

SAKHA -1 NEW CULTIVAR OF OKRA

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ABSTRACT

This investigation carried out in co-operation work between Horticulture Department, Faculty of Agriculture, Kafr El-Sheikh and Horticulture Research Institute during the period of 2001 to 2010 through two stages. The first stage: Six strains of okra were obtained after six generations of inbreeding and selection from the local cultivars. The six selected strains and the original cultivars were evaluated during the summer season of 2006 for yield and horticultural characteristics. Evaluation results indicated that the, Strain No. 1 had the lowest values of vegetative traits and it produced the largest values of early and total yield as a number and weight of pods, therefore, this strain was chosen as a new cultivar under name of Sakha-1 after produced their seeds in isolated area in two successive years. The second stage: The new cultivar and two commercial cultivars, i.e., Balady Green and Sabahia -1 cultivars were evaluated in summer seasons of 2009 and 2010 in the Experimental Farm of Sakha Agricultural Research Station. The new cultivar Skha-1 surpassed the Balady Green and Sabahia -1 cultivars for early and total yield as a number and weight of pods and pod quality.

INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench], $2n = 2x = 130$. It is an important fruit vegetable crop of the tropical and subtropical regions of the world. In Egypt, it is one of the most popular vegetables and considered a valuable source of calcium, iron and vitamins. It has been grown for its edible green pods which can be used as fresh, canned, frozen, or dried food.

Okra is considered one of the partial allogamous crops, since its natural cross pollination exceeded 20 % (Tindal, 1983), subsequently variation in its characteristics could be expected. Some characteristics of okra such as, plant height, branch number, color of veins and base of leaf, leaf lobes, pod type, pod color, pod pubescence and earliness proved its simply inheritance and high heritability (Martin *et al.*, 1981 and Ariyo, 1990), as well as number of pods per plant which is very important character.

Many researchers noticed high variations for the previous characteristics in the Egyptian local cultivars of okra (Abd El-Maksoud *et al.*, 1984; Damarany and Farag, 1994; Hussein, 1994 and Masoud, *et al.*, 2007).

Pod yield represented as a number and weight of pods per unit area (square meter or fedden) is very important economic character, since selection has to be applied simultaneously to all of its components and quality characters (Falconer, 1960).

There are great variations in vegetative growth, earliness, productivity and pods quality in okra plants growth in Kafr EL- Sheikh Governorate. Therefore, pure line selections which used in this study were evaluated to select superior strain (strain 1) from the local cultivars through inbreeding and

selection programs and compared this strain with the two local cultivars of okra, i.e., Balady Green and Sabahia 1.

MATERIALS AND METHODS

This work was carried out at Sakha Agricultural Research Station, during the summer seasons of 2009 and 2010. Great variations in plant vigor, earliness, productivity and pod characteristics are present in local cultivars of okra plants grown in Kafr El-Sheikh Governorate. Selection of individual plants based on earliness, high number of pods, uniformity of plant phenotype with moderate vegetative growth and uniformity of fruit color (pale green) and shape was carried out. Inbreeding and selection for chosen plants were carried out for six successive generations, the pollination technique method described by Lee (1980) was followed. After six generations of inbreeding and selection, six strains were selected. The six selected strains as well as the original cultivars were evaluated during the summer season of 2006 at a private farm in Disuq district, Kafr El-Sheikh Governorate. In isolation area, seeds of the best strain were produced in summer seasons of 2007 and 2008. The best strain was selected as a new cultivar of okra under the name of Sakha -1 (Masoud *et al*, 2007).

In the summer seasons of 2009 and 2010, the new cultivar (Sakha-1) besides Sabahia -1 and Balady Green cultivars of okra were evaluated in the Experimental Farm of Sakha Agricultural Research Station, seeds were sown on April 18th. The experimental plot area was 22.5 m², including 5 rows, each of 6 m length and 75 cm width using one plant per hill with 20 cm apart. The cultural practices were regularly done according to the general program of okra cultivation as reported by Egyptian Ministry of Agriculture.

The following data were recorded:

1. Vegetative traits

Five plants were uprooted from each plot after 55 days from sowing, and the following data were recorded: 1) Stem length (cm), 2) Number of branches per plant, 3) Number of leaves per plant, 4) Plant fresh weight (g), and 5) Leaf area per plant (cm²). Also, five plants were uprooted from each plot after 120 days from sowing, and the following data were recorded: 1) Stem length (cm), 2) Number of nodes on main stem, 3) Internode length (cm), 4) Number of branches per plant, and 5) Number of leaves per plant.

2. Earliness

Earliness was recorded as number of nodes to the first flower and number of elapsed days from sowing to first flower anthesis.

3. Early and total pods yield

Early and total yield expressed as total number of pods per plant and weight of pods (kg per fed.) were recorded. Early yield was determined from the first four pickings, and twenty harvests were recorded and calculated as the total yield.

4. Pods characteristics

At the 5th picking, ten flowers were labeled in each plot, after six days from anthesis pods were picked as reported by Metwally and Etman (1992), and

the following data were recorded: pod weight (g), pod length (cm), pod diameter (cm), peduncle length (cm) and peduncle weight (g).

Description of selected strains

All observations determined by measurement, weighting or counting were done on 20 plants or parts taken from each of the 20 plants. All observations on the fruits were recorded on the young fruits at commercial harvest stage (six days from anthesis). All observations on the stem, the leaf blade and the petiole were made on the 10th to 15th nodes of the main stem (UPOV, 1999).

Statistical Analysis

Data were statistical by analysis of variance, and Duncan's multiple range test was used for the comparisons among the genotype means (Duncan, 1955).

RESULTS AND DISCUSSION

Vegetative traits

Data presented in Table (1) show that the differences among the Sakha-1 cv. and the original cultivars of okra were significant for all studied traits; i.e., stem length, number of branches per plant, number of leaves per plant, plant fresh weight and leaf area per plant. Balady Green cv. showed the largest values of stem length (40.8 and 45.3 cm), number of branches per plant (2.9 and 3.1), number of leaves per plant (12.8 and 14.2), plant fresh weight (109.4 and 115.3 g) and leaf area per plant (1801.5 and 1895.8 cm²), while Sakha -1 cv. produced the lowest values for all the studied vegetative traits, i.e., stem length (26.5 and 28.8 cm), number of branches per plant (0.1 and 0.2), number of leaves per plant (8.1 and 10.0), plant fresh weight (79.5 and 88.9 g) and leaf area per plant (1265.3 and 1300.5 cm²) in 2009 and 2010, respectively .

Table (1): Vegetative and flowering traits of the three cultivars of okra after 55 days from sowing in 2009 and 2010 seasons.

Cultivars	Vegetative traits										Flowering traits			
	Stem length (cm)		No. of branches /plant		No. of leaves /plant		Plant fresh Weight (g)		Leaf area / plant (cm ²)		Nods to first flower		Days to flowering	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
Sakha-1	26.5	28.8	0.1	0.2	8.1	10.0	79.5	88.9	1265.3	1300.5	3.4	3.5	48.9	49.0
	c	c	c	c	b	b	c	c	c	c	c	c	c	c
Balady Green	40.8	45.3	2.9	3.1	12.8	14.2	109.4	115.3	1801.5	1895.8	6.0	6.5	60.1	62.0
	a	a	a	a	a	a	a	a	a	a	a	a	a	a
Sabahia-1	32.4	36.2	2.1	2.5	11.3	11.5	100.8	109.5	1713.0	1769.5	5.1	5.5	55.8	56.1
	b	b	b	b	ab	b	b	b	b	b	b	b	b	b

Means designated by the same letter are not significantly different at 0.05 level, of probability, according to Duncan's test.

Data in Table (2) show that the same trend was notice in vegetative traits, i.e., stem length, number of nodes on main stem, internode length, number of branches per plant and number of leaves per plant after 120 days from sowing, except for number of nodes on the main stem as Sakha -1 cv. produced the highest number, while Balady Green cv. Gave the lowest one.

The significant differences among the Sakha- 1, Balady Green and Sabahia -1 cultivars in the vegetative traits indicate that variations among the three cultivars of okra are due to genetic differences. Early work indicated high variations for vegetative traits of the Egyptian local cultivars of okra (Ragheb *et al.*, 1994, Abo El-khar 2003 and Masoud *et al.*, 2007)

Table (2): Vegetative traits of the three cultivars of okra after 120 days from sowing in 2009 and 2010 seasons.

Cultivars	Vegetative traits									
	Stem length (cm)		No. of nodes on main stem		Internode length (cm)		No of branches/ plant		No. of leaves / plant	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
Sakha -1	108.5 c	115.7 c	42.5 a	45.7 a	2.0 c	2.2 c	0.5 c	0.6 c	28.3 c	30.5 c
Balady Green	135.8 a	140.2 a	14.3 c	15.5 c	9.5 a	9.6 a	4.5 a	5.0 a	53.9 a	59.2 a
Sabahia - 1	128.6 b	130.8 b	19.6 b	20.0 b	6.4 b	6.9 b	3.2 b	3.5 b	49.5 b	51.3 b

Means designated by the same letter are not significantly different at 0.05 level, of probability, according to Duncan's test.

Flowering traits

It is obvious from Table (1) that Sakha -1 cv. was earlier in flowering than the other cultivars. Differences among Sakha -1 cv. and original cultivars were significant for number of nodes to the first flower and number of days from sowing to flowering (Table 1). The new cultivar (Sakha-1) had the lowest number of nodes to the first flower (3.4 and 3.5), while, Balady green cultivar had the highest number of nodes to the first flower (6.0 and 6.5). The number of days from sowing to flowering ranged from 48.9 and 49.0 days in Sakha -1 cv. to 60.1 and 62.0 days in Balady green cv in 2009 and 2010, respectively.

Okra plants which bear the first flower on a lower node, and need fewer days to flowering will be earlier than those bearing the first flower on a higher node and need more days to flowering (Metwally *et al.* 1988). Therefore, Sakha - 1 cv. was earlier than the other original cultivars.

Early and total pods yield

Data in Table (3) indicate that Sakha -1 cv. produced higher early yield than Sabahia -1 and Balady Green cvs.

Table (3): Early and total yield of the three cultivars of okra in 2009 and 2010 seasons.

Cultivars	Early yield				Total yield			
	No. of pods /plant		Pods weight (kg/fed.)		No. of pods / plant		Pods weight (kg/fed.)	
	2009	2010	2009	2010	2009	2010	2009	2010
Sakha -1	11.5 a	12.2 a	908.5 a	963.8 a	39.7 a	42.5 a	6285.8 a	6729.1 a
Balady Green	0.8 c	1.2 c	120.5 c	180.8 c	17.9 c	19.4 c	2273.3 c	2463.8 c
Sabahia -1	1.5 b	2.1 b	235.7 b	324.0 b	23.7 b	25.8 b	3143.6 b	3422.1 b

Means designated by the same letter are not significantly different at 0.05 level, of probability, according to Duncan's test.

Data elicited that the differences were significant for early pods yield, as a number and weight of pods. Sakha-1 cv. produced the highest values for number of pods per plant with a value of 11.5 and 12.2 and pods weight with 908.5 and 963.8 kg per fed. in 2009 and 2010, respectively. The superiority of Sakha -1 cv. for early yield as a number and weight may be due to its early flowering compared with the other cultivars.

As for the total yield; i.e., number of pods per plant and pod weight (kg/fed.), data in Table (3) show that Sakha -1 cv. surpassed the original cultivars. Sakha -1 cv. produced the largest values of total pods yield as number and weight with 39.7 and 42.5 pods per plant and 6285.8 and 6729.1 kg per fedden. However, Balady Green cultivar produced the lowest values of total pods yield as number and weight with 17.9 and 19.4 pods per plant and 2273.3 and 2463.8 kg per fedden in 2009 and 2010, respectively. The differences among Sakha -1 cv. and other original cultivars for total pods yield were significant. The superiority of Sakha -1 cv. is due to the higher number of pods produced per plant compared with the other original cultivars. Many investigators noticed high variation for pods yield of the Egyptian local cultivars of okra (Abd El-hafez and Salah, 1977; Damarany and Farag, 1994; Hussein, 1994; Ragheb et al., 1994 Abo El-khar, 2003 and Massoud *et al.*, 2007).

Pod characteristics

Data presented in Table (4) show that pod length ranged from 4.3 and 4.0 cm for Balady Green cultivar to 5.6 and 5.5 cm for Sakha -1 cv. Pod diameter ranged from 1.5 cm for Sakha -1 cv. to 1.8 and 2.0 cm for Balady Green cultivar. The length of peduncle of pods ranged from 3.3 and 3.0 cm for Balady Green cultivar to 4.9 and 4.8 cm for Sakha -1 cv. Average pod weight was 3.95, 3.90 and 4.85, 4.70 g. for Sakha -1 cv. and Sabahia 1 in 2009 and 2010, respectively. Average peduncle weight was 1.50, 1.46 and 2.60, 2.58 g. for Balady Green cultivar and Sakha -1 cv. in 2009 and 2010, respectively.

Table (4): Pods characteristics of the three cultivars of okra after 6 days from anthesis in 2009 and 2010 seasons.

Cultivars	Average pod length (cm)		Average pod diameter (cm)		Average pod weight (g)		Average peduncle length (cm)		Average peduncle weight (g)	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
Sakha -1	5.6 a	5.5 a	1.5 b	1.5 b	3.95 b	3.90 b	4.9 a	4.8 a	2.60 a	2.58 a
Balady Green	4.3 b	4.0 b	1.8 a	2.0 a	4.32 ab	4.10 b	3.3 c	3.0 c	1.50 c	1.46 c
Sabahia -1	5.3 ab	5.2 ab	1.7 ab	1.8 b	4.85 a	4.70 a	3.9 bc	4.1 ab	1.85 bc	1.90 b

Means designated by the same letter are not significantly different at 0.05 level, of probability, according to Duncan's test.

It is clear from the pod characteristics that the differences among the new cultivar Sakha -1 and the two original cultivars of okra were significant. These data confirm that Sakha -1 cv. is genetically different than the original cultivars.

1. Egyptian investigators noticed high variations for pod characteristics of the Egyptian cultivars of okra (Damarany and Farag, 1994; Hussein, 1994; Abo El-khar, 2003 and Masoud *et al.*, 2007).

Description of the the new and original cultivars

Data presented in Table (5) show that the differences among the Sakha-1 cv. and the original cultivars of okra, according to UPOV guideline.



Fig. (1): Size and shape of pods after six days from anthesis of the three studied cultivars.

Table (5): Description of Sakha -1 cv. and their original cultivars of okra according to UPOV guideline.

Characteristics ¹	Character states	Cultivars	Note ²
1. Plant: degree of branching	Weak	Sakha -1	3
	Medium	Sabahia -1	5
	Strong	Balady Green	7
2. Plant: height	Short	Sakha -1	3
	Medium	Sabahia -1	5
	Tall	Balady Green	7
3. Stem: diameter	Small	Sakha-1, Sabahia-1, Balady Green	3
	Medium		5
	Large		7
4. Stem: color	Green	Sakha-1, Sabahia-1, Balady Green	1
	Red		2
5. Stem: intensity of color	Light	Sakha-1, Sabahia-1, Balady Green	3
	Medium		5
	Dark		7
6. Stem: number of nodes (up to and including the first flowering node)	Few	Sakha-1	3
	Medium	Sabahia-1	5
	Many	Balady Green	7

7. Leaf blade: size	Small	Sakha-1, Sabahia -1 Balady Green	3
	Medium		5
	Large		7
8. Leaf blade: depth of lobbing	Shallow	Sakha-1, Sabahia-1, Balady Green	3
	Medium		5
	Deep		7
9. Leaf blade: denotation of margin	Weak	Sakha-1, Sabahia-1, Balady Green	3
	Medium		5
	Strong		7
10. Leaf blade: color between veins	Green	Sakha-1, Sabahia-1, Balady Green	1
	Red		2
11. Leaf blade: intensity of color between veins	Light	Sakha-1, Sabahia-1, Balady Green	3
	Medium		5
	Dark		7
12. Petiole: length	Short	Sakha-1, Sabahia-1, Balady Green	3
	Medium		5
	Long		7
13. Petiole: diameter	Small	Sakha-1, Sabahia-1, Balady Green	3
	Medium		5
	Large		7
14. Flower: size	Small	Sabahia-1, Balady Green Sakha-1	3
	Medium		5
	Large		7
15. Fruit: color	Green	Sakha-1, Sabahia-1, Balady Green	1
	Red		2
16. Fruit: intensity of color	Light	Sabahia -1 Sakha-1, Balady Green	3
	Medium		5
	Dark		7
17. Fruit: diameter of young fruit (at mid length)	Small	Sakha -1 Sabahia-1, Balady Green	3
	Medium		5
	Large		7
18. Fruit: surface between ridges	Concave	Sakha-1, Sabahia-1, Balady Green	3
	Flat		5
	Convex		7
19. Fruit: constriction of basal part	Absent or very weakly expressed	Balady Green Sakha-1, Sabahia-1	1
	Weakly expressed		2
	Strongly expressed		3
20. Fruit: shape of apex	Narrow acute	Sakha-1, Sabahia-1, Balady Green	1
	Acute		2
	Broad acute		3
21. Fruit: number of locules	Five	Sakha-1, Sabahia-1, Balady Green	1
	More than five		2

22. Fruit: thickness of carpel	Thin	Sakha -1	3
	Medium	Sabahia-1, Balady Green	5
	Thick		7
23. Fruit: length of mature fruit	Short	Balady Green	3
	Medium	Sabahia -1	5
	Long	Sakha -1	7
24. Fruit: diameter of mature fruit (at mid length)	Small	Sakha-1, Sabahia-1	3
	Medium	Balady Green	5
	Large		7
25. Time of flowering	Early	Sakha -1	3
	Medium	Sabahia -1	5
	Late	Balady Green	7
26. Time of commercial harvest	Early	Sakha -1	3
	Medium	Sabahia -1	5
	Late	Balady Green	7

(1) To assess distinctness, uniformity and stability, the characteristics and their states as given in the table of characteristics should be used.

(*) Characteristics that should be used on all lines in every growing period over which the examinations are made and always be included in the lines description, except when the state of expression of a preceding characteristic or regional environmental conditions render this impossible.

(**) Notes (number, for the purposes of electronic data processing, are given opposite the states of expression for each characteristic.

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صنف جديد من الباميا 1*** سخا

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**بحوث الخضر - معهد البساتين - مركز البحوث الزراعية

أجرى هذا البحث كعمل مشترك بين قسم البساتين بكلية الزراعة بكفر الشيخ ومعهد بحوث البساتين وذلك فى الفترة من 2001 حتى 2010 م وذلك على مرحلتين: المرحلة الأولى: تم عمل تربية داخلية وانتخاب لمدة ستة أجيال فى صنفى البامية " البلدى الأخضر والبلدى الأحمر" المنزرعة فى محافظة كفر الشيخ " حتى تم الحصول على عدة سلالات متماثلة. بعد ذلك تم انتخاب أفضل ستة سلالات بها صفات يستانية جيدة وقيمت هذه السلالات مع الصنفين الأصليين (البلدى الأخضر والبلدى الأحمر) فى تجربة حقلية خلال الموسم الصيفى لعام 2006 وأوضحت النتائج المتحصل عليها ان السلالة (1) أعطت أقل القيم لصفات النمو الخضرى ولكنها أعطت أكبر القيم لمحصول القرون المبكر والكلى وكانت نسبة الزيادة عن الصنف البلدى الأخضر 93,3 و 194 % فى محصول القرون المبكر والكلى على التوالى . المرحلة الثانية: تم تقييم السلالة (1) المتفوقة والمبشرة بالإضافة الى الصنفين البلدى الأخضر وصباحية 1 وقيمت بمزرعة البحوث الزراعية بسخا فى الموسم الصيفى لعام 2009، 2010م. وقد ظهر من التقييم تفوق السلالة (1) على الصنفين البلدى الأخضر وصباحية 1 فى محصول القرون المبكر والكلى ومعظم صفات الجودة. وبذلك نوصى بادخال السلالة (1) كصنف جديد من البامية تحت اسم سخا -1.

قام بتحكيم البحث

كلية الزراعة - جامعة المنصورة
كلية الزراعة - جامعة كفر الشيخ

أ.د / محمود محمد زغلول
أ.د / عبد الشفيق اسماعيل الزعوىلى