	2.1	4.1	0.8	6.4	0.5
Line-2	4.0	1.0	57.0	0.0	192.3	31.9	5.0	0.8	970.6	287.2	9.3	2.3	5.3	0.6	185.0	5.0	5.3	0.3	5.1	0.3
Line-3	4.0	0.0	59.0	0.0	167.7	24.1	6.0	0.4	1006.1	100.2	8.3	2.1	8.0	0.0	171.7	12.6	4.0	0.4	6.3	0.2
Line-4	3.0	1.0	56.0	0.0	140.0	22.6	4.0	0.9	548.0	42.0	5.7	1.2	5.0	0.0	265.3	18.2	3.5	0.2	5.1	0.2
Line-5	3.3	0.6	56.0	0.0	296.7	8.3	6.2	0.4	1840.4	142.4	10.7	1.2	9.0	1.7	182.3	21.4	4.5	0.5	5.8	0.2
Line-6	2.7	0.6	58.0	0.0	274.3	8.4	5.1	1.1	1385.0	276.1	9.3	1.5	7.0	1.0	289.3	21.1	5.6	0.3	4.9	0.5
Line-7	3.3	0.6	58.0	0.0	213.7	31.9	6.8	0.4	1467.3	295.6	6.7	1.2	7.7	0.6	235.7	34.6	3.7	0.2	6.3	0.3
Line-8	4.0	1.0	58.0	0.0	190.0	29.0	6.1	0.9	1169.2	264.2	9.0	3.5	5.0	0.0	258.3	59.3	5.0	0.6	5.6	0.2
Line-9	2.3	0.6	57.0	0.0	188.3	16.7	5.1	0.5	971.9	168.5	6.0	1.0	5.7	1.2	241.7	53.5	3.5	0.5	6.0	0.6
LSD	0.05	1.04	0.47		41.22		1.46		408.8		3.20		1.26		46.79		0.78		0.56	
	0.01	1.41	0.63		55.73		1.97		552.6		4.33		1.70		63.25		1.06		0.76	

(R) : Romy - (B) : Balady - (HM) : Mansoura Red - (HK) : Cairo Red. (NNF) Number of first fruiting node - (NDF) Number of days to flowering - (NF/p) Number of Fruits/plant - (FW gr) Fruit Weight in grams - (TP/p gr) Total product of pods/plant - (NB/p) Number of Branches/plant - (NL/F) Number of Lecules/fruit - (PH cm) Plant Height - (FL cm) Fruit Length in cm - (FD cm) Fruit Diameter in cm.