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GENOTYPIC VARIATIONS IN EGYPTIAN GENE POOL OF BARSEEM CLOVER ' *Trifolium alexandrinum*,l"

Mohamed Abd El-Sattar Ahmed, Barakat, M.N. and Asmaa Mohamed Samir Rady

Crop Science Dept, Faculty of Agriculture(Elshatby),Alexandria University, Egypt

ABSTRACT

The present study was carried out to detect the prevailing variability within the gene pool of barseem clover "Trifolium alexandrinum, L.". Five random populations of expected variable expressions were included. These were; ''Fahl" a single cut and "Meskawi", "Khadarawi I", "Khadrawi II" and "Saeidi" a multi-cut types. The study period covered two winter seasons of 2005/2006 and 2006/2007.The obtained results could be summarized in the following.Dry forage yield at first cutting of barseem population at first season, showed a wide range of 173 g/m^2, while, the corresponding range in second season was only 18.1 g/m^2. Over all the two years, the traced range was wider amounting to 197.9 g/m^2. The phenotypic variability in green forage yield of the subsequent cutting amounted to 21.3% of the grand mean over seasons. The corresponding values represented between 17.82% and 8.6% of each of the first and the second seasons grand mean, respectively. Phenotypic variations represented 15.4 and 19.1% of each of the first and second seasons dry forage yield, respectively. Whereas, over the two years of the study, the magnitude of phenotypic variations represented about 28% of the over all mean. Phenotypic differences among barseem populations amounted to 29.7, 12.7 and 4.84 percent of the obtained mean number of heads per plant at first, second seasons and combined analysis. In the same time, genotypic differences among populations of barseem amounted to 22.95, 6.3 and 10.41% of the populations grand mean over first, second seasons and combined data. As for, number of seeds per head, values of 62.89 and 89 were expressed as a range in the first, second seasons and overall the two seasons. Over the two years, the magnitude of genotypic and phenotypic variations was quite equal and around 20%. Estimate of heritability for seed yield components varied between the seasons, where, the genotypic variance represented about 60 and 24% of the phenotypic variance of number of heads per plant at the two successive seasons, respectively. Low heritabilities estimates of about 0.31 and 0.28 were obtained for number of flowers per head at the two seasons, respectively .Estimates from the combined analysis over seasons, were approaching 0.96 and 0.65 for number of seeds per plant and seed weight per plant. The high values of heritability estimates, which were obtained with number of seeds per inflorescence and seed weight per plant, indicate that these two traits might be the main components of seed yield. Furthermore, the low estimates of heritability with number of heads per plant and number of flowers per inflorescence might indicate that these characters are largely affected by environmental factors.

Key words: Genotypic variability, Barseem clover, Heritability, Expected genetic advance, Seed yield components and Forage yield.

INTRODUCTION

Barseem clover " *Trifolium alexandrinum ,L* " is the principle forage crop in Egypt . About 30% of winter cropped area is devoted to barseem . It's the basic feed for animals during at least seven month yearly . Forage and seed yield improvement depend essentially at the prevailing genetic variability. Variability is traced through estimating coffecients of variation , heritability and excepted genetic advance . Researchers published results that describe variability in different barseem population since early seventies of the last century. **Radwan (1970),** estimated broad – sense heritability, from partitioning variance components, from 37 *Fahl* barseem lots. The estimate was 0.46 for green forage yield. **Ali (1971),** indicated that, seasonal forage yield was generally of low heritability, where, estimates of 3.29 and 0.03% were obtained from regression of cycle one selection materials in drilled rows and spaced progenies, respectively. The Corresponding estimates were 0.50 and 0.07 obtained from variance components analysis. **Radwan and Abo El-Zahab (1972),** estimated heritability from combined analysis of variance of three progeny tests for multi-cut Egyptian clover. They obtained estimates of 26.0, 31.0, 30.0 and 39.0 % for green forage yield of the three successive cutting and seasonal yield, respectively. **Ali (1977),** evaluated 289 seed-lots of multi-cut Egyptian clover. He reported that, heritability in broad- sense for green yield, varied with cuts and seasons. Heritability ranged according to cut from 51.6 to 74.4%. Maximum heritability values were obtained in the second season (51.61, 74.47 and 66.29 for the three successive cuttings, respectively) relative to the first season (49.21, 53.17 and 19.32, respectively) over three cuts. **El-Nahrawy (1980)**, compared the performance of 58 seed-lots selected for seasonal forage yield from 331 farmer's seed-lots of Egyptian clover. He pointed that, heritability differed according to seed-lots, location and cut. Heritability estimates values were medium to high obtained for seasonal yield of six groups of lots at each of two locations and over locations while in Giza were (21.4, 9.1, 16.4, 22.9 and 24.3), in Gemmiza were (38.9, 0.5, 18.8, 38.6, 42.3)and combined were (52.4, 17.7, 10.4, 53.6, 48.0 and 45.6). He added that, Selection of the top lots from original seed, had expected to be fruitful approach to the improvement of forage yield by selection. **Bakheit (1985**), reported that, the realized heritability and expected selection advance for first and second cycles of mass selection for green forage yield were 0.381, 0.035 and 31.77, 3.948, respectively. **Bakheit (1986),** estimated the variance among 54 multi-cut Egyptian clover accessions in Alexandria and Nubaria. Broad -sense heritability estimates were high, reached 78 and 81% at Alexandria and Nubaria, respectively. **Bakheit and Mahdy (1989),** reported that, broad-sense heritability estimates of fresh forage yield differed from selected accession to another and ranged from 44.18 to

