Improvement Jew's Mallow (*Corchorus Olitorius* L.) By Two Cycles of Mass Selection

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ABSTRACT

The present investigation was carried out during the four successive summer seasons of the years from 2005 till 2008, at Sabahia Horticultural Research Station, Alexandria, in order to study the effect of two mass selection cycles on improving some important characters of some jew's mallow ecotypes, as well as calculate some important genetic parameters of the studied characters. Plant materials of this study consisted of six ecotypes of jew's mallow, which were collected from different regions of Egypt in addition to the check Eskandarany cultivar. The results of the general performances of the evaluated genetic populations indicated, generally, that the means values of most studied characters for the populations derived from the two mass selection cycles, C1 and C2, significantly increased, comparing with those of the original population and check cultivar, in all studied population of jew's mallow ecotypes. The obtained results reflected, generally, that the effects of years on all studied characters, with four exceptions, were found to be significant or highly significant. The effects of genotypes components appeared highly significant for all studied characters of all jew's mallow ecotypes. Genotypes × years effects appeared to be significant for most of the studied characters of all six ecotypes. The estimated broad sense heritability of the various studied characters reflected high values (> 80%) in all tested ecotypes. The expected genetic response (EGR) for total fresh leaves yield ranged from 0.312 in Sharkeia ecotype to 4.493 in Sohag ecotype. Regarding seed yield, the expected genetic response ranged from 0.102 in Isma'aellyia ecotype to 3.647 in Siwi ecotype. The highest realized gain for total fresh leafy yield (144) was at cycle 2 in Sharkeia ecotype. Concerning seed yield, the highest realized gain (71) was at cycle 2 in Siwi ecotype

INTRODUCTION

Jew's mallow (*Corchorus olitorius* L., 2n=14) is one of the popular leafy vegetables, called Jew's mallow, in Egypt. It is grown in many tropical countries of the world such as China, India, Africa, Malaysia, Korea, and Japan (Oomen and Grubben 1978). It is a rich source of vitamin "A" as well as calcium, potassium, magnesium, phosphorous and iron high quantities of ash (Nezam EL-Din et al.,2005), so, it used as fresh or dry.

In Egypt, it is noticed that the devoted area and average production per faddan of jew's mallow are very low. Moreover, the grower's seeds are not produced by specialists. Therefore, this could be due to using old local cultivars, which have a relatively low productivity level as well as it is characterized with a great amount of variability in most of its traits presented among the individual plants. So, no serious attempts have been made to purification and upgrade the productivity of this crop. Accordingly,

it is important to open immense scope to plan effective breeding programs for jew's mallow improvement such as selection procedure, which leading to the identification of superior genotypes. Therefore, it is thought to start a breeding program for jew's mallow depending on mass selection method. In this concern, some investigators studied the effect of mass selection technique in improving different characters of some leafy crops included jew's mallow (Paul and Eunus, 1976; Saha et al. 2002).

Pertaining the information of the effects of the different genotypes, years, and their interaction were studied by Abd – Allah (2006) and Ahmed et al. (1993). Heritability is one of the most important parameters. Some information concerning heritability estimates of some jew's mallow characters were studied by some investigators (Abd – Allah, 2006; Islam et al., 2002). Concerning the expected genetic response and / or realized gain due to selection for some characters of jew's mallow and some leafy vegetables were estimated by Abd – Allah (2006) and Ahmed et al. (1993).

The objective of the present investigation was to study the efficiency of two cycles of mass selection on the general behavior for some characters of six ecotypes of jew's mallow in comparison with two population; Eskandarany and the base population of each ecotype. Moreover, calculate some important genetic parameters of the studied characters.

MATERIALS AND METHODS

This investigation was carried out Sabahia Horticultural Research Station, Alexandria, during the period of 2005 till 2008 summer seasons. The genetic materials used in this study included six ecotypes of jew's mallow, which were collected from different regions of Egypt in addition to the "Eskandarany" as a check cultivar. These genotypes and their sources are presented in Table 1.

Table 1. Sources and local names of jew's mallow genotypes

Genotype	Local names	Local sources in Egypt
Check variety	Eskandarany	Horticultural Research Institute
Ecotype 1	Siwi	Siwa
Ecotype 2	Sharkeia	Sharkeia
Ecotype 3	Sohag	Sohag
Ecotype 4	Minia	Minia
Ecotype 5	Bani sweef	Bani sweef
Ecotype 6	Isma'aellyia	Isma'aellyia

On the first of June 2005 summer season, seeds of each genotype of jew's mallow were sown in 20 rows, 4 m long, 20 cm apart. As seedlings

were established, plants were thinned to 20 cm between plants for sake of selection. Every two rows were considered as a sub-plot. Two cuttings were taken from each genotype of jew's mallow. The highest productive plant within each sub-plot was selected (the first selection cycle CI) for the following planting cycle. In 2006 summer season, selected seeds from C1 were planted at the same spacings as in the first season, and the plants were subjected to the same previous agricultural practices. Selection was continued among and within lines according to the productivity of each individual plant. Two lines (20% selection intensity) were chosen and the best plant within each line was selected (the second cycle of selection, C2), and the seeds were saved. On the first of June of 2007 and 2008 summer seasons, the base populations (of each ecotype) and the check Eskandarany, seeds of the selected plants of cycle 1 and cycle 2 were evaluated in a randomized complete blocks design, with three replications. Each entry was sown in 10 rows, 4 m long, 20 cm apart. As seedlings were established, plants were thinned to 5 or 20 cm between plants for leaves yield or seed yield, respectively. Two cuttings were taken from each genotype of jew's mallow. The first cut was done at 45 days after sowing, meanwhile the second cut were taken 30 days later. All the agricultural practices were followed according to recommendations.

Recorded data:

1- Fresh leafy yield and its components.

In each cutting, vegetative growth, yield and its component characters were recorded on the basis of a mean of 20 randomly plants for each genotype. These characters were plant weight (g), leaves weight (g), number of leaves per plant, fresh leafy yield (Kg/m^2), and net leaves weight (%).

2- Seed yield and its components.

At the seeds harvest stage end of the season, the seed yield and its components traits were recorded as an average of 20 plants for each genotype. These characters were plant height (cm), number of branches/plant, number of pods/pant, number of seeds/pod, and total seed yield (g/plant).

Statistical procedures:

Data of the studied characters of each group of populations for the different jew's mallow genotypes were, separately, arranged and statistically analyzed, using a combined analysis of variance for the two evaluated seasons, as illustrated by Herbert *et al.* (1955). The differences among the various means in each group of data were tested, using Duncan's multiple range test (L.S.R.).

The combined analyses of variance are illustrated in Table 2.

Table 2: The combined analyses of variance

S.O.V.	d.f.	S.S.	M.S.	E.M.S.
Reps./y	y(r-1) = 4	s.s.r/y	s.s.r/y/ y(r-1)	
Years (Y)	(y-1) = 1	s.s.y	s.s.y/(y-1)	$\sigma^2_e + r\sigma^2_{gy} + gr\sigma^2_y$
Genotypes (G)	(g-1) = 6	s.s.g	s.s.g/(g-1)	$\sigma^2_e + r\sigma^2_{gy} + ry\sigma^2_g$
G × Y	(y-1)(g-1)=6	s.s.gy	s.s.gy/(y-1) (g-1)	$\sigma^2_e + r\sigma^2_{gy}$
Combined error	y(r-1)(g-1)=12	s.s.e/y	s.s.e/y/y(r-1) (g-1)	σ^2_e

$$\sigma_g^2 = \frac{M.S.g - (\sigma_e^2 + r\sigma_{gy}^2)}{ry}$$

$$\sigma_y^2 = \frac{M.S.y - (\sigma_e^2 + r\sigma_{gy}^2)}{rg}$$

$$\sigma_y^2 = \frac{M.S.gy - \sigma_e^2}{r}$$

$$\sigma_p^2 = \sigma_e^2 + \sigma_g^2 + \sigma_{gy}^2$$

Where; σ^2_g, σ^2_y, σ^2_{gy} and σ^2_p are the types of variances for genotype, year, genotype × year interaction and phenotype, respectively.

Heritability in broad sense was calculated as illustrated by Falconer (1989), using the following formula

$$H^2_{bs} = \frac{\sigma_g^2}{\sigma_p^2} \times 100$$

Genotypic coefficient of variation (GCV) was estimated according to the procedure outlined by Burton (1952) as follows:

$$GVC = \frac{\sqrt{\sigma_g^2}}{\bar{x}} \times 100$$

Expected genetic response was estimated as illustrated by Falconer (1989), using the following formula

$$G_s = (K)\,\sigma_A\,(H^2_{bs})$$

Where;

G_s : expected genetic advance

K : selection differential (at 5% selection intensity)

σ_A : phenotypic standard deviation.

Genetic advance as percentage of mean (GAM) or genetic gain was calculated using the following formula:

$$GAM = \frac{G_s}{\bar{x}} \times 100$$

RESULTS AND DISCUSSION

Mean performances of siwi ecotype show that mean values of cycle 2 significantly surpassed the check variety in all studied traits except of plant weight of 1st cut and number of seeds/pod (Table 3). Meanwhile, in balady sharkeia ecotype (Table 4), mean values of cycle 2 significantly exceeded the check variety in all studied traits except of net leaves weight, number of branches/plant, number of pods/plant, and seed yield/plant. Concerning balady sohag ecotype (Table 5), plant weight of cycle 2 was equal to that of check variety in the 1st cut, but surpassed it in the 2nd cut. However, the check variety had the highest mean values for leaves weight/plant, number of leaves/plant in (the 2nd cut), net leaves weight, and plant height. On the other hand, means performance of cycle 2 were the highest for the other traits. Regarding balady minia ecotype (Table 6), leaves weight/plant of cycle 2 was equal to that of check variety. However, mean values of cycle 2 exceed the check variety in the other traits except plant weight and number of seeds/pod. Balady beni sweef ecotype in cycle 2 did not exceed check variety in plant weight, and in 1st cut of leaves weight/plant, net leaves weight, and fresh leafy yield, but surpassed it in the orher traits except of number of seeds/pods (Table 7). Balady isma'aellyia ecotype in cycle 2 exceeded the check variety in all studied traits except of fresh leafy yield in 1st cut, and number of seeds/pods, which did not differ significantly(Table 8). Paul and Eunus (1976) reported that base diameter, plant height, leaf angle and leaf area contribute mostly to yield and selection for theses characters would be worth while. But, Saha et al. (2002) reported that selection on plant height did not reflect a corresponding response in yield.

Application of high selection intensity may be risky, so, a low selection intensity on plant height should be applied when selection is done based on plant height only. In such situation, yield estimation of the plants above mean height may increase selection efficiency. But for higher yield direct selection appeared to be efficient over indirect selection.

Mean squares from the combined analysis revealed that the differences between the two selection cycles and both of the base population and the check variety were highly significant for all the studied traits of all Jew's mallow ecotypes (Table 9). With regard to genotype × year component of variance, it reached the significant level for all the studied traits except of plant weight only in 2nd cut, number of leaves/plant, number of branches/plant, and number of pods/plant (Table 9). The significant of this component showed that the selected genotypes failed to posses the same performance in each year of the test; in addition, it is common in variety trails to find large variety × year component of variance because of year-to-year fluctuations which cannot be predicted (Allard and Bradshow, 1966).

Table 3: Mean performances of fresh leaves yield and seed yield and its components of siwi ecotype in cycle 1 and 2 selections with the base population and the check variety, calculated from the combined data over two summer seasons, 2007 and 2008.

Generations	Fresh leafy yield and its components										
	Plant weight (g)		Leaves weight/pant (g)		No. leaves/plant		Net leaves weight (%)		Fresh leafy yield (kg/m²)		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
Check variety	77.04 a*	93.95 d	31.55 b	37.37 c	14.4 d	19.6 c	40.93 b	45.85 b	1.903 b	2.225 d	4.128 d
Base population	56.96 d	115.31 c	26.66 c	40.37 c	17.9 c	19.7 c	32.65 c	36.95 c	1.638 d	3.279 c	4.917 c
Cycle 1	61.88 c	126.89 b	33.68 b	53.77 b	21.0 b	22.9 b	42.15 b	45.11 b	1.842 c	4.241 b	6.083 b
Cycle 2	65.13 b	134.31 a	38.70 a	63.84 a	25.0 a	26.9 a	46.99 a	49.16 a	1.984 a	5.598 a	7.582 a

Generations	Seed yield and its components				
	Plant height (cm)	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant (g)
Check variety	130.2 b	5.0 c	221.0 a	19.9 c	7.19 d
Base population	104.4 c	8.2 b	208.8 c	32.5 b	11.13 c
Cycle 1	130.9 b	8.6 ab	211.1 bc	34.2 ab	11.84 b
Cycle 2	144.3 a	8.9 a	213.0 b	35.3 a	12.33 a

*Values with the same alphabetical letters, within a comparable group of means, do not significantly differ from one another, using Duncan's multiple range test at 0.05 level of probability.

Table 4: Means performance of fresh leafy yield and seed yield its components of baladv sharkeia ecotype in cycle 1 and 2 selections with the base population and the check variety, calculated from the combined data over two summer seasons, 2007 and 2008.

Generations	Fresh leafy yield and its components										
	Plant weight (g)		Leaves weight/pant (g)		No. leaves/plant		Net leaves weight (%)		Fresh leafy yield (kg/m²)		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
Check variety	77.04 d*	93.95 d	31.55 b	37.37 b	14.4 c	19.6 c	40.97 a	39.76 a	1.903 b	2.225 c	4.128 d
Base population	85.96 c	108.34 c	23.30 c	26.44 c	13.9 d	16.2 d	27.08 d	24.40 d	1.654 c	3.393 b	5.048 c
Cycle 1	93.61 b	116.12 b	30.36 b	36.39 b	17.9 b	21.3 b	32.42 c	31.29 c	1.954 b	3.535 ab	5.489 b
Cycle 2	98.35 a	123.45 a	34.72 a	43.65 a	23.8 a	26.5 a	35.29 b	35.35 b	2.086 a	3.590 a	5.676 a

Generations	Seed yield and its components				
	Plant height (cm)	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant (g)
Check variety	130.2 c	5.0 a	221.0 d	19.9 a	7.193 a
Base population	124.9 d	3.4 d	235.0 c	13.6 c	5.252 d
Cycle 1	147.4 b	3.8 c	240.1 b	15.3 bc	6.024 c
Cycle 2	166.4 a	4.2 b	244.1 a	16.6 b	6.655 b

*Values with the same alphabetical letters, within a comparable group of means, do not significantly differ from one another, using Duncan's multiple range test at 0.05 level of probability.

Table 5: Means performance of fresh leafy yield and seed yield its components of balady sohag ecotype in cycle 1 and 2 selections with the base population and the check variety, calculated from the combined data over two summer seasons, 2007 and 2008.

Generations	Fresh leafy yield and its components										
	Plant weight (g)		Leaves weight/pant (g)		No. leaves/plant		Net leaves weight (%)		Fresh leafy yield (kg/m²)		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
Check variety	77.04 a*	93.95 b	31.55 a	37.37 a	14.4 b	19.6 a	40.97 a	39.76 a	1.903 d	2.225 d	4.128 d
Base population	72.92 c	81.59 d	18.73 d	22.42 d	10.9 c	12.6 d	25.67 d	27.46 d	2.325 c	4.288 c	6.613 c
Cycle 1	75.46 b	89.09 c	24.81 c	28.35 c	13.9 b	15.0 c	32.87 c	31.81 c	3.122 b	5.562 b	8.684 b
Cycle 2	77.05 a	97.15 a	28.79 b	35.04 b	16.2 a	17.2 b	37.36 b	36.06 b	3.604 a	6.495 a	10.099 a

Generations	Seed yield and its components				
	Plant height (cm)	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant (g)
Check variety	121.1 a	5.0 c	221.0 b	19.9 d	7.193 d
Base population	79.7 d	5.6 b	216.3 c	22.5 c	7.973 c
Cycle 1	97.1 c	5.9 a	220.4 b	23.4 b	8.468 b
Cycle 2	110.1 b	6.0 a	223.2 a	24.2 a	8.847 a

*Values with the same alphabetical letters, within a comparable group of means, do not significantly differ from one another, using Duncan's multiple range test at 0.05 level of probability.

Table 6: Means performance of fresh leafy yield and seed yield its components of balady minia ecotype in cycle 1 and 2 selections with the base population and the check variety, calculated from the combined data over two summer seasons, 2007 and 2008.

Generations	Fresh leafy yield and its components										
	Plant weight (g)		Leaves weight/pant (g)		No. leaves/plant		Net leaves weight (%)		Fresh leafy yield (kg/m²)		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
Check variety	77.04 a*	93.95 a	31.55 a	37.37 ab	14.4 d	19.6 c	40.97 c	39.76 b	1.903 b	2.225 c	4.128 c
Base population	53.08 d	62.86 d	20.81 c	25.79 c	17.1 c	20.6 c	39.17 d	41.01 b	1.568 d	2.946 c	4.514 c
Cycle 1	56.67 c	75.61 c	26.62 b	35.92 b	22.4 b	24.8 b	46.96 b	47.51 a	1.879 c	4.159 b	6.038 b
Cycle 2	59.72 b	83.43 b	30.92 a	39.71 a	24.5 a	27.3 a	51.75 a	47.63 a	2.236 a	5.475 a	7.711 a

Generations	Seed yield and its components				
	Plant height (cm)	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant (g)
Check variety	130.2 b	5.0 c	221.0 a	19.9 bc	7.193 b
Base population	116.2 c	4.7 d	196.1 c	18.8 c	6.058 c
Cycle 1	131.6 b	5.4 b	204.2 b	21.7 b	7.250 b
Cycle 2	139.6 a	6.0 a	207.9 b	24.1 a	8.210 a

*Values with the same alphabetical letters, within a comparable group of means, do not significantly differ from one another, using Duncan's multiple range test at 0.05 level of probability.

Table 7: Means performance of fresh leafy yield and seed yield its components of baladv bani sweef ecotype in cycle 1 and 2 selections with the base population and the check variety, calculated from the combined data over two summer seasons, 2007 and 2008.

Generations	Fresh leafy yield and its components										
	Plant weight (g)		Leaves weight/pant (g)		No. leaves/plant		Net leaves weight (%)		Fresh leafy yield (kg/m²)		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
Check variety	77.04 a*	93.95 a	31.55 a	37.37 b	14.4 c	19.6 b	40.97 ab	39.76 b	1.903 a	2.225 d	4.128 d
Base population	69.26 c	89.60 b	22.54 c	23.84 c	11.1 d	13.4 c	32.54 c	26.60 c	1.425 c	3.228 c	4.653 c
Cycle 1	72.47 b	92.71 a	27.56 b	35.57 b	16.9 b	18.9 b	38.02 b	38.35 b	1.721 b	3.721 b	5.442 b
Cycle 2	75.17 a	95.66 a	32.47 a	45.78 a	21.1 a	22.2 a	43.18 a	47.66 a	1.873 a	3.936 a	5.808 a

Generations	Seed yield and its components				
	Plant height (cm)	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant (g)
Check variety	130.2 b	5.0 d	221.0 a	19.9 d	7.193 d
Base population	99.3 c	7.0 c	185.9 c	28.1 c	8.551 c
Cycle 1	132.2 b	7.8 b	186.8 bc	31.3 b	9.594 b
Cycle 2	145.2 a	8.4 a	187.1 b	33.5 a	10.272 a

* Values with the same alphabetical letters, within a comparable group of means, do not significantly differ from one another, using Duncan's multiple range test at 0.05 level of probability.

Table 8: Means performance of fresh leafy yield and seed yield its components of baladv isma'aeilyia ecotype in cycle 1 and 2 selections with the base population and the check variety, calculated from the combined data over two summer seasons, 2007 and 2008.

Generations	Fresh leafy yield and its components										
	Plant weight (g)		Leaves weight/pant (g)		No. leaves/plant		Net leaves weight (%)		Fresh leafy yield (kg/m²)		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
Check variety	77.04 bc*	93.95 b	31.55 b	37.37 b	14.4 c	19.6 b	40.97 b	39.76 c	1.903 a	2.225 d	4.128 c
Base population	75.23 c	86.99 c	22.17 d	25.70 c	13.2 d	14.6 c	29.46 d	29.54 d	1.504 c	2.644 c	4.148 c
Cycle 1	79.39 b	95.69 b	29.16 c	39.41 b	18.1 b	20.1 ab	36.72 c	41.17 b	1.711 b	4.145 b	5.856 b
Cycle 2	83.01 a	101.57 a	35.04 a	44.56 a	19.8 a	22.1 a	42.20 a	43.66 a	1.908 a	4.499 a	6.407 a

Generations	Seed yield and its components				
	Plant height (cm)	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant (g)
Check variety	130.2 b	5.0 bc	221.0 a	19.9 c	7.193 bc
Base population	105.3 c	4.9 c	216.4 c	19.7 c	6.981 c
Cycle 1	138.8 b	5.1 b	218.8 bc	20.4 b	7.320 b
Cycle 2	152.6 a	5.5 a	219.8 ab	21.9 a	7.902 a

* Values with the same alphabetical letters, within a comparable group of means, do not significantly differ from one another, using Duncan's multiple range test at 0.05 level of probability.

Table 9: Mean squares of the combined analysis for the studied traits of all Jew's mallow genotypes families.

S. O. V.	d.f.	Fresh leafy yield and its components										
		Plant weight		Leaves weight/pant		No. leaves/plant		Net leaves weight		Fresh leafy yield		
		1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
Genotype (G)	6	292.3**	1240.24**	99.773**	603.4**	80.58**	47.91**	142.04**	107.86**	8.75**	8.232**	9.026**
Year (Y)	1	9.41*	139.54**	7.385**	225.8**	4.101**	5.063**	15.781**	12.870**	5.48**	1.008**	1.533**
G × Y	6	14.75**	2.77	1.452**	8.601**	0.442	0.318	1.628**	3.303**	14.15*	0.384**	0.358*
Error	24	0.789	7.31	0.165	0.183	0.106	0.273	0.085	0.106	0.53	0.038	0.044

S. O. V.	d.f.	Seed yield and its components				
		Plant height	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant
Genotype (G)	6	1110.3**	12.87**	111.99**	205.21**	21.94**
Year (Y)	1	128.82**	0.276**	0.601**	4.306**	0.485**
G × Y	6	4.098**	0.019	1.417**	0.306	0.058*
Error	24	0.416	0.005	0.005	0.118	0.013

*,** Significant differences at 5% and1% levels of probability, respectively.

The partitioning of variance into its various components (Table 10) revealed that a large portion of variance for all the studied traits of all Jew's mallow ecotypes would be attributed to genotypes. It should be mentioned here that genetic variance would be biased upward since it contains non-partitioned genotypic × location source of variance (Comstock and Robinson 1952), so, these results could be accepted under the designed conditions of this investigation and any wider implications warrant further research.

The estimated broad sense heritability of the various studied characters reflected high values (> 80%) in most studied traits of jew's mallow ecotypes (Table 10). These results gave information on the magnitude of genetic variation (Dully and Moll, 1969). However, Herbert et al. (1955) pointed out that heritability give no indication of the amount of progress expected from selection. However, it seems to be most meaningful when accompanied by the estimates of genetic coefficient of variability (Burton, 1952). On the other hand, Herbert et al (1955) stated that heritability estimates, when related to the expected genetic advance, a considerable progress in modifying some characters by selection could be expected. Depending on these points of view, when the relatively high or moderate estimates of heritability related to relatively high or moderate estimates of genetic coefficient of variability, it would resulted in noticeable gain from selection. Therefore, plant weight, net leaves weight, plant height, number of seeds /pod, and number of pods/plant may be improved by selecting the top 5% of the studied genotypes of Jew's mallow. These results were agreement with Abd – Allah (2006). But other experimental findings (Shukla and Singh 1967; Singh, 1970; Alam and Husain, 1986) on phenotypic inter dependence have indicated the importance of direct selection for yield over indirect selection. Probably, a high heritability of yield has rendered indirect selection inefficient in jute. But literatures on different aspects of selection efficiency are scanty.

Data in Tables 11, 12, 13, 14, 15 and 16 showed that a considerable realized gain was obtained in the most studied traits of all Jew's mallow ecotypes for cycle 1 and cycle 2 when compared with the base population. The expected genetic response (EGR) for total fresh leafy yield ranged from 0.312 in balady sharkeia ecotype (Table 12) to 4.493 in balady sohag ecotype (Table 13). Regarding seed yield, the expected genetic response ranged from 0.102 in balady isma'aellyia ecotype (Table 16) to 3.647 in siwi ecotype (Table 11). The highest realized gain for total fresh leafy yield (144) was at cycle 2 in balady sharkeia ecotype (Table 12). Concerning seed yield, The highest realized gain (71) was at cycle 2 in siwi ecotype (Table 11). It worth mentioning that Byth et al. (1989) mentioned that the actual gain computed across environments was the only accurate criteria when genotype × environmental interaction is existed.

Table 10: Genotypic (δ^2_g), phenotypic (δ^2_{ph}), year (δ^2_y), genotypic × year (δ^2_{gy}) variances, heritability (H%), and genetic coefficient of variability (GCV), calculated from the combined data over two seasons for the studied traits all Jew's mallow genotypes families.

	Fresh leafy yield and its components										
	Plant weight		Leaves weight/pant		No. leaves/plant		Net leaves weight		Fresh leafy yield		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
δ^2_g	46.258	206.245	16.387	99.133	13.356	7.932	23.402	17.426	0.014	1.308	1.445
δ^2_{ph}	54.028	211.285	17.839	107.734	13.798	8.250	25.030	20.729	0.019	1.692	1.803
δ^2_y	-36.439	-154.116	-12.451	-75.402	-10.059	-5.955	-17.744	-13,469	-0.011	-1.024	-1.123
δ^2_{gy}	6.981	-2.270	1.287	8.418	0.336	0.045	1.543	3.197	0.005	0.346	0.314
H%	85.62	97.61	91.86	92.02	96.80	96.15	93.50	84.07	73.68	77.30	80.14
GCV	443.801	1689.034	132.152	486.254	71.562	62.664	196.771	184.811	0.216	4.387	6.824

	Seed yield and its components				
	Plant height	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant
δ^2_g	184.367	2.142	18.429	34.151	3.647
δ^2_{ph}	188.465	2.161	19.846	34.457	3.705
δ^2_y	-138.736	-1.608	-13.998	-25.637	-2.741
δ^2_{gy}	3.682	0.014	1.412	0.188	0.045
H%	97.83	99.12	92.86	99.11	98.43
GCV	1730.200	11.168	916.289	177.982	20.283

Table 11: Expected genetic response (EGR), expected genetic response in mean for cycle 1 (C1) and cycle 2 (C2), and realized gain (%) for C1 and C2, calculated from the combined data over two seasons for the studied traits of siwi ecotype.

	Fresh leafy yield and its components										
	Plant weight		Leaves weight/pant		No. leaves/plant		Net leaves weight		Fresh leafy yield		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
EGR	8.811	19.864	5.432	13.371	5.034	3.866	6.549	5.358	0.139	1.408	1.506
EGR in mean (C1)	0.142	0.157	0.161	0.249	0.240	0.169	0.155	0.119	0.076	0.332	0.248
EGR in mean (C2)	0.135	0.148	0.140	0.209	0.201	0.144	0.139	0.109	0.070	0.251	0.199
Realized gain (%)											
C1 (base pop.)	8.638	10.042	26.332	33.193	17.318	16.244	29.096	22.084	12.454	29.338	23.714
C1 (check var.)	-19.678	35.061	6.751	43.885	45.833	16.837	2.981	-1.614	-3.205	90.607	47.359
C2 (base pop.)	14.343	16.477	45.161	58.137	39.665	36.548	43.920	33.099	21.123	70.723	54.200
C2 (check var.)	-15.460	42.959	22.662	70.832	73.611	37.245	14.806	7.263	4.256	151.596	83.672

	Seed yield and its components				
	Plant height	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant
EGR	18.802	2.040	5.792	8.145	2.653
EGR in mean (C1)	0.144	0.237	0.027	0.238	0.224
EGR in mean (C2)	0.130	0.229	0.027	0.231	0.215
Realized gain (%)					
C1 (base pop.)	25.383	4.878	1.102	5.231	6 379
C1 (check var.)	0.538	72.000	-4.480	71.859	64.673
C2 (base pop.)	38.218	8.537	2.011	8.615	10.782
C2 (check var.)	10.829	78.000	-3.620	77.387	71.488

Table 12: Expected genetic response (EGR), expected genetic response in mean for cycle 1 (C1) and cycle 2 (C2), and realized gain (%) for C1 and C2, calculated from the combined data over two seasons for the studied traits of balady sharkeia ecotype.

	Fresh leafy yield and its components										
	Plant weight		Leaves weight/pant		No. leaves/plant		Net leaves weight		Fresh leafy yield		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
EGR	9.852	14.069	5.253	7.713	5.175	4.851	6.588	7.054	0.175	0.730	0.759
EGR in mean (C1)	0.105	0.121	0.173	0.212	0.289	0.228	0.203	0.225	0.090	0.206	0.138
EGR in mean (C2)	0.100	0.114	0.151	0.177	0.217	0.183	0.187	0.200	0.084	0.203	0.134
Realized gain (%)											
C1 (base pop.)	8.899	7.181	30.300	37.632	28.777	31.481	19.719	28.238	18.138	4.185	8.736
C1 (check var.)	21.508	23.598	-3.772	-2.622	24.306	8.673	-20.869	-21.303	2.680	58.876	32.970
C2 (base pop.)	14.414	13.947	49.013	65.091	71.223	63.580	30.318	44.877	26.119	5.806	12.441
C2 (check var.)	27.661	31.400	10.048	16.805	65.278	35.204	-13.864	-11.092	9.616	61.348	37.500

	Seed yield and its components				
	Plant height	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant
EGR	21.330	0.739	11.067	2.958	0.924
EGR in mean (C1)	0.145	0.195	0.046	0.193	0.153
EGR in mean (C2)	0.128	0.176	0.045	0.178	0.139
Realized gain (%)					
C1 (base pop.)	18.014	11.765	2.170	12.500	14.699
C1 (check var.)	13.210	-24.000	8.643	-23.116	-16.252
C2 (base pop.)	33.227	23.529	3.872	22.059	26.714
C2 (check var.)	27.803	-16.000	10.452	-16.583	-7.479

Table 13: Expected genetic response (EGR), expected genetic response in mean for cycle 1 (C1) and cycle 2 (C2), and realized gain (%) for C1 and C2, calculated from the combined data over two seasons for the studied traits of balady sohag ecotype.

	Fresh leafy yield and its components										
	Plant weight		Leaves weight/pant		No. leaves/plant		Net leaves weight		Fresh leafy yield		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
EGR	2.180	7.602	6.278	7.718	2.517	3.358	7.522	6.047	0.086	2.107	2.963
EGR in mean (C1)	0.029	0.085	0.253	0.272	0.181	0.224	0.229	0.190	0.027	0.379	0.341
EGR in mean (C2)	0.028	0.078	0.218	0.220	0.155	0.195	0.201	0.168	0.024	0.324	0.293
Realized gain (%)											
C1 (base pop.)	3.483	9.192	32.461	26.450	27.523	19.048	28.048	15.841	34.280	29.711	31.317
C1 (check var.)	-2.051	-5.173	-21.363	-24.137	-3.472	-23.469	-19.771	-19.995	64.057	149.978	110.368
C2 (base pop.)	5.664	19.071	53.711	56.289	48.624	36.508	45.540	31.318	55.011	51.469	52.714
C2 (check var.)	0.013	3.406	-8.748	-6.235	12.500	-12.245	-8.811	-9.306	89.385	191.910	144.646

	Seed yield and its components				
	Plant height	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant
EGR	20.382	0.538	3.221	2.149	0.813
EGR in mean (C1)	0.210	0.091	0.015	0.092	0.096
EGR in mean (C2)	0.185	0.090	0.014	0.089	0.092
Realized gain (%)					
C1 (base pop.)	21.832	5.357	1.896	4.000	6.208
C1 (check var.)	-19.818	18.000	-0.271	17.588	17.726
C2 (base pop.)	38.143	7.143	3.190	7.556	10.962
C2 (check var.)	-9.083	20.000	0.995	21.608	22.995

Table 14: Expected genetic response (EGR), expected genetic response in mean for cycle 1 (C1) and cycle 2 (C2), and realized gain (%) for C1 and C2, calculated from the combined data over two seasons for the studied traits of balady minia ecotype.

	Fresh leafy yield and its components										
	Plant weight		Leaves weight/pant		No. leaves/plant		Net leaves weight		Fresh leafy yield		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
EGR	12.143	14.885	5.658	6.996	5.307	4.082	6.564	4.641	0.305	1.626	1.859
EGR in mean (C1)	0.214	0.197	0.213	0.195	0.237	0.165	0.140	0.098	0.163	0.391	0.308
EGR in mean (C2)	0.203	0.178	0.183	0.176	0.217	0.150	0.127	0.097	0.137	0.297	0.241
Realized gain (%)											
C1 (base pop.)	6.763	20.283	27.919	39.279	30.994	20.388	19.888	15.850	19.834	41.174	33.762
C1 (check var.)	-26.441	-19.521	-15.626	-3.880	55.556	26.531	14.620	19.492	-1.261	86.921	46.269
C2 (base pop.)	12.509	32.724	48.582	53.974	43.275	32.524	32.116	16.142	42.602	85.845	70.824
C2 (check var.)	-22.482	-11.197	-1.997	6.262	70.139	39.286	26.312	19.794	17.499	146.067	86.797

	Seed yield and its components				
	Plant height	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant
EGR	11.096	0.655	11.828	2.620	1.003
EGR in mean (C1)	0.084	0.121	0.058	0.121	0.138
EGR in mean (C2)	0.079	0.109	0.057	0.109	0.122
Realized gain (%)					
C1 (base pop.)	13.253	14.894	4.131	15.426	19.716
C1 (check var.)	1.075	8.000	-7.602	9.045	0.792
C2 (base pop.)	20.138	27.660	6.017	28.191	35.568
C2 (check var.)	7.220	20.000	-5.928	21.106	14.139

Table 15: Expected genetic response (EGR), expected genetic response in mean for cycle 1 (C1) and cycle 2 (C2), and realized gain (%) for C1 and C2, calculated from the combined data over two seasons for the studied traits of balady bani sweef ecotype.

	Fresh leafy yield and its components										
	Plant weight		Leaves weight/pant		No. leaves/plant		Net leaves weight		Fresh leafy yield		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
EGR	3.831	2.638	5.152	10.326	4.817	4.201	5.213	9.992	0.243	0.869	0.861
EGR in mean (C1)	0.053	0.028	0.187	0.290	0.285	0.222	0.137	0.261	0.141	0.234	0.158
EGR in mean (C2)	0.051	0.028	0.159	0.226	0.228	0.189	0.121	0.209	0.130	0.221	0.148
Realized gain (%)											
C1 (base pop.)	4.635	3.471	22.272	49.203	52.252	41.045	16.841	44.173	20.772	15.273	16.957
C1 (check var.)	-5.932	-1.320	-12.647	-4.817	17.361	-3.571	-7.200	-3.546	-9.564	67.236	31.831
C2 (base pop.)	8.533	6.763	44.055	92.030	90.090	65.672	32.698	79.925	31.439	21.933	24.823
C2 (check var.)	-2.427	1.820	2.916	22.505	46.528	13.265	5.394	20.372	-1.576	76.899	40.698

	Seed yield and its components				
	Plant height	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant
EGR	22.244	1.709	19.655	6.835	1.532
EGR in mean (C1)	0.168	0.219	0.105	0.218	0.160
EGR in mean (C2)	0.153	0.203	0.105	0.204	0.149
Realized gain (%)					
C1 (base pop.)	33.132	11.429	0.484	11.388	12.197
C1 (check var.)	1.536	56.000	-15.475	57.286	33.380
C2 (base pop.)	46.224	20.000	0.646	19.217	20.126
C2 (check var.)	11.521	68.000	-15.339	68.342	42.806

Table 16: Expected genetic response (EGR), expected genetic response in mean for cycle 1 (C1) and cycle 2 (C2), and realized gain (%) for C1 and C2,calculated from the combined data over two seasons for the studied traits of balady isma'aellyia ecotype.

	Fresh leafy yield and its components										
	Plant weight		Leaves weight/pant		No. leaves/plant		Net leaves weight		Fresh leafy yield		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total yield
EGR	3.816	6.736	6.212	9.105	3.504	3.591	6.562	7.150	0.206	1.269	1.332
EGR in mean (C1)	0.048	0.070	0.213	0.231	0.194	0.179	0.179	0.174	0.121	0.306	0.227
EGR in mean (C2)	0.046	0.066	0.177	0.204	0.177	0.163	0.155	0.163	0.108	0.282	0.208
Realized gain (%)											
C1 (base pop.)	5.530	10.001	31.529	53.346	37.121	37.671	24.644	39.370	13.763	56.770	41.176
C1 (check var.)	3.050	1.852	-7.575	5.459	25.694	2.551	-10.373	3.546	-10.089	86.292	41.860
C2 (base pop.)	10.342	16.761	58.051	73.385	50.000	51.370	43.245	48.544	26.862	70.159	54.460
C2 (check var.)	7.749	8.111	11.062	19.240	37.500	12.755	3.002	10.362	0.263	102.202	55.208

	Seed yield and its components				
	Plant height	No. branches/ plant	No. of seeds /pod	No. of pods /plant	Seed yield /plant
EGR	22.723	0.286	2.231	1.140	0.442
EGR in mean (C1)	0.164	0.056	0.010	0.056	0.060
EGR in mean (C2)	0.149	0.052	0.010	0.052	0.056
Realized gain (%)					
C1 (base pop.)	31.814	4.082	1.109	3.553	4.856
C1 (check var.)	6.605	2.000	-0.995	2.513	1.766
C2 (base pop.)	44.919	12.245	1.571	11.168	13.193
C2 (check var.)	17.204	10.000	-0.543	10.050	9.857

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الملخص العربى

تحسين الملوخية بتطبيق الانتخاب الاجمالى لدورتين متتاليتين

سامح عبد المنعم محمد عبد الله

معهد بحوث البساتين - مركز البحوث الزراعية - مصر

أجرى هذا البحث بمحطة بحوث البساتين بالصبحية ؛ خلال المواسم الصيفية فى الفترة من ٢٠٠٥ وحتى ٢٠٠٨ لدراسة تأثير الانتخاب الاجمالى لدورتين متتاليتين على تحسين المحصول الخضرى والبذرى للملوخية، وكذلك حساب بعض القياسات الوراثية الهامة للصفات المدروسة. وقد استخدمت ستة طرز محلية من الملوخية جمعت من مناطق مختلفة من جمهورية مصر العربية بالإضافة إلى صنف المقارنة الاسكندراتى المستنبط بمعهد بحوث البساتين. وقد وجد زيادة قيم معظم الصفات المدروسة للنبات فى الدورتين الأولى والثانية للانتخاب مقارنة بكل من العشيرة الأساسية وصنف المقارنة لكل الطرز

المحلية للملوخية. وقد كان تباين التركيب الوراثى × السنة معنويا لمعظم الصفات المدروسة ، كذلك كانت قيم التوريث عالية لكل الصفات المدروسة فى كل الطرز المحلية للملوخية. وقد تحصل على زيادة فعلية مرغوبة لمعظم الصفات المدروسة فى كل الطرز المحلية للملوخية الدورتين الأولى والثانية للانتخاب مقارنة بالعشيرة الأساسية. وقد تراوحت الاستجابة الوراثية المتوقعة (EGR) للمحصول الخضرى من ٠,٣١٢ فى بلدى شرقية إلى ٤,٤٩٣ فى سوهاج . أما فى المحصول البذرى فقد تراوح من ٠,١٠٢ فى بلدى إسماعيلية إلى ٣,٦٤٧ فى الطراز السيوى .