Similarity degree in two sugar beet populations after two selection cycles

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ABSTRACT

The main objectives of this investigation were to study similarity degree in two sugar beet populations before selection [C_{11}-R_{540} (Eg.1) and EL-Kasr (Eg.8)] and after selection for one cycle (Eg.3 and Eg.10) and for two cycles (Eg.5 and Eg.11). Selection was carried out by (El-Manhaly *et al.*, 2000). Seven morphological characters (leaf blade length, leaf blade width, leaf petiole length, rosette height, root length, root diameter and root weight) were studied. In addition, electrophoretic patterns of cathodal peroxidase were employed, to assess such similarity. Field experiment was carried out in the experimental farm of El-Sabahia station in two experimental seasons (2002-2003). The results obtained from the analysis of the morphological characters as well as the analysis of isozymes in this investigation revealed that the genetic similarity was highly increased in selected populations compared with that of non-selected ones after one and two selection cycles.

INTRODUCTION

Sugar beet *(Beta vulgaris* L.) has been specifically selected and bred for sucrose production over the past two centuries (De Bock 1986; Winner 1993). During the first 100 years of selection, sucrose levels in *B. vulgaris* dramatically increased from relatively low levels of sucrose (e.g. from less than 6% to more than 12%). Sugar beet is a relatively new crop; beginning from open-pollinated selections of fodder beets grown in a small region of Europe, its selection was initiated in the late 18th century (Fischer 1989). Like other cultivated beets sugar beet is a biennial.

Morphological characters have been studied by several investigators to estimate its influence on yield component characters such as root yield and sugar percentage (Tawfic *et al* 1997). Rogozhin, (1979) obtained positive correlation between root weight and leaf surface. Shevtsov *et al.* (1980) found close correlations between yield and leaf rosette size. Kapur *et al.* (1985) found that (leaf length, leaf width, petiole length, root length and root diameter) were positively related to root weight in sugar beet. Others investigators studied such morphological characters to identify sugar beet varieties and lines, (Antonov 1984) studied variability and inheritance of leaf number and leaf weight in sugar beet of monogerm

diploid male-sterile lines. Kamal *et al.* (2003) examined thirteen sugar beet varieties in respect of bolting, disease resistance, root length, polarity%, leaf length and width beside root girth, root yield and found correlation between bolting percentage and leaf length and leaf width.

In the past, breeders have mostly used morphological markers in the assessment of breeding programs. However in sugar beet, such markers are only available in limited numbers (Smith 1980).Recently many investigators used biochemical assays such as isozymes and storage protein electrophoresis for idintificate sugar beet breeding materials (Oleo *et al* 1992) and for linkage maps in sugar beet (Van Geyt & Jacobs, 1986; Abe & Tsuda, 1987;; Smed et al., 1989; Aicher & Saunders, 1990., Wagner & Wricke, 1991).

In the present investigation similarity degree was studied in two sugar beet populations before selection [C_{11}-R_{540} (Eg.1) and EL-Kasr (Eg.8)] and effect of selection for two selection cycles on the homozygosity (El-Manhaly *et al.*, 2004). In order to achieve such purposes the morphological characters and peroxidase isozymes analysis were studied in two experimental seasons (2002-2003). The morphological studied characters were (leaf blade length, leaf blade width, leaf petiole length, rosette height, root length, root diameter and root weight).

MATERIALS AND METHODS

The sugar beet materials used throughout the present study, were obtained from the Sugar Crops Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. Six sugar beet (*Beta vulgaris* L.) open-pollinated populations were employed in this work and classified into three categories. They are: two original populations (before selection) [C_{11}-R_{540} (Eg.1) and EL-Kasr (Eg.8)]; two populations obtained after one selection cycle (Eg.3 and Eg.10); and two populations obtained after two selection cycles (Eg.5 and Eg.11).

The selection against bolting was conducted at Kafer EL-Sheikh area, in (1997&1998) and (1999&2000) growing seasons, and seed production was carried out at Marsa Matruh experimental station in (1999 and 2001) reproductive seasons. This can be illustrated as follows:

	C_{11}-R_{540} (Eg.1)	Original populations	El-Kasr (Eg.8)
1997 – 1999	↓ Eg.3	First selection cycle	↓ Eg.10
1999 – 2001	↓ Eg.5	Second Selection cycle	↓ Eg.11

Seeds of the six open–pollinated populations were grown in October 2001 and October 2002 as well. Seeds were planted in rows (50 cm spaced) and on a distance of 20 cm from plant to plant. The plants received the normal agricultural treatments throughout the vegetative seasons. Two rows from each replicate were chosen to estimate the measurements.

Morphological study:

The measurements were taken in the end of growing season. These measurements were as follows:

- Leaf blade length: length of the largest three leaves per plant was measured in cm.
- Leaf blade width: width of the largest three leaves per plant was measured in cm.
- Leaf petiole length: petiole length of the largest three leaves per plant was measured in cm.
- The rosette height: distance between soil surface to top of the root crown.
- Root length: distance in cm between top and the base of the root.
- Root diameter: diameter of each root was measured in cm.
- Root weight: weight of each root in Kg.

Homozygosity was estimated employing the obtained covariance according to (Steel and Torrie, 1981).

Electrophoresis technique

Peroxidase analysis

Isozyme patterns of peroxidase for sugar beet were obtained using the following procedure:

Buffers

0.23 M Tris - Citric acid buffer, pH 8.0.

0.01 M Sodium acetate - acetic acid buffer, pH 5.0 was prepared according to Sabrah (1980).

Gel media

Agar-Starch-polyvinyl pyrolidine (P.V.P.) gel: were prepared as Sabrah and El-Metainy (1985).

Staining solution

100 ml of 0.01 M Sodium acetate - acetic acid buffer, pH 5.0 containing 0.1 gm Benzidine and 0.5% Hydrogen peroxide (H_2O_2) was added immediately before staining.

Procedures

Leaf samples were homogenized in a cool mortar, and the homogenate was absorbed on filter paper strips which placed on the origin line of agar gel plate for about one hour, electrophoretic started for two hours at current of 13–14 V/Cm. After separating the peroxidase isozymes were stained and band scoring was done according to TOTAL LAB software V.1.11.

RESULTS AND DISCUSSION

Effect of selection on morphological characters similarity degree:

Seven morphological characters were studied in the selected populations and original ones to estimate the effect of selection upon the similarity degree. Four of the morphological studied characters were vegetative and three of them were root characters. These characters are:

a. Leaf blade length.
b. Leaf blade width.
c. Leaf petiole length.
d. Rosette height.
e. Root length.
f. Root diameter.
g. Root weight.

Table (1) shows degree of similarity for the seven studied morphological characters. The obtained data showed that selection increased homozygosity for leaf blade length character in the selected populations from 86.66% in the original population (Eg.1) to (93.20% and 92.47%) in (Eg.3 and Eg.5); respectively. In the original population (Eg.8) it increased from 83.60% to (92.09% and 93.53%); in selected populations (Eg.10 and Eg.11); respectively.

The results obtained from this work indicate that for leaf blade width homozygosity increased from 87.62% to (92.33% and 91.33%) in original population (Eg.1) and in the selected populations (Eg.3 and Eg.5); respectively. The other original population (Eg.8) had similarity degree of

85.01% and this similarity degree was increased in the selected populations (Eg.10 and Eg.11) to (92.09% and 91.63%); respectively.

The other two vegetative characters leaf petiole length and rosette height showed that the same trend was achieved whereas the homozygosity was increased from the original populations (Eg.1 and Eg.8) to the selected populations after one selection cycle (Eg.3 and Eg.10) and in populations (Eg.5 and Eg.11) after two selection cycles.

Figure (1) shows the averages of homozygosity (percentages) in the four studied vegetative characters in the two original populations (Eg,1 and Eg.8) and its selected progenies after one selection cycle (Eg.3 and Eg.10) and after two selection cycles (Eg.5 and Eg.11) for two seasons. The figure illustrates an increase in similarity percentages in the selected populations compared with that of their original parents.

With respect to root characters the similarity was increased in the selected populations after selections; whereas in root length character the similarity degree increased from 90.91% to 91.94% and 94.05% in Eg.1 population to Eg.3 and Eg.5; respectively. While in the second original population Eg.8 the similarity was increased from 90.02% to 94.17% after one selection cycle and 95.18% after two selection cycles.

In root diameter character the obtained results showed that homozygosity for root diameter was increased in first original population Eg.1 from 89.68% to 93.94% after two selection cycles in population Eg.5. In the second original population Eg.8, similarity increased from 88.27% to 89.31% and 93.02% after two selection cycles in populations Eg.10 and Eg.11; respectively.

The data obtained from this part of the present work revealed that the lowest degree of similarity was recorded for root weight character whereas in the first original population Eg.1 the homozygosity degree was 85.10% and it increased after one selection cycle to 88.93% in population Eg.3 and it was reached the steady state after two selection cycles in population Eg.5 (88.75%). In the second original population Eg.8 the similarity increased from 82.86% to 83.29% and 90.68% in its selected progeny populations Eg.10 and Eg.11; respectively.

Figure (2) shows the averages of homozygosity percentages for three studied root characters in the original populations before selection (Eg.1 and Eg.8) and its selected progeny (Eg.3, Eg.5, Eg.10 and Eg.11) for two seasons. The figure shows that selection was proven to be capable in increasing homozygosity percentages while root weight character had the lowest similarity degree in all studied morphological characters before selection.

Effect of selection on isoperoxidase similarity degree:

Homozygosity between the selected populations and original ones was compared in peroxidase isozymes patterns. To achieve such a purpose seventy five plant samples from each studied population were investigated by isozyme analysis in five agar starch gel plates. Each plate contained 15 leaf plant samples. Measurement of bands was carried out using the computer program software TOTALLAB V.1.11. The obtained data showed differences in band numbers, band volume, peak height and R.f. parameter in the investigated materials whereas:

Band volume: it indicates the value resulting from the interaction between band area and band density. It refers to the amount of isozyme, which was expressed from a given gene.

Peak height: it refers to the density of the band and this indicates to the activity of the isozyme.

R.f. (Retardation factor): it refers to the position of band from the original line to its position as relative number–typically between 0 and 1.

The similarity degree was studied in selected populations and non-selected ones using cathodal peroxidase. Kolodziejczak and Krzakowa (2003) suggested that cathodic peroxidase system is controlled by four independent genes, of which only one is polymorphic. The data indicated that the degree of homozygosity was increased by selection. Figure (3) shows the isozyme band separation in agar starch gel electrophoresis plates for Eg.1 population (the first original population). Table (2) shows the bands exist in the 15 leaf plant samples of population Eg.1. Data indicated that there were six bands in the cathodal side. The band No.6 had a highest relative existence and had R.f. value of about 0.94; while band No.2 had the lowest relative existence and had a R.f. value of about 0.34.

Figure (4) shows the peroxidase patterns of population Eg.3 (after one cycle of selection). Table (3) presents bands of Eg.3 population. The data showed that the relative existence of bands No.2 & 5 in the selected population after one selection cycle was increased compared with that of the original population. These bands had R.f. values of about 0.34 and 0.85; respectively. While band No.1; 3 & 4 were decreased after one selection cycle. These bands had R.f. values of about 0.12, 0.45 and 0.63; respectively.

Figure (5) shows the peroxidase band separation of the second cycle of selection for population (Eg.5). Table (4) shows that bands No.2 & 5 which had R.f. values of about 0.34 and 0.84; respectively were increased as relative existence when compared with that of Eg.1 and Eg.3 populations. Figure (6) shows the electrophoretic separation of the second

original population (Eg.8). Table (5) illustrates bands of population Eg.8. Data showed that bands No.1; 5 & 6 had the highest relative existence, these bands had R.f. values of about 0.12, 0.85 and 0.95; respectively. While band No.2 had the lowest relative existence which had R.f. value of about 0.32.

Figure (7) shows separation of the peroxidase isozyme for Eg.10 population (the first cycle selected population). Table (6) shows bands of Eg.10 population. Data showed that there was an increase in the relative existence in band No.2 which had R.f. values of about 0.31; while band No.3 & 4 which had R.f. value of about 0.47 and 0.64; respectively was decreased compared with that of the original population (Eg.8). Figure (8) shows separation of peroxidase of population Eg.11 (after second cycle of selection). Table (7) presents bands of population Eg11.

Comparing either with the original population (Eg.8) or with the first cycle of selection (Eg.10), the data show decrease in relative existence of band No.3 & 4, which had R.f. value of about 0.46 and 0.62; respectively.

Table (8) represents the relative existence percentages of cathodal peroxidase bands of the selected populations and original ones. In population Eg.1 the effect of selection was proven to be capable in increasing of existence percentages for bands No.2 & 5 in comparison with those of original population. Similarly to this data, in population Eg.8 band No.2 was increased after selection compared with the original population. Contrary to this, bands No.1; 3 & 4 were decreased after selection compared with those of the original population Eg.1. In population Eg.8 bands No.3 &4 were decreased after selection.

The results obtained from the analysis of the morphological characters as well as the analysis of isozymes in this investigation revealed that the genetic similarity was highly increased in selected populations compared with that of non-selected ones after one and two cycles of selection. This conclusion is in agreement with that mentioned by (EL-Manhaly *et al.*, 2004).

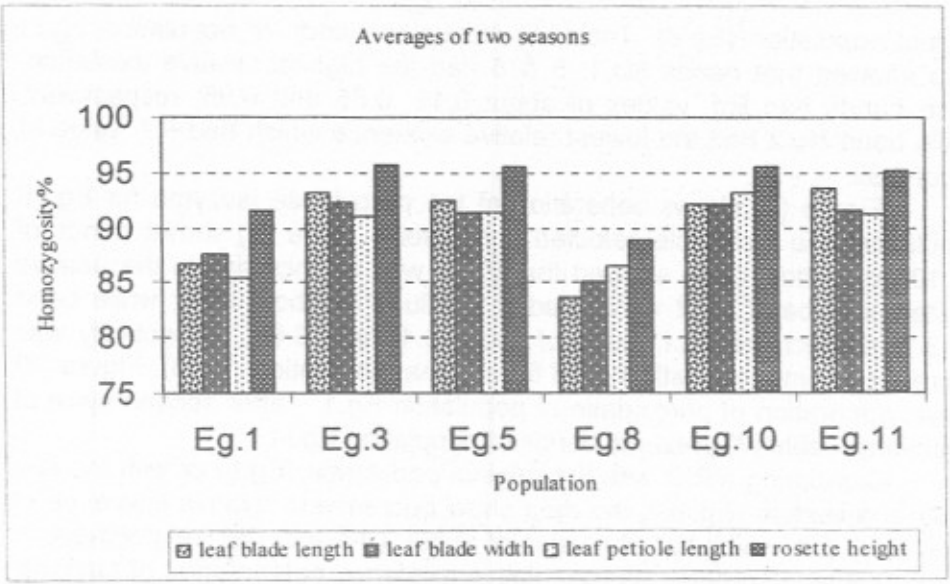

Figure (1) : The averages of homozygosity percentages in four vegetative characters in origional and selected populations for two seasons .

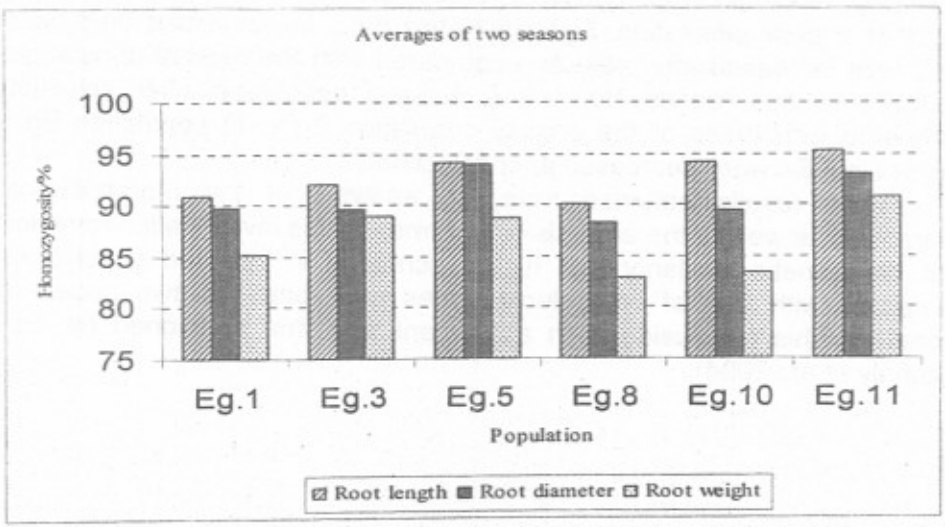

Figure (2) : **The averages of homozygosity percentages in three root characters in origional and selected populations for two seasons .**

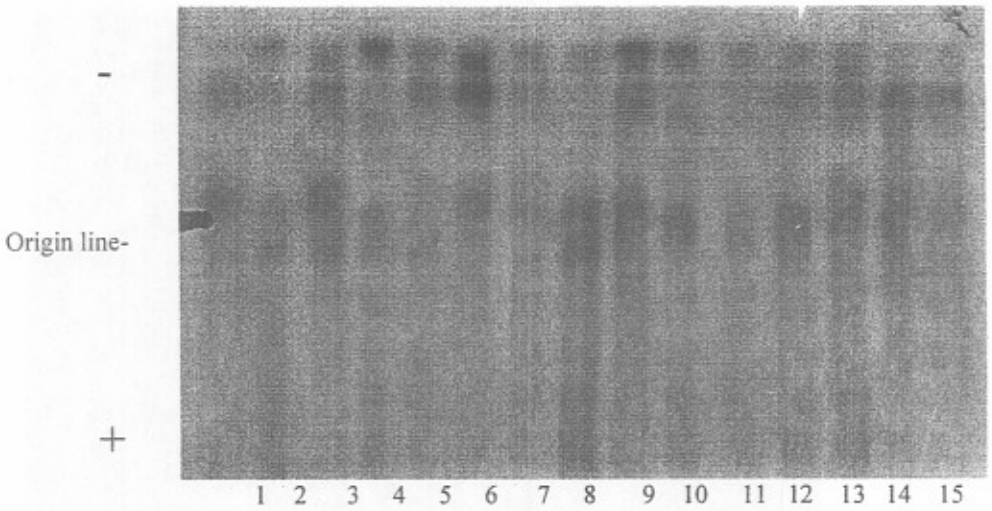

Figure (3): Isozyme patterns of peroxidase obtained for the 15 leaf plant samples of the original population Eg.1.

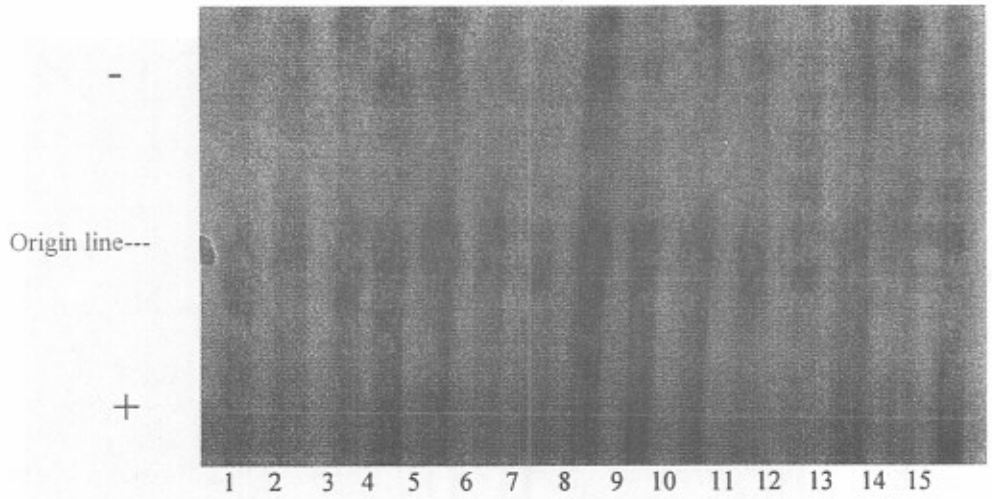

Figure (4): Isozyme patterns of peroxidase obtained for the 15 leaf samples of Eg.3 population after one cycle of selection.

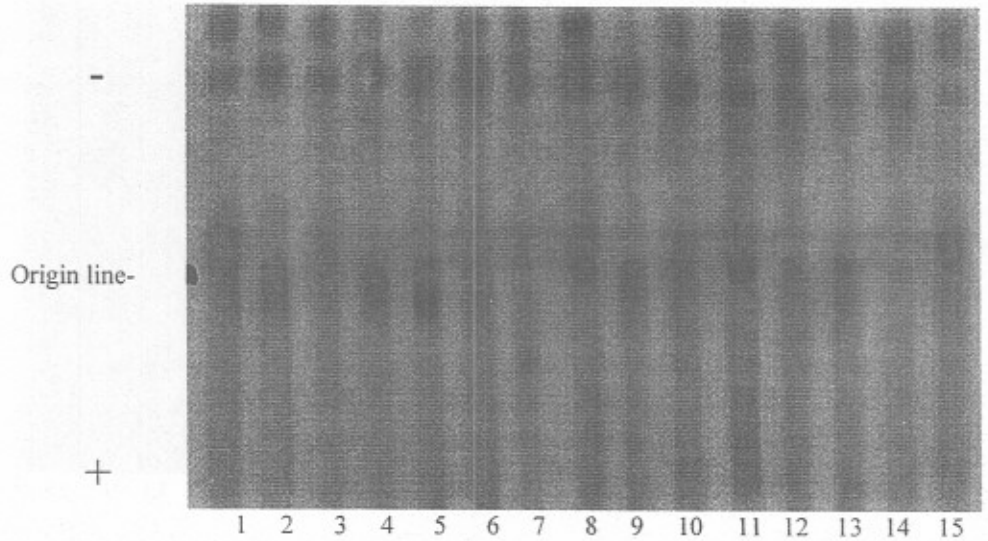

Figure (5): Isozyme patterns of peroxidase obtained for the 15 leaf samples of Eg.5 population after two cycles of selection.

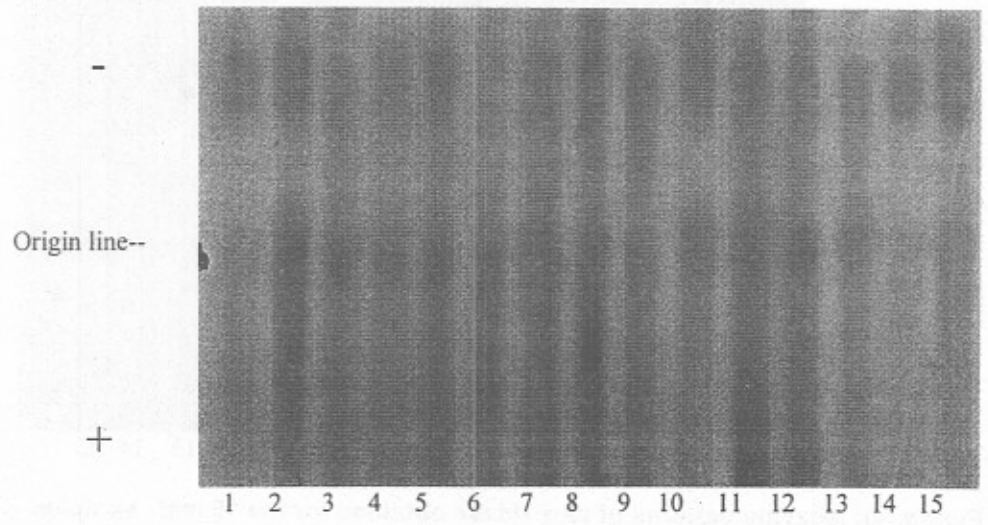

Figure (6): Isozyme patterns of peroxidase obtained for the 15 leaf plant samples of the original population Eg.8.

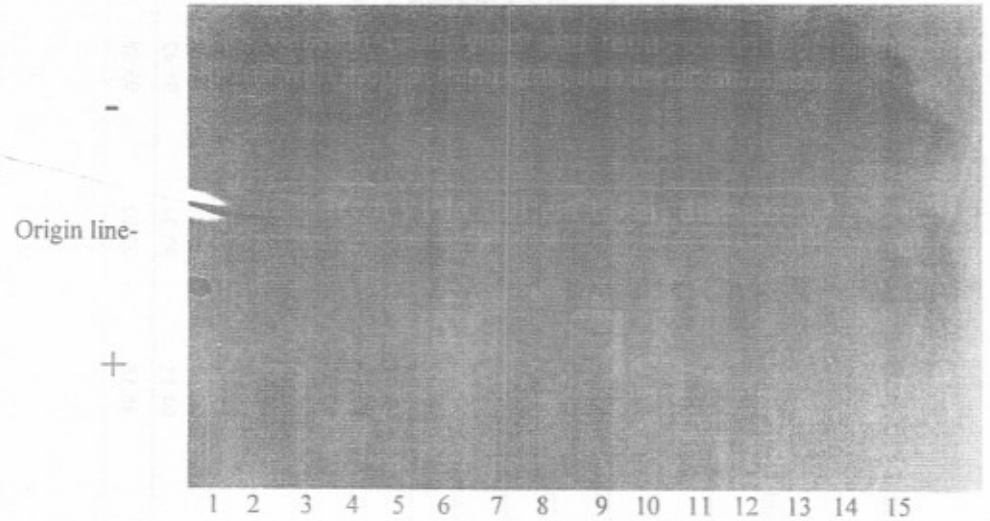

Figure (7): Isozyme patterns of peroxidase obtained for the 15 leaf samples of Eg.10 population after one cycle of selection.

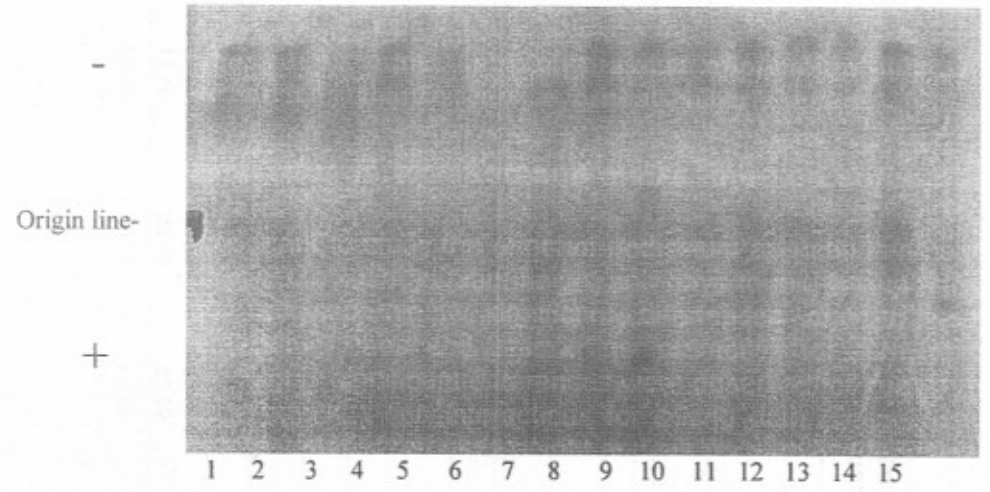

Figure (8): Isozyme patterns of peroxidase obtained for the 15 leaf samples of Eg.11 population after two cycles of selection.

Table (1): Means of homozygosity degree of seven morphological characters in original and selected populations

Population \ Traits	Season	Leaf blade length	Leaf blade width	Leaf petiole length	rosette height	Root length	Root diameter	Root weight
Eg.1	1	84.61	86.56	84.46	90.97	90.10	90.51	84.83
	2	88.72	88.68	86.27	91.97	91.73	88.86	85.38
Average		86.66	87.62	85.36	91.47	90.91	89.68	85.10
Eg.3	1	93.07	93.13	90.53	95.34	90.34	88.80	87.80
	2	93.33	91.54	91.32	95.86	93.54	90.30	90.07
Average		93.20	92.33	90.92	95.60	91.94	89.55	88.93
Eg.5	1	92.48	90.94	92.14	96.35	94.00	95.01	89.15
	2	92.46	91.73	90.51	94.54	94.10	92.87	88.36
Average		92.47	91.33	91.32	95.44	94.05	93.94	88.75
Eg.8	1	85.36	86.72	85.24	87.81	90.29	86.38	79.54
	2	81.85	83.30	87.79	89.87	89.75	90.16	86.18
Average		83.60	85.01	86.51	88.84	90.02	88.27	82.86
Eg.10	1	93.48	92.69	92.88	95.95	93.43	87.74	80.54
	2	90.70	91.50	93.49	95.16	94.91	90.89	86.05
Average		92.09	92.09	93.18	95.55	94.17	89.31	83.29
Eg.11	1	93.98	92.01	91.25	94.66	96.26	92.81	89.94
	2	93.08	91.25	91.21	95.62	94.11	93.24	91.42
Average		93.53	91.63	91.23	95.14	95.18	93.02	90.68

Table (2): Electrophoretic cathodal peroxidase bands obtained from the original population Eg.1

Plant number	Band 1			Band 2			Band 3			Band 4			Band 5			Band 6		
	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.
1	-	-	-	354.23	0.14	0.342	-	-	-	-	-	-	1.089.10	0.69	0.823	321.23	0.15	0.921
2	-	-	-	735.36	0.59	0.345	-	-	-	-	-	-	597.59	0.87	0.827	689.17	0.67	0.937
3	632.64	1.07	0.133	-	-	-	615.32	0.20	0.453	741.71	0.84	0.641	-	-	-	648.25	0.88	0.942
4	642.85	0.89	0.127	-	-	-	417.30	0.37	0.458	653.31	0.86	0.649	-	-	-	1.022.95	1.06	0.928
5	449.97	0.45	0.115	524.25	0.19	0.352	-	-	-	-	-	-	352.84	0.63	0.844	506.14	0.65	0.931
6	463.65	0.72	0.124	1.654.32	0.50	0.341	-	-	-	-	-	-	389.94	0.91	0.859	635.25	0.95	0.941
7	612.85	0.82	0.129	735.36	0.59	0.345	-	-	-	-	-	-	598.81	0.75	0.835	428.36	0.72	0.947
8	-	-	-	-	-	-	-	-	-	-	-	-	530.07	0.56	0.841	968.25	0.63	0.943
9	360.29	0.57	0.134	-	-	-	935.01	1.16	0.441	1.332.89	1.19	0.633	-	-	-	1.216.52	1.29	0.939
10	447.19	0.35	0.136	-	-	-	710.14	0.19	0.469	301.40	0.46	0.644	-	-	-	651.91	0.99	0.924
11	-	-	-	362.54	0.21	0.354	-	-	-	-	-	-	434.39	0.26	0.842	652.28	0.49	0.935
12	-	-	-	-	-	-	351.89	0.14	0.458	803.78	0.29	0.618	-	-	-	587.25	0.52	0.925
13	498.29	0.73	0.115	-	-	-	564.58	0.77	0.446	590.80	0.68	0.625	-	-	-	642.25	0.86	0.923
14	417.23	0.55	0.134	-	-	-	935.21	0.75	0.452	516.84	0.67	0.612	-	-	-	475.28	0.54	0.935
15	771.65	0.52	0.136	-	-	-	752.25	0.71	0.465	681.56	0.77	0.605	-	-	-	658.21	0.53	0.925

Table (3): Electrophoretic cathodal peroxidase bands obtained from Eg.3 after one selection cycle

Plant number	Band 1			Band 2			Band 3			Band 4			Band 5			Band 6		
	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.
1	-	-	-	376.38	0.16	0.337	-	-	-	-	-	-	432.34	0.85	0.852	-	-	-
2	-	-	-	501.98	0.25	0.332	-	-	-	-	-	-	617.84	0.60	0.804	698.34	0.64	0.947
3	-	-	-	347.35	0.34	0.348	-	-	-	-	-	-	361.04	0.69	0.828	1.279.82	0.88	0.963
4	665.89	0.63	0.093	-	-	-	949.14	0.36	0.469	418.56	0.54	0.631	-	-	-	902.05	0.60	0.964
5	343.63	0.75	0.116		-	-	357.72	0.26	0.454	532.48	0.21	0.637	-	-	-	1.587.56	0.94	0.969
6	-	-	-	314.58	0.22	0.341	-	-	-	-	-	-	445.14	0.90	0.803	-	-	-
7	-	-	-	403.64	0.35	0.334	-	-	-	-	-	-	1.483.37	0.92	0.809	-	-	-
8	-	-	-	311.59	0.39	0.339	-	-	-	-	-	-	1.307.62	0.76	0.817	1.390.30	0..77	0.944
9	-	-	-	347.75	0.25	0.331	-	-	-	-	-	-	436.13	0.60	0.831	950.41	0.52	0.941
10	331.46	0.68	0.117	372.75	0.32	0.333	-	-	-	-	-	-	412.63	0.46	0.849	587.32	0.85	0.952
11	-	-	-	329.62	0.16	0.327	-	-	-	-	-	-	898.67	0.55	0.867	654.25	0.45	0.947
12	341.24	0.59	0.123	-	-	-	258.15	0.46	0.477	461.33	0.29	0.639	-	-	-	-	-	-
13	361.57	0.13	0.124	-	-	-	671.49	0.33	0.453	536.84	0.20	0.633	-	-	-	547.35	0.54	0.987
14	-	-	-	378.85	0.20	0.329	-	-	-	-	-	-	542.36	0.89	0.847	745.36	0.75	0.977
15	328.01	0.70	0.127	916.52	0.36	0.304	-	-	-	-	-	-	854.33	0.75	0.864	547.25	0.54	0.975

Table (4): Electrophoretic cathodal peroxidase bands obtained from Eg.5 after two selection cycles

Plant number	Band 1			Band 2			Band 3			Band 4			Band 5			Band 6		
	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.
1	956.50	0.63	0.105	576.54	0.35	0.345	-	-	-	-	-	-	599.61	0.36	0.837	746.30	0.30	0.935
2	-	-	-	1.254.32	0.38	0.324	-	-	-	-	-	-	682.25	0.68	0.846	687.77	0.66	0.923
3	-	-	-	1.365.21	0.49	0.338	-	-	-	-	-	-	555.11	0.53	0.831	517.03	0.55	0.949
4	-	-	-	854.32	0.38	0.341	-	-	-	-	-	-	540.21	0.55	0.834	992.65	0.52	0.941
5	-	-	-	969.25	0.72	0.354	-	-	-	-	-	-	469.95	0.65	0.822	658.45	0.68	0.938
6	-	-	-	932.25	0.75	0.365	-	-	-	-	-	-	576.73	0.84	0.832	1 641.45	0.84	0.932
7	-	-	-	506.12	0.72	0.347	-	-	-	-	-	-	823.76	0.63	0.829	619.53	0.65	0.947
8	979.72	1.32	0.121	-	-	-	862.04	0.36	0.467	678.06	0.41	0.644	-	-	-	1.475.96	0.77	0.945
9	856.18	0.26	0.108	-	-	-	-	-	-	-	-	-	654.25	0.79	0.841	-	-	-
10	735.69	0.89	0.094	-	-	-	501.95	0.49	0.451	834.23	0.53	0.629	-	-	-	638.02	0.52	0.921
11	1.095.91	0.91	0.101	883.88	0.86	0.323	-	-	-	-	-	-	587.36	0.82	0.841	1.128.73	0.75	0.937
12	-	-	-	522.01	0.54	0.328	-	-	-	756.20	0.50	0.618	725.36	0.78	0.854	758.36	0.79	0.945
13	-	-	-	697.41	0.53	0.321	-	-	-	-	-	-	425.36	0.81	0.846	1.325.35	0.84	0.935
14	-	-	-	778.65	0.53	0.315	-	-	-	-	-	-	853.25	0.92	0.857	1.023.20	0.81	0.957
15	979.07	0.93	0.111	580.18	0.63	0.329	-	-	-	-	-	-	543.25	0.53	0.864	996.21	0.49	0.934

Table (5): Electrophoretic cathodal peroxidase bands obtained from the original population Eg.8

Plant number	Band 1			Band 2			Band 3			Band 4			Band 5			Band 6		
	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.
1	325.32	0.11	0.115	365.87	0.10	0.324	-	-	-	-	-	-	890.76	0.93	0.842	587.32	0.32	0.947
2	482.50	0.80	0.113	354.23	0.79	0.315	-	-	-	-	-	-	995.07	1.23	0.854	677.23	1.25	0.964
3	684.36	0.21	0.115	868.16	0.42	0.325	-	-	-	547.36	0.40	0.643	-	-	-	584.36	0.24	0.934
4	526.44	0.20	0.114	-	-	-	754.36	0.39	0.447	364.32	0.13	0.634	758.25	0.52	0.852	742.54	0.16	0.946
5	462.13	0.26	0.149	-	-	-	536.38	0.34	0.447	328.56	0.14	0.641	696.01	0.61	0.854	547.35	0.31	0.954
6	99.71	0.26	0.108		-	-	625.38	0.32	0.434	414.93	0.35	0.646	794.26	0.78	0.862	836.54	0.29	0.948
7	315.89	0.43	0.112	-	-	-	568.73	0.86	0.455	363.70	0.88	0.633	544.46	0.93	0.854	686.36	0.42	0.947
8	510.72	0.28	0.124	-	-	-	785.90	0.82	0.441	437.65	0.86	0.645	767.60	0.96	0.851	985.69	0.74	0.967
9	425.36	0.24	0.127	-	-	-	946.93	0.69	0.454	479.59	0.62	0.641	582.36	0.92	0.847	-	-	-
10	529.02	0.63	0.107	-	-	-	-	-	-	-	-	-	487.93	0.95	0.836	825.36	0.76	0.946
11	622.87	0.79	0.128	524.36	0.24	0.318	-	-	-	-	-	-	658.35	0.99	0.852	736.35	0.19	0.951
12	402.40	0.68	0.102	-	-	-	460.09	0.52	0.458	485.61	0.75	0.622	674.48	1.14	0.842	756.35	0.34	0.942
13	330.18	0.67	0.129	-	-	-	738.95	0.63	0.447	543.36	0.85	0.632	742.36	0.94	0.864	-	-	-
14	313.21	0.11	0.125	326.53	0.11	0.324	-	-	-	-	-	-	614.19	0.91	0.832	352.25	0.14	0.965
15	442.12	0.58	0.094	362.69	0.12	0.321	-	-	-	-	-	-	725.32	0.93	0.834	858.35	0.83	0.954

Table (6): Electrophoretic cathodal peroxidase bands obtained from Eg.10 after one selection cycle

Plant number	Band 1			Band 2			Band 3			Band 4			Band 5			Band 6		
	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.
1	-	-	-	684.25	0.42	0.312	-	-	-	-	-	-	-	-	-	458.35	0.26	0.924
2	689.50	0.42	0.125	-	-	-	798.07	0.56	0.472	663.60	0.58	0.635	575.68	0.61	0.862	-	-	-
3	630.84	0.51	0.115	745.32	0.36	0.318	-	-	-	-	-	-	980.82	0.66	0.875	658.25	0.31	0.931
4	-	-	-	-	-	-	-	-	-	-	-	-	917.68	0.70	0.878	752.36	0.57	0.931
5	829.31	0.72	0.137	654.52	0.39	0.324	-	-	-	-	-	-	698.17	0.61	0.863	759.25	0.51	0.944
6	352.25	0.12	0.132	874.25	0.68	0.314	-	-	-	-	-	-	404.66	0.41	0.873	685.25	0.64	0.931
7	635.90	0.58	0.126	-	-	-	1.514.20	0.69	0.484	710.20	0.62	0.641	-	-	-	1.985.24	0.79	0.935
8	715.36	0.56	0.132	-	-	-	-	-	-	-	-	-	633.03	0.64	0.857	658.25	0.41	0.937
9	-	-	-	-	-	-	994.16	0.50	0.468	630.25	0.58	0.647	504.62	0.71	0.854	754.25	0.45	0.956
10	657.32	0.51	0.117	-	-	-	958.17	0.62	0.474	758.25	0.49	0.641	826.10	0.69	0.861	523.52	0.76	0.954
11	865.44	0.73	0.131	-	-	-	1.622.20	0.75	0.477	658.25	0.69	0.634	884.76	0.95	0.875	973.25	0.84	0.952
12	-	-	-	687.58	0.46	0.297	-	-	-	-	-	-	477.84	0.58	0.879	786.36	0.52	0.935
13	959.11	0.41	0.113	684.25	0.26	0.314	-	-	-	-	-	-	624.07	0.49	0.867	849.56	0.69	0.931
14	627.04	0.47	0.128	730.74	0.68	0.304	-	-	-	-	-	-	553.14	0.85	0.872	685.38	0.25	0.947
15	596.12	0.63	0.118	901.92	0.41	0.308	-	-	-	-	-	-	668.26	0.71	0.851	587.36	0.23	0.944

Table (7): Electrophoretic cathodal peroxidase bands obtained from Eg.11 after two selection cycles

Plant number	Band 1			Band 2			Band 3			Band 4			Band 5			Band 6		
	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.	Volume	Peak Height	R.f.
1	451.05	0.28	0.138	391.25	0.10	0.214	-	-	-	-	-	-	673.92	0.87	0.867	666.41	0.85	0.957
2	316.21	0.25	0.125	325.87	0.12	0.321	-	-	-	-	-	-	782.03	0.98	0.845	775.25	0.94	0.962
3	-	-	-	-	-	-	-	-	-	-	-	-	595.48	0.52	0.831	654.32	0.35	0.955
4	484.64	0.13	0.138	453.25	0.29	0.343	-	-	-	-	-	-	655.03	0.83	0.839	664.25	0.87	0.961
5	393.25	0.16	0.133	584.36	0.29	0.332	-	-	-	-	-	-	510.39	0.60	0.833	673.25	0.64	0.976
6	358.41	0.15	0.125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	437.90	0.19	0.114	-	-	-	1.616.02	0.65	0.467	647.35	0.72	0.649	416.03	0.88	0.852	658.25	0.35	0.962
8	495.44	0.15	0.121	253.98	0.11	0.332	-	-	-	-	-	-	986.80	1.37	0.824	582.36	0.95	0.951
9	685.25	0.20	0.134	542.36	0.25	0.339	-	-	-	-	-	-	685.03	0.97	0.841	774.35	0.94	0.974
10	663.36	0.20	0.128	598.35	0.21	0.328	-	-	-	-	-	-	557.44	0.71	0.866	646.28	0.52	0.961
11	596.25	0.22	0.134	-	-	-	-	-	-	562.24	0.59	0.625	558.46	0.74	0.857	665.21	0.63	0.989
12	-	-	-	-	-	-	458.32	0.28	0.473	-	-	-	710.99	0.92	0.852	753.17	0.76	0.985
13	-	-	-	-	-	-	354.25	0.31	0.463	-	-	-	679.97	0.63	0.861	557.39	0.51	0.961
14	494.32	0.12	0.133	622.71	0.57	0.348	-	-	-	-	-	-	494.89	0.92	0.826	568.35	0.86	0.954
15	547.46	0.12	0.126	442.17	0.37	0.332	-	-	-	-	-	-	417.05	0.66	0.804	472.36	0.81	0.944

Table (8): Percentages of relative existence of the cathodal peroxidase bands in the selected and non-selected populations

Band number / Population	Band 1	Band 2	Band 3	Band 4	Band 5	Band 6
Eg.1	66.66%	40.00%	56.00%	60.00%	60.00%	81.33%
Eg.3	36.00%	60.00%	30.66%	33.33%	70.66%	76.00%
Eg.5	21.33%	74.66%	12.00%	18.66%	85.33%	86.66%
Eg.8	90.66%	40.00%	54.66%	53.33%	90.66%	85.33%
Eg.10	86.66%	50.66%	33.33%	34.66%	90.66%	85.33%
Eg.11	88.00%	65.33%	18.66%	14.66%	93.33%	90.66%

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الملخص العربي

درجة التماثل في عشيرتين من بنجر السكر بعد دورتين من الأنتخاب

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** قسم التربية والوراثة – معهد بحوث المحاصيل السكرية

أجري هذا البحث بغرض دراسة درجة التماثل الوراثي في عشيرتين من بنجر السكر بعد دورتين من الأنتخاب وذلك بالمقارنه بالعشيرتين الأصليتين قبل الأنتخاب وهذه العشائر هي

C_{11}-R_{540} (Eg.1) و EL-Kasr (Eg.8) (قبل الأنتخاب).

(Eg.3 و Eg.5 و Eg.10 و Eg.11) (بعد الأنتخاب).

وقد تم أستخدام سبع صفات مورفولوجيه في هذه الدراسة وهذه الصفات هي:-

١- طول النصل

٢- عرض النصل

٣- طول العنق

٤- أرتفاع المجموع الخضري

٥- طول الجذر

٦- محيط الجذر

٧- وزن الجذر

كذلك تم دراسة مشابهات أنزيم البيروكسيديز في الأتجاه السالب للعشائر المنتخبه والغير منتخبه بغرض دراسة درجة التماثل عن طريق أستخدام طريقة الفصل الكهربي. وقد أجري هذا البحث في مزرعة محطة البحوث الزراعيه بالأسكندريه في موسمي (٢٠٠٢- ٢٠٠٣). وقد أوضحت النتائج المتحصل عليها أن الأنتخاب أدي الي زيادة درجة التماثل في الصفات تحت الدراسه في العشائر المنتخبه عن تلك التي لم يحدث بها أنتخاب.