87.38%.**Ahmed (2000)**, reached an estimate of broad –sense heritability as 92.56% for total green forage yield. **Ahmed (2006)**, stated that, Heritability estimate was the lowest for seasonal green forage yield (52.03 and 52.30% for *Khadarawi* and *Miskawy* populations, respectively).**Bakheit *et al*. (2005)** obtained broad-sense heritability derived from variance components as 76.10 for fresh forage yield. However, heritability for fresh forage yield was smaller than dry yield suggesting more environmental influence on fresh yield. **Abd El-Galil *et al*. (2006)** showed that heritability in broad, sense for seasonal fresh yield was as high as 88.7%.**Rajab (2010)**, estimated the variation among some ecotypes of Egyptian clover and response of selection among and within those ecotypes. Heritability estimate in broad-sense for fresh forage yield was 83.93%. **Radwan and Abou El-Fittoh (1970)** reported that, phenotypic coefficient of variability for dry forage yield was 12.3 %.**Mikhiel (1987),** recorded a genetic coefficients of variability for dry yield of 10.5 and 14.6% at Alexandria and Nubaria, respectively **.Radwan and Abou El-Fittoh (1970** found that the coefficient of variability for green yield was 7.5 %.**Ali (1977),** evaluated 289 seed- lots of multi-cut Egyptian clover. He stated that, the phenotypic coefficients of variability for green forage yield in the second season were 11.9, 14.0, 14.2 and 22.5% in the first, second, third and annual yield, respectively. **El-Nahrawy *et al*. (2006)**, estimated phenotypic variability of fresh forage yield in some cultivars of Egyptian clover under two locations. He reached that; phenotypic coefficient of variation (P.C.V) was low in all cuts for fresh forage yield. The recorded values for successive cuttings at *Sakha* location in 2003/ 2004 were 2.4, 1.7, 1.1 and 1.1%. In 2004/2005 season the recorded values were; 1.3, 1.9, 0.98 and 0.4% for the four cuttings, respectively. At *Sids* location the obtained values were, 0.9, 6.9, 0.98 and 0.45% in 2003/3004 season, while in 2004/2005 were 0.69, 0.7, 0.79 and 1.6%, respectively. **Rajab (2010),** reached that, the highest phenotypic coefficient of variation value (P.C.V.) was recorded for fresh forage yield as 5.075 % in 2001/2002,9.036 % in 2003/2004 and 6.792 % in 2004/2005 seasons.

Radwan (1970 showed that, the expected gain from one cycle of selection for green forage yield was 12.4%. **Bakheit (1985**) reported that, the expected selection advance for first and second cycles of mass selection for green forage yield were 31.77, 3.948%, respectively. Also, he found that, family selection was more rewarding that mass selection and produced a response of 15.48% of the unselected base family mean after one cycle of selection. **Bakhiet (1986),** reported that, the expected genetic advance from selecting the best six accessions among 54 accessions of Egyptian clover was 17.5 % for fresh forage yield. **Ahmed (2000),** reached that the expected gain in green forage yield from selecting the highest 20% families was about 8.98%. That indicated the feasibility of selection based on half-sib family's evaluation. **Abd El- Galil *et al.* (2006),** estimated the expected genetic advance in fresh forage yield as 8.1%.

The objectives of the recent study were to estimate morphologic and genetic variation in Egyptian pool of barseem clover *via* conventional tools.

MATERIALS AND METHODS

The present study was carried out at the Agricultural Experimental Research Station, Crop Science Department, Faculty of Agriculture, Alexandria University. The main objectives were to estimate morphological and genetic variations in barseem clovers “*Trifolium alexandrinum*, L.” gene pool. The materials used in this study were a random samples comprised five populations of barseem clover namely; "Fahl", "Meskawi", "Khadarawi I", "Khadarawi II" and "Saeidi". "Fahl" and "Meskawi" populations are commercial varieties realized by Forage Research Department, ARC, Ministry of Agriculture. "Khadarawi I" was kindly supplemented by Dr. M.S. Rady, Professor of Crop Science, Univeristy of Menufeya. "Khadarawi II" was an improved population developed by Dr. M. Abd El-Sattar Ahmed, Professor of Crop Science, Alexandria University **(Ahmed, 2006).** "Saeidi" population is a representative sample for available farmer’s seed lots. The studied materials were field evaluated during the two successive winter seasons of 2005/2006 and 2006/2007. Sowing dates were 18^{th} and 20^{th} of October for the two seasons, respectively. Preceeding crop were maize in the two seasons. Randomized complete block design with four replicates was used in both seasons. Plot area was 12.88 m^2 comprises eight rows 4.6 meters long and 0.3 meter apart. Seeds were hand drilled at the rate of 24 kg/ fad. Four cuts per season were taken in both seasons. The first cutting was harvested after 65 days from sowing, whereas, the second, third and fourth cuttings were taken after 105, 140 and 170 days, respectively. Normal practices for barseem production were followed when every possible. The following characters were determined:1- Green forage yield (Kg/m^2): one random guarded square meter were taken from each plot, weighed after cutting in kilograms.2- dry forage yield (kg/ m^2): was estimated using the data of green forage yield and dry matter percentage and 3- seed yield components.

