Assiut J. Agric. Sci., 52 (4) 2021 (129-141) *ISSN: 1110-0486*
Website:www.aun.edu.eg/faculty_agriculture/journals_issues_form.php *E-mail: ajas@aun.edu.eg*

Selection of New Architecture Lines from Egyptian Local Okra Cultivars (*Abelmoschus esculentus* L. Moench) Using Pure Line Selection Program

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Accepted for publication on: 30/12/2021

Abstract

This study was conducted during six cycles of an individual plant selection program to obtain promising pure lines of okra; that possess a new uniform architecture with desirable traits, using two local cultivars of okra, Balady and Eskandirani. This was followed by an evaluation of the selected pure lines with the two base populations. So, this study was conducted during the seven successive summer seasons of 2014 to 2020, at the Experimental Station Farm (at Abies) of the Faculty of Agriculture, Alexandria University, Egypt. The obtained results revealed that in the two original populations, the estimated means, ranges, and coefficients of variations of all analyzed characteristics exhibited noticeable variation in vegetative growth, productivity, and pod quality. Also, positive performance was obtained in the selected pure lines, where they were characterized by short to medium plant height, broad stem diameter, no branches (zero-type plants), and short internodes, as well as a low position of nodes number to the first flower or pod. Regarding productivity and quality of pods, the results showed that the selected pure line L_{15} showed significantly the highest mean values for the characteristics of pods number per plant, pods yield per plant, pods yield per square meter. Also, the seven pure lines L_{14}, L_{10}, L_{12}, L_{9}, L_{8}, L_{11}, and L_{13} recorded significantly higher mean values than the Eskandirani cultivar for the same traits mentioned earlier; while the five pure lines L_3, L_4, L_5 L_6, and L_7 did not reflect any statistically significant differences from the Eskandirani cultivar.

Keywords: *Selection, Coefficient of variation, Architecture, Okra, Zero-type.*

Introduction

Okra (*Abelmoschus esculentus* L. Moench) is one of the most important Malvaceae vegetable crops. Its origins can be traced back to South Africa and it is also one of Egypt's oldest traditional vegetable crops, having been mentioned in Egypt as early as 1216 AD (Chheda and Fatokum, 1982). Okra is grown worldwide for its leaves, fruits, seeds, flower parts, and stems. While in Egypt and other parts of the eastern Mediterranean it is grown for its fruits, which are used in thick soups made of vegetables and meat. Okra fruits are also characterized by high nutritional and medicinal value, as they are rich in dietary fiber, minerals, and vitamins. That is why they are often recommended by nutritionists in cholesterol control and weight loss programs. As a result, it is frequently referred to as the “ideal villager factory” (Holser and Bost, 2004, Temam *et al*. 2020).

Cultivated okra is partially self-pollinated, with insect cross-pollination ranging from 4 to 19% (Choudhury and Choonsai, 1970), with a maximum of 42.2% (Mitidieri and Vencovsky, 1974), indicating a high level of genetic variability within a population. Knowledge of genetic diversity is the basic requirement in any crop improvement program. Okra is grown in Egypt using local cultivars produced by farmers without referring to specialists in seed production. Therefore, it is possible to improve the okra crop by using local cultivars, as it is characterized by a high genetic diversity, as well as more ability to adapt to the local environment (Abd El-Maksoud *et al*. 1984; Hussein, 1994; Masoud *et al*. 2007; Ibrahim *et al* 2018). Variations in this crop allow for significant genetic improvement through various selection methods, leading to increased okra yield and access to new improved genotypes (Abo El-Khar, 2003; Masoud *et al*. 2007; Ibrahim *et al* 2018).

Plant architecture plays an important role in the productivity, quality, and cultivation practices of many crops. It is considered a key that can significantly affect the light distribution within and penetration into a crop canopy and thus can alter plant growth, flower distribution, and yield potential (Marois, *et. al*. 2004). Many researchers have studied changes in plant architecture, including repressed lateral shoots (Brown, 1955), determining growth habit (Denna, 1970), short internodes (Rick, 1980), and branching growth habits (Napoli and Ruehle, 1996). In view of this, many vegetable crops have been improved to have new architectural features, such as pumpkin with short internodes (Kobayashi, 1967), cucumber with determinate lateral branches (Kanno and Uemura, 1980), and watermelon with branchless (Lin *et al*. 1992).

The architecture of the okra plant consists of several components of growth that can be improved, such as the number and length of branches, the length of the main stem, and the distribution of okra flowers throughout the plant, which allows the breeder to try to produce or choose a suitable vegetable architecture with high yield and quality. One of the most essential components of the structure of the okra plant is the branching pattern; it is one of the most important aspects connected with okra productivity. The fundamental obstacle limiting the density of okra farming and consequently the inability of increasing the number of plants per unit area is the broad or loose structure characteristic of local cultivars. Based on the foregoing; branchless okra plants (zero-type plants, Fanjia *et al*. 2014) can be considered as suitable plants for intensive cultivation, through which production costs and labor intensity can be reduced, also suitable for the advantage of mechanized harvesting with increased yield. Zero-type plants indicate that all flower on the plant give fruits; only on the main stem, because of the branches stop growing.

As a result, the current study used an individual plant selection program to select highly productive okra plants with optimal plant architecture, known as zero-type plants (branchless).

Materials and Methods

This study was conducted at the Experimental Station Farm of the Faculty of Agriculture, Alexandria University; Abies; Alex., A.R.E. during the period from 2014 to 2020.

Original genetic materials.

The basic plant material, in this study, were consisted of the two okra cultivars Eskandirani (roomee) and Balady (local), since a lot of variation and deterioration were observed for some important morphological and agronomical traits that reported by many farmers and researchers. Moreover, both cultivars are characterized by huge architecture, which needs a wide planting space. Also, the two cultivars are very popular in Egypt as well as their ability to adapt to local environmental conditions.

Breeding program and generations of selection.

In the first season, the seeds of the original population of the two cultivars were sown separately in a field trial on March 10, 2014. Agricultural practices such as fertilization, irrigation and preventive spraying were followed, as recommended for commercial production of okra.

Initial visual selection was made according to the following traits that were recorded in selected individual plants; zero-type plants (no branches), plant height (cm), stem diameter (cm), internode length (cm), nods number to first flower, nods number to first pod, pod length (cm), pod diameter (cm), pod weight (g), pods number per plant, pods yield per plant (g) and pods yield per meter square (g). During this study, five traits were focused on, during different generations, namely: the zero-type (no branches), a short to medium and strong main stem, and a short internode length, in addition to high productivity for each plant, as these traits will determine the desired architecture for selected okra plants with high yield. The measures of the studied traits were recorded, on the basis of the individual plant, through the procedure followed in the method of selecting the individual plant. During the flowering stage, each flower was packaged into paper bags for most of the cultivated plants of both cultivars to obtain selfed seeds from each selected plant. The seeds of the first selfed progenies of each selected plant were collected, removed, and kept separately at the end of the pod ripening stage for use in the next cycle of the selection procedure. During that season, some statistical parameters were estimated on some of the studied traits, namely, Range (R), mean (X), and coefficient of variation (CV%).

On March 15, 2015; seeds of each selected plant were cultivated in the form of separated families; then, selection on the same forgoing basis was also practiced within –and between- the selfed progenies of the individual selected plants. At the end of the growing season, selfed seeds of each selected plant from each selected family were separately collected to get seeds of the second cycle of individual plant selection. With the same previous steps, work was carried out during the four consecutive seasons from 2016 to 2019 to reach the best pure lines with desirable qualities through the program. At the end of the program, 15 promising pure lines were reached, which were evaluated during the summer season of 2020.

Evaluation of the various genetic populations.

In the seventh season of 2020, a field experiment was conducted to evaluate the efficiency of individual plant selection for six generations of selfing with selection on the overall performance of the studied characters of the selected lines. The fifteen resulting pure lines were evaluated along with their two original populations, Eskandirani and Balady, in a randomized complete block design with three replicates on March 15, 2020. In each replication, all the genotypes under study were planted, where each genotype was represented by two lines, the length of the line is 3.0 m, the width is 0.7 m, and the plant density is 0.3 m. Accordingly, the line contains 11 plants, and then the experimental unit contains 22. All recommended agricultural practices have been followed in commercial okra cultivation. Five plants were randomly selected from each genotype in each replication to measure the studied traits, and the mean values of these plants were used for statistical analysis.

Statistical analysis

The mean values of each character under the study were computed and subjected to analysis of variance, following the procedures described by Al-Rawi and Khalf-Allah (1980), using Co-Stat computer software program (2004). Treatment means were compared using Duncan's multiple range test at 0.05 level of significance.

Results and Discussion

The variability of vegetative growth characters, pod characteristics, and pod yield of the original populations of okra were recorded, Table 1. The average performance of the various selected pure lines and their original populations were also estimated and presented in Tables 2, 3, and 4.

Variability estimates in the two original populations.

Table 1 shows the mean, range, and coefficient of variation for the important traits studied for the original population, Eskandirani and Balady cultivars. As can be seen from the calculated coefficients of variation values, the two original populations reflected a lot of variability in most of the traits studied. In both original populations, the estimatedcoefficients of variation revealed values more than 20% for all the traits investigated. Furthermore, estimated coefficients of variation for the eight studied traits ranged from 22.13% to 30.45% in Balady cultivar and from 20.21% to 28.66% in Eskandirani cultivar for nodes number to first pod and number of main branches, respectively.

Table 1. Estimates of variability parameters; range, mean $\bar{X}$ and coefficient of variation (C.V. %), for the studied important characters in the two original populations of okra.

Cultivars / Parameters / Characters	Balady			Eskandirani		
	$\bar{X}$	Range	C.V%	$\bar{X}$	Range	C.V%
Plant length (cm)	175.16	80.00 – 250	22.22	155.13	70.00 – 190.00	25.32
Stem diameter (cm)	3.40	1.20 – 5.40	29.50	3.75	1.5 – 4.00	25.22
Internode length (cm)	7.12	2.00 – 9.32	26.41	5.10	1.90 – 7.00	20.98
Number of main branches	4.00	0.00 – 7.00	30.45	3.16	0.00 – 5.43	28.66
Nodes number to first pod	6.95	4.02 – 10.15	22.13	5.60	3.00 – 10.00	20.21
Nodes number to first pod	9.00	5.43 – 12.65	27.31	7.12	3.65 – 13.20	21.00
pods number per plant	40.31	11.05 – 60.33	30.21	32.11	10.22 – 47.52	28.17
pods yield per plant (g)	165.16	150.13 – 302.00	25.52	145.44	140.43 – 234.78	25.33

The findings also revealed that the calculated range values for each character in both populations studied were quite large. This is due to the fact that these two cultivars are old enough and have been produced commercially for a long time without any purification or improvement. So, okra crop has great chances of improvement, but to varied degrees that depending on the amount of variability, which in turn might provide more scope for selection of desired genotypes as well as better overall performance than their original populations. The obtained results agreed, generally, with those of Ibrahim *et al.* 2013; Ibrahim *et al.* 2018 on some local okra cultivars; who, found wide ranges of variation in most of the studied characters and concluded that the studied characters could be improved through selection methods.

Analysis of variance for studied traits.

For all the variables tested, the differences among genotypes were very significant, according to the analysis of variance (Table 2). Furthermore, the magnitudes of genotypic mean squares were greater than the magnitudes of their corresponding error mean squares. The results also showed that the genotype mean squares were extremely significant for all attributes studied. Thus, these important differences of genotypes allow comparison of means of different genotypes. These results agree with those obtained by Bello *et al.* 2006; Soldier 2012; Ibrahim *et al.* 2018; which recorded statistically significant differences among all tested genotypes for all studied traits when estimating the F test.

Table 2. Mean squares from analysis of variance for all studied traits of studied genotypes after six cycles of individual plant selection.

Sources of variation	d.f.	Plant height (cm)	Stem diameter (cm)	Inter-node length (cm)	Nods No. to first flower	Nods No. to first pod	Pod length (cm)	Pod diameter (cm)	Average pod weight (g)	Pods No. per plant	Total yield per plant (g)	Total pods yield per m^2 (g)
Replications	2	3.63	4.62	0.02	0.86	0.25	1.45	0.27	1.39	7.85	22.31	22.32
Genotype	16	1257.89**	12.25**	80.18**	33.04**	31.92**	9.15**	10.25**	6.85**	42.73**	118.43**	118.45**
Error	32	2.72	0.07	0.07	0.16	0.30	0.13	0.01	0.14	4.81	29.35	802.67

Okra's economic returns are influenced not only by the pod production, but also by the plant's development and the quality of the fruit. Plant height (between short and medium), broad stem diameter, no branches (zero-type), short internode length, low position of first - flowering and fruiting - node are among the qualities targeted by the present breeding program. These characteristics to be improved are considered as the basic architecture of the plant, which expresses the bearing surface of the fruits, which in turn reflects the extent of productivity. For that reason, all selected pure lines in this study characterized with no branching; called zero-type plants; with short internode length.

Data based on plant vegetative growth characteristics of the evaluated populations were recorded and shown in Table 3 and Fig 1 and 2. The results showed, in general, that the examined genotypes varied in their growth characteristics after six cycles of individual plant selection with selfing. Moreover, the differences between the mean values of all the selected pure lines and those of the two original populations appear to be significant, but with different degrees. The results regarding the overall performance of the plant height trait showed a large variation in the trait studied among the tested genotypes. As a result, the fifteen selected pure lines were divided into four groups based on plant height: group I contains three pure lines (less than 86 cm), group II contains five pure lines (90-110 cm), group III contains five pure lines (111-130 cm), and group IIII contains two pure lines (above 130 cm). When comparing the genotypes groups under study, we found that the selected pure line L_{15}, which belongs to the fourth group, had the highest plant height (170.04 cm); while the selected pure line L_1, which belongs to the first group, had the shortest and significant mean value of plant height (75.63 cm), even though the fifteen pure lines were still significantly shorter than the original populations. Concerning number of branches per plant; obvious that all selected pure lines recorded no branches; which considered a desirable effect in this study (zero-type), compared to the original populations.

Table 3. Mean values of plant architecture characteristics in respect to plant height, stem diameter, and internode length, as well as nodes number to first - flower and - pods of the fifteen okra pure lines and their two original populations.

Characters / Genotypes	Plant height (cm)	Stem diameter (cm)	Internode length (cm)	Nodes No. to first flower	Nodes No. to first pod
L_1	75.63 k (I)	2.50 e	2.05 ef	2.00 e	3.00 de
L_2	82.33 j (I)	3.50 cd	2.68 cd	3.00 d	3.00 de
L_3	85.43 i (I)	2.59 e	3.06 c	3.00 d	4.00 cd
L_4	98.13 h (II)	3.35 d	3.03 c	3.00 d	4.00 cd
L_5	98.43 h (II)	2.83 e	2.02 ef	3.00 d	5.00 c
L_6	100.03 h (II)	3.60 b-d	3.00 c	4.00 c	4.00 cd
L_7	105.33 g (II)	3.53 cd	3.00 c	2.00 e	2.00 e
L_8	107.33 g (II)	3.53 cd	1.82 f	2.00 e	2.00 e
L_9	115.63 f (III)	3.97 a-c	3.00 c	2.00 e	2.00 e
L_{10}	116.33 f (III)	3.73 a-d	2.00 f	3.00 d	3.00 de
L_{11}	117.3 f (III)	4.09 ab	2.03 ef	3.00 d	4.00 cd
L_{12}	126.33 e (III)	3.86 a-c	3.00 c	4.00 c	4.00 cd
L_{13}	127.13 e (III)	3.93 a-c	3.03 c	3.00 d	4.00 cd
L_{14}	150.21 d (IIII)	4.13 a	2.93 c	2.00 e	4.00 cd
L_{15}	170.04 c (IIII)	4.23 a	2.36 de	2.00 e	2.00 e
Eskandirani	179.13 b	4.13 a	5.27 b	5.00 b	6.00 b
Balady	190.33 a	4.20 a	7.06 a	7.00 a	9.00 a

Values having the same alphabetical letter (s) within each column, don't significantly differ from one another, using Duncan's multiple range test at 0.05 level of significance.

L_1 to L_{15} mean the selected pure lines from 1 to 15
(I) mean group1 (II) mean group 2 (III) mean group 3 (IIII) mean group 4

Figure 1: A: Phenotypic of whole plant of zero-type okra pure line.

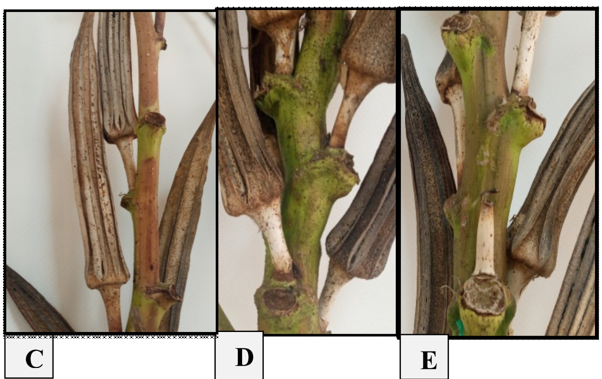

Figure 2: C: internode length in the original population. **D** and **E** internode length in two selected pure lines.

In the case of the character internode length; the mean values of all selected pure lines were reduced significantly (desirable effect) after the six cycles of individual plant selection, compared to the two original populations. The pure line L_8 reflected the lowest mean value for the internode length trait, which did not differ significantly with L_1, L_5, L_{10}, L_{11}, and L_{15}. Whereas the maximum and significant mean value of this trait was recorded in the Balady cultivar. Regarding the characteristic of the stem diameter, the original populations recorded the highest mean values of the character, which did not differ significantly from seven of the selected pure lines. Through the findings on the four growth characteristics; it has been observed to reflect a new architecture compared to the original populations and some other commercial cultivars; where the selected pure lines were distinguished by the absence of branches, short to medium length, and short internode length. The combination of the above features allows for maximum and uniform exposure of all leaves and other plant parts to better sunlight, which in turn leads to higher dry matter production and a higher cropping pattern (Ariyo, and Odulaja, 1991; Chinatu, *et al*. 2014; Ogwu, *et al*. 2016). This new architecture also allows farmers to increase the number of plants per unit area; therefore, the expenditure on agricultural operations can be reduced in light of the doubling of production. Likewise, the nature of the plant's height, from short to medium, allows easy harvesting of the fruits; whereas, once the okra plants become too tall, harvesting becomes more difficult, and the plant yields less. Also, short to medium plants can be suitable for planting under medium tunnels and for obtaining a fresh, marketable crop in the off-season.

Table 3 further revealed that after six selection cycles, mean values for nodes number to first flower and nodes number to first pod were much lower than the initial populations. As a result, these findings reflect the extent of early harvest in the pure lines selected. The mean values of the two traits studied for all the selected pure lines ranged from (2-4) and (2-5) in the case of nodes number to first flower and nodes number to first pod, respectively. As noted, these values differed significantly from the two base populations, where the minimum number of nodes to first flower or pod for six pure lines out of fifteen was 2.00 nodes. According to the results of the aforementioned two traits; it can be revealed that most of the selected pure lines gave an earlier yield compared to the original populations where the Balady cultivar began to flowering when some of the selected pure lines began to dry up. In other words, the selected pure lines of okra that bear the first flower or pod on a lower node will flower in fewer days than those bearing the first flower or pod on a higher node, and hence will flower earlier. In this regard, Jagan *et al*. 2013; Metwally *et al*. 2011; Vishnu Priyanka *et al*. 2017; Vishnu Priyanka *et al*. 2018 recorded similar results for nodes number to first flower character on okra genotypes.

The yield of the plant and the characteristics of any crop's green pods are the final indicators of the experiment's success or failure. As a result, the productivity of pods as well as some of the most essential okra pod properties were recorded and presented in Table 4. Regarding the pod characteristics, the data showed that the L_3 pure line has the longest pod length with the highest and significant mean value (6.01 cm), followed by the L_{14} (5.22 cm); while the cultivar Eskandirani recorded the shortest pod length as it gave the lowest mean value (3.35 cm), preceded by the pure line L_2 and L_8. Regarding pod diameter, all the selected pure lines showed lower mean values (desirable trait) compared to the original population cultivars. The selected pure line L_6 has the narrowest and lowest mean value (1.00 cm), while the original population of the cultivar Balady (2.02 cm) has the greatest mean value (2.02 cm), preceded by the Eskandirani cultivar (1.67 cm), with significant differences between them and all the selected pure lines. In terms of average pod weight, the mean values of all genotypes were convergent; the L_3 pure line produced the heaviest mean pod weight (5.30 g), followed by the L_1 pure line (4.95 g) and the L_9 pure line (4.78 g) without significant differences; and the pure line L_{13} produced the lightest pod (3.37 g).

When comparing the resident genotypes for the characteristic pods number per plant, obvious significant differences appear among the mean values for these genotypes, which ranged from 17.01 to 45.00 pods per plant. The pure line L_{15} also had the highest number of pods per plant (45.00), followed by the Balady cultivar (41.36) and the pure line L_8 (41.45). While pure line L_1 represented the smallest number of pods per plant (17.01) and was statistically equivalent to pure line L_2 (20.00). The data analysis for the two characteristics pod yield per plant and pod yield per square meter revealed a substantial influence among the examined genotypes. The selected pure line L_{15} recorded the maximum productivity, followed by the Balady cultivar, L_{14} and L_{10}, with significant differences among them. While the lowest and significantly pod yield per plant and per square meter was recorded by the pure line L_2.

Table 4. Mean values of yield and some fruit characteristics of the fifteen okra pure lines and their original populations.

Characters / Genotypes	Pod length (cm)	Pod diameter (cm)	Average pod weight (g)	Pods No. per plant	Total yield per plant (g)	Total yield per m^2 (g)
L_1	5.00 b-d	1.35 cd	4.95 ab	17.01 h	80.15 i	419.18 i
L_2	3.61 fg	1.21 c-e	3.51 gh	20.00 gh	70.26 j	367.49 j
L_3	6.01 a	1.35 cd	5.30 a	22.25 fg	117.33 g	613.65 g
L_4	5.04 bc	1.20 c-e	4.61 b-d	24.11 f	107.61 h	562.79 h
L_5	4.10 ef	1.11 de	3.80 e-h	32.10 de	120.56 g	630.56 g
L_6	4.31 d-f	1.00e	3.51 gh	30.10 e	103.73 h	542.50 h
L_7	4.52 c-e	1.21 c-e	4.09 c-h	30.00 e	120.86 g	632.09 g
L_8	3.71 fg	1.20 c-e	3.51 gh	41.45 ab	144.86 e	757.65 e
L_9	4.51 c-e	1.20 c-e	4.78 a-c	32.oo de	148.05 de	774.33 de
L_{10}	4.31 d-f	1.35 cd	4.50 b-e	35.09 cd	155.46 d	813.06 d
L_{11}	4.01 e-g	1.20 c-e	3.65 f-h	39.87 b	144.77 e	757.14 e
L_{12}	4.61 b-e	1.35 cd	3.98 d-h	38.33 bc	151.29 de	791.24 de
L_{13}	3.90 e-g	1.11 de	3.37 h	39.04 b	130.66 f	683.31 f
L_{14}	5.22 b	1.35 cd	4.14 c-g	40.00 b	165.30 c	864.54 c
L_{15}	4.51 c-e	1.40 c	4.50 b-e	45.00 a	201.20 a	1052.27 a
Eskandirani	3.35 g	1.67 b	3.73 f-h	30.70e	112.23 gh	586.99 gh
Balady	4.29 d-f	2.02 a	4.28 b-f	41.36 ab	180.20 b	945.68 b

Values having the same alphabetical letter (s) within each column, don't significantly differ from one another, using Duncan's multiple range test at 0.05 level of significance.

Except for the pure line L_{15}, which gave the highest mean value, the local cultivar "Balady" clearly outperformed all of the selected pure lines in terms of yield. Pure okra lines have a low yield due to their new branchless architecture; where this yield is produced from just one main stem; whereas, in the original populations, the plants have many branches, and the crop is the sum of several stems per plant. According to this fact, the new pure lines should be planted with new planting spaces, in which the plants are closer together, in other words, increase or double the number of plants per square meter and accordingly the total yield per square meter will be doubled as well. In general, the obtained results showed a clear improvement to different degrees in vegetative growth characteristics, yield, and its components, as well as pod qualities, after six cycles of individual plant selection program.

Conclusion and recommendation

Based on the current study, estimates of variability parameters (range and coefficient of variation) showed that the two original populations under study have a large variability for many characters, which indicates that the selection program is the appropriate primary breeding method for okra improvement. Therefore, the use of individual plant selection method for six generations was very effective in improving the yield of okra. This selection program resulted in the emergence of new pure lines that are architecturally distinct from the two original populations. The branchless plants (zero-type), short to medium, and short internodes, as well as the low position of the first node of flowering and pod, were all characteristics of the new pure lines. Accordingly, this new architectural structure will allow for different agricultural practices as well as increase the plant density, which in turn leads to a doubling of productivity.

As a result of the findings of this study, it can be recommended that the newly selected pure lines are promising and should be considered an important genetic resource, as they will provide a great opportunity to develop new hybrids that are suitable for growth under local environmental conditions and have high productivity.

References

Abo El-Khar, YY (2003). Efficiency of selection with inbreeding on improving some characteristics in the Balady cultivar of okra. M.Sc. Alex. Univ., Fac. Agric., Egypt.

Abd El-Maksoud, MA, Hela RM and Mohamed MH (1984). Heritability estimates and correlation studies of six economic characters in okra. Agric. Sci. Ain. Shams Univ. 29: 439 – 452.

Al-Rawi, KM and Khalf-Allah AM (1980). Design and analysis of agriculture experiments. Text book. El Mousil Univ. Press. Ninawa, Iraq. 487 p.

Ariyo, O J and Odulaja A (1991). Numerical analysis of variation among accessions of okra (*Abelmoschus esculentus* L. Moench). Malvaceae. Ann. Bot. 67: 527 – 531.

Bello, D, Sajo AA, Chubado D, and Jellason JJ (2006). Variability and correlation studies in okra (*Abelmoschus esculentus* L. Moench*)*. J. Sust. Dev. Agric. Environ. 2: 120 – 126.

Brown, A (1955). A mutant with suppressed lateral shoots. TGC Rep. 5: 6 – 7.

Chheda, HR and Fatokum CA (1982). Numerical analysis of variation patterns in okra (*Abelmoschus esculentus* L. Moench). Bot. Gaz. 143: 253 – 261.

Chinatu, LN, Okocha PI and Eka MJ (2014). Evaluation of West African varieties for agronomic traits in umudike in Southern Western Nigeria. Int. J. Agric. Rural. Dev. Research. 11: 43 – 47.

Choudhury, B and Choonsai M L (1970). Natural cross-pollination in some vegetable crops. Indian J. Agric. Sci. 40(9): 805 – 812.

Co-State Software (2004). User's manual version. Cohort Tusson, Arizona, USA.

Denna, D (1970). Expression of determinate habit in cucumber. J. Amer. Soc. Hort. Sci. 96: 277- 279.

El-Gendy, SE (2012). Selection of some promising lines through pedigree method in okra. J. Agric. Chem. Biotechnol. 3: 41 – 48.

Fanjia, P, Xuelin Z, Xingping Z and Yangcang G (2014). A new short-fruit branch and low-phenol cotton variety suitable for machine harvesting. State Intellectual Property Office of the People's Republic of China. Application Publication number CN104221848A.

Holser, R and Bost G (2004). Hybrid Hibiscus seed oil compositions. J. Amer. Oil Chemists' Soc. 81(8): 795 – 797.

Hussein, HA (1994). Variation, heritability and response to selection in okra. Assiut J. Agric. Sci. 25: 193 – 202.

Ibrahim, EA, Abed MY and Moghazy AM (2013). Genetic behavior of families selected from some local okra (*Abelmoschus esculentus* L. Moench) population in Egypt. Pl. Breed. Biotech. 1(4): 396 – 405.

Ibrahim, EA, Abed MY and Moghazy AM (2018). Improving some economical traits of local okra (*Abelmoschus esculentus* L. Moench) through selection and inbreeding. J. Pl. Prod., Mansoura Univ. 9(9): 743 – 748.

Jagan, K, Ravinder Reddy K, Sujatha M, Sravanthi V and Madhusudhan Reddy S (2013). IOSR J. Agric. & Veter. Sci. 5(1): 59 – 61.

Kanno, A and Uemura S (1980). Characteristics of the progeny derived from a cross between determinate type and normal type cultivar in cucumber. Annu. Rep. Morioka Branch. Veg. Ornam Crops Res. Stn. 5: 31 – 33.

Kobayashi, T (1967). New cultivars of vegetables. 3. Pumpkin "Turunashi-Kiji". Bull Niigatta Hortic. Exp. Stn. 2: 13 – 19.

Lin, D, Wang T, Wang Y, Zhang X and Rhodes B (1992). The effect of the branchless gene bl on plant morphology in watermelon. CGC Rep. 15: 74 – 75.

Masoud, AM, El-Waraky YB, Shalaby TA, Kasem MH (2007). Developing new strains of okra. J. Agric. Sci. Mansoura Univ. 32: 583 – 590.

Marois, JJ, Wright DL, Wiatrak PJ and Vargas MA (2004). Effect of row width and nitrogen on cotton morphology and canopy microclimate. Crop Sci. 44(3): 870 – 877.

Mitidieri, J and Vencovsky R (1974). Rivista de Agriculture. Brazil. 49:3-6.

Metwally EI, Masoud AM, El-Waraky YB and Kasem MH (2011). J. Pl. Prod. Mansoura Univ. 2(6): 787 – 795.

Napoli, CA and Ruehle J (1996). New mutations affecting meristem growth and potential in *Petunia hybrid* Vilm. J. Hered. 87: 371 – 377.

Ogwu, MC, Edorisiagbon AO and Osawaru A I (2016). Vegetative growth pattern of West African okra from Southern Edo Stat, Nigeria. J. Ind. Res. Technol. 5(2): 27 – 42.

Rick, CM (1980). Tomato linkage survey. TGC Rep. 30: 2 – 17.

Temam, N, Mohamed W, Aklilu S (2020). Agro morphological characterization and evaluation of okra (*Abelmoschus esculentus* L. Moench) genotypes for yield and other variability components at Melkassa, central Ethiopia. MOJ Ecology & Environ. Sci. 5(2): 80 – 87.

Vishnu, Priyanka D, Thirupathi Reddy M, Begum H, Sunil N and Jataprada M (2017). Int. J. Curr. Microbiol. App. Sci. 6(11): 379 – 388.

Vishnu, Priyanka D, Thirupathi Reddy M, Begum H, Sunil N and Jataprada M (2018). Int. J. Curr. Microbiol. App. Sci. 7(5): 401 – 411.

Assiut J. Agric. Sci., 52 (4) 2021 (129-141) *ISSN: 1110-0486*
Website:www.aun.edu.eg/faculty_agriculture/journals_issues_form.php *E-mail: ajas@aun.edu.eg*

انتخاب سلالات جديدة البنية من أصناف البامية المصرية المحلية باستخدام برنامج انتخاب السلالة النقية

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الملخص

أجريت هذه الدراسة خلال ست دورات من برنامج انتخاب النباتات الفردية للحصول على سلالات نقية واعدة من البامية تمتلك بنية موحدة جديدة ذات سمات مرغوبة، من صنفين محليين من البامية (البلدي والإسكندراني). تبعها تقييم السلالات النقية المحسنة مع عشيرتى الاساس؛ باستخدام تصميم القطاعات العشوائية الكاملة. وعليه أجريت هذه الدراسة خلال مواسم الصيف السبعة المتعاقبة من ٢٠١٤ إلى ٢٠٢٠ ، في مزرعة المحطة التجريبية (بأبيس) بكلية الزراعة، جامعة الإسكندرية، مصر. أظهرت النتائج المتحصل عليها أن المتوسطات المقدرة والمدى ومعامل الاختلافات لجميع الصفات المدروسة تعكس تباينًا ملحوظًا في النمو الخضري والإنتاجية وجودة القرون في عشيرتى الاساس. أيضا عكست جميع السلالات المنتخبة سلوكا مرغوبا لجميع الصفات موضع الدراسة ولكن بدرجات متفاوته، حيث تتميز جميع السلالات النقية المنتخبة في هذه الدراسة بارتفاع قصير إلى متوسط للنبات، وقطر ساق عريض، وعدم وجود فروع على النبات(Zerotyp)، وقصر طول السلامية، بالإضافة إلى أقل عدد من السلاميات حتى الوصول لأول زهرة أو ثمرة على النبات - فيما يتعلق بالإنتاجية وجودة القرن؛ أوضحت النتائج أن السلالة النقية المنتخبة L_{15} أظهر معنوياً أعلى قيمة معنوية لمتوسط ثلاث صفات وهى: عدد القرون للنبات، وإنتاجية القرون للنبات، وانتاجية المتر المربع. كما سجلت السلالات النقية السبعة : L_{14} و L_{10} و L_{12} و L_9 و L_8 و L_{11} و L_{13} أعلى قيمًا معنوية لمتوسطات الثلاث صفات سابقة الذكر مقارنة بعشيرة الاساس (صنف الاسكندرانى)؛ علاوة على ذلك، فإن السلالات الخمسة النقية L_3 و L_4 و L_5 و L_6 و L_7 لم تعكس أي اختلافات معنوية لنفس الصفات مقارنة بالصنف الإسكندرانى.