Analysis of variance for the data collected in each cutting per year as well as combined analysis over years and cuts was performed as described by **Cochran and Cox (1957).** According to the analysis of variance assumptions, numerical data were subjected to square root transformation before analysis. Combined analysis over cuts and years was performed, when the assumption of homogeneity of error was not rejected. Forms of analysis of variance for first cutting combined over years and subsequent cuttings (second, third and fourth) combined over cuttings and years were illustrated in Table (1).

From the analysis of variance (Table 1) the following parameters were estimate as follows :

- Phenotypic variance (σ_p^2): Is the total variance among genotypes. It was estimated by the following formulae;

(a) From analysis of variance for each cut:

$$\sigma_p^2 = \sigma_G^2 + \sigma_e^2 / Pr$$

(b) From analysis of variance for first cut over years:

$$\sigma_p^2 = \sigma_G^2 + \sigma_{gy}^2 / y + \sigma_e^2 / Pr\,y$$

(c) From analysis of variance over years and cuts:

$$\sigma_p^2 = \sigma_G^2 + \sigma_{gyc}^2 / Pr + \sigma_{gc}^2 / Pr\,y + \sigma_{gy}^2 / Pr\,c + \sigma_c^2 / Pr\,gy + \sigma_e^2 / P$$

- Genotypic variance: was estimated as follows:

(a) From analysis of variance for each cut:

$$\sigma_g^2 = M_1 - M_2 / rp$$

(b) From analysis of variance for first cut over years:

$$\sigma_g^2 = M_1 - M_2 / rpy$$

(c) From analysis of variance over years and cuts:

$$\sigma_g^2 = \frac{M_1 + M_5 - (M_3 + M_4)}{rpyc}$$

Table (1): Forms of analysis of variance for randomized complete block design in each cut and combined over year or over years and cuts.

Source of variance	d.f.	M.S.	EMS
(a) Each cut			
Replications	(r* – 1)		
Populations(G)	(g – 1)	M_1	$\sigma_p^2 + P\sigma_e^2 + rp\sigma_g^2$
Error	(r – 1) (g –	M_2	$\sigma_p^2 + P\sigma_e^2$
Remainder	(P–1) (r) (g)	M_3	σ_p^2
(b) First cut over years			
Years (Y)	(y – 1)		
Reps / year	(r – 1) (y)		
Populations(G)	(g – 1)	M_1	$\sigma_p^2 + P\sigma_e^2 + rp\sigma_{gy}^2 + rpy\sigma_g^2$
Y × G	(y – 1) (g –	M_2	$\sigma_p^2 + P\sigma_e^2 + rP\sigma_{yg}^2$
R × Y × G	(r – 1) (g–	M_3	$\sigma_p^2 + rP\sigma_e^2$
Remainder	(P–1) (r) (y)	M_4	σ_p^2
(c) Over years and cuts			
Years (Y)	(y – 1)		
Reps / year	(r – 1) (y)		
Populations(G)	(g – 1)	M_1	$\sigma_p^2 + P\sigma_e^2 + pr\sigma_{gyc}^2 + pry\sigma_{gc}^2 + prc\sigma_{gy}^2 + pryc\sigma_g^2$
Cuttings (C)	(c – 1)	M_2	$\sigma_p^2 + P\sigma_e^2 + pr\sigma_{gyc}^2 + pry\sigma_{gc}^2 + prc\sigma_{gy}^2 + prgy\sigma_c^2$
G × Y	(g–1) (y–1)	M_3	$\sigma_p^2 + P\sigma_e^2 + pr\sigma_{gyc}^2 + pry\sigma_{gc}^2 + prc\sigma_{gy}^2$
G × C	(g–1) (c–1)	M_4	$\sigma_p^2 + P\sigma_e^2 + pr\sigma_{gyc}^2 + pry\sigma_{gc}^2$
G × Y × C	(g–1) (y–1)	M_5	$\sigma_p^2 + rP\sigma_e^2 + pr\sigma_{gyc}^2$
R × G × Y × C	(r – 1) (gc–	M_6	$\sigma_p^2 + rP\sigma_e^2$
Reminder	(P–1) (g) (y)	M_7	σ_p^2

*r = replications. g = Populations.
c = cuts. y = years.
p = plants

• Genotype × environment variance : was estimated as follows:

(a) From analysis of variance for first cut over years:

$$\sigma^2_{g\times e} = M_2 - M_3 / rp$$

(b) From analysis of variance over years and cuts:

$$\sigma^2_{g\times e} = M_2 - M_3 / prgy + M_3 - M_4 / prc + M_4 - M_5 / pry + M_5 - M_6 / pr$$

• Environmental variance (σ^2_e) calculated as follows:

(a) From analysis of variance for each cut:

$$\sigma^2_e = M_2 - M_3 / p$$

(b) From analysis of variance for first cut over years:

$$\sigma^2_e = M_3 - M_4 / rp$$

(c) From analysis of variance over years and cuts:

$$\sigma^2_e = M_6 - M_7 / crp$$

• Heritability estimate in broad-sense (h^2): was calculated from the variance component to describe the ratio of genetic variance among entries to the total variance as given by **Hallauer and Miranda (1981**) as; $h^2 = \sigma^2_g / \sigma^2_p$

• Genotypic coefficient of variability (G.C.V.); is the part of the phenotypic variance which can be attributed to genotypic differences among entries:

$$\text{G.C.V.} = \frac{\sigma_G}{\bar{x}} \times 100$$ (**Burton and De Vance, 1953**).

Where;

σ_G : represents genetic standard deviation.

$\bar{X}$: trait's over all mean.

• Phenotypic coefficient of variability (P.C.V.); is an index for the variability among entries which result from both genetic variability and environmental heterogeneity:

$$\text{P.C.V.} = \frac{\sigma_P}{\bar{x}} \times 100$$ (**Burton and De Vance, 1953**).

Where;

σ_P : represents the phenotypic standard deviation.

$\bar{x}$: trait overall mean.

RESULTS AND DISCUSSION

Green and dry forage yields:

Estimates of phenotypic and genotypic variations for green and dry forage yields at first cutting were presented in Table (2). The range of green forage productivity (kg/m^2) among the tested barseem populations at first cutting was 3.5, 1.2 and 4.3 for first, second seasons and combined values. The magnitude of genotypic and phenotypic variance was about equal in both seasons. But, the phenotypic variations in green forage among barseem populations were about 180, 70 and 59 percent of the trait grand mean in the first, second seasons and combined yield , respectively. In the meantime, genotypic variation in green forage productivity, reached 172.4, 61.5 and 31.2 percent of the overall mean in the first, second seasons and combined data, respectively.

Dry forage yield at first cutting of barseem population in first season, showed a wide range of 173 g/m^2, while, the corresponding range in second season was only 18.1 g/m^2. Over all the two years, the traced range was wider amounting to 197.9 g/m^2. The magnitudes of genotypic and phenotypic variances were nearly alike, in both seasons. But, over the two years, genotypic variance was only about three percent of the phenotypic. That was reflected on the ratio of phenotypic to genotypic variations, where, both types of variations were about similar (110.4, 109.7 and 6.7, 5.95 percent of trait mean for phenotypic and genotypic variations in the first and second years, respectively). Meanwhile, overall the two years of the study, phenotypic variability in dry forage yield at first cutting was about eight percent of the grand mean. The magnitude of genotypic variations was very limited, amounting to about two percentage of the mean.

At subsequent cuttings barseem populations exhibited a range in green forage productivity over all the two seasons of the study as kilogram/m^2 of 3.5 (Table 3). The limits of that range were 1.7 to 5.2 kg/m^2, which is quite wide. In first season, the range of variability in green yield of first season was narrower (1.7 kg/m^2) than the corresponding value of the second season (3.2 kg/m^2). The estimate of genotypic variance was positive from the combined analysis over season, only. The phenotypic variability in subsequent cuttings for green forage yield, amounted to 21.3% of the grand meal over seasons. On separate season analysis the corresponding values for phenotypic variability, represented between 17.82% and 8.6% of each of first and the second season's grand means, respectively.

The range of variation in dry forage of the subsequent cuttings of the study over the two years, reached 71.1 g/m^2, while, that range was only 55.6 and 37.22 g/m^2 in first and second seasons, respectively. Phenotypic variations, represented

Table (2): Estimates of genetic parameters for green forage yield and dry forage yield of barseem populations in first cutting the two seasons and combined analysis.

Statistic	Green forage yield	Dry forage yield
	First season	
Range	(2.63 – 6.100) 3.5	(55.4 – 228.44) 173.04
(σ^2_G)	34.97	1991.8
(σ^2_P)	35.6	2018.7
(P.C.V.)	179.95	110.4
(G.C.V.)	172.41	109.7
	Second season	
Range	(1.800 – 3.00) 1.2	(30.5 – 48.6) 18.1
(σ^2_G)	2.18	9.11
(σ^2_P)	2.79	11.4
(P.C.V.)	69.6	6.7
(G.C.V.)	61.52	5.95
	Combined analysis	
Range	(1.800 – 6.100) 4.3	(30.5 – 228.44) 197.9
(σ^2_G)	0.82	0.57
(σ^2_P)	2.88	14.59
(P.C.V.)	58.52	8.4
(G.C.V.)	31.23	1.7

σ^2_G: genotypic variance.

σ^2_P: phenotypic variance.

P.C.V.: phenotypic coefficient of variability.

G.C.V.: genotypic coefficient of variability.

Table (3): Estimates of genetic parameters for green forage yield and dry forage yields of barseem populations in Subsequent cuttings of the two seasons and combined analysis

Statistic	Green forage yield	Dry forage yield
	First season	
Range	(1.700 – 3.4) 1.7	(98.6 – 153.9) 55.6
(σ^2_G)	*	*
(σ^2_P)	0.183	316.6
(P.C.V.)	17.82	15.4
(G.C.V.)	*	*
	Second season	
Range	(2.0 – 5.2) 3.2	(82.8 – 120.02) 37.22
(σ^2_G)	*	110.01
(σ^2_P)	0.08	350.4
(P.C.V.)	8.6	19.1
(G.C.V.)	*	10.7
	Combined analysis	
Range	(1.700 – 5.2) 3.5	(82.8 – 153.9) 71.1
(σ^2_G)	0.05	142.74
(σ^2_P)	0.38	862.9
(P.C.V.)	21.3	27.5
(G.C.V.)	7.71	11.2

*** Negative estimate of variance.**

σ^2_G: genotypic variance.

σ^2_P: phenotypic variance.

P.C.V.: phenotypic coefficient of variability.

G.C.V.: genotypic coefficient of variability.

15.4 and 19.1% of each of the first and second seasons dry forage yield, respectively. Whereas, over the two years of the study, the magnitude of phenotypic variations, represented about 28% of the over all mean. The genotypic variability among the studied barseem populations at subsequent cuttings amounted to about 11% of the character mean values in the second season and over all seasons, as well. The available review on variability within populations of barseem is relatively rare. Ali (1977) detected values of phenotypic and genotypic coefficient of variability for green forage yield of "Meskawi" barseem clover as 11.9 and 8.5%, 14.0 and 12.1%, 14.2 and 11.6%, 11.6 and 22.5% and 22.5 and 8.7% in first, second, third, fourth cuts and annual yield, respectively. **Ahmed and Nour (1996)** reported a coefficient of phenotypic and genotypic variations in green forage yield of 19.14 and 18.7, 13.3 and 12.04 and 18.59 and 15.49 for first, second seasons and combined analysis over season, respectively. He added that, the ranges of variation in green forage productivity of barseem populations were 24.57, 16.17 and 20.1 tons/ faddan for first, second season and combined data, respectively.

The success in tracing the genotypic variance for both green and dry forage yield from the combined data over seasons, indicates that, the estimation of genotypic parameters of variability might depend on data replicated over season. Also, the results reported in tables (2 and 3) indicated that genotypic variance (σ^2_G), existed among the studied barseem populations. That genetic variance reported here, includes both additive and non-additive components. These results are in general agreement with those of **Ali (1977), El-Nehrawi (1980), Rammah *et al*. (1984), Mikheil (1987 and Ahmed (2006).**

Seed yield components:

Table (4) showed, the estimates of genetic variability for seed yield components, i.e.; number of heads/ plant, number of flowers/ head, number of seeds/ head, seed weight/ plant and percentage of seed setting.Range of number of heads per plant for barseem populations, was very wide, since, reached 33, 11 and 33 heads/ plant for the first, second seasons and combined data over years. Phenotypic differences among barseem populations amounted to 29.7, 12.7 and 4.84 percent of the obtained mean number of heads per plant of first, second seasons and combined over seasons. In the same time, genotypic differences among populations of barseem amounted to 22.95, 6.3 and 10.41% of the populations grand mean over first, second seasons and combined data.

Wider range was noticed with flowers number per head. The magnitude of range, reached the maximum value in second season (108 flowers/ head). Whereas, phenotypic variations among populations of barseem in flowers density

Table (4): Estimates of genetic parameters for seed yield component i.e. Number of heads/plant, Number of flowers/head, No. of seeds/head, seed weight/plant and seed setting percentage of barseem populations from the analysis of separate year and combined analysis.

Statistic	Seed yield component				
	No. of heads	No. of flowers	No. of seeds	Seed weight	% seed setting
	First season				
Range	(1 – 34)	(36 – 78)	(1 – 63)	(0.01 – 1.08)	(1.7 – 100)
	33.0	42.0	62.0	10.7	98.3
Genetic var. (σ^2_G)	5.18	10.6	*	3.2×10^{-3}	*
Phenotypic var. (σ^2_P)	8.66	33.72	2442.1	0.0114	*
(P.C.V.)	29.67	10.52	382.8	35.6	*
(G.C.V.)	22.95	5.89	*	0.6	*
	Second season				
Range	(4 – 15)	(17 – 125)	(9 – 98)	(0.08 – 0.9)	(14.04 – 100)
	11	108	89	0.82	85.96
Genetic var. (σ^2_G)	0.331	21.94	34.99	2.4×10^{-3}	35.94
Phenotypic var. (σ^2_P)	1.36	79.24	83.59	0.44	76.2
(P.C.V.)	12.7	13.6	19.82	32.7	12.82
(G.C.V.)	6.3	7.2	12.82	0.31	8.80
	Combined analysis				
Range	(1 – 34)	(17 – 125)	(1 – 98)	(0.01 – 1.08)	(1.7 – 100)
	33	108	89	107	98.3
Genetic var. (σ^2_G)	*	*	45.8	6.9×10^{-4}	*
Phenotypic var. (σ^2_P)	0.214	3.22	47.9	1.07×10^{-3}	8.92
(P.C.V.)	4.84	2.97	20.52	0.3	6.9
(G.C.V.)	*	*	20.1	0.07	*

per head, was 10.52, 13.6 and 2.97% of populations overall mean in the first, second seasons and combined analysis. While, genotypic variations were about 50% less in magnitude than the phenotypic one, where, 5.89, 7.2 percent were scored with genotypic coefficient of variations in years one and two, respectively. In the meantime, the estimate of genetic variance, as well as, genotypic coefficient of variations for the recent character was negative and negligible.

As for, number of seeds per head, values of 62, 89 and 89 were expressed as a range in season one, season two and overall the two seasons. Negative estimate of genotypic variance was obtained in season one, indicating a negligible magnitude. While, positive genotypic variance was recorded in second season and overall seasons. The magnitude of phenotypic variations among barseem populations in number of seeds/ head in second season, amounted to about 20% of the grand mean. That value was similar to the figure of phenotypic variations over all the two years. While, genotypic variations in number of seeds per head, during the second year, were of lower magnitude, reached 12.82%. Over the two years, the magnitude of genotypic and phenotypic variations were quite equal and around 20%.

Seed weight per plant of barseem populations showed a range between 1.08 and 0.01 g/ plant, overall the two years of the study. Different magnitude of range was expressed in second season, as from 0.08 to 0.1 g/ plant. Phenotypic variations among barseem populations in seed weight per plant amounted to about one third of the mean value of the character mean in both years (35.6 and 32.7%, respectively). While, these variation were only 0.3% of the overall mean over years. Genotypic variations amounted to less than one percent weather in separate season or over the two seasons. Seed setting in barseem populations ranged between 1.7 and hundred percent, overall the two seasons of the study. The low limit of the range raised to about 14.0 percent in the second season. These variations phenotypically amounted to about 86 and 13%, respectively, of the grand mean of seasons one and two. Meanwhile, genotypic variations in the second seasons represented only 8.8% of the character mean. Overall the two seasons, phenotypic variations in seed setting amounted to about seven percent of the grand mean.

Heritability estimates:

Broad-sence heritability estimated from variance components for separate years as well as combined analysis over years were presented in Table (5).Heritability estimate for all studied barseem characters varied with analysis method and cutting. Range of estimates in first cutting of first season, varied from 83.5% for height of first branch to 100% first season for number of branches, stem diameter, leaf/ stem ratio, leaves dry weight and stem dry weight, while, at second season, a wider range of estimates between 48.02% for root dry matter percentage and

Table (5): **Heritability estimates (%) of forage yield and agronomic characters of barseem populations from separate season analysis and from combined analysis.**

Characters	First cutting			Subsequent cutting		
	1st Season	2nd Season	Combined	1st Season	2nd Season	Combined
Green forage yield	98.23	78.14	28.5	*	*	13.2
Dry forage yield	98.7	79.9	3.91	*	31.4	16.5
Plant height	*	*	53.9	2.3	*	93.5
Root length	*	*	*	0.32	26.4	*
Height of 1st branch	83.5	97.81	75.44	*	*	*
Length of 1st branch	98.2	95.2	37.8	*	*	*
Number of branch	100	*	99.2	16.7	24.3	88.9
Number of leaves	97.41	95.4	78.4	96.2	42.5	91.1
Number of nodes	98.81	93.6	71.98	*	*	*
Stem diameter	100	*	43.96	*	*	66.1
Leaf / stem ratio	100	99.01	85	2.8	*	50.0
Leaves fresh weight	95.9	*	78.6	*	22.83	70.6
Leaves dry weight	100	*	23.3	*	0.43	83.0
Root fresh weight	90	92.2	26.73	*	78.5	90.9
Root dry weight	*	*	*	*	64.94	27.5
Stem fresh weight	99.5	82.3	68.6	*	64.94	27.5
Stem dry weight	100	93.3	15.1	*	2.70	70.0
Root dry matter %	86.8	48.02	*	*	64.3	42.31
Stem dry matter %	*	*	*	*	59.80	*
Leaves dry matter %	93.04	95.3	*	*	*	*
Leaf area	*	91.6	*	*	*	77.63

* : Negative estimate of variance

99.01 for leaves/ stem ratio were recorded. From the combined analysis over seasons, heritability was between 15.1% for stem dry weight to 99.2% for number of branches /plant. The high values of estimates of heritability from separate year analysis might be due to the under estimate of environmental variance, while, narrow range that result from combined analysis, probably due to better estimate of environmental variance. High values of estimates of heritability at first cutting, whether, from separate year analysis or from combined analysis over seasons (height of first branch, number of leaves, number of nodes, leaf/ stem ratio and stem fresh weight), indicates strong genetic control over such traits. Consequently, most of the variability in those traits is essentially attributed to genetic factors. Also, the resemblance between values obtained from single year and combined analysis indicate that, these traits could be measured with a very limited error during first cutting. Also, such high values of estimate refer to the limited share of environmental variance within the phenotypic one.

At subsequent cuttings, heritability estimates from the analysis of first season, were either negligible (estimate of zero) or of a small magnitude, except, for number of leaves, which showed an estimate of 96.2%. From the second season analysis, high estimates were noticed with root fresh weight (78.5%), root dry weight (64.9%), root dry matter percentage (64.3%). Whereas, other characters showed moderate or low values. From the combined analysis, high estimates were noticed with plant height (93.4%), number of branches (88.9%) number of leaves (91.1%), stem diameter (66.1%), leaves fresh weight (70.6%), root fresh weight (90.9%), stem fresh and dry weight (69.7 and 70.0%, respectively) and leaf area per plant (77.63%).

Commonly, a character that gave high estimates from first, second seasons and combined analysis, like number of leaves per plant, might be measured or traced with limited error whether depending on single year or combined analysis over years. Estimates of heritability in the literature of barssem clover, varied depending on type of entries and analysis method**. Rammah (1969)** estimated heritability in broad sence, from spaced nurseries of “Meskawi” and “Fahl”. He obtained values ranged between 10.4% to 35.0% for fresh forage yield. He added that, heritability estimates were highest at first cutting of “Meskawi” for all traits**. Radwan (1970),** reported that the estimate of heritability for fresh forage yield of 37 Fahl accessions was 46%. **Radwan and Abo El-Zahab (1972)** estimated heritability from three progeny tests of multi-cut barseem as 26, 31, 30 and 39% for fresh yield of first, second, third and seasonal, respectively. **Bakheit (1986)** estimated broad-sence heritability, from four experiments for multi-cut barseem green forage as 78% and 81% at Alexandria and Nubaria regions, respectively**. Bakheit and Mahdy (1989)** obtained values of broad-sence estimates for fresh forage yield of 44.18 to 87.3%. **Ahmed (2006)** reported estimates for green forage from progeny test of “Meskawi” and “Khadarawi” reached about 52%. Meanwhile, moderate values were obtained for plant characters.Variable estimates for heritability of plant height were published. **Rammah (1969)** obtained values between 2.8 and 35.6%. **Radwan (1970)** reported 88% heritability. **Ali (1977)** published values ranged from zero to 78% with maximum magnitude at second cutting. **Ahmed (2006)** had a value of 75.71 and 67.96% for plant height of “Meskawi” and "Khadarawi" populations, respectively.Estimates of heritability in broad-sence for leaves weight, were recorded as from 0.2 to 27.0% **(Rammah, 1969),** whereas, **Radwan (1970)** reached a value of 31% for that same character.

Rammah, (1969) published that the value of heritability for stem weight were from 1.4 to 23.9%.
Estimate of heritability for seed yield components varied with seasons (Table 6). Where, the genotypic variance represented about 60 and 24% of the phenotypic variance of number of heads per plant at the two successive seasons, respectively. Also, low estimates of about 31% and 28% were obtained for number of flowers per head at the two seasons. While, In the mean time, estimates from the combined analysis over seasons, were high approaching 96% and 65% for number of seeds per plant and seed weight per plant.
The high values of heritability estimates, which were obtained with number of seeds per inflorescence and seed weight per plant, indicate that these two traits might be the main components of seed yield. Furthermore, the low estimates of heritability with number of heads per plant and number of flowers per inflorescence might indicate that these characters are largely affected by environmental factors. The recent findings are in according with those reported by **Ahmed and Nour (1996).**

Table (6): Heritability estimates (%)for seed yield component i.e.; number of heads/plant, number of flowers/head, number of seeds/head, seed weight/plant and seed setting percentage of barseem populations from separate season and combined analysis.

character	First season	second season	Combied analysis
Number of heads/plant	59.8	24.3	*
Number of flowers/head	31.44	27.7	*
Number of seeds/head	*	41.86	95.62
Seed weight/plant	2.9	0.55	64.5
Seed setting(%)	*	47.2	*

*** Negative estimate of variance**

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الاختلافات الوراثيه فى الوعاء الجينى للبرسيم المصرى

محمد عبد الستار احمد - محمد نجيب بركات - أسماء محمد سمير راضى
قسم علوم المحاصيل- كلية الزراعة جامعة الإسكندرية

أجريت الدراسة الحالية لتقدير الاختلافات الموجودة داخل (الوعاء) الجيني للبرسيم المصري.*"Trifolium alexandrinum,L"*. استخدم في الدراسة خمسة عشائر اختيرت عشوائيا وذات مواصفات متباينة وهي: برسيم "فحل" وحيد الحشة، برسيم "مسقاوي"، برسيم "خضراوى I " ، برسيم "خضراوي II " ، وبرسيم "صعيدي"، والاربعة عشائر الاخيره متعددة الحشات. وقد نفذت الدراسة خلال موسمى شتاء 2006/2005و2007/2006بمزرعة كلية الزراعة-جامعة الإسكندرية. بقسم علوم المحاصيل- كلية الزراعة جامعة الإسكندرية.

ويمكن تلخيص أهم النتائج المتحصل عليها من الدراسة كما يلى :

1. أظهر محصول العلف الجاف في الحشة الأولى للموسم الاول مدى واسع بين العشائر بلغ 173 جم/م^2، بينما ضاق هذا المدى في الموسم الثاني إلى 18.1 جم/م^2، و كمتوسط للموسمين بلغ مدى الاختلاف بين العشائر 197.9 جم/م^2.
2. بلغت الاختلافات المظهريه فى الحشات التالية لصفة محصول العلف الأخضر حوالي 21.3% من المتوسط العام للموسمين فى مقابل 17.82%و 8.6% من المتوسط العام للموسم الأول والثاني على الترتيب.
3. بلغت الاختلافات المظهرية حوالي 15.4و 19.1% لصفة محصول العلف الجاف في الموسم الأول والثاني على الترتيب ، بينما بلغت الاختلافات المظهرية حوالى 28% من المتوسط العام لموسمى الدراسه.
4. كان مدى الاختلاف فى صفة عدد الرؤوس/ نبات في عشائر البرسيم واسعاً حيث بلغ 33و 11و 33 رأس/ نبات لكل من الموسم الأول والثاني و المتوسط العام للموسمين على الترتيب.
5. بلغت تقديرات الاختلافات المظهرية بين عشائر البرسيم 29.7% و 12.7% و 4.84% من متوسط عدد النورات للنبات لكل من الموسم الاول والثانى والبيانات المجمعه.وفى ذات الوقت بلغت الاختلافات الوراثية بين عشائر البرسيم 22.95%و6.3%و10.41% من المتوسط العام للعشائر في الموسم الأول و الثاني والبيانات المجمعة للموسمين.
6. تقديرات الاختلافات المظهرية بين عشائر البرسيم في كثافة الأزهار على النورات بلغت 10.52%و13.6%و 2.97% من متوسطات الموسم الاول والثانى والمتوسط العام للموسمين على الترتيب. كما بلغت الاختلافات الوراثية حوالى 50% من قيمة الاختلافات المظهرية المقدره. كما كانت تقديرات التباين الوراثي ومعامل الاختلاف الوراثي لتلك الصفة سالبة وضئيلة.
7. مدى الاختلاف في عدد البذور/ رأس بلغ 62و 89 بذره /رأس وذلك للموسم الأول و الثاني والبيانات المجمعة للموسمين. و قد كانت تقديرات الاختلافات الوراثية والمظهرية لتلك الصفه متساوية وفي حدود 20%.
8. ظهرت نتائج وزن البذور/ نبات في عشائر البرسيم مدى اختلاف بين 1.08 إلى 0.01 جم/ نبات خلال موسمى الدراسة.وقد بلغت الاختلافات المظهرية حوالى ثلث قيمة متوسط الصفة في كلا موسمى الدراسه (35.6%و 32.7% على الترتيب). بينما بلغت قيمة تقديرات الاختلافات الوراثية أقل من 1% من المتوسطات سواء لكل موسم على حده أو للبيانات المجمعة للموسمين.
9. تراوحت قيم نسبه عقد البذور في عشائر البرسيم بين 1.7% الى 100% خلال موسمى الدراسة. هذه الاختلافات مثلت مظهريا حوالى 86%و 13% من متوسطات الموسم الأول و الثاني على الترتيب . و مثلت الاختلافات الوراثيه حوالى 7% من المتوسط العام للبيانات المجمعة للموسمين.
10. اختلفت تقديرات درجة التوريث لمكونات محصول البذور باختلاف الموسم، حيث بلغت قيم التباين الوراثي حوالى 60% و 24% من قيم التباين المظهري لصفة عدد النورات/ نبات خلال الموسمين المتتاليين على الترتيب.
11. سجلت تقديرات منخفضة لدرجة توريث عدد الأزهار في النورة حيث بلغت 31%، 28% خلال الموسميين المتتابعيين على الترتيب.
12. تقديرات درجة التوريث من التحليل التجميعي للسنوات لصفتي عدد البذور/ نبات ووزن البذور/ نبات كانت عالية وبلغت 96% و 65% على الترتيب.

13. تقديرات درجة التوريث العالية المتحصل عليها لصفتي عدد البذور في النورة ووزن البذور للنبات تدل على ان هاتين الصفتين من أهم مكونات لمحصول البذور. علاوة على ذلك، فإن تقديرات درجة التوريث المنخفضة لكل من عدد النورات/ نبات، وعدد الأزهار/ النورة تشير إلى شده تأثير هاتين الصفتين بالعوامل البيئية.